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RESILIENCE AND VULNERABILITY FACTORS IN RESPONSE TO STRESS

EDITED BY: Chantal Martin-Soelch and Ulrich Schnyder
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RESILIENCE AND VULNERABILITY FACTORS IN RESPONSE TO STRESS

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Editorial: Resilience and Vulnerability Factors in Response to Stress

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Keywords: resilience (psychological), vulnerability (psychological), stress, trauma, PTSD (post traumatic stress disorder)

Editorial on the Research Topic

Resilience and Vulnerability Factors in Response to Stress

Stress exposure is a major determinant for the development of several mental disorders (1), one of the major causes of disability worldwide (2). For both treatment and prevention of mental disorders, the identification of vulnerability and resilience factors is essential. For instance, it is still not clear which factors differentiate between individuals who will develop mental disorders, in particular, post-traumatic stress disorder (PTSD), following exposure to a potentially traumatic event from the ones who will be resilient, i.e., who may show a strong initial reaction to the event but will not suffer long-term mental health consequences and may even go on to develop post-traumatic growth (3, 4). At the moment, the interplay between vulnerability and resilience factors as well as the role of different types of stress in the development of psychopathological conditions remains unclear. Therefore, our research topic aimed to gather scientific contributions on the relationship between stress and psychopathology in general, and in particular on the field of stress-related resilience and vulnerability.

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METHODOLOGICAL ISSUES IN STUDYING VULNERABILITY AND RESILIENCE FACTORS

To investigate vulnerability or resilience factors, prospective longitudinal designs are the methods of choice. However, these designs are costly in time and resources. Alternative designs include longitudinal, retrospective, and cross-sectional studies in victims of traumatic events or longitudinal and cross-sectional studies in so-called vulnerable populations, i.e., in individuals with an increased risk of developing mental disorders, for instance, because they are regularly exposed to stress at work (e.g., nurses in intensive care units) (Favrod et al.; Schäfer et al.), because they have experienced early-life adversity (5, 6), or because their parents suffered from a mental disorder, such as depression (7). A further methodological option is to investigate remitted PTSD patients to disentangle the effects of the disorder from potential vulnerabilities. A caveat of this design is, however, that it is not possible to differentiate between chronic, long-term sequelae from the disorder and vulnerability factors present before the onset of the disorder (8).

The majority of the articles published under this research topic report on research performed in vulnerable populations, mostly in individuals exposed to regular stress during work, including nurses (Favrod et al.; Schäfer et al.; Oe et al.), physicians (Weilenmann et al.), or students (Recabarren et al.), but also in individuals exposed to stress because of their sexual orientation or because they suffer mental disorders (Wang et al.; Tanner et al.). A narrative review article

provides an overview of the current state of the research on resilience in cancer patients (Seiler and Jenewein). McGee et al. used a longitudinal design to identify potential protective factors between chronic stress and exposure to early-life adversity and health outcomes in a population of older Swiss adults. Finally, Recabarren et al. report the results of a multidimensional stress prevention program in students. Five articles report on results from studies in individuals exposed to traumatic events, including two longitudinal studies, one in assault survivors in Switzerland (Kleim et al.) and one in survivors of the Fukushima disaster in Japan. Nsabimana et al. investigated factors predicting psychological adjustment in institutionalized orphans in Rwanda using a cross-sectional design. Millon et al. report the results of a study testing autobiographical memories in survivors of sexual assault in the United States. Finally, Sun et al. tested brain network alterations in a sample of remitted PTSD patients. However, none of the published articles used a truly prospective design.

Not only designs but also validated measures are important for the investigation of vulnerability and resilience factors. Two publications addressed the question of the development and validation of questionnaires. Van der Meer et al. report the results of the Dutch and English validation of a resilience scale, the Resilience Evaluation Scale (RES), while Jacobs et al. validated the French version of the Secondary Traumatic Stress Scale.

VULNERABILITY AND RESILIENCE FACTORS: WHAT DO WE KNOW?

Vulnerability Factors

Vulnerability factors for PTSD can be categorized into pre-traumatic, peri-traumatic, and post-traumatic variables. Across all types of potentially traumatic events, variables such as female gender, low socio-economic status, or previous trauma exposure, consistently predict higher PTSD symptom levels. Type of trauma, trauma severity, and the number of traumatic event types a given person has been exposed to are the most important peri-traumatic risk factors. It has to be emphasized, however, that although statistically significant, the weighted effect sizes of all these single variables are very low. One post-traumatic variable sticks out, though, namely, lack of social support post-trauma (9, 10).

The authors of our topic have focused, on one hand, on the investigation of cognitive mechanisms involved in the development of PTSD and, on the other hand, on the identification of vulnerability factors specific to the context of the stress experience, extending therefore the state of the research. With regard to cognitive processes, Kleim et al. evidenced in a sample of assault survivors in Switzerland the role of specific linguistic markers, showing that more cognitive elaboration is associated with lower risk for PTSD. Millon et al. reported that autobiographic memories of stressful events are stronger in women with than in women without experience of sexual violence and that the strengths of these memories strongly correlated with traumatic cognitions, ruminative thoughts, and psychopathological scores irrespective of the presence of

PTSD. Changes in neural connectivity also differentiated healthy individuals from PTSD and remitted PTSD, suggesting that specific neural functioning could be a vulnerability factor for PTSD (Sun et al.).

Context-specific vulnerability factors were evidenced in traumatized child samples, with Nsabimana et al. reporting that being institutionalized in an orphanage and having at least one living parent is a vulnerability factor for reduced self-esteem and increased externalizing behaviors. Further, Oe et al. identified important factors for the parent's recognition of school bullying in survivors of the Fukushima disaster (Oe et al.). Both studies have a specific cultural context, as parents in Rwanda place their children in orphanages out of poverty or in the hope that they will get a better education (Nsabimana et al.); and in Japan, displaced survivors of the Fukushima disaster are often victims of stigmatization (Oe et al.). Context-specific vulnerability factors were also reported in vulnerable samples. For instance, Favrod et al. showed that symptoms of secondary post-traumatic stress in nursing staff are specific to the work environment, with higher scores reported in nurses working in neonatal intensive care than in midwives and with more work-related traumatic stressors reported in the former group. In contrast, a cross-cultural study indicates that midwives working in Switzerland have higher symptom levels of psychological distress and secondary traumatic stress than midwives working in Japan (Oe et al.). These findings stress again the importance of the cultural context. In individuals suffering mental illness in Switzerland, fear of negative evaluation, fatigue, concentration problems, negative alterations in mood, and dissociative symptoms showed the strongest negative association with recovery from functional impairment after 18 months (Tanner et al.), suggesting that specific psychiatric symptoms and stigmatization (or fear of stigmatization) represent vulnerability factors in this sample.

Resilience Factors

The best documented psychological protective factors include perceived social support [see Refs. (11, 12) for review], sense of coherence (SOC) (13, 14), self-efficacy, and sense of mastery (15–17). It is therefore not surprising that three articles published in this research topic examined the protective effect of SOC. These studies evidenced a strongly predictive effect of SOC on general mental health in nurses of intensive care units (Schäfer et al.), as well as a stress-mediating effect in older adults (McGee et al.), and SOC was identified as a resilience factor in cancer patients (Seiler and Jenewein).

In addition to the well-documented resilience factors, the contributions to our research topic investigated new and promising variables, including adaptive emotion regulation strategies and empathy (Weilenmann et al.), as well as mindfulness abilities (Wang et al.). This last study used an interesting approach, creating an index for psychosocial resources based on the scores of 14 general factors related to resilience. From those, mindful attention, purpose in life, non-rumination, positive affect, vitality, and positive relationships with others stuck out as the most protective ones (Wang et al.).

CONCLUSION AND CLINICAL IMPLICATIONS

Our research topic also points out the necessity to develop well-validated measures of stress, resilience, and vulnerability, in particular, culturally adapted measures to stimulate research outside of the industrialized countries. Further, none of the presented studies used a prospective longitudinal design in vulnerable individuals, which would be the method of choice to identify vulnerability and resilience factors. This should be the focus of future studies and become a priority for funding agencies.

In addition, this research topic highlights the role of well-documented resilience factors, including perceived social support and SOC, to mediate the effects of stress on mental health in vulnerable individuals. In addition, mindfulness abilities, successful emotion regulation strategies, and positive affect, among others, were identified as potentially promising protective factors. The identification of resilience and protective factors is in turn relevant for the development of specific clinical

prevention and intervention programs. This is well illustrated by the results of a preventive stress prevention program (Ge-D-Stress) in university students that successfully increased quality of life and resilience factors and was able to decrease psychological symptoms as well by activating several psychosocial resources (Recabarren et al.). However, the majority of the published works in this research topic investigated vulnerability factors. Interestingly, they focused on the role of cognitive and neural processes as well as of context-specific factors, for instance, related to the work environment or the cultural context. A better understanding of specific vulnerability factors might allow us to detect individuals at risk in specific populations in order to provide tailored preventive or clinical interventions, such as the Ge-D-Stress program.

AUTHOR CONTRIBUTIONS

Both authors contributed in writing of the editorial.

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Brain Structural Covariance Network Topology in Remitted Posttraumatic Stress Disorder

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Posttraumatic stress disorder (PTSD) is a prevalent, chronic disorder with high psychiatric morbidity; however, a substantial portion of affected individuals experience remission after onset. Alterations in brain network topology derived from cortical thickness correlations are associated with PTSD, but the effects of remitted symptoms on network topology remain essentially unexplored. In this cross-sectional study, US military veterans ($N = 317$) were partitioned into three diagnostic groups, current PTSD (CURR-PTSD, $N = 101$), remitted PTSD with lifetime but no current PTSD (REMIT-PTSD, $N = 35$), and trauma-exposed controls (CONTROL, $n = 181$). Cortical thickness was assessed for 148 cortical regions (nodes) and suprathreshold interregional partial correlations across subjects constituted connections (edges) in each group. Four centrality measures were compared with characterize between-group differences. The REMIT-PTSD and CONTROL groups showed greater centrality in left frontal pole than the CURR-PTSD group. The REMIT-PTSD group showed greater centrality in right subcallosal gyrus than the other two groups. Both REMIT-PTSD and CURR-PTSD groups showed greater centrality in right superior frontal sulcus than CONTROL group. The centrality in right subcallosal gyrus, left frontal pole, and right superior frontal sulcus may play a role in remission, current symptoms, and PTSD history, respectively. The network centrality changes in critical brain regions and structural networks are associated with remitted PTSD, which typically coincides with enhanced functional behaviors, better emotion regulation, and improved cognitive processing. These brain regions and associated networks may be candidates for developing novel therapies for PTSD. Longitudinal work is needed to characterize vulnerability to chronic PTSD, and resilience to unremitting PTSD.

Keywords: posttraumatic stress disorder, remission, structural covariance network, cortical thickness, centrality

INTRODUCTION

Posttraumatic stress disorder (PTSD) is common, typically chronic, and associated with high rates of psychiatric comorbidity. In about 30–50% of patients with PTSD, marked symptoms persist after treatment (1) and severely impact quality of life (2, 3). However, a sizable minority of veterans who initially experience prominent symptoms of PTSD eventually experience remission (4, 5).

A reassessment after 40 years of veterans who participated in the National Vietnam Veterans Readjustment revealed that while PTSD symptoms worsened for theater veterans with PTSD as a whole, there were 7.6% who showed significant clinical improvement (4). A similar large-scale longitudinal re-examination of the Vietnam era twins after 20 years identified 17% of theater veterans developed PTSD early and experienced early symptom remission, and 7.4% who developed PTSD early and experienced late symptom remission (5). These results clearly highlight relapse and remission in PTSD (6, 7). Some recent studies have investigated the neural changes associated with the remission of PTSD in response to specific therapeutic interventions (8–10). However, our understanding of the associated neurostructural and network correlates of remission is still limited.

A wealth of research demonstrates that PTSD is associated with an array of functional and anatomical changes at specific anatomical loci in the brain, including amygdala, hippocampus, insula, ventral/dorsal medial/lateral prefrontal cortex, and anterior/posterior cingulate cortex (11–14). However, the human brain is organized into complex networks (15) supported by long range connections (16) that may be modified by exposure to traumatic events, precipitate alterations in network topology, and ultimately in behavior/symptoms (17, 18). Changes in network topology can be conveniently quantified by graph theoretical measures to understand changes in associated behavior and neuropsychiatric symptoms (i.e., dysfunctional behaviors) (19–21). Network architecture can be inferred from various neuroimaging methods including functional resting or task-based functional magnetic resonance imaging (fMRI), fiber connectivity from diffusion tensor imaging of white-matter tracts, and structural brain network derived from between-subject regional correlation of cortical thickness (22). Among them, cortical morphometric network analyses (23) are based on inferences about structural covariance between pairs of cortical regions that covary with respect to cortical thickness or subcortical regions that covary with respect to volume (24). The dependence between brain areas is postulated to derive from structural or functional associations between these regions (22, 24–26). The brain structural network method is relatively immune to a range of noisy components that accompany task-based and resting state fMRI, and purportedly reflects a highly choreographed developmental process of neuronal growth and migration throughout the cortical mantle (24, 27).

Mueller et al. (28) showed PTSD-associated alterations of structural brain networks, demonstrating an enhanced role of the left insula and right orbitofrontal cortices (betweenness centrality) and a diminished role of left orbitofrontal and anterior cingulate cortices (degree centrality) within the network. Centrality is a mathematical measure from graph theory that characterizes the importance of a particular region within a network of connections (edges) between brain regions (nodes). We investigated the network characteristics of remitted PTSD (lifetime but not current diagnosis) by comparing the centralities of structural networks to those in patients with current PTSD and trauma-exposed control subjects without lifetime PTSD. Our goal was to identify structural network characteristics associated with PTSD and its remission. Such knowledge may help identify potential

targets for interventions to ameliorate chronic PTSD by facilitating remission. The disorder is characterized by symptoms and behaviors that produce cognitive impairment particularly with attention and memory (29); difficulty with regulating emotions, particularly in response to threat and fear (30); avoidance, often in the form of social anxiety (31) and hypervigilance, among others (11). Thus, we hypothesized between-group differences of network centrality in cortical regions associated with cognitive function, emotion regulation, fear processing, social cognition, and inhibitory control, by focusing on the prefrontal cortex including anterior cingulate cortex, specifically subcallosal gyrus (32, 33), frontal pole, and superior frontal areas (34, 35) that have been associated with PTSD.

MATERIALS AND METHODS

Participants

Participants ($n = 317$) recruited from a repository (Mid-Atlantic MIRECC Post-Deployment Mental Health Repository, Durham, NC, USA) (36, 37) of Iraq and Afghanistan era military service members underwent structural MRI scans. Participants were screened for inclusion/exclusion criteria based on information available in the repository. Important exclusions included major axis I diagnosis (other than major depressive disorder or PTSD), contraindication to MRI, traumatic brain injury, substance dependence, neurological disorders, and age over 65 years. This study was carried out in accordance with the recommendations of the Institutional Review Boards at Duke University and the Durham VA Medical Center with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Institutional Review Boards at Duke University and the Durham VA Medical Center. Participants previously completed questionnaires upon entering the repository that were available for this study to assess traumatic life events [Traumatic Life Events Questionnaire (TLEQ) (38)], combat exposure [Combat Exposure Scale (CES) (39)], depressive symptoms [Beck Depression Inventory-II (BDI-II) (40)], and serotonergic antidepressant medication use (Med_5HT). Diagnosis of PTSD was performed with the Clinician-Administered PTSD Scale to determine three groups (1) current PTSD who met diagnostic criteria based on symptoms experienced in the past month (CURR-PTSD; $n = 101$), (2) lifetime PTSD but no current PTSD for participants who met diagnostic criteria before the last month but not since (REMIT-PTSD; $n = 35$), and (3) those without PTSD who never met diagnostic criteria (CONTROL; $n = 181$). Comorbid psychiatric diagnoses were ascertained upon entering the repository with the Structured Clinical Interview for DSM-IV (SCID). Childhood trauma (child-trauma) was coded from the number of trauma categories experienced before age 18 (e.g., physical abuse, sexual abuse, and serious accident) as reported in the TLEQ (41).

MRI Acquisition and Analyses

All images were acquired on 3-T scanners equipped with an 8-channel headcoil. The majority (90.6%) of images was acquired

on two GE scanners using high-resolution T1-weighted whole-brain axial images with 1-mm isotropic voxels with array spatial sensitivity encoding technique and fast spoiled gradient recall (3D-FSPGR). Image parameters were optimized for contrast between white matter, gray matter, and CSF on the (i) GE Discovery MR750 ($n = 156$, including 79 CONTROL, 21 REMIT-PTSD, and 56 CURR-PTSD) (TR/TE/flip angle = 7.484 ms/2.984 ms/12°, FOV = 256 mm, 1 mm slice thickness, 166 slices, 256×256 matrix, 1 excitation) and (ii) GE Signa EXCITE ($n = 132$, including 80 CONTROL, 11 REMIT-PTSD, and 41 CURR-PTSD) (TR/TE/flip angle = 8.208 ms/3.22 ms/12°, FOV = 256 mm, 1-mm slice thickness, 166 slices, 256×256 matrix, 1 excitation). The remaining images (9.4%) were collected on a Philips Ingenia scanner ($n = 29$, including 22 CONTROL, 3 REMIT-PTSD, and 4 CURR-PTSD) using higher in-plane resolution $0.9375 \text{ mm} \times 0.9375 \text{ mm} \times 1.0 \text{ mm}$ 3D turbo field echo pulse sequence with contrast enhancement and SENSE (TR/TE/flip angle = 8.148 ms/3.728 ms/8°, FOV = 240 mm, 1-mm slice thickness, 170 slices, 256×256 matrix, 1 excitation). Chi-square test showed that the group distribution is independent of scanner ($\chi^2 = 8.725$, $df = 4$, $p = 0.068$). All T1 images were visually inspected to assure sufficient quality for automated segmentation and labeling, which were performed using the FreeSurfer image analysis suite (version 5.3.0; <http://surfer.nmr.mgh.harvard.edu/>) and its library tool *recon-all*. Details of FreeSurfer parcellations have been previously described (12, 42–45). Thickness measures were calculated for 148 cortical regions (74 per hemisphere) using the *aparc.a2009s* template (44) through the FreeSurfer software.

Network Analyses

We generated interregional partial correlation matrices for each participant group by calculating partial correlation coefficients for all regional pairings of cortical thickness across group members. The partial correlation between two regions represents their relationship after partialing out the effects of potential influences of age, sex, IQ, BDI-II, TLEQ, CES, child-trauma, and Med_5HT. These confounding factors have previously been associated with brain structural volumetry (46, 47). A threshold was imposed on the partial correlation matrices to create a binary graph with connections (edges) between regions (19, 48). Using the same threshold for group comparisons may give the results that reflect not only topological differences but also connectivity strength differences. We were interested in topological differences only and thus adopted group-specific thresholds to ensure that the graphs of all groups had an equal number of edges or wiring cost defined as the number of edges present divided by maximum possible number of edges. This method has been successfully utilized in the recent published works on maltreatment (48) and PTSD (28). We calculated the minimum wiring cost required to produce a fully connected network for each group and chose the largest minimum wiring cost (i.e., 0.4987, which was from the CONT group; minimum wiring costs were 0.0868 for REMIT-PTSD and 0.2075 for CURR-PTSD) across groups to derive the corresponding threshold for each group. This method ensured that all nodes were in the network while minimizing the number of redundant paths. We only kept the positive suprathreshold partial correlations in the networks due to the observation that

only positive thickness correlations were mediated by direct fiber pathways (24). The network analyses were conducted using in-house Matlab (R2016b) scripts running on an iMac computer (macOS Sierra, version 10.12.6) (49).

Centrality Measures

A large array of network topology measures can be calculated for a given network and some provide very similar information to other measures. For ease of comparison to previous studies, we analyzed four types of centrality using Brain Connectivity Toolbox [BCT (50)]: (1) degree centrality—number of connections that a node has, (2) betweenness centrality—frequency with which a node falls between pairs of other nodes when traveling along their shortest interconnecting path, (3) closeness centrality—normalized number of steps required to access every other node from a given node in a network (adapted from the distance function in BCT), and (4) eigenvector centrality—a spectral centrality measure based on the idea that the importance of a node is recursively related to the importance of the nodes associated with it. Graph theory postulates that nodes with high centrality play an important role in communication and information transfer within a network (20, 28, 48). Naturally, the various centrality constructs are sometimes correlated but still reflect different aspects in nodal roles of a brain networks.

Statistics

The variance in the groups' measures was determined to be equal despite the disparate sample sizes of the three groups (51). We detected four cortical regions showing unequal variances (left lateral sulcus, right frontal pole, right anterior transverse temporal gyrus, and right temporal pole) through two-sample F tests for equal variances (at the 1% significance level) and excluded them from further analysis. Furthermore, we tested the reliability of the centrality measures with the Jackknife resampling method (52) to calculate the 99% confidence interval (CI). The Jackknife resampling method has been successfully utilized in analyzing the network derived from partial correlations (48). Finally, to assess between-group differences, we employed permutation testing to compute the probability that the difference in centrality measures between two groups occurred by chance. The permutation testing was based on 10,000 network comparisons derived by randomly permuting the group label of subjects (20, 53). To control for type 1 error, we followed the procedure by Teicher et al. (48) and employed a more conservative threshold that deems a node differs in centrality between groups only if the permutation-derived p -values are ≤ 0.05 for at least three of four centrality measures, which very conservatively reduces the odds of chance occurrence to ≤ 0.000125 ($0.05 \times 0.05 \times 0.05$). The more conservative threshold was used because we were comparing among three groups while Teicher et al. (48) only compared between two groups. For *a priori* cortical regions, the nodal between-group differences were considered significant when the permutation-derived p -values are ≤ 0.05 for at least two of four centrality measures. The statistical analyses were conducted using in-house Matlab scripts. The code for permutation testing was modified from the GREYNA toolbox (54).

RESULTS

Demographic and Clinical Characteristics

Participants' age, sex, and other demographic and clinical information are summarized in **Table 1**. The three groups did not significantly differ with respect to age and gender.

Centrality Measures

The centrality measures of all nodes were within their corresponding 99% CI, supporting the reliability of the analyses. Significant between-group differences of nodal centrality were identified in several cortical regions. Specifically, centrality between-group differences were detected in anterior cingulate cortex, frontal pole and superior frontal areas (see **Figure 1**).

TABLE 1 | Demographic information.

Test	Mean (SD) ^a			t-Statistic (p-value) ^b		
	REMIT-PTSD (n = 35)	CURR-PTSD (n = 101)	CONTROL (n = 181)	REMIT-PTSD versus CONTROL	REMIT-PTSD versus CURR-PTSD	CURR-PTSD versus CONTROL
Age	40.9 (10.7)	40.3 (10.0)	39.4 (9.9)	0.829 (0.408)	0.299 (0.765)	0.756 (0.450)
Sex	28 (7)	87 (14)	145 (36)	0.000 (0.988)	0.750 (0.386)	-1.615 (0.204)
IQ	99.6 (11.6)	95.8 (12.3)	101.8 (9.5)	-1.174 (0.242)	1.500 (0.136)	-4.440 (0.001)
BDI-II	10.4 (7.8)	22.2 (12.1)	5.1 (7.8)	3.648 (<0.001)	-5.336 (<0.001)	14.386 (<0.001)
TLEQ	20.5 (11.5)	23.7 (14.0)	12.2 (10.0)	3.999 (<0.001)	-1.138 (0.257)	7.254 (<0.001)
CES	11.1 (11.1)	17.1 (10.6)	6.5 (8.4)	2.572 (0.011)	-2.634 (0.010)	8.412 (<0.001)
Child-trauma	1.0 (1.0)	0.7 (1.0)	0.4 (0.8)	3.168 (0.002)	1.161 (0.248)	2.371 (0.019)
Med_5HT	5 (29)	51 (49)	4 (172)	-10.738 (0.001)	13.740 (<0.001)	-94.888 (<0.001)
AUDIT	4.6 (3.5)	4.2 (5.4)	2.8 (3.4)	2.618 (0.010)	0.362 (0.718)	2.414 (0.017)
CAPS_curr	19.4 (13.9)	68.2 (22.4)	7.0 (11.1)	5.451 (<0.001)	-11.437 (<0.001)	29.119 (<0.001)
CAPS_life	63.5 (21.0)	83.5 (29.6)	14.7 (15.8)	14.885 (<0.001)	-3.462 (0.001)	24.160 (<0.001)
DAST	0.7 (1.5)	1.1 (2.5)	0.4 (0.8)	1.404 (0.162)	-0.923 (0.357)	3.295 (0.001)
DTS	26.3 (24.5)	68.6 (33.7)	9.8 (18.7)	4.145 (<0.001)	-6.324 (<0.001)	17.023 (<0.001)

^aValues outside/inside brackets are number of either males/females for "sex" or yes/no for "Med_5HT."

^bStatistical values are from chi-square tests for "sex" and "med_5HT."

CONTROL, control group with trauma exposure; CURR-PTSD, current PTSD group; REMIT-PTSD, lifetime but no current PTSD group; IQ, intelligence quotient; BDI-II; Beck Depression Inventory-II; TLEQ, trauma life events questionnaire; CES, Combat Exposure Scale; Child-trauma, categories of trauma exposure as child/adolescent; Med_5HT, serotonergic medication; AUDIT, Alcohol Use Disorders Identification Test; CAPS_curr, Clinician-Administered PTSD Scale reflecting symptoms in the last 30 days; CAPS_life, Clinician-Administered PTSD Scale reflecting symptoms in the worst 30-day period of subject's life; DAST, Drug Abuse Screening Test; DTS, Davidson Trauma Scale; PTSD; posttraumatic stress disorder; TLEQ; Traumatic Life Events Questionnaire.

FIGURE 1 | Between-group differences of centrality measures. Left column, REMIT-PTSD (lifetime but no current PTSD group) group showed larger centrality in right subcallosal gyrus (R Sub) than both CURR-PTSD (current PTSD group) and CONTROL (control group with trauma exposure) groups. Middle column, both REMIT-PTSD and CONTROL groups showed larger centrality in left frontal pole (L FP) than CURR-PTSD group. Right column, both REMIT-PTSD and CURR-PTSD groups showed larger centrality in right superior frontal sulcus (R SFS) than CONTROL group. For observation purpose, the regions of interest (red), their connected nodes (blue), and the connections (gray) were shown. Node size was scaled by degree centrality.

REMIT-PTSD Versus CONTROL

As shown in **Table 2**, REMIT-PTSD patients (versus CONTROL) showed smaller centrality in left paracentral lobule and sulcus and bilateral precentral gyrus. They also showed larger centrality in right subcallosal gyrus, vertical ramus of the anterior segment of the lateral sulcus, superior segment of the circular sulcus of the insula, superior frontal sulcus, and anterior occipital sulcus.

REMIT-PTSD Versus CURR-PTSD

As shown in **Table 3**, REMIT-PTSD (versus CURR-PTSD) patients showed smaller centrality in left precentral gyrus, right precuneus, right middle temporal gyrus, and right inferior frontal sulcus. They also showed larger centrality in left transverse frontopolar gyri and sulci, left posterior-dorsal part of the cingulate gyrus, right lateral occipito-temporal gyrus, and right subcallosal area.

CURR-PTSD Versus CONTROL

As shown in **Table 4**, CURR-PTSD patients (versus CONTROL) showed smaller centrality in left transverse frontopolar gyri and sulci, left posterior-dorsal part of the cingulate gyrus, left postcentral gyrus, left inferior segment of the circular sulcus of the insula, and right anterior transverse collateral sulcus. They also showed larger centrality in left sulcus intermedius primus (of Jensen), right precuneus, right inferior/middle/superior

frontal sulcus, right lateral orbital sulcus, and right inferior part of the precentral sulcus.

DISCUSSION

We characterized neuroanatomical networks defined by cortical thickness correlations for comparison between groups with current PTSD, remitted PTSD, and trauma-exposed controls. Consistent with our *a priori* hypotheses, significant differences between REMIT-PTSD and CURR-PTSD as well as CONTROL participants were detected in the right subcallosal gyrus, frontal pole (left transverse frontopolar gyri and sulci) and superior frontal sulcus. Network connectivity of the frontal pole in REMIT-PTSD appeared to assume a connectivity profile that is consistent with trauma-exposed controls, whereas the CURR-PTSD group had altered frontopolar network connectivity. On the other hand, the REMIT-PTSD group demonstrated brain network architecture at the superior frontal sulcus that was consistent with CURR-PTSD but clearly altered compared with CONTROL despite the lack of PTSD symptoms. A precise neurobiological interpretation of the between-group differences in the covariance of cortical thickness between regions is yet unclear. It is possible that the correlation strength increases between regions that are concurrently affected by disorder (or recovery) processes, which are perhaps due to loss of (or new) input from directly affected regions, and the

TABLE 2 | Centrality between-group comparisons: REMIT-PTSD (lifetime but no current PTSD group) versus CONTROL (control group with trauma exposure).

No.	Area	Degree	Betweenness	Closeness	Eigenvector
REMIT-PTSD < CONTROL					
3	L Paracentral lobule and sulcus	41/91	14.0/63.0	0.639/0.803	0.046/0.099
29	L Precentral gyrus	64/117	31.5/194.8	0.718/0.891	0.074/0.119
29	R Precentral gyrus	67/112	60.8/134.7	0.728/0.874	0.073/0.115
REMIT-PTSD > CONTROL					
32	R Subcallosal gyrus*	67/0	53.9/0.0	0.728/0.000	0.075/0.000
40	R Vertical ramus of the anterior segment of the lateral sulcus	88/7	111.7/0.0	0.799/0.509	0.095/0.008
49	R Superior segment of the circular sulcus of the insula	120/108	264.4/246.4	0.908/0.861	0.124/0.105
54	R Superior frontal sulcus*	101/58	126.6/19.8	0.844/0.690	0.111/0.063
59	R Anterior occipital sulcus	110/70	210.7/42.6	0.874/0.731	0.116/0.076

At least three of four (two of four in *a priori* areas marked with *) centrality measures showed significant between-group differences in these areas.

"No." is the label of cortical area in the *aparc.a2009s* template (44).

L, left; R, right.

TABLE 3 | Centrality between-group comparisons: REMIT-PTSD (lifetime but no current PTSD group) versus CURR-PTSD (current PTSD group).

No.	Area	Degree	Betweenness	Closeness	Eigenvector
REMIT-PTSD < CURR-PTSD					
29	L Precentral gyrus	64/105	31.5/108.8	0.718/0.857	0.074/0.112
30	R Precuneus	80/119	59.5/202.1	0.772/0.905	0.090/0.121
38	R Middle temporal gyrus	71/112	76.0/137.9	0.741/0.881	0.074/0.118
52	R Inferior frontal sulcus	66/114	41.0/159.0	0.724/0.888	0.075/0.118
REMIT-PTSD > CURR-PTSD					
5	L Transverse frontopolar gyri and sulci	65/18	46.0/1.2	0.721/0.543	0.071/0.011
9	L Posterior-dorsal part of the cingulate gyrus	94/45	154.5/18.5	0.820/0.653	0.097/0.044
21	R Lateral occipito-temporal gyrus	116/83	205.2/97.3	0.895/0.782	0.124/0.081
32	R Subcallosal area*	67/8	53.9/4.0	0.728/0.518	0.075/0.006

At least three of four (two of four in *a priori* areas marked with *) centrality measures showed significant between-group differences in these areas.

"No." is the label of cortical area in the *aparc.a2009s* template (44).

L, left; R, right.

TABLE 4 | Centrality between-group comparisons: CURR-PTSD (current PTSD group) versus CONTROL (control group with trauma exposure).

No.	Area	Degree	Betweenness	Closeness	Eigenvector
CURR-PTSD < CONTROL					
5	L Transverse frontopolar gyri and sulci	18/68	1.2/56.6	0.543/0.724	0.011/0.073
9	L Posterior-dorsal part of the cingulate gyrus	45/104	18.5/241.0	0.653/0.847	0.044/0.104
28	L Postcentral gyrus	57/92	7.7/52.4	0.686/0.806	0.063/0.101
48	L Inferior segment of the circular sulcus of the insula	51/105	107.4/151.0	0.673/0.850	0.042/0.105
50	R Anterior transverse collateral sulcus	19/62	1.0/26.1	0.557/0.704	0.023/0.068
CURR-PTSD > CONTROL					
55	L Sulcus intermedius primus (of Jensen)	47/11	5.9/0.0	0.653/0.514	0.052/0.012
30	R Precuneus	119/91	202.1/48.0	0.905/0.803	0.121/0.100
52	R Inferior frontal sulcus	114/90	159.0/101.0	0.888/0.799	0.118/0.095
53	R Middle frontal sulcus	99/31	150.4/13.2	0.837/0.598	0.100/0.029
54	R Superior frontal sulcus*	115/58	339.8/19.8	0.891/0.690	0.114/0.063
62	R Lateral orbital sulcus	62/14	50.7/1.2	0.711/0.536	0.068/0.014
68	R Inferior part of the precentral sulcus	112/81	183.5/75.3	0.881/0.769	0.117/0.089

At least three of four (two of four in *a priori* areas marked with *) centrality measures showed significant between-group differences in these areas.

"No." is the number of cortical area in the *aparc.a2009s* template (44).

L, left; R, right.

correlation strength decreases between affected and unaffected regions (28). Our result is consistent with previous findings that frontopolar cortical thinning is associated with increased PTSD symptom severity (35) but to the best of our knowledge this is the first published report to directly compare remitted PTSD to current PTSD, and trauma-exposed controls.

The REMIT-PTSD and CONTROL groups showed larger centrality in the left frontal pole than the CURR-PTSD group, thereby implicating this area in current PTSD symptoms. We posited that lower frontal pole centrality in CURR-PTSD is associated with non-synchronized cortical thickness changes with regions involving cognitive, social, emotional, and most notably self-referential processing (55). This idea is consistent with previous findings that PTSD patients showed altered functional connectivity within brain structures associated with default model network (DMN), which plays a key role in self-referential processing and social cognition (56). The DMN consists of several areas including the anterior medial cortices. Interestingly, REMIT-PTSD and CONTROL groups did not differ in left frontopolar centrality. Clinically, PTSD associates with disturbances in self-referential processing whereby trauma undermines a sense of adaptive self-agency (57). Other closely related cognitive constructs of self-reference that are negatively impacted by PTSD include shame, guilt, self-blame, and a fragmented self-image (58–60). Key neural correlates of these self-referential cognitions are situated in the frontal pole (12, 55). Accordingly, PTSD exhibits functional differences in the frontopolar area for behavioral challenge tasks (11) and during the resting state (61). It is yet unclear whether the higher centrality in REMIT-PTSD (versus CURR-PTSD) patients reflects a recovery of network topology back to a configuration that was present before onset of PTSD, or a compensatory re-organization of network topology to comparable centrality at the frontal pole. These interpretations will require testing in future studies on the role of the frontal pole in remitted and current PTSD and could be explored as a potential target for therapeutic intervention. A recent study using transcranial direct current stimulation (tDCS) has already targeted ventromedial prefrontal cortex for the treatment of PTSD (62). Future clinical intervention

on PTSD may utilize interventions including tDCS and deep brain stimulation targeting frontal pole.

The REMIT-PTSD group showed larger centrality in right subcallosal area than CURR-PTSD and CONTROL groups, suggesting the role of subcallosal area in representing the specific status of remitted PTSD patients. The subcallosal area is located in subgenual anterior cingulate cortex and is strongly associated with emotion processing (63). Reduced volume in this area was reported in combat-related PTSD patients compared with trauma-exposed controls (32) and cortical thinning in PTSD remitters compared with non-remitters following treatment with prolonged exposure and trauma-exposed healthy volunteers (9). The subcallosal area also connects with several cortical and subcortical structures including prefrontal cortex, cingulate cortex, amygdala, and hippocampus (64), which have been implicated in PTSD based on anatomical and functional changes (11, 12, 14). However, our findings demonstrated that concurrent changes in cortical thickness in the subcallosal area and its structurally correlated regions were present only in the REMIT-PTSD group, but not in CURR-PTSD (compared with CONTROL). It is possible that a compensatory re-organization of network topology with larger centrality at right subcallosal area contributes to the resilience after experiencing PTSD symptoms by promoting symptom remission. However, we cannot exclude the possibility that some patients have special network topology with greater centrality in subcallosal area that helps with remission from PTSD symptoms. Indeed, US Special Forces who demonstrated resilience in the face of severe trauma have enhanced subcallosal activity during expectation of reward (65).

The REMIT-PTSD and CURR-PTSD groups showed larger centrality in right superior frontal sulcus than the CONTROL group, possibly implicating an enduring marker of prior PTSD even when symptoms remit. Our findings are consistent with previous reports that reduced cortical thickness in the superior frontal area is associated with PTSD symptom severity (34, 35). The superior frontal regions (covering both superior frontal sulcus and gyrus) have been associated with high-level cognitive

functions such as working memory and inhibition control (66, 67), which contribute to downregulating the personal relevance of the negative events (68). Structural and functional connectivity methods show that the superior frontal area consists of subregions that connect with nodes of the cognitive executive network (including middle and inferior frontal gyrus), default mode network (including anterior and middle cingulate cortex), and motor control network (including precentral gyrus, caudate, thalamus, and frontal operculum) (69). Thus, our results suggest that a high centrality in the right superior frontal sulcus represents lifetime PTSD-related neural changes in brain areas typically associated with executive, motor, and self-processing. Given that PTSD is a chronic relapsing and remitting disorder (4, 70), it is possible that some neural changes persist following symptom remission and may serve as a biomarker of possible future relapse. It is possible, although unlikely, that these network connectivity changes are precipitated by trauma in certain individuals given the absence of this neural configuration in the trauma-exposed group. However, given that childhood trauma that is associated with lasting brain changes (71), we cannot exclude the possible influence of higher childhood trauma scores in the CURR-PTSD and REMIT-PTSD patients.

Our study provided comparable results to previous structural network analyses on individuals with PTSD. We found larger centrality in right lateral orbital sulcus in individuals with CURR-PTSD than in CONTROL subjects, which is consistent with Mueller et al. (28) who report larger betweenness centrality in the right orbitofrontal area of veterans with PTSD obtained from either a whole-brain network analysis or a network analysis restricted to prefrontal-limbic areas. These convergent findings suggest that larger centrality in right orbitofrontal area is associated with PTSD symptoms. Previous studies have detected reduced gray matter volume/concentration in orbitofrontal cortex in patients with either PTSD (72) or depression (73). In line with these results, the larger centrality in right orbitofrontal area in CURR-PTSD patients may reflect reduced gray matter in both right orbitofrontal area and its connected regions. No significant differences of centrality in this area were detected between REMIT-PTSD group and the other groups.

Various factors influence remission, including the trauma type, chronicity of trauma exposure, comorbid substance use, and others (74). In a large meta-analysis of 42 studies with a total of 81,642 participants, 44% of individuals with PTSD experienced spontaneous remission (without specific treatment) at a mean follow-up duration of 40 months (75). Given that we did not specifically assess the antecedents of PTSD remission, it is likely that the present sample was comprised of a mix of patients who experienced spontaneous remission, pharmacotherapeutic remission, psychotherapeutic remission, and some combination thereof. While spontaneous remission is perhaps of particular interest since it represents a form of resilience to PTSD-onset following trauma exposure, the ability to remit in response to treatment is equally interesting because it represents its own form of resilience when contrasted with patients who suffer chronic persistent PTSD and are refractory to treatment. Thus, our REMIT-PTSD sample represents a resilient sample, albeit heterogeneous, composed of a mix of individuals who recovered spontaneously and others

who responded to treatment. Future research will be required to dissect the cortical network changes that are unique to each of the various subtypes of remitted patients.

The CURR-PTSD patients showed more severe depression and PTSD symptoms than REMIT-PTSD individuals, suggesting that the differences between CURR-PTSD and REMIT-PTSD patients might be confounded with the severity of depression and PTSD. However, a recent study showed that high depression severity is accompanied with greater centrality in ventral medial prefrontal cortex and posterior cingulate cortex, and smaller centrality in temporal areas and middle/inferior frontal areas (76), which are largely contrary to our findings of the comparison between CURR-PTSD and REMIT-PTSD patients. Therefore, depression severity should not be a confounding factor when explaining our findings. On the other hand, veterans with PTSD were found to be associated with decreased degree centrality in medial orbital frontal areas and rostral cingulate cortex (28), consistent with our contrast between CURR-PTSD and REMIT-PTSD patients. We thus cannot reject the hypothesis that patients with less severe PTSD symptoms are more amenable to remission. Future studies on CURR-PTSD and REMIT-PTSD patients who are matched for lifetime PTSD scores should further address this issue.

Limitations

There are several limitations in this study. First, our analysis was based on the large-scale covariance of cortical thickness. Some subcortical regions important to PTSD, such as amygdala and hippocampus (14, 77), were not considered. Recent studies have included both cortical thickness and subcortical volumes in structural network analyses (28) although the reliability of this method still needs validation. Future studies should delineate the role of subcortical structures in the brain network of REMIT-PTSD patients. Second, the role of individual differences on network characteristics is unclear, given that a network is defined at the group level. A new approach for investigating cortical thickness networks is needed to investigate the relationship between cortical thickness-based network attributes and individual characteristics (e.g., age and gender). A single-subject gray matter graph method has been developed in recent years (78, 79) and should be utilized in future studies of PTSD and remission. Furthermore, other connectivity analyses methods such as resting state fMRI, based on interregional relationship across measures within each subject, may complement our understanding of the effect of individual difference in network topography. Third, our study utilized a cross-sectional design, which limits inferences about the causal relationships between PTSD remission and cortical thickness network. Future longitudinal studies should fill this gap and explore the relationship between brain network characteristics and treatment outcomes. Longitudinal studies (4, 5) assessing PTSD at two time points to assess the course of illness would be more reliable and robust than a cross-sectional approach because it does not rely on patients' memories of prior symptoms from the distant past. Last but not least, it is a challenge to estimate the sample size appropriate for a structural covariance network analysis. Conventional

power analysis makes comparisons of the group means and variances of the same measures from individuals. By contrast, in our study, no centrality measures can be calculated at the individual subject level that can be pooled for group means and variances. Moreover, connection topology at each node determines the centrality, which means that each graph (group) has 148 relevant centrality measures to consider in any power or sample size calculation. The centrality at each node is not available as a mean and pooled variance that is derived from all subjects in that group. Furthermore, the large number of nodes at which centrality is compared between groups is a separate but related concern about adjusting power for multiple comparison testing. At this stage the field of connectomics, which is based on graph theoretical measures is yet grappling to develop appropriate corrections for multiple comparison testing that may be deployed on graph theoretical measures, and is even further from reaching consensus on best practices (80).

Conclusion

Our methods and results advance our understanding of the network configuration defined by structural relationships within REMIT-PTSD patients and may offer therapeutic targets for PTSD. Cortical thickness networks, specifically centrality of the right subcallosal gyrus, left frontal pole, and right superior frontal sulcus, differ between remitted PTSD, current PTSD diagnosis, and trauma exposure without PTSD. Our findings in REMIT-PTSD show enhanced structural connectivity that may represent a marker of resilience by promoting symptom remission through a recovery of network topology to a premorbid configuration or a compensatory re-organization of network topology with comparable centrality features.

MID-ATLANTIC MIRECC WORKGROUP

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ETHICS STATEMENT

All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Institutional Review Boards at Duke University and the Durham VA Medical Center.

AUTHOR CONTRIBUTIONS

All of the authors made substantial contributions to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Assessing Psychological Resilience: Development and Psychometric Properties of the English and Dutch Version of the Resilience Evaluation Scale (RES)

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Background: Psychological resilience is a distinct factor that affects mental health outcomes after adversities. This study describes the development, validity and measurement invariance (MI) of a Dutch and English scale on psychological resilience, called the Resilience Evaluation Scale (RES).

Methods: Separate online surveys with the Dutch and English version of the RES and hypothesized related measures were distributed in a Dutch- and English-speaking group, both drawn from the general population.

Results: Exploratory factor analysis, using data from 522 respondents ($n = 296$ Dutch, $n = 226$ English), yielded a two-factor structure for the final 9-item RES. The factors reflected the hypothesized underlying constructs of psychological resilience: *self-confidence* and *self-efficacy*. The items and constructs of psychological resilience as measured by the RES were interpreted and conceptualized in the same way by both language groups, with the exception of one item. The RES showed good convergent validity and good internal consistency.

Conclusions: The current study establishes sound psychometric properties of a new, brief, and freely available scale on psychological resilience. This study contributes to the identification and measurement of psychological resilience after adversities. The final 9-item RES may serve as a valuable instrument in research and in clinical practice.

Keywords: psychological resilience, scale development, traumatic stress, posttraumatic stress disorder (PTSD), measurement invariance, psychometric properties

INTRODUCTION

An abundance of studies have shown a high prevalence of adverse outcomes such as posttraumatic stress, anxiety and depressive symptoms after potential traumatic events (PTE's) (1–3). However, more recently, there has been a shift in focus toward healthy adjustment and even thriving after experiencing trauma (4–9). Although a clear consensus on the definition is lacking (10), resilience

is often defined as the process wherein an individual maintains a relatively stable, healthy level of psychological and physical functioning when confronted with PTEs (4, 11, 12). Resilience is influenced by multiple factors and varies in the context of individuals, environments, organizations and cultures (13). This complex and multidimensional nature of resilience makes it challenging to operationalize and measure the concept (8, 9, 13, 14). In order for resilience to establish itself as a meaningful concept in research and clinical practice, it is crucial to determine its distinct factors and to measure those factors in a reliable and valid way.

Factors that determine a resilient outcome after a PTE are often divided into two categories: *internal* capacities, and *external* factors (such as a healthy family environment) (13–17). A vital aspect of the internal capacity is psychological resilience, defined as the extent to which individuals evaluate themselves as being resilient (18, 19). According to the stress-coping model of Lazarus and Folkman (20), responses to stressful events are the result of the individual's appraisal of potential threat a situation imposes (primary appraisal) in combination with the individual's self-assessment of their own capability and resources to successfully handle the situation (secondary appraisal). It follows that an event will only be perceived as stressful when individuals believe that the demands of the situation exceed their coping abilities and resources (20). Secondary appraisal points at two potential underlying constructs of psychological resilience: *self-confidence* (i.e., trust in oneself) and *self-efficacy* (i.e., positive beliefs about adaptive coping with stressful situations) (20, 21). Aside from the external factors that determine a resilient outcome, internal capacities such as self-confidence and self-efficacy have been shown to be related to positive outcomes after stressful events, and buffer against symptoms of posttraumatic stress disorder (PTSD) (22–25).

Currently, several scales on resilience have been proposed (for a recent overview, see (10)). These scales often aim to assess both internal and external factors of resilience. For instance, the Connor-Davidson Resilience Scale (CD-RISC) (26) and the Resilience Scale for Adults (RSA) (27) aim to measure a composite of resilience factors, e.g., secure relationships, spiritual influences, family coherence, and social support. Indeed, various studies found conflicting conceptualizations (i.e., factor structures) for the CD-RISC across different populations and cultures, so it remains unclear which distinct resilience factors this scale measures (28–30). The same problems and findings regarding factor structure apply to the widely used Resilience Scale (RS) (31), which attempts to measure resilience factors such as perseverance, self-reliance, and meaningfulness (32–38). A clearer theoretical distinction between relevant resilience factors as well as a set of distinct measurement tools seems to be needed.

Moreover, despite the fact that most resilience scales are translated in different languages, it is often not investigated whether the concepts of the scales are measured in the same manner across different language groups (9). If this is the case, the scale is called measurement invariant across different language groups, which entails that the items of the scale, as well as the concepts they are measuring, are interpreted and conceptualized in the same way by individuals with

different language backgrounds (39, 40). In order to meaningfully compare observed scale scores between language groups, it is essential that the scale is measurement invariant across those groups (40–42).

To address these gaps, the current study aims to describe the development, validation and measurement invariance (MI) of the first, brief, freely available measure for psychological resilience: the Resilience Evaluation Scale (RES). The RES is developed to operationalize psychological resilience as defined by the secondary appraisal of adverse events [cf. (20)]. The RES thereby focuses on the internal capacity in resilient behavior. The RES was developed in Dutch and English. This study examines the factor structure and psychometric properties of both versions of the RES, and whether the RES is measurement invariant across Dutch- and English-speaking groups. We expected that the RES would be measurement invariant across both language groups, and would be positively associated with a comparable measure of resilience. Also, we hypothesized that the RES would show positive associations with related constructs (i.e., self-efficacy, self-esteem, and level of global functioning), and a negative association with PTSD symptoms.

METHODS

Development of the RES

The secondary appraisal concept of the Lazarus and Folkman model on stress guided the choice for a proposed two-factor RES: *self-confidence* and *self-efficacy*. These two factors were hypothesized to reflect internal psychological factors leading an individual to positively appraise its capacity to deal with an adversity. A team of clinicians and scholars with expertise in resilience and psychotrauma developed 10 new items for the Dutch version of the RES in several iterative sessions. The team did not use existing resilience scales in developing the 10 new RES items due to copyright regulations. In order to evaluate the RES, each team member filled out an evaluation form with open-ended questions on face validity, relevance, formulation, difficulty, and clarity for each RES item. In addition, overall suggestions or remarks about the RES and the RES instruction text were collected. The individual responses were then used in adapting the RES items, mostly in formulation, relevance and clarity. After multiple rounds of adaptations, re-evaluating the items within the team, and pilot testing with 10 trauma-exposed police officers, the Dutch version of the RES was established. Subsequently, the RES was translated by a certified translator (who fluently mastered Dutch and English) into English. Both versions were compared and evaluated within a team of Dutch- and English-speaking psychotrauma clinicians and scholars. Additional translation options were incorporated and back-translated by a psychotrauma expert who fluently mastered both Dutch and English. This back-translation was again evaluated within the team, and the best translation for each item was chosen. For this 10-item English version of the RES, see **Table 1**.

Items 1, 3, 5, 7, and 9 of the RES were hypothesized to reflect the subscale *self-confidence*, and items 2, 4, 6, 8, and 10 were hypothesized to reflect the subscale *self-efficacy*. All items carry a 5-point range of responses: completely disagree (0), disagree (1),

TABLE 1 | Geomin rotated factor loadings for the two-factor solution model of the RES with 10 and 9 items as estimated by EFA.

	2-factor solution 10 items		2-factor solution 9 items	
	F1	F2	F1	F2
1. I have confidence in myself	0.215*	0.729*	0.214*	0.729*
2. I can easily adjust in a difficult situation	0.794*	−0.050	0.795*	−0.048
3. I am able to persevere	0.643*	0.032	0.643*	0.026
4. After setbacks, I can easily pick up where I left off	0.792*	0.043	0.784*	0.032
5. I am resilient	0.828*	−0.001	0.840*	0.001
6. I can cope well with unexpected problems	0.773*	−0.061	0.773*	−0.056
7. I appreciate myself	−0.040	0.907*	−0.039	0.907*
8. I can handle a lot at the same time	0.614*	0.029	0.611*	0.028
9. I believe in myself	0.007	0.916*	0.007	0.916*
10. I am not easily discouraged	0.418*	0.308*		

Factor loadings greater than 0.60 are in bold. Model fit indices for the two-factor solution with 10 items: $\chi^2 = 125.615$, $df = 26$, $CFI = 0.982$, $TLI = 0.969$, $RMSEA = 0.086$. Model fit indices for the two-factor solution with 9 items: $\chi^2 = 98.418$, $df = 19$, $CFI = 0.985$, $TLI = 0.971$, $RMSEA = 0.089$; this model was selected as the model with the best factor solution. *Significant at 5% level.

neutral (2), agree (3) and completely agree (4). The total score can be computed by summing the individual item scores, and varies from 0 to 40, with higher scores indicating greater psychological resilience.

Procedure

This study was performed between 2014 and 2015. Separate online surveys were disseminated in an adult Dutch- and English-speaking group in the Netherlands and United States (U.S.) respectively. Both groups were drawn from the general (healthy) population. The surveys included demographic questions (age, gender, level of education and marital status), the 10-item RES, and a number of expected related constructs (see *Measures*). In the English-speaking group, the link to the survey was distributed via U.S. university online forums, social media and via personal social networks of an American researcher (author P. Dashtgard). The link to the Dutch online survey was distributed via newsletters, social media and e-mails to a network of social and behavioral scientists and clinicians, policy makers and college students. The links were accompanied by a short announcement about the purpose of the study and the target population (i.e., adults). The links were active for a period of 6 weeks in each country. Both surveys started with an introduction page which informed participants about the aim of the study and the estimated duration to complete the online survey. Also, contact details of the researchers were provided. In addition,

all participants were informed that their answers on the online survey would be used in the study, and if they started the survey, they provided consent to use their data. Furthermore, participants were informed that all the data would be treated as strictly confidential, saved in a secured database, and that only the researchers would have access to this database. The study was conducted in compliance with the standard principles of ethical research established by the Academic Medical Center (AMC) and the principles of the Declaration of Helsinki. The Medical Ethical Committee of the AMC exempted this study from formal review because the Medical Research Involving Human Subjects Act (WMO) did not apply to the study (participants were asked to complete one online survey and the psychological integrity of the participants was not in question).

Measures

The Dutch and English versions of the 25-item Resilience Scale (RS) were administered (31, 38). The RS is intended to measure the following five factors of resilience: equanimity (a balanced perspective of one's life and experiences), perseverance (being able to keep going despite difficulties), self-reliance (the belief in oneself and one's capabilities), meaningfulness (feeling that life has a purpose and life is valuable), and existential aloneness (sense of uniqueness, feeling of freedom). Following the rating instructions for the original versions of the RS, each item of the Dutch version is rated on a 4-point Likert scale ("1 = totally disagree" to "4 = totally agree"; total score ranging from 25 to 100) and each item of the English version is rated on a 7-point Likert scale ("1 = strongly disagree" to "7 = strongly agree"; total scores ranging from 25 to 175). Higher scores indicate greater resilience.

The Rosenberg Self-Esteem Scale (RSE) measures an individual's overall sense of being worthy as a person (43, 44). In both versions, the 10 items are rated on a 4-point Likert scale ("0 = strongly agree" to "3 = strongly disagree"). Higher scores reflect more self-esteem.

The General Self-Efficacy Scale (GSE) (45) is a 10-item questionnaire that measures optimistic self-beliefs to cope with stressful situations (45–47). Each item is rated on a 4-point Likert scale, ranging from "1 = completely incorrect" to "4 = completely correct" for the Dutch version, and "1 = not at all true" to "4 = exactly true" for the English version. Higher scores reflect greater general self-efficacy.

Respondents were asked to rate their current level of global functioning, considering both private life and work, on a 10-point Likert scale ("1 = extremely bad" to "10 = excellent").

For the Dutch-speaking sample, the 10-item Trauma Screening Questionnaire (TSQ) (48, 49) was used to screen for PTSD symptoms (re-experiencing and arousal symptoms). For each item, participants indicate whether or not (a score of 1 or 0 respectively) they had experienced the particular symptom at least twice in the past week. The total score ranges from 0 to 10, with higher scores indicating more PTSD symptoms. Since DSM-5 PTSD screening measures were available at the time we conducted our study in the English-speaking sample, the PTSD checklist for DSM-5 (PCL-5) was used (50). The PCL-5 is a self-report questionnaire assessing the 20 PTSD symptoms in the

past month and the following symptom clusters: re-experiencing; avoidance; negative alterations in cognitions and mood; and alterations in arousal and reactivity. Each item is rated on a 5-point Likert scale (“0 = not at all” to “4 = extremely”), resulting in a total score from 0 to 80, with higher scores reflecting more PTSD symptoms. The TSQ and PCL-5 were only administered if respondents indicated that they had experienced a PTE.

In the current study, the internal consistency of all the above-mentioned measures ranged from good to excellent. See **Table 2** for the Cronbach's α found in this study for all the administered measures.

Statistical Analyses

Differences in respondent characteristics between the two language groups were assessed by conducting Mann-Whitney *U*-tests (non-normally distributed variables), chi-square tests (categorical variables), or Fisher's exact tests (categorical variables with cell frequencies <5), using SPSS Version 23.

To determine the factor structure of the RES in the total sample, an *exploratory factor analysis* (EFA) with geomin rotation for ordinal data with the WLSMV estimator was conducted in Mplus version 7.3 (51). The WLSMV estimator is recommended in factor analytic procedures with categorical data (51). Exploratory factor analysis (EFA) was used to test the factor structure of the items of the RES. EFA was deemed the most useful strategy for this purpose because the RES is a novel measure for which new items were constructed which were not based on the items of existing scales. In addition, the RES is the first measure of psychological resilience. Therefore, no previously defined factor model for psychological resilience could be used and it should first be tested whether the constructed items were interpreted and conceptualized in the intended way. Due to low frequency of the first response category (i.e., “0 = completely disagree”) on some items of the RES, the two lowest

response categories were merged into one. An underlying normal distribution was assumed for each item, where the resulting four response categories were divided by three thresholds which were estimated from the data. Five models with one to five factor solutions were examined. Multiple parameters, i.e., Kaiser criterion (eigenvalue >1) and the model fit statistics comparative fit index (CFI), Tucker-Lewis Index (TLI), and root mean-square residual error of approximation (RMSEA) were used to assess the number of latent factors needed to adequately account for the correlations among item scores. The model with the optimal balance between model fit, parsimony, and conceptual interpretability was selected as the best factor solution.

Measurement invariance (MI) of the RES across the two language groups was examined in Mplus version 7.3 (51). Three levels of MI (i.e., configural, scalar and strict measurement invariance) were investigated by conducting a typical sequence of single and multigroup factor models using confirmatory factor analyses (CFA) with categorical factor indicators (40, 52, 53). In factor analytic models with categorical data, metric measurement invariance cannot be tested because factor loadings and thresholds can only be constrained in tandem (51). Factor models were estimated with the WLSMV estimator using the THETA parameterization. The first level of MI, *configural invariance*, implies that the underlying construct is conceptualized in a similar manner by respondents from different groups (42). Configural invariance is met when the same factor structure is valid across groups, but parameter estimates (i.e., factor loadings, thresholds, and residual variances) may vary across groups. Configural invariance was tested by fitting the best factor model derived from the EFA in a multiple group CFA for the total sample, wherein the factor loadings and thresholds were freely estimated across the language groups, and the residual variances were fixed at one in both groups. In addition, single group CFAs were fit for the two language groups separately. The

TABLE 2 | Spearman's rho correlations between the RES (total and subscale scores) and the positively and negatively related scales (total scores) and the internal consistency for all administered measures.

	RES total		RES self-efficacy		RES self-confidence		Cronbach's α	
	Dutch	English	Dutch	English	Dutch	English	Dutch	English
Resilience (RS)	0.62** (<i>n</i> = 274)	0.74** (<i>n</i> = 200)	0.54**	0.66**	0.51**	0.65**	0.843	0.909
Self-efficacy (GSE)	0.55** (<i>n</i> = 257)	0.73** (<i>n</i> = 162)	0.51**	0.70**	0.42**	0.58**	0.856	0.857
Self-esteem (RSES)	0.53** (<i>n</i> = 256)	0.71** (<i>n</i> = 155)	0.36**	0.53**	0.64**	0.81**	0.885	0.917
Global functioning ^a	0.47** (<i>n</i> = 214)	0.55** (<i>n</i> = 226)	0.37**	0.52**	0.39**	0.46**	–	–
PTSD symptoms: (TSQ or PCL-5) ^b	–0.22** (<i>n</i> = 171)	–0.39** (<i>n</i> = 77)	–0.20**	–0.26*	–0.16*	–0.47**	0.802	0.958

RES total, total score item 1–9; RES self-efficacy, total score of items 2, 3, 4, 5, 6, and 8; RES self-confidence, total score of items 1, 7 and 9. All depicted correlation coefficients are Spearman's rho correlation coefficients. **p* < 0.05, ***p* < 0.01.

^aThis item was placed as the second item in the English survey, and as the last item in the Dutch survey. There was missing data (*n* = unknown) on this item in the Dutch survey due to a technical error.

^bThe TSQ was administered in the Dutch-speaking sample, the PCL-5 was administered in English-speaking sample (only to respondents that indicated that they had experienced a stressful event in their life).

second level of MI, *scalar invariance*, entails that the strength of the relations between the items and the underlying construct is similar across groups, i.e., that individuals in different groups attribute the same meaning to the construct under study (42), and that cross-group comparisons of mean differences on the underlying construct are meaningful. Scalar invariance is met when, in addition to configural invariance, factor loadings and thresholds are equal across groups (40, 42), and was tested by fitting a multigroup CFA in which factor loadings and thresholds were constrained to be equal across groups, and the residual variances were fixed at one in the first group and freely estimated in the second group. The model fit of scalar invariance was compared with the model fit of the multigroup CFA representing configural invariance. When all thresholds and factor loadings are invariant across groups, scalar invariance holds. In case it does not hold, cross-group comparisons of latent (i.e., not observed) mean differences are still meaningful as long as scalar MI holds for at least two items (54). When scalar invariance does not hold, *partial scalar invariance* should be examined by studying the largest differences in thresholds and factor loadings between groups (40, 42). Partial scalar invariance was tested by releasing the constraints for the item with the largest between-group differences in thresholds and factor loadings, determined by scrutinizing the largest modification indices in the scalar invariance model. The model fit of partial scalar invariance was compared to the model fit of configural invariance.

Model fit of the single and multigroup CFAs was evaluated with the CFI, TLI, and RMSEA. For CFI and TLI, model fit is considered good if values are close to or larger than 0.95 (55). For the RMSEA, a value <0.05 indicates good model fit, a value between 0.05 and 0.08 suggests adequate model fit, a value between 0.08 and 0.10 indicates a mediocre model fit, and >0.10 indicates a poor fit (56). To compare the goodness-of-fit between the nested MI models, the χ^2 difference test and the difference in CFI values (<0.01) between nested models were used (57). The “difftest” option in Mplus was used for appropriate χ^2 difference testing with the WLSMV estimator (51). Because the χ^2 difference test is highly sensitive to sample size, it may reject models that actually fit the data (40, 57). It is recommended to interpret the χ^2 difference test by the ratio of the χ^2 value and the degrees of freedom (χ^2/df ratio). The nested model has a better fit than the more complex model if the ratio is less than 3 (58).

Convergent validity of the RES was examined by calculating the correlations between the RES total and subscale scores (as derived from the EFA) and the total scores of the following expected positively related measures: RS (resilience), RSES (self-esteem), GSE (general self-efficacy), and a single item measuring global functioning in the two languages groups separately. In addition, the total and subscale scores of the RES were correlated to the hypothesized negatively related total scores of the TSQ and PCL-5 (PTSD symptoms in the Dutch and English samples respectively). Because the RES scores followed a non-normal distribution, Spearman's rho correlations were used.

The *internal consistency* of the RES was assessed by obtaining the inter-item and item-total correlations, the Cronbach's α , and alpha if item deleted for the RES total scale and the two

subscales (as derived from the EFA) for the two language groups separately. A Cronbach's α of ≥ 0.90 indicates excellent internal consistency, a value between 0.90 and 0.80 reflects good internal consistency (59).

RESULTS

Respondent Characteristics

In total, 569 individuals responded to the online survey, of whom 92% ($n = 524$) completed the RES. The scores of two respondents were excluded due to an unreliable response pattern (in both cases, the same answer was given on all the items of different scales). **Table 3** presents the respondent characteristics and RES scores for the total sample ($n = 522$), and the Dutch ($n = 296$) and English ($n = 226$) subsample separately. The English group consisted of more female respondents than the Dutch group [$\chi^2_{(1)} = 8.973$, $p < 0.05$]. The English group was younger ($U = 19121.00$, $p < 0.001$), higher educated [$\chi^2_{(1)} = 12.535$, $p < 0.001$] and more often single than the Dutch group [$F_{(4)} = 63.551$, $p < 0.001$, **Table 3**]. The two language groups did not significantly differ in terms of the mean score on the total RES scale and the mean score on the RES subscale self-efficacy. The Dutch group had a higher mean score on the RES subscale self-confidence than the English group ($U = 29932.00$, $p < 0.05$).

Exploratory Factor Analysis

The EFA on the total sample yielded a two-factor solution as a good fit (based on the eigenvalues, CFI, TLI, and RSMEA values) for the 10 RES items with eigenvalues of 5.545 and 1.217 respectively. Eigenvalues of the third to tenth factor were all lower than one (0.696, 0.656, 0.565, 0.383, 0.348, 0.231, 0.191 and 0.167 respectively).

The CFI and TLI values of the two-factor solution indicated a good model fit, the RSMEA value reflected a mediocre model fit (**Table 1**). Item 10 cross-loaded significantly on both factors, with only a small difference between the two factor loadings ($\lambda = 0.110$), indicating that item 10 did not sufficiently distinguish between both factors (**Table 1**). Also, item 10 showed relatively low factor loadings on the first and second factor ($\lambda = 0.418$ and $\lambda = 0.308$ respectively), suggesting that this item did not considerably add to either factor. Therefore, the EFA was rerun without item 10, yielding a two-factor solution with eigenvalues of 5.098 and 1.210 respectively (eigenvalues of the third to tenth factor were lower than one, ranging from 0.169 to 0.670). The CFI and TLI indicated a good model fit, the RSMEA indicated a mediocre model fit (**Table 1**). All factor loadings on the two factors were significant and no cross-loadings were observed. This model, without item 10, was selected as the best factor solution. Factor 1 (items 2, 3, 4, 5, 6, 8) was termed “self-efficacy” and factor 2 (items 1, 7, 9) was labeled “self-confidence.” For the final 9-item version of the RES, see Appendix A.

Measurement Invariance

The two-factor solution with 9 items derived from the EFA was used for the MI analysis across the two language groups. **Table 4** presents the details of the performed models and model fitting

TABLE 3 | Respondent characteristics and RES scores.

	Total group (n = 522)	Dutch group (n = 296)	English group (n = 226)	Test-value	p
Female, n (%)	371 (71.1)	195 (65.9)	176 (77.9)	$\chi^2_{(1)} = 8.973$	<0.05
Age, mean (SD)	37.2 (13.04)	41.9 (13.7)	31 (8.9)	U = 19121.00	<0.001
Education, n (%) [*]				$\chi^2_{(1)} = 12.535$	<0.001
Low	71 (13.6)	54 (18.2)	17 (7.5)		
High	451 (86.4)	242 (81.8)	209 (92.5)		
Marital status, n (%)				$F_{(4)} = 63.551$	<0.001
Single	207 (39.7)	75 (25.3)	132 (58.4)		
Married/cohabitation	268 (51.3)	188 (63.5)	80 (35.4)		
Divorced	26 (5)	15 (5.1)	11 (4.9)		
Widow(er)	7 (1.3)	7 (2.4)	0 (0)		
Other	14 (2.7)	11 (3.7)	3 (1.3)		
RES					
Total score	25.76 (5)	25.95 (4.11)	25.52 (5.98)	U = 33043.50	0.81
Subscale self-efficacy	17.29 (3.48)	17.24 (2.98)	17.36 (4.05)	U = 31233.00	0.19
Subscale self-confidence	8.47 (2.18)	8.71 (1.80)	8.16 (2.57)	U = 29932.00	<0.05

RES total, total score item 1–9; RES self-efficacy, total score of items 2, 3, 4, 5, 6, and 8; RES self-confidence, total score of items 1, 7, and 9. ^{*}High level of education included higher professional education, university and graduate school. Low level of education included elementary, primary, middle and high school, lower and secondary professional education. p-values < 0.05 are in bold.

TABLE 4 | Model fitting results for each measurement invariance level of the RES across the English- and Dutch-speaking groups.

	vs.	χ^2	df	$\Delta\chi^2$	Δdf	χ^2/df	CFI	ΔCFI	TLI	RMSEA
1. Configural invariance: total sample	–	125.224	52	–	–	–	0.987	–	0.981	0.073
1a. Configural invariance: English language	–	68.352	26	–	–	–	0.987	–	0.981	0.085
1b. Configural invariance: Dutch language	–	57.336	26	–	–	–	0.986	–	0.981	0.064
2. Scalar invariance	1	197.990	75	75.614	23	3.29	0.977	–0.010	0.978	0.079
3. Partial scalar invariance	1	171.357	72	49.483	20	2.47	0.982	–0.005	0.982	0.073

Model 1: multigroup two-factor model with free estimation of thresholds and factor loadings across groups. Model 1a and 1b: two-factor model with free estimation of thresholds and factor loadings for each language group. Model 2: multigroup two-factor model with thresholds and factor loadings constrained to be equal across groups. Model 3: multigroup two-factor model with thresholds and factor loadings constrained to be equal across groups, except for item 4. The model with the best model fitting indices is printed in bold, partial scalar invariance holds. vs. = versus (the model of comparison). χ^2 , df = chi-square test statistic value and degrees of freedom. $\Delta\chi^2$, Δdf = chi-square test statistic value and degrees of freedom for chi-square difference test between two nested models. χ^2/df = ratio between χ^2 and degrees of freedom for the chi-square difference test. ΔCFI = CFI difference between two nested models.

results for each level of MI. In model 1, the CFI and TLI indicated good model fit, and the RMSEA suggested adequate model fit. In model 1a and 1b, the CFI and TLI also indicated good model fit, and the RMSEA a mediocre and acceptable model fit for the English and Dutch group respectively. Therefore, configural invariance is met for the RES across the two language groups. In model 2, the CFI and TLI represented a good model fit, and the RMSEA indicated adequate model fit. Although the difference in CFI between model 1 and 2 was acceptable, the χ^2/df ratio between model 1 and 2 suggested a worse fit of model 2 compared to model 1. Consequently, full scalar invariance did not hold, and partial scalar invariance was examined by studying potential between-group differences in thresholds and factor loadings. The modification indices indicated a substantial between-group difference in the thresholds of item 4. Model 3 tested a multigroup two-factor model, where thresholds and factor loadings were constrained to be equal across groups, except for item 4. The CFI and TLI of model 3 suggested a good model fit, and the RMSEA indicated adequate model fit.

The χ^2/df ratio and the difference in CFI indicated that the fit of model 3 was not worse compared to model 1. Model 3 was preferred over model 1 and 2, indicating that partial scalar invariance holds for the RES across the two language groups (Table 4).

Convergent Validity

Table 2 presents the correlations between the 9-item RES (total and subscale scores) and all hypothesized related questionnaires (total scores). There was a significant positive correlation between the RES scores and all hypothesized related constructs (i.e., resilience, self-efficacy, self-esteem, and global functioning) in both language groups (Table 2). The RES total score showed the highest positive correlation with the RS total score (resilience) in both groups. Also, a significant negative correlation was found between the RES total and subscale scores, and the total PTSD symptom scores in both groups.

Internal Consistency

Table 5 presents the internal consistency measures (Cronbach's alpha and the inter-item and item-total correlations) for the 9-item RES. Cronbach's alpha for the 9-item RES total and subscale scores was good in both language groups, and acceptable for the subscale *self-efficacy* in the Dutch group. Cronbach's α did not improve if items were deleted (this applied to the RES total scale and subscales in both groups).

DISCUSSION

This study demonstrates a two-factor structure and sound psychometric properties of a new, brief, freely available Dutch and English scale on psychological resilience, called the RES. The final 9-item RES consists of two underlying constructs of psychological resilience: *self-confidence* and *self-efficacy*. The Dutch- and English-speaking group interpreted and conceptualized the items and underlying constructs of the RES in the same manner, with the exception of one item. Furthermore, the RES showed good convergent validity, and good internal consistency.

The RES was developed to operationalize psychological resilience, and the secondary appraisal concept of the Lazarus and Folkman model on stress guided the choice for a proposed two-factor RES (i.e., *self-confidence* and *self-efficacy*), assessing psychological resilience. Indeed, EFA yielded the best factor solution for a model with two factors that reflected these hypothesized constructs. Item 10 "I am not easily discouraged" was removed from the scale because it did not substantially add to, and insufficiently differentiated between, both factors. Item 10 was a Dutch expression, with no direct English equivalent available. Therefore, the item potentially reflected different concepts in both versions of the RES, which in turn may have led to a different conceptualization of the item between the Dutch- and English-speaking group. Also, item 10 was the only item with a negation, which could increase the chance of misinterpretation (60).

A two-factor structure was found for the final 9-item version of the RES, with three items reflecting *self-confidence* and six items clustering on *self-efficacy*. Contrary to our hypothesis, item 3 "I am able to persevere" and item 5 "I am resilient" clustered on the construct *self-efficacy* instead of *self-confidence*.

On a conceptual level, being resilient and able to persevere could be interpreted as more closely related to behavior during difficulties, and therefore adaptive coping, rather than to a general positive belief in oneself, i.e., *self-confidence* (61). Also, based on face validity, the three RES items that were intended to and found to reflect *self-confidence* ("I have confidence in myself," "I appreciate myself," and "I believe in myself") seem to capture the construct *self-confidence* in a more direct and literal manner than item 3 and item 5. Furthermore, it should be noted that differentiating between the two constructs of psychological resilience is somewhat ambiguous because it is likely that beliefs of *self-confidence* and *self-efficacy* within psychological resilience are conceptually related, which may lead to challenges in strictly distinguishing the two constructs. This may potentially have contributed to the finding that two items clustered on the construct *self-efficacy* instead of *self-confidence*. Future work on the factor structure of the RES needs to further establish and replicate the current structure, as well elucidate as how these psychological resilience factors relate to or distinguish from other proposed resilience factors.

The MI analysis showed that the RES is partial scalar invariant across the two language groups. This means that the items and the constructs of psychological resilience as measured with the RES are interpreted and conceptualized in the same manner by individuals with a Dutch or English language background, with the exception of item 4 ("After setbacks, I can easily pick up where I left off"). This implies that cross-group comparisons of observed scale scores (i.e., result of summing the individual item scores) with regard to the RES partly reflect measurement bias instead of true underlying differences. Therefore, cross-group comparisons of observed scale scores are only meaningful when item 4 is discarded. This finding provides a great opportunity to compare the RES scores (without item 4) between Dutch and English groups on a global level, in research and in clinical practice. Interestingly, similar to item 10, item 4 is a Dutch saying, which could have led to differences in conceptualization and interpretation of the item between the two languages groups. The other eight items of the RES do not reflect a Dutch saying and had direct English equivalents.

The RES demonstrated good convergent validity. In both language groups, the RES total scale and subscales were positively associated with all the hypothesized related measures (i.e., resilience, self-esteem, self-efficacy, and global functioning).

TABLE 5 | Internal consistency of the RES (total score and subscale scores).

	Cronbach's α		Range inter-item correlation		Range item-total correlation	
	Dutch	English	Dutch	English	Dutch	English
RES						
Total score	0.825	0.898	0.122–0.665	0.318–0.751	0.370–0.653	0.539–0.738
Self-efficacy subscale	0.786	0.870	0.197–0.601	0.367–0.661	0.407–0.645	0.533–0.766
Self-confidence subscale	0.838	0.887	0.607–0.665	0.682–0.751	0.678–0.723	0.762–0.817

RES total = total score of item 1–9; RES self-efficacy = total score of items 2, 3, 4, 5, 6, and 8; RES self-confidence = total score of items 1, 7, and 9.

Furthermore, the confirmed negative correlation between the RES and PTSD symptoms in both language groups concurs with the previous finding that resilience buffers against PTSD symptoms (22–25). Of notice, the convergent validity and internal consistency values were higher in the English speaking group than in the Dutch speaking group. Further research is needed to shed some insight into potential explanations for this result.

Some limitations of the current study should be considered. Our sample consisted mostly of women and highly educated individuals, limiting generalizability to the general Dutch- and English-speaking population. Replication in other study samples is warranted with regard to a variety of sample characteristics, such as gender, education, language, culture, (high-risk) profession, and mental health status. A different PTSD measure was used in the Dutch- and the English-speaking group, limiting the comparison between groups on the relationship between psychological resilience and PTSD symptoms. Results on other specific psychometric properties of the RES such as the short- and long-term test-retest reliability, the robustness and stability of the RES scores, the relation between the RES and theoretically related scales such as the RSA and CD-RISC, and the discriminant validity of the RES are not investigated in this study, and should be examined in future research. A full structural equation modeling approach would be an interesting method in this regard, to simultaneously study the measurement model for the RES and the relationships with hypothesized related constructs. Also, longitudinal studies in healthy individuals, as well as in patients with psychological problems, could provide information on the sensitivity of the RES in capturing changes in psychological resilience over time, as well as the characteristics of the scale in observing reliable clinical change. Prospective longitudinal designs may broaden our understanding of the mechanisms underlying resilient outcomes, and the predictive validity of the RES on mental health after adversities in general. To note, the final 9-item RES is currently used and examined as one of the outcome measures in a randomized controlled trial on the effectiveness of a PTSD self-help tool in traumatized individuals (62). In addition, a Chinese translation of the RES is developed and the psychometric properties of this scale are currently investigated (63).

The current study has several important strengths. Studies on the MI of resilience scales are seriously lacking (9, 32), this study fills this gap by extensively investigating MI in two

language groups. Further, our sample was relatively large and the completion rate of the RES was very high, the latter reducing potential biases. Also, we used valid and reliable instruments to determine the validity of the RES. Moreover, the convergent validity of the RES was examined in the two groups separately (serving as replication samples), which strengthened the results regarding construct validity.

To conclude, the final 9-item RES is a valid, reliable, and valuable instrument that can be used in its current form on a large scale worldwide, both in research and in clinical practice. This study contributes to the urgent need for identifying and measuring distinct factors that affect mental health outcomes after trauma. The final 9-item RES can be freely used on a global level by individuals with a Dutch or English language background, and cross-group comparisons on the observed scores are meaningful (when item 4 is discarded). Scholars and clinicians are encouraged to use the final 9-item RES in other populations and research designs, hopefully replicating our finding that psychological resilience is a distinguishable construct, and strengthening the universal use of the RES. By giving ample attention to translation, adaptation and cross-cultural validation (as was done in this study), it will deepen our understanding of the factors that play a role in resilience and its potential determinants.

AUTHOR CONTRIBUTIONS

CvdM, HtB, AB, and MO designed the study. PD commented on the design of the study and collected data in the U.S. sample. HtB and CvdM collected data in the Dutch sample. CvdM and NvdA performed the statistical analyses. All authors commented on the statistical analyses. CvdM wrote the first draft of the manuscript and prepared the tables. All the authors contributed to the manuscript, and have approved the final version of the manuscript.

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APPENDIX A:

Final 9-Item English Version of the Resilience Evaluation Scale (RES)

RES instruction: Below you will find a number of statements about how you think about yourself and the way in which you usually respond to difficult situations. Please indicate to what extent each statement applies to you.

	Completely disagree	Disagree	Neutral	Agree	Completely agree
1. I have confidence in myself	0	1	2	3	4
2. I can easily adjust in a difficult situation	0	1	2	3	4
3. I am able to persevere	0	1	2	3	4
4. After setbacks, I can easily pick up where I left off	0	1	2	3	4
5. I am resilient	0	1	2	3	4
6. I can cope well with unexpected problems	0	1	2	3	4
7. I appreciate myself	0	1	2	3	4
8. I can handle a lot at the same time	0	1	2	3	4
9. I believe in myself	0	1	2	3	4

Mindfulness and Other Psycho-Social Resources Protective Against Mental Illness and Suicidality Among Gay Men

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Background: There is considerable evidence of health disparities among gay men characterized by higher levels of stress and distress. Psycho-social resources have been linked to numerous positive health outcomes and shown to act as buffers in the stress-distress pathway.

Methods: With data from the 3rd Geneva Gay Men's Health Survey carried out in 2011 using time-space sampling ($n = 428$), a relatively elaborate profile of 14 psycho-social resources—including mindfulness—is presented. Using their original scores, latent class analysis created an index variable dividing the respondents into meaningful groups. Psycho-social resources—the index variable as well as each resource individually—were then compared to two recent outcomes—i.e., serious mental illness in the past 4 weeks and short-term disability in the past 2 weeks—using a series of logistic regression models, controlling for all other psycho-social resources and socio-demographic confounders. To assess their potential role as buffers, a similar series of logistic regression models were erected using victimization and three outcomes—i.e., major depression, suicidal ideation, and suicide attempt—in the past 12 months.

Results: According to the latent class analyses, (1) 5.1% of this sample had a low level of psycho-social resources (i.e., one standard deviation (SD) below the group means), (2) 25.2% a medium-low level, (3) 47.4% a medium level (i.e., at the group means), and (4) 22.2% a high level of psycho-social resources (i.e., one SD above the group means). Psycho-social resources appeared to strongly protect against recent mental morbidity and buffer against the impact of victimization on major depression and suicidality in the past 12 months, reducing the adjusted odds ratios below statistical significance. The explained variance and the individual psycho-social resources which remained independent in the models differed for each outcome.

Conclusions: There may be disparities in several psycho-social resources among gay men, and as strong compensatory and protective factors, they may explain in part

the well-established disparities in stress and distress in this population. While multiple psycho-social resources should be promoted in this population, gay men under 25 years should receive particular attention as all three disparities are most pronounced in this age group.

Keywords: psycho-social resources, mindfulness, depression, suicidality, victimization, homosexuality

INTRODUCTION

Psycho-social resources have been linked to positive mental and physical health outcomes (1) and even reduced mortality in the general population (2), but since it has been shown that psycho-social resources are not distributed equally (1, 3), they may also help explain health disparities as important mediators and moderators for poor health outcomes (4). For example, mastery has been shown to mediate the relationship between sex (5), education (6), and poor physical health (7, 8) with depressive symptoms.

A review of the literature on stress and health has underscored the role of psycho-social resources such as mastery, self-esteem, and social support as key buffers in the stress-distress pathway (9). For example, longitudinal data from the Canadian National Population Health Survey (NPHS) established a link between mastery and social support with depression symptoms, but mastery was also shown to moderate and mediate the negative impact of stressors such as daily stress on depression symptoms (8). However, the review also noted the adverse coincidence of more acute and chronic stressors and fewer psycho-social resources among groups with lower social status (9).

Victimization constitutes a severe stressor which entails immediate psychological sequelae in both the general population (10) and sexual minorities (11), although research on its long-term effects has been equivocal (10). Victimization is significantly more prevalent among sexual minority adults and teens than their heterosexual counterparts (12–14). In Add Health—a longitudinal study of adolescent health in the US—victimization and same-sex attraction were independently associated with depressive symptoms and suicidality (15), but structural equation modeling with cross-sectional data from the Chicago Youth Risk Behavior Survey (YRBS) showed that victimization constitutes the pathway between sexual identity and suicidality (16).

A considerable international evidence base documents the increased risk of mental morbidity and suicidality among sexual minorities (17). Contributing to this evidence base (18, 19), previous findings from Switzerland have also revealed marked differences in underlying personality traits such as neuroticism which appear to account in part for the increased risk (19). This finding points to the potential relevance of other long-standing factors such as psycho-social resources, yet they remain relatively under-researched among sexual minorities (20).

Dispositional/trait mindfulness has been associated with other psycho-social resources—e.g., self-esteem, empathy, attention, cognitive reactivity, rumination, positive affect, life satisfaction, and vitality—long-standing personality traits—e.g., conscientiousness and neuroticism—as well as mental illness—e.g., depression and anxiety—and to a lesser extent

suicidality (21–23). Two population-based studies in Europe found that mindfulness scores for select facets differ by sex, age, education, and income (24, 25), but there have been no comparisons by sexual orientation to date. Only two recent studies have published mindfulness data on sexual minorities: a national online convenience sample of gay men aged 40 years and over in Australia (26, 27) and a national online convenience sample of Latino sexual minority youth aged 14–24 years in the US (28).

In accordance with efforts to conceive (29, 30) and present (31) a more complete view of mental health in a population beyond mental illness alone, we forward a relatively elaborate psycho-social profile (4) of gay men in order to characterize the psycho-social resources—including mindfulness—and their distribution in a probability sample of a stigmatized group with low social status, juxtapose them alongside well-established outcomes of mental illness and suicidality, and assess their potential role as buffers in the stress-distress pathway in a population with higher levels of both stress and distress.

METHODS

The third Geneva Gay Men's Health Survey (GGMHS) was carried out in 2011 with a focus on mental health literacy, mental illness, and suicidality, and the methods have been described in detail elsewhere (32).

Procedure

Briefly, the target population consisted of gay-identified men and other men who have sex with men who access meeting points—both real and virtual—in Geneva, Switzerland. All three waves employed time-space sampling, a multi-stage randomized sampling scheme developed by the US Centers for Disease Control and Prevention (CDC), involving mapping of meeting points, enumeration of visits, and random selection of both venues and participants (33, 34). Men were informed and invited to participate in a general health survey, and consenting respondents were given a unique access code to complete the anonymous survey in French either immediately at laptops provided on-site or later at a time of their own choosing online. In 2011, 486 gay men participated in the survey (response rate 38%), whereby 428 respondents have complete data for the variables used in this publication.

Measures

Fourteen psycho-social resources were included in the 2011 survey to yield a more complete picture of mental health and well-being, and they have been organized into 6 families to facilitate reader navigation in the tables.

Core self-evaluation includes 1) mastery and 2) internalized homophobia (aka acceptance of one's homosexuality). Mastery or self-efficacy was measured by the Sense of Mastery Scale (35) which includes 7 items measured on a 4-point scale, with the total score ranging from 7 to 28 (Cronbach's $\alpha = 0.79$). A key component of self-acceptance among gay men, self-acceptance of one's homosexuality was measured in part by the negatively valenced Internalized Homophobia Scale (IHP-R) (36, 37) which includes 5 items measured on a 5-point scale, with the total averaged score ranging from 1 to 5 (Cronbach's $\alpha = 0.85$).

Conative resources include 3) purpose in life, 4) hedonism, 5), altruism, 6) religion, and 7) spirituality. Representing a eudaimonic orientation, purpose in life was measured by one question from the life of meaning sub-scale in the Approaches to Happiness Questionnaire—"My life serves a higher purpose (has meaning)" (38)—measured on a 4-point scale. Hedonism was measured by one question representing the basic value hedonism in the Schwartz Value Scale (39)—"He seeks every chance he can to have fun. It is important to him to do things that give him pleasure."—measured on a 6-point scale. Altruism was measured by one question representing the basic value of benevolence in the Schwartz Value Scale (39)—"It's very important to him to help the people around him. He wants to care for their well-being."—measured on a 6-point scale. Religion and spirituality were each measured with one question from the Midlife in the US (MIDUS) survey (40)—"How important is [religion/spirituality] in your life?"—on a 4-point scale.

Cognitive resources include several skills targeted by mindfulness training and meditation—i.e., 8) mindful attention (aka acting with awareness), 9) pausing before reacting, and 10) non-rumination. Originally, the 5-item Mindfulness Attention Awareness Scale (MAAS) (41) was chosen to assess mindfulness and 2 items from the Freiburg Mindfulness Inventory (FMI) (42) to assess emotion management. However, reliability testing showed that a 4-item solution for the MAAS had slightly higher Cronbach's α (0.80) than the original 5-item scale, with the 4 core items targeting attention or acting with awareness. The 2 items selected from the FMI to assess emotion management had unacceptable internal consistency (Cronbach's $\alpha = 0.49$), but one item from the FMI about being easily lost in thoughts and feelings had good reliability with the excluded MAAS item about being preoccupied with the past or future to create an indicator for ordinary rumination (Cronbach's $\alpha = 0.69$) or rather "non-rumination" in keeping with the indirect assessment approach and positive coding of the MAAS. The single remaining item from the FMI pausing before reacting is kept as an indicator of emotional reactivity. All items were measured on a 6-point scale from the MAAS, yielding an averaged score from 1 to 6.

Affective resources include 11) positive affect and 12) life satisfaction. Positive affect (in the past 4 weeks) was assessed by the Mental Health Index (MHI-5; 5 items, standardized score from 0 to 100, Cronbach's $\alpha = 0.83$) from the Medical Outcomes Study (MOS) 36-Item Short-Form Health Survey (SF-36) (43). Recommended by the EUROHIS project on harmonizing indicators for health interview surveys in Europe (44), the MHI-5 includes items representing both positive and negative affect but is scored positively. Life satisfaction was

measured by a single question from the World Values Survey (45)—"All things considered, how satisfied are you with your life as a whole these days?"—on a 10-point scale.

Often considered a measure of positive mental health, 13) vitality, as measured by the Energy Vitality Index (EVI; 4 items, standardized score from 0 to 100, Cronbach's $\alpha = 0.78$) from the Medical Outcomes Study (MOS) 36-Item Short-Form Health Survey (SF-36) (43) and recommended by EUROHIS (44), is a psycho-somatic resource.

Social resources include 14) positive relations with others. EUROHIS (44) recommends the 3-item Oslo Social Support (OSS-3) scale (46). Given its poor internal consistency (Cronbach's $\alpha = 0.53$), however, two additional items on satisfaction with personal relationships and loneliness from the personal relationships facet of the WHOQOL-100 (47) were added to the OSS-3, yielding better internal consistency for a 5-item indicator on positive relations with others (standardized score from 0 to 100, Cronbach's $\alpha = 0.68$).

Several standard indicators of mental morbidity and suicidality were measured in this survey. The prevalences of these main health outcomes have already been reported (32).

Temporary Disability

Short-term disability (in the past 2 weeks)—i.e., reducing or stopping usual activities—was measured separately for physical and mental health, using a series of questions recommended by EUROHIS (44).

Serious Mental Illness

Serious mental illness (in the past 4 weeks) was measured using the K6 with 6 items describing negative affect and a cut-off point at 13 on a 0–24 scale (48).

Mental Illness

Depression and anxiety were assessed by a series of questions recommended by EUROHIS (44)—i.e., 1) self-reported history of chronic depression and anxiety taken from a standardized checklist of chronic conditions (49) modified to yield both 12-month and lifetime prevalences and 2) assessment of 12-month major depression by the WHO Composite International Diagnostic Interview Short Form (CIDI-SF) (50).

Suicidality

12-month and lifetime suicidality were measured using Paykel's items covering suicidal ideation ("Have you ever thought of taking your life, even if you would not really do it?"), suicide plans ("Have you ever reached the point where you seriously considered taking your life or perhaps made plans how you would go about doing it?"), and suicide attempt ("Have you ever made an attempt to take your life?") (51).

Victimization

A series of questions from the 1997 Swiss Health Survey (52) was adapted to yield 12-month and lifetime prevalences of verbal violence (insults and threats), physical violence, sexual harassment, rape, and robbery (in and outside the home), and the corresponding results from the 2002 and 2011 Geneva Gay Men's Health Surveys have been published in a local report (53).

Since most studies use a global index of victimization, anyone experiencing any of the aforementioned forms of violence in the past 12 months was considered a victim of violence.

Analysis

Seven of the 14 psycho-social resources involve scales with multiple items which were combined in accordance with their original scoring procedures, yielding scores in different ranges which have been maintained to facilitate comparison of these sample means with others. Their internal consistency was assessed by reliability testing. Improvements on two original scales were made for cognitive and social resources as detailed in the previous section. Pearson correlation coefficients were calculated for each of the 14 psycho-social resources with all the others, using a two-tailed test of significance.

Latent class/profile analysis was carried out to identify latent sub-groups of the respondents, according to their responses for all 14 psycho-social resources. Since there was no theoretically expected number of clusters, we planned an initial run of 1–6 classes given the relatively large number of indicators. The original intent was to account more precisely for different types of ordinal and continuous variables; however, such models had difficulty reaching convergence past 3 classes. By increasing the number of variables treated with Poisson and decreasing the number of variables treated as ordinal, workable models could be erected through 5 classes. Comparing the model fit statistics, a 4-class model was found to yield the lowest Bayes Information Criterion ($BIC = 23001.52$), together with the most interpretable and meaningful classes.

As no item response probabilities were generated for the continuous variables, analysis of variance (ANOVA) was carried out for each of the 14 psycho-social resources, generalizing the *t*-test for 4 classes with Tukey correction for multiple comparisons. These findings yielded analogous information on response patterns for each class and psycho-social resource, confirming both robust discrimination between classes and meaningful class membership.

In order to assess the relationship between the 4-class index of psycho-social resources and mental illness and suicidality health outcomes, ANOVA with Tukey correction was used once again for the continuous variables, while contingency tables and the chi-squared test were used for dichotomous variables.

Similar analyses with socio-demographic variables—i.e., place of residence, commune size, cohabitation, partnership status, age, nationality, education, employment status, and sexual identity—were carried out for health outcomes and psycho-social resources to identify potential confounders. Unemployed men demonstrated significantly poorer health outcomes and lower levels of psycho-social resources, as did the youngest men (<25 years). Upon closer examination, men under 25 years demonstrated the lowest levels of mindful attention, non-rumination, and positive affect.

A series of binary logistic regression models was erected in order to quantify and elucidate the relationship between psycho-social resources and common mental illness outcomes. In the first series, recent mental illness outcomes—i.e., serious mental illness in the past 4 weeks and short-term disability due

to mental/emotional problem in the past 2 weeks—were each taken as dependent variables and compared to current/recent levels of psycho-social resources. Since findings using the 4-class summary index of psycho-social resources were highly significant, similar analyses were performed using all 14 psycho-social resources as independent variables in order to identify the most relevant for each outcome. In Model 1, all 14 psycho-social resources were entered as a single block, thereby yielding adjusted odds ratios (AOR) for each psycho-social resource whilst simultaneously controlling for all the others. In Model 2, all 14 psycho-social resources were entered as a single block, followed by back-step elimination of select socio-demographic covariates—i.e., cohabitation, age, nationality, education, and employment status—thereby yielding AOR for each psycho-social resource whilst simultaneously controlling for all the others and any significant socio-demographic confounders. In Model 3, the most parsimonious logistic regression model was identified by back-step elimination of all 14 psycho-social resources and the aforementioned socio-demographic covariates, thereby yielding AOR for each significant psycho-social resource whilst simultaneously controlling for all other significant psycho-social resources and socio-demographic confounders. (NB: Due to the relatively small number of suicide attempts in the past 12 months, the only socio-demographic covariate included in Models 2–3 for this outcome was age).

Since the latent class solution for current/recent psycho-social resources appeared to distinguish strongly even for mental illness and suicidality outcomes in the past 12 months, we decided to explore potential mediation effects of psycho-social resources in the classic stressor-distress pathway. The stressor was any experience of victimization in the past 12 months, and the 3 distress outcomes were major depression (according to CIDI-SF), suicidal ideation, and suicide attempt in the same timeframe. For each outcome, a second series of 3 logistic regression models was carried out with victimization accompanying the 14 psycho-social resources in the single block in Models 1–2 and constituting the sole block entry variable in Model 3, thereby yielding AOR for victimization, adjusting for psycho-social resources and/or socio-demographic confounders. Data analysis was performed using IBM SPSS Statistics 23 and STATA 15 for PC.

RESULTS

Table 1 displays the mean scores with standard deviations of each of the 14 psycho-social resources according to the original scales and the simple correlations between them. Higher scores indicate a higher level of all psycho-social resources, except for internalized homophobia where higher scores indicate a lower level of self-acceptance of one's homosexuality. Since the scales for the cognitive and social resources have been altered for this publication, the means and standard deviation (SD) for the original 5-item MAAS (mean 4.23, *SD* 0.93) and the 3-item OSS (mean 9.80, *SD* 2.25) scales are presented for reference here. The mean scores will be compared with available population mean scores in the Discussion section. The correlation matrix

shows that most indicators are significantly correlated with each other at weak to moderate levels. Of note, altruism, religion, and spirituality are correlated weakly if at all with other indicators.

Since most of these indicators do not have cut-offs to facilitate interpretation, the respondents were grouped according to their scores for all 14 psycho-social resources into 4 distinct classes using latent class analyses: 1) 5.1% of this sample had a low level of psycho-social resources, 2) 25.2% a medium-low level, 3) 47.4% a medium level, and 4) 22.2% a high level of psycho-social resources.

In lieu of a standard item probability graph, **Table 2** presents the statistical comparison of mean scores for all 14 psycho-social resources by latent class. The respondents in each class differ significantly from all others along 7 indicators. The respondents' responses to altruism, religion, and spirituality do not distinguish between these classes at all. The means of the class with the medium level, which include nearly half the respondents, correspond neatly to the mean scores for the overall group for each indicator, making it a true intermediate group. For the class with a low level of psycho-social resources, most of their mean scores are more than one standard deviation below the medium (i.e., overall) group mean, whereas for the class with a high level of psycho-social resources, many of their mean scores are more than one standard deviation above the medium (i.e., overall) group mean.

Relationship Between Psycho-Social Resources and Mental Illness/Suicidality

Table 3 shows that the 4-class index based on the level of psycho-social resources appears to distinguish the respondents robustly along mental illness and suicidality, not just recent morbidity corresponding to the mostly implicit time frame of the responses for psycho-social resources, but also in the past 12 months and even lifetime. Along all indicators, respondents with a low level of psycho-social resources demonstrate the worst level of recent health (e.g., 90.9% with serious mental illness in the past 4 weeks), but also in the past 12 months (e.g., 68.2% with major depression) and lifetime (e.g., nearly half reporting a suicide attempt). Although respondents with a high level of psycho-social resources demonstrate modest levels of current and 12-month mental morbidity, a quarter reported depression and suicidal ideation and 9.5% a suicide attempt in their lifetime.

In **Table 4**, we examine the relationship between psycho-social resources and recent mental illness outcomes more closely, by looking at psycho-social resources both in classes and singly, with and without controlling for select socio-demographic variables. Looking at a screening variable for serious mental illness in the past 4 weeks, we see that 10 psycho-social resources are significantly protective, yet 2 of them are significant risk factors at the bivariable level: internalized homophobia (OR = 1.82, 95% CI 1.38–2.39) and religion (OR = 1.32, 95% CI 1.03–1.69). The strongest protective factors at the bivariable level are purpose in life (OR = 0.39, 95% CI 0.28–0.55), non-rumination (OR = 0.40,

95% CI 0.30–0.53), and mindful attention (OR = 0.43, 95% CI 0.28–0.55).

In Model 1 with the 4-class index (Nagelkerke r^2 0.54), respondents with higher levels of psycho-social resources are strongly protected against recent serious mental illness compared to those with low levels. In Model 1 with all 14 psycho-social resources as a block (Nagelkerke r^2 0.72), purpose in life (AOR = 0.39, 95% CI 0.21–0.73) and positive affect (AOR = 0.83, 95% CI 0.78–0.88) remain significantly protective at prior levels whereas religion becomes a stronger risk factor (AOR = 1.76, 95% CI 1.03–2.98). Controlling for socio-demographics in Model 2 does not change these findings; however, increasing age is independently protective (p = 0.04) with the 4-class index (Nagelkerke r^2 0.55) but not with the 14 psycho-social resources (Nagelkerke r^2 0.72). In Model 3 whereby variables are removed from Model 2 until the most parsimonious model is found (Nagelkerke r^2 0.71), the same three psycho-social resources from Models 1 and 2 remain significant, with increasing age remaining independently protective (p = 0.03).

As for the second outcome short-term disability due to mental/emotional problems in the past 2 weeks, 9 of the psycho-social resources are significantly associated with the outcome at the bivariable level, with all these resources being significantly protective except for internalized homophobia which is a significant risk factor (OR = 1.35, 95% CI 1.01–1.82). Among the significantly protective resources, mindful attention (OR = 0.51, 95% CI 0.39–0.69) and non-rumination (OR = 0.45, 95% CI 0.34–0.60) are once again the most strongly protective.

In Model 1 with the 4-class index (Nagelkerke r^2 0.26), respondents with medium and high levels of psycho-social resources are strongly protected against the outcome of short-term disability compared to those with low and medium-low levels (NB: no AOR generated for high category due to zero cases). In Model 1 with all 14 psycho-social resources as a block (Nagelkerke r^2 0.33), only positive affect remains significantly protective (AOR = 0.94, 95% CI 0.91–0.95), with most of the other resources moving toward parity. Controlling for socio-demographics in Model 2 does not change these findings, but increasing age is borderline protective (p = 0.07) with the 4-class index (Nagelkerke r^2 0.30) and independently protective (p = 0.002) with the block of 14 psycho-social resources (Nagelkerke r^2 0.33).

In Model 3 (Nagelkerke r^2 0.31), positive affect remains significantly protective (AOR = 0.93, 95% CI 0.92–0.95), with hedonism becoming a significant risk factor (AOR = 1.41, 95% CI 1.04–1.92) and religion a borderline significant risk factor (AOR = 1.31, 95% CI 0.97–1.78). Increasing age remains independently protective (p = 0.03). Since serious mental illness in the past 4 weeks itself may constitute a risk factor for short-term disability due to mental/emotional problems in the past 2 weeks, we added the former to Model 3 in a supplementary model (Nagelkerke r^2 0.32). Indeed, serious mental illness is a significant risk factor (AOR = 3.00, 95% CI 1.18–7.64), yet hedonism, positive affect, and age still remain independently significant at levels seen in Model 3.

TABLE 1 | Means, standard deviations, and zero-order correlations of psycho-social resources among gay men in Geneva, Switzerland, in 2011(*n* = 428).

Family	Variable	Range	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CORE SELF-EVALUATION																		
1	Mastery	7-28	20.54	3.56	—													
2	Internalized homophobia (aka acceptance of one's homosexuality)	1-5	1.84	0.89	-0.21***	—												
CONATIVE																		
3	Purpose in life	1-4	3.02	0.78	0.39***	-0.11*	—											
4	Hedonism	1-6	4.56	1.10	0.15**	-0.19***	0.18***	—										
5	Altruism	1-6	4.45	1.18	0.08	-0.10	0.18***	0.25***	—									
6	Religion	1-4	1.75	1.03	0.04	0.24***	0.20***	-0.03	0.08	—								
7	Spirituality	1-4	2.57	1.15	0.05	0.13**	0.15**	0.05	0.08	0.45***	—							
COGNITIVE																		
8	Mindful attention (aka acting w/ awareness)	1-6	4.42	0.96	0.39***	-0.21***	0.18***	0.03	0.06	0.07	0.02	—						
9	Pausing before reacting (aka emotional reactivity)	1-6	3.63	1.20	0.48***	-0.17***	0.21***	-0.02	-0.07	-0.01	-0.07	0.55***	—					
10	Non-rumination	1-6	4.13	1.18	0.24***	-0.003	0.22***	0.10*	0.10*	0.08	0.14**	0.16**	0.10*	—				
AFFECTIVE																		
11	Positive affect	0-100	66.10	17.61	0.55***	-0.27***	0.32***	0.14**	0.05	-0.04	0.02	0.43***	0.51***	0.19***	—			
12	Life satisfaction	1-10	7.24	1.95	0.53***	-0.35***	0.41***	0.18***	0.02	0.06	0.02	0.36***	0.39***	0.14**	0.59***	—		
PSYCHO-SOMATIC																		
13	Vitality	0-100	58.63	17.09	0.46***	-0.19***	0.32***	0.20***	0.02	-0.01	0.02	0.34***	0.40***	0.18***	0.66***	0.50***	—	
SOCIAL																		
14	Positive relations with others	0-100	64.29	18.92	0.52***	-0.24***	0.38***	0.16**	0.11*	0.05	-0.03	0.28***	0.38***	0.19***	0.52***	0.60***	0.43***	—

p* < 0.05, *p* < 0.01, *** *p* < 0.001.

TABLE 2 | Latent class model as characterized by psycho-social resources among gay men in Geneva, Switzerland, in 2011 (n = 428).

Family	Variable	Range	Mean	SD	Psychosocial resources				Statistical significance
					Low (L)	Medium-low (LM)	Medium (M)	High (H)	
					Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
CORE SELF-EVALUATION									
1	Mastery	7–28	20.5	3.58	15.3 (3.92)	18.4 (3.13)	20.7 (2.68)	23.7 (2.58)	L < LM < M < H***
2	Internalized homophobia (aka acceptance of one's homosexuality)	1–5	1.84	0.90	2.50 (0.96)	2.15 (1.08)	1.75 (0.80)	1.54 (0.67)	L LM > M H*
CONATIVE									
3	Purpose in life	1–4	3.01	0.79	2.41 (0.67)	2.68 (0.85)	3.05 (0.74)	3.43 (0.58)	L LM < M < H**
4	Hedonism	1–6	4.43	1.18	3.55 (1.68)	4.38 (1.10)	4.52 (1.11)	4.52 (1.18)	L < LM M H*
5	Altruism	1–6	4.58	1.09	4.45 (1.54)	4.58 (1.04)	4.54 (1.05)	4.67 (1.11)	
6	Religion	1–4	1.75	1.03	1.82 (1.01)	1.70 (1.04)	1.78 (1.00)	1.74 (1.10)	
7	Spirituality	1–4	2.57	1.15	2.55 (1.14)	2.47 (1.16)	2.64 (1.12)	2.57 (1.22)	
COGNITIVE									
8	Mindful attention (aka acting w/ awareness)	1–6	4.42	0.96	3.42 (1.08)	3.96 (0.96)	4.44 (0.78)	5.18 (0.69)	L < LM < M < H*
9	Pausing before reacting (aka emotional reactivity)	1–6	4.14	1.18	3.50 (1.23)	3.95 (1.13)	4.07 (1.12)	4.63 (1.18)	L LM M < H**
10	Non-rumination	1–6	3.65	1.20	2.32 (0.85)	2.95 (0.96)	3.60 (1.04)	4.85 (0.75)	L < LM < M < H*
AFFECTIVE									
11	Positive affect	0–100	66.2	17.7	27.1 (13.7)	50.4 (9.81)	70.5 (9.00)	84.2 (8.82)	L < LM < M < H***
12	Life satisfaction	1–10	7.23	1.94	3.91 (2.39)	5.99 (1.90)	7.59 (1.37)	8.65 (1.03)	L < LM < M < H***
PSYCHO-SOMATIC									
13	Vitality	0–100	58.6	16.8	18.2 (11.0)	47.2 (10.6)	61.3 (9.86)	75.2 (9.47)	L < LM < M < H***
SOCIAL									
14	Positive relations with others	0–100	64.6	18.6	36.6 (18.3)	53.1 (16.2)	66.7 (14.9)	79.8 (12.0)	L < LM < M < H***

SD, standard deviation; NB, multiple pair-wise comparisons with Tukey's test correction in ANOVA, with highest significant p value indicated. *p < 0.05, **p < 0.01, ***p < 0.001.

TABLE 3 | Overall health, mental illness, and suicidality by latent classes of psycho-social resources among gay men in Geneva, Switzerland, in 2011 (*n* = 428).

Family	Variable	Psychosocial resources				Statistical significance
		Low (L) mean (SD) or %	Medium-low (LM) mean (SD) or %	Medium (M) mean (SD) or %	High (H) mean (SD) or %	
SUBJECTIVE GLOBAL HEALTH						
	Subjective global health (1–5)	3.14 (1.17)	3.98 (0.61)	4.20 (0.69)	4.56 (0.52)	L < LM < M < H***
	Subjective global health (5 very good)	9.1	16.7	33.5	56.8	<0.001
SHORT-TERM DISABILITY						
	Short-term disability due to physical health / illness < 2 wks	22.7	16.7	13.3	6.3	0.08
	Short-term disability due to mental health / illness < 2 wks	36.4	27.8	5.9	0.0	<0.001
NEGATIVE AFFECT						
	Serious mental illness < 4 wks (0–24)	16.7 (3.34)	11.23 (3.33)	6.65 (2.71)	3.79 (2.74)	L > LM > M > H**
	Serious mental illness < 4 wks (>13)	90.9	32.4	1.5	1.1	<0.001
	Major depression < 12 mon	68.2	26.9	4.9	2.1	<0.001
	Self-reported depression < 12 mon	54.5	26.9	5.4	4.2	<0.001
	Self-reported anxiety < 12 mon	50.0	25.9	5.4	0.0	<0.001
	Self-reported depression lifetime	77.2	69.4	40.9	27.4	<0.001
	Self-reported anxiety lifetime	81.8	50.9	27.1	9.5	<0.001
SUICIDALITY						
	Suicidal ideation < 12 mon	72.7	32.4	8.9	2.1	<0.001
	Suicide attempt < 12 mon	18.2	3.7	0.0	0.0	<0.001
	Suicidal ideation lifetime	86.4	66.7	43.8	28.4	<0.001
	Suicide attempt lifetime	45.5	28.7	9.4	9.5	<0.001

SD, standard deviation. NB: multiple pair-wise comparisons with Tukey's test correction in ANOVA, with highest significant *p* value indicated - **p* < 0.05, ***p* < 0.01, ****p* < 0.001.

TABLE 4 | Recent mental illness outcomes by psycho-social resources among gay men in Geneva, Switzerland, in 2011 ($n = 428$).

Family	Variable	Serious mental illness < 4 wks (score >13)			Short-term disability due to mental health/illness < 2 wks				
		OR	Model 1 AOR	Model 2 AOR	Model 3 AOR	OR	Model 1 AOR	Model 2 AOR	Model 3 AOR
PSYCHO-SOCIAL RESOURCES (INDIVIDUALLY)									
Core self-evaluation									
1	Mastery	0.74 (0.67–0.81)***	1.05 (0.89–1.24)	1.05 (0.89–1.24)		0.87 (0.81–0.95)**	1.12 (0.99–1.27)	1.10 (0.97–1.25)	
	Internalized homophobia (aka acceptance of one's homosexuality)	1.82 (1.38–2.39)***	1.17 (0.69–1.98)	1.17 (0.69–1.98)		1.35 (1.01–1.82)*	0.93 (0.62–1.38)	0.91 (0.61–1.35)	
Conative									
3	Purpose in life	0.39 (0.28–0.55)***	0.39 (0.21–0.73)**	0.39 (0.21–0.73)**	0.39 (0.22–0.71)**	0.64 (0.45–0.90)*	0.82 (0.49–1.35)	0.80 (0.48–1.32)	
4	Hedonism	0.80 (0.64–1.00)*	1.21 (0.80–1.82)	1.21 (0.80–1.82)		1.13 (0.87–1.46)	1.37 (0.99–1.90)	1.31 (0.94–1.83)	1.41 (1.04–1.92)*
5	Altruism	1.08 (0.84–1.39)	1.38 (0.89–2.13)	1.38 (0.89–2.13)		1.31 (0.98–1.75)	1.22 (0.87–1.70)	1.20 (0.86–1.67)	
6	Religion	1.32 (1.03–1.69)*	1.76 (1.03–2.98)*	1.76 (1.03–2.98)*	2.04 (1.30–3.18)**	1.20 (0.92–1.58)	1.21 (0.83–1.77)	1.28 (0.87–1.89)	1.31 (0.97–1.78)
7	Spirituality	1.16 (0.91–1.48)	1.34 (0.83–2.19)	1.34 (0.83–2.19)		1.15 (0.89–1.50)	1.12 (0.80–1.59)	1.13 (0.80–1.60)	
Cognitive									
8	Mindful attention (aka acting w/ awareness)	0.43 (0.32–0.57)***	0.78 (0.43–1.40)	0.78 (0.43–1.40)		0.51 (0.39–0.69)***	0.85 (0.56–1.28)	0.84 (0.56–1.28)	
9	Pausing before reacting (aka emotional reactivity)	0.71 (0.57–0.89)**	0.81 (0.53–1.23)	0.81 (0.53–1.23)		0.90 (0.71–1.14)	0.99 (0.73–1.34)	1.01 (0.74–1.38)	
10	Non-rumination	0.40 (0.30–0.53)***	1.16 (0.67–2.01)	1.16 (0.67–2.01)		0.45 (0.34–0.60)***	0.75 (0.50–1.14)	0.81 (0.53–1.22)	
Affective									
11	Positive affect	0.84 (0.81–0.88)***	0.83 (0.78–0.88)***	0.83 (0.78–0.88)***	0.84 (0.78–0.88)***	0.94 (0.92–0.95)***	0.94 (0.91–0.96)***	0.94 (0.91–0.97)***	0.93 (0.92–0.95)***
12	Life satisfaction	0.57 (0.49–0.66)***	0.96 (0.73–1.25)	0.96 (0.73–1.25)		0.69 (0.61–0.79)***	0.86 (0.68–1.09)	0.85 (0.67–1.08)	
Psycho-somatic									
13	Vitality	0.92 (0.90–0.94)***	0.99 (0.95–1.02)	0.99 (0.95–1.02)		0.95 (0.94–0.97)***	1.00 (0.97–1.02)	1.00 (0.97–1.02)	
Social									
14	Positive relations with others	0.94 (0.93–0.96)***	1.01 (0.97–1.04)	1.01 (0.97–1.04)		0.97 (0.96–0.98)***	1.01 (0.99–1.04)	1.01 (0.99–1.04)	
PSYCHO-SOCIAL RESOURCES (LATENT CLASSES)									
4-class model									
	Low	—	—	—		—	—	—	
	Medium-low	0.05 (0.01–0.22)***	0.05 (0.01–0.24)***	0.05 (0.01–0.24)***		0.67 (0.26–1.77)	0.95 (0.35–2.56)		
	Medium	0.002 (0.000–0.01)***	0.002 (0.000–0.01)***	0.002 (0.000–0.01)***		0.11 (0.04–0.31)***	0.14 (0.05–0.42)***		
	High	0.001 (0.000–0.01)***	0.001 (0.000–0.01)***	0.001 (0.000–0.01)***		NA	NA		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

OR, odds ratio; AOR, adjusted odds ratios; NA, not available due to zero in the cells.

Model 1: 2 separate logistic regression models: a) all 14 psycho-social resources in one block and b) latent classes in one block.

Model 2: 2 separate logistic regression models controlling for socio-demographic covariates: a) all 14 psycho-social resources in one block and b) latent classes in one block.

Model 3: Most parsimonious logistic regression model controlling for socio-demographic covariates, starting with all 14 psycho-social resources.

Psycho-Social Resources Protective in Stress-Distress Pathway

Table 5 examines the impact of a stressor—i.e., victimization—on three outcomes of distress—i.e., major depression, suicidal ideation, and suicide attempt in the past 12 months—and explores potential mediation by psycho-social resources using a similar approach as in **Table 4**. At the bivariable level, victimization is a significant risk factor for major depression ($OR = 2.24$, 95% CI 1.26–4.00). However, entering the 4-class index into the model shows that higher levels of psycho-social resources are independently and strongly protective and pushes the AOR for victimization toward parity, thereby losing statistical significance ($AOR = 1.79$, 95% CI 0.92–3.47; Nagelkerke r^2 0.33), similarly after adjusting for socio-demographics ($AOR = 1.59$, 95% CI 0.81–3.14; Nagelkerke r^2 0.35). Looking at potential mediation by psycho-social resources singly in simple logistic regression models, non-rumination ($AOR = 0.43$, 95% CI 0.32–0.57), positive affect ($AOR = 0.93$, 95% CI 0.91–0.94), vitality ($AOR = 0.94$, 95% CI 0.92–0.95), and positive relations with others ($AOR = 0.95$, 95% CI 0.94–0.97) are each independently protective and decrease the AOR for victimization below statistical significance.

In Model 1 with all 14 psycho-social resources as a block (Nagelkerke r^2 0.42), mindful attention ($AOR = 0.61$, 95% CI 0.40–0.94), positive affect ($AOR = 0.95$, 95% CI 0.92–0.98), and vitality ($AOR = 0.97$, 95% CI 0.95–1.00) remain independently protective factors, with mastery ($AOR = 1.14$, 95% CI 1.00–1.30) flipping from being a protective to an independent risk factor. However, just as in the analyses with the 4-class index, the AOR for victimization decreases and loses statistical significance ($AOR = 1.61$, 95% CI 0.78–3.33). Controlling for socio-demographics in Model 2 does not change these findings one bit (Nagelkerke r^2 0.42). In Model 3 (Nagelkerke r^2 0.40), mindful attention ($AOR = 0.59$, 95% CI 0.41–0.84), positive affect ($AOR = 0.95$, 95% CI 0.93–0.98), and vitality ($AOR = 0.97$, 95% CI 0.95–1.00) remain independently protective factors which decrease the impact of victimization ($AOR = 1.54$, 95% CI 0.76–3.13) on major depression in the past 12 months below statistical significance.

Victimization is not a significant risk factor for suicidal ideation in the past 12 months at the bivariable level ($OR = 1.41$, 95% CI 0.82–2.43), and adding psycho-social resources—which are significantly protective factors in both 4-class index and single permutations—to the models just moves the AOR for victimization to parity. In Model 3 (Nagelkerke r^2 0.40), religion ($AOR = 0.69$, 95% CI 0.49–0.98), mindful attention ($AOR = 0.70$, 95% CI 0.48–1.01), pausing before acting ($AOR = 0.72$, 95% CI 0.55–0.95), non-rumination ($AOR = 0.65$, 95% CI 0.46–0.92), positive affect ($AOR = 0.96$, 95% CI 0.94–0.98), and life satisfaction ($AOR = 0.82$, 95% CI 0.69–0.97) all protect independently from suicidal ideation in the past 12 months, as does increasing age ($p = 0.04$).

Victimization is a strong risk factor for suicide attempt in the past 12 months at the bivariable level ($OR = 4.58$, 95% CI 1.08–19.5). Introducing the 4-class index into the model, higher levels of psycho-social resources remain independently

and strongly protective (NB: no AOR generated for medium and high categories due to zero cases) and decrease the AOR for victimization below statistical significance ($AOR = 3.31$, 95% CI 0.72–15.3; Nagelkerke r^2 0.36). Adjusting for age pushes the AOR for victimization even lower and increases the variance explained ($AOR = 2.14$, 95% CI 0.44–10.4; Nagelkerke r^2 0.44). Looking at the mediation effect of psycho-social resources singly, the 8 psycho-social resources which are significantly protective for suicide attempt each push victimization toward parity, thereby losing statistical significance.

In Model 1 with all 14 psycho-social resources as a block (Nagelkerke r^2 0.56), the AOR for victimization drops to 2.27 (95% CI 0.27–19.3), with positive affect remaining a protective factor ($AOR = 0.90$, 95% CI 0.82–0.99) and internalized homophobia ($AOR = 4.41$, 95% CI 1.14–17.0) and purpose in life ($AOR = 5.59$, 95% CI 1.06–29.4) as strong risk factors. Adjusting for age in Model 2 (Nagelkerke r^2 0.61), victimization drops to near parity ($AOR = 1.13$, 95% CI 0.09–14.5) with only internalized homophobia ($AOR = 4.47$, 95% CI 1.01–19.9) remaining as a significant risk factor. In the most parsimonious Model 3 (Nagelkerke r^2 0.51), internalized homophobia ($AOR = 2.73$, 95% CI 1.12–6.64) remains a significant risk factor at bivariable levels, but mastery ($AOR = 0.66$, 95% CI 0.51–0.86) and spirituality ($AOR = 0.39$, 95% CI 0.15–0.98) become independently protective factors, together with increasing age ($p = 0.01$).

DISCUSSION

This relatively elaborate profile of psycho-social resources presents a more complete picture of gay men's mental health than has been available to date based on psychiatric symptoms and morbidity alone. Using their own scores, men were grouped into meaningful classes with (relatively) low, medium, or high levels of psycho-social resources. This 4-class index of current/recent psycho-social resources appears to be remarkably robust in distinguishing the gay male sample along multiple mental illness and suicidality outcomes in the past 2–4 weeks, in the past 12 months, and lifetime, with logistic regression models underscoring the association between psycho-social resources and mental morbidity (1). Of note, psycho-social resources appear to buffer the effects of serious stressors such as victimization in leading to distressful outcomes such as major depression and suicide attempt in the past 12 months.

Psycho-Social Resources Associated With Mental Illness and Suicidality

Individually, most psycho-social resources are consistently protective against multiple mental illness and suicidality outcomes in bivariable analyses. The dramatic reduction in the number of independently protective psycho-social resources when moving from bivariable to multivariable analyses suggests possible inter-relationships which require closer examination. While psycho-social resources explain a considerable proportion of variance in the logistic regression

TABLE 5 | Major depression and suicidality by victimization in the past 12 months and current psycho-social resources among gay men in Geneva, Switzerland, in 2011 ($n = 428$).

Family Variable	Major depression < 12 months			Suicidal ideation < 12 months			Suicide attempt < 12 months		
	(AOR)	Model 1 AOR	Model 2 AOR	Model 3 AOR	(AOR)	Model 1 AOR	Model 2 AOR	Model 3 AOR	Model 3 AOR
PSYCHO-SOCIAL RESOURCES (INDIVIDUALLY)									
Core self-evaluation									
1 Mastery	0.82 (0.75–0.89)***	1.14 (1.00–1.30)*	1.14 (1.00–1.30)*		0.77 (0.71–1.99)***	1.04 (0.93–1.16)	1.05 (0.93–1.17)	0.66 (0.54–0.81)***	0.66 (0.51–0.86)***
2 Internalized homophobia (aka acceptance of one's homosexuality)	1.45 (1.09–1.94)*	0.99 (0.66–1.48)	0.99 (0.66–1.48)		1.43 (1.10–1.86)**	1.01 (0.70–1.47)	1.00 (0.69–1.46)	2.31 (1.24–4.29)**	2.73 (1.12–6.64)*
Conative									
3 Purpose in life	0.56 (0.40–0.78)**	0.99 (0.61–1.62)	0.99 (0.61–1.62)		0.50 (0.33–0.63)***	0.86 (0.56–1.32)	0.89 (0.58–1.36)	0.56 (0.26–1.20)	5.59 (1.06–29.4)*
4 Hedonism	0.87 (0.69–1.10)	1.15 (0.84–1.58)	1.15 (0.84–1.58)		0.88 (0.72–1.09)	1.14 (0.86–1.52)	1.15 (0.87–1.53)	0.67 (0.38–1.16)	1.70 (0.65–4.46)
5 Atrulism	0.98 (0.75–1.27)	0.99 (0.71–1.38)	0.99 (0.71–1.38)		0.83 (0.66–1.02)	0.80 (0.59–1.08)	0.79 (0.59–1.08)	0.76 (0.41–1.42)	0.84 (0.34–2.05)
6 Religion	0.90 (0.68–1.20)	0.84 (0.55–1.28)	0.84 (0.55–1.28)		0.77 (0.58–1.02)	0.69 (0.47–1.03)	0.69 (0.46–1.04)	0.46 (0.14–1.50)	0.18 (0.03–1.23)
7 Spirituality	0.96 (0.75–1.23)	0.98 (0.70–1.37)	0.98 (0.70–1.37)		0.96 (0.77–1.20)	1.07 (0.79–1.44)	1.04 (0.77–1.42)	0.61 (0.32–1.19)	0.33 (0.09–1.20)
Cognitive									
8 Mindful attention (aka acting w/ awareness)	0.39 (0.28–0.54)***	0.61 (0.40–0.94)*	0.61 (0.40–0.94)*	0.59 (0.41–0.84)**	0.40 (0.30–0.54)***	0.69 (0.46–1.01)	0.68 (0.46–1.01)	0.43 (0.23–0.79)**	1.20 (0.33–4.42)
9 Pausing before reacting (aka emotional reactivity)	0.72 (0.57–0.91)**	0.81 (0.59–1.12)	0.81 (0.59–1.12)		0.68 (0.55–0.84)***	0.74 (0.56–0.99)*	0.72 (0.54–0.97)*	0.75 (0.43–1.31)	0.87 (0.42–1.81)
10 Non-rumination	0.43 (0.32–0.57)***	0.73 (0.47–1.13)	0.73 (0.47–1.13)		0.41 (0.31–0.54)***	0.66 (0.45–0.95)*	0.63 (0.43–0.92)*	0.36 (0.17–0.75)**	1.04 (0.28–3.95)
Affective									
11 Positive affect	0.93 (0.91–0.94)***	0.95 (0.92–0.98)**	0.95 (0.92–0.98)**	0.95 (0.93–0.98)***	0.94 (0.92–0.95)***	0.96 (0.94–0.99)**	0.96 (0.93–0.99)**	0.92 (0.89–0.96)***	0.90 (0.82–0.99)*
12 Life satisfaction	0.65 (0.56–0.75)***	0.98 (0.77–1.24)	0.98 (0.77–1.24)		0.61 (0.54–0.70)***	0.85 (0.70–1.05)	0.86 (0.70–1.05)	0.59 (0.44–0.78)**	0.88 (0.47–1.67)
Psycho-somatic									
13 Vitality	0.94 (0.92–0.95)***	0.97 (0.95–1.00)*	0.97 (0.95–1.00)*	0.97 (0.95–1.00)*	0.95 (0.94–0.97)***	1.00 (0.98–1.02)	1.00 (0.97–1.02)	0.95 (0.92–0.98)**	1.05 (0.98–1.12)
Social									
14 Positive relations with others	0.95 (0.94–0.97)***	0.98 (0.96–1.01)	0.98 (0.96–1.01)		0.95 (0.94–0.97)***	0.99 (0.96–1.01)	0.99 (0.96–1.01)	0.94 (0.91–0.98)**	0.99 (0.92–1.06)
PSYCHO-SOCIAL RESOURCES (LATENT CLASSES)									
4-class model									
Low	—	—	—	—	—	—	—	—	—
Medium-low	0.17 (0.06–0.45)***	0.21 (0.08–0.58)**	0.21 (0.08–0.58)**		0.18 (0.07–0.50)**	0.19 (0.07–0.56)**	0.19 (0.07–0.56)**	0.16 (0.04–0.73)*	0.25 (0.05–1.16)
Medium	0.03 (0.008–0.08)***	0.03 (0.01–0.09)***	0.03 (0.01–0.09)***		0.04 (0.01–0.11)**	0.04 (0.01–0.11)**	0.04 (0.01–0.11)**	NA	NA
High	0.01 (0.002–0.06)***	0.01 (0.003–0.08)***	0.01 (0.003–0.08)***		0.008 (0.001–0.04)***	0.009 (0.002–0.05)***	0.009 (0.002–0.05)***	NA	NA
STRESSOR									
Victimization < 12 months									
bivariate	2.24 (1.26–4.00)**	1.61 (0.78–3.33)	1.61 (0.78–3.33)	1.54 (0.76–3.13)	1.41 (0.82–2.43)	0.92 (0.46–1.83)	1.05 (0.52–2.12)	4.58 (1.08–19.5)*	2.27 (0.27–19.3)
multivariate with psycho-social resources individually									1.13 (0.09–14.5)
multivariate with psycho-social resources in latent classes									2.14 (0.44–10.4)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

OR, odds ratio; AOR, adjusted odds ratios; NA, not available due to zero in the cells.

Model 1: 2 Separate logistic regression models with victimization: (a) All 14 psycho-social resources in one block and (b) latent classes in one block.

Model 2: 2 Separate logistic regression models with victimization controlling for socio-demographic covariates: (a) All 14 psycho-social resources in one block and (b) latent classes in one block.

Model 3: Most parsimonious logistic regression model with victimization controlling for socio-demographic covariates, starting with all 14 psycho-social resources.

models, the percentage varies considerably depending on the outcome. By examining multiple psycho-social resources and multiple mental morbidity outcomes, distinctive results for each of the five outcomes of mental illness and suicidality belie simplistic generalizations.

Positive affect as measured by the MHI-5 is a consistent, independent protective factor for four of the five outcomes, and since it is also the indicator closest to those for mental illness, its relationship to other psycho-social resources may be a good place to start examining inter-relationships. The importance of positive affect in the models with mental morbidity outcomes is supported by a large body of evidence that mood and anxiety disorders are characterized in part by deficiencies in positive affect (54) and that positive affect may protect against mental illness directly via physiological systems but also indirectly via improved cognitive resources (1, 55).

The two cognitive resources related to mindfulness—attention and non-rumination—are consistently the most strongly protective factors across all outcomes and remain independently protective for major depression and suicidal ideation in the past 12 months. In the literature, dispositional mindfulness has been shown to mediate the relationship between neuroticism and depressive symptoms / psychological distress (21–23) which may be particularly relevant given the role of neuroticism in mental illness and suicidality among sexual minority men (19). However, it is unclear why the independent effects do not apply to recent non-specific mental morbidity outcomes. Although higher mindfulness was associated with lower psychological distress in the past 4 weeks, a longitudinal study among gay men aged 40 years and over showed that dispositional mindfulness did not predict psychological distress at 12-month follow-up (27).

Religion is peculiar, since it is one of several conative resources which are insignificant at the bivariable level for most outcomes, yet functions as an independent risk factor for recent mental morbidity but a protective factor for suicidal ideation in the past 12 months. In the general literature, religion is protective against both depression and suicide attempts—with inconsistent evidence for suicidal ideation (56)—constituting a risk factor in only a small number of studies (57). The evidence suggests that religion is similarly protective against depression and suicidality among adolescents (58); however, among sexual minority adolescents, religion has null association with depression in most studies (59), except in the presence of negative experiences or conflict when religion becomes a risk factor among all adolescents, including sexual minorities. In two recent studies, religion was protective against suicidal ideation (60) and suicide attempts (61) among heterosexual adolescents and young adults but not their sexual minority counterparts and actually acted as a risk factor for suicide attempts amongst the latter. Indeed, religious struggle constitutes a clear risk factor for mental illness generally (62), and qualitative research has shown that due to stigmatization of homosexuality, sexual minorities may experience religious conflict more often, resulting in shame/guilt, depression, and suicidal ideation (63, 64).

While positive relations with others are associated with other psycho-social resources and all mental illness and suicidality

outcomes at the bivariable level, it is not an independently protective factor in any multivariable model, a finding which has also been evidenced elsewhere (65). Generally, social support has been shown to be protective against depression among adolescents and adults (66). Although social support has been linked to the psycho-social resources of self-esteem and self-acceptance (including internalized homophobia) among sexual minority adolescents (67, 68) and adults (69), its link to depression, anxiety, and suicidal ideation is equivocal among adolescents (59, 67). While social support was associated with psychological distress cross-sectionally, it did not predict psychological distress longitudinally in cohorts of young LGBTQ (70) and gay men aged 40 years and over (27). Although positive relations with others appear to have no independent effects on mental morbidity outcomes in this sample, they may exert indirect effects via other psycho-social resources (8, 67, 71) as have been found for parental social support in studies among adolescents generally (66).

Psycho-Social Resources Protective in Stress-Distress Pathway

Much of the evidence linking victimization with mental morbidity comes from studies among adolescents. Meta-analyses have confirmed that victimization leads to higher risk of poor mental health, depression, anxiety, suicidal ideation, and suicide attempt among adolescents, with pooled OR ranging from 1.60 to 2.55 [(72, 73)]. Our findings confirm higher levels of depressive symptoms yet mixed findings for suicidality among sexual minority adolescents (11).

Cross-sectional studies among general population and sexual minority adults and adolescents have demonstrated the protective role of several psycho-social resources in the victimization-distress pathway. In a national sample of US adults, sense of control (i.e., mastery and perceived constraints), but not social support, moderated the impact of childhood physical abuse on negative affect in the past month and self-reported global health (74). In a community sample of gay men in the US, several forms of victimization in the past 2 years remained independently associated with depressive symptoms in the past year, alongside most of the psycho-social resources included in the model—i.e., self-esteem (the strongest predictor), internalized homophobia, and social support (with some forms being protective whilst others being risk factors) (75). Among sexual minority youths in the US, self-acceptance (i.e., self-esteem and comfort with one's sexual orientation) and social support from family (i.e., acceptance, protection, and relations) mediated the impact of victimization on psychiatric symptoms in the past week in one study (76), yet neither social support from family nor from friends mediated the impact of lifetime victimization on psychiatric symptoms in the past week in another (77).

Higher levels of mindfulness protected against the effect of victimization due to sexual orientation but not due to ethnicity on depressive symptoms in the past week among young Latino sexual minority youth in the US (28). Mindfulness has also been shown to protect against other stressors. Mindfulness

and positive affect were independently protective factors in attenuating the impact of discrimination (racism) in the past 12 months on recent depressive symptoms (78) and anxious arousal symptoms (79) in the US, and mindfulness attenuated the impact of sexuality- and age-based discrimination in the past 2 years on recent psychological distress in an Australian sample of gay men aged 40 and over (26). Mindfulness—especially the facet acting with awareness—moderated the impact of perceived stress in the past month on current depression, but not current anxiety in the Swedish general population (24).

Fewer Psycho-Social Resources Among Gay Men

Population norms are not available for many psycho-social resources in this paper, nor do most of their scores have clear cut-offs or categories, rendering interpretation challenging. As in this study, scores for psycho-social resources tend to be used relatively (higher vs. lower) within a study population, but this state of affairs is not entirely satisfactory when studying vulnerable populations whose scores may differ significantly from those in the referent general population. As this study design yields a sample that is representative of all gay men who fall within the sampling scheme of meeting points (33, 34) and by extension gay men who live in that corresponding urban area (80), we compare our study means with available population means to identify possible disparities in psycho-social resources.

Using data matched for sex, age, region, and nationality between the 2002 Geneva Gay Men's Health Survey and the 2002 Swiss Health Survey, more gay men demonstrated low mastery than matched men from the general population (53.9% vs. 31.1%, $p < 0.00001$), even though a quarter of men in both samples had high mastery. Gay men in 2011 had significantly lower altruism scores (vs. mean 4.97, SD 0.82, $p < 0.0001$), marginally higher hedonism scores (vs. mean 4.30, SD 1.23, $p = 0.08$), and significantly lower life satisfaction scores (vs. mean 8.23, SD 1.65, $p < 0.0001$) than general population men in the Swiss arm of the 2012 European Social Survey. The mean scores for positive affect and vitality are comparable to population means from the neighboring canton of Vaud (81), yet significantly lower than those from a young to mid-age university-based sample from Geneva (82) with a more similar socio-demographic profile.

Even more robust evidence of disparities in psycho-social resources come from large population-based surveys elsewhere that include sexual orientation. Among US adults aged 25–74 years, men and women identifying as gay, lesbian, or bisexual had significantly lower scores for self-acceptance, environmental mastery, purpose in life, and positive relations with others than their heterosexual counterparts, with no differences for autonomy and personal growth (83). Findings from the US General Social Survey showed stronger altruistic values among homosexually experienced men than their heterosexual counterparts, yet empathic concern and actual altruistic and reciprocal behaviors did not differ by sexual orientation (84). National data have evidenced significantly lower levels of life

satisfaction among sexual minority adults in Australia and the UK (85) and same-sex attracted adolescents in the Netherlands (86) and Iceland, where there was also lower social support from both friends and family (87). In fact, for many of the supportive resources commonly linked to positive outcomes among adolescents, the evidence suggests fewer are available to sexual minority adolescents than their heterosexual peers (88), pointing to early onset of psycho-social disparities.

Young Gay Men With Highest Stress, Highest Distress, and Fewest Psycho-Social Resources

Increasing age was independently protective for all mental morbidity outcomes except major depression in the past 12 months—i.e., young gay men under 25 years were at highest risk. Data from Switzerland have established higher risk of mental illness and suicidality among gay men generally, with 12-month prevalences highest among young gay men (18, 19). Data from the 2002 Geneva Gay Men's Health Survey also showed that gay men were 3–4 times more likely to have been a victim of violence in the past 12 months (34% in 2002 and 27% in 2011) than their matched counterparts in the general population (53), with the highest 12-month prevalences among gay men under 25 years. A higher risk of victimization was also found among sexual minority mid-adolescents in a 2014 school-based survey in the cantons of Vaud and Zurich (89). In summary, the highest levels of suicidality and victimization are found among gay men under 25 years which are commensurate with age trends in the general population internationally (10, 90, 91).

In a large convenience sample in the US, age was an independent mediator in the relationship between victimization and depressive symptoms among gay men, but not among lesbians (75). The age-sensitivity in prevalences of both stressor and distress was most clearly evidenced in a cohort of LGBTQ youth in the US, whereby both victimization in the past 6 months and psychological distress in the past week decreased over time as probands progressed from late adolescence into young adulthood (70). In fact, a meta-analysis found age as the only significant moderator between bullying victimization and mental health problems and suicidality among sexual minority youth (12).

The present findings have shown that young gay men have the lowest level of psycho-social resources overall and specifically of cognitive resources such as mindful attention and non-rumination but also of positive affect. Review articles have not elucidated age/developmental trends in psycho-social resources (1, 4), but there are some indications from population-based studies. The Canadian NPHS confirmed highest AOR of depression and distress in the youngest age groups but also an upside-down U curve for both mastery and self-esteem, peaking in the 40–49 age group (31). Although a population-based study in Sweden found increasing mindfulness scores for select facets with increasing age, higher education, and higher income (24), our findings in this gay male sample replicate lower scores for mindful awareness and non-rumination only among gay men under 25 years.

Limitations

This cross-sectional study does not permit assessments of causality or temporality in the associations presented. This limitation is particularly relevant for the examination of psycho-social resources as potential buffers in the stress-distress pathway. Although we chose a serious stressor—i.e., victimization—and serious indicators of distress—i.e., major depression and suicidality—with the same time frame—i.e., in the past 12 months—we cannot preclude instances where the distress might have preceded the stressor. The temporality of psycho-social resources is a general issue, since they are usually measured without explicit reference to any time frame. Although the literature supports a dispositional quality for many of the psycho-social resources—even positive affect (92)—studies also suggest fluctuation across time and the life course for some (31). For example, although the mean score for internalized homophobia did not change between 2002 and 2011, it may differ currently. Good practice dictates that just as the internal consistency of these scales needs to be re-assessed for every sample, the same applies to latent classes which may change between samples or across time.

There is an issue of valence for some of the indicators used in this paper, but this is another general issue for the field of psycho-social resources as a whole. Although psycho-social resources are positive in valence (1), some are measured using positive items, some using negative items, and some using a mix of positive and negative items. For example, the general concept of self-acceptance was measured by an indicator of self-acceptance of one's homosexuality—a key factor according to prior qualitative research in this population (93, 94)—which was operationalized in part by a purely negative indicator of internalized homophobia designed to capture ego-dystonic homosexuality (36). Both gay-specific and generalized indicators of self-acceptance should be considered in future work among gay men and include masculinity/femininity. However, findings among LGB youths suggest that valence matters: although internalized homophobia was consistently associated with depression and drug use, positive permutations of self-acceptance of one's homosexuality were not related to depression or anxiety (67).

Finally, the relatively large number of psycho-social resources measured using ordinal/continuous scores created some issues with both latent class analyses and logistic regression models. For the latter, we decided to forego the examination of interaction terms between individual psycho-social resources due to the large number of potential combinations. This is an important limitation, since many papers using models with just a handful of psycho-social resources identify significant interactions between them. The loss of fine-grained analyses is offset in part by the presentation of a more elaborate profile of psycho-social resources juxtaposed against multiple mental morbidity outcomes. The larger number of psycho-social resources also precluded the use of structural equation modeling which requires models whereby the inter-relationships between the individual psycho-social resources—treated as a single layer in this paper—are

mapped out a priori, yet the current state of the art does not facilitate the construction of such an elaborate model. The analyses presented in this paper can inform subsequent model building.

Conclusions

There is considerable evidence of health disparities among gay men characterized by higher levels of stress and distress. Psycho-social resources are distributed unequally in populations (1, 3, 9), and evidence of disparities in several psycho-social resources among gay men has been presented. Psycho-social resources have been used to explain established health disparities among several groups (4), and this paper has provided additional evidence that higher levels of psycho-social resources are strongly and negatively associated with mental illness and suicidality among gay men.

Both collectively and individually, psycho-social resources protect against the impact of a severe stressor such as victimization on indicators of distress—i.e., major depression and suicidality—in the past 12 months. But given the strength of these associations in the presence and absence of a stressor, psycho-social resources should not only be considered protective factors but also compensatory/promotive factors (95). As such, strategies to promote psycho-social resources may not only prevent or alleviate mental illness but may also promote positive mental health. Of note, several types of psycho-social resources are relevant, as resources in five different families remain significant in multivariable models. Since the individual psycho-social resources in the multivariable models differ depending on the mental illness outcome and possibly also time period and since some psycho-social resources may exert indirect effects via other psycho-social resources, efforts targeting overall mental health may need to promote multiple psycho-social resources.

Due to the unfortunate confluence of highest stress, highest distress, and fewest psycho-social resources among young gay men, these adolescents and young adults should be prioritized in future studies and interventions on multiple psycho-social resources. To date, only a handful of group-level interventions targeting sexual minority youth have been evaluated scientifically in North America, but results appear promising (96–98). The large body of research and interventions promoting socio-emotional competencies among children and adolescents (99) and mindfulness-based interventions (MBI) targeting adolescents and adults (100–102) may be particularly informative. Although increasingly offered to sexual minorities, we are aware of only two published studies among adults in North America: Mindfulness-based Stress Reduction (MBSR) improved positive affect and mindfulness and decreased depression in a randomized controlled trial (RCT) among HIV-positive gay men (103), and Acceptance and Commitment Therapy (ACT) improved internalized homophobia, mindfulness, and social support and decreased stress, depression, and anxiety in a small group of gay men and lesbians (104).

ETHICS STATEMENT

Health survey data collected anonymously do not require approval by cantonal ethics committees in Switzerland. Potential respondents were informed both orally and in writing about the general subject matter of the survey and the anonymous, yet secure, data collection and handling procedures.

AUTHOR CONTRIBUTIONS

JW and MH conceived and directed the project. JW and A-EA conceived the article. JW performed the data analysis and drafted the article. All authors contributed to interpretation of the findings as well as the development of the manuscript.

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Mental Health Symptoms and Work-Related Stressors in Hospital Midwives and NICU Nurses: A Mixed Methods Study

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Hospital midwives and neonatal intensive care (NICU) nurses frequently encounter work-related stressors and are therefore vulnerable to developing mental health problems, such as secondary traumatic stress, burnout, anxiety, and depression. However, so far, the exact nature of these work-related stressors (traumatic vs. non-traumatic stressors) has not been investigated. This concurrent triangulation mixed methods cross-sectional study aimed to compare mental health symptoms in hospital midwives and NICU nurses, and to identify and compare work-related traumatic and non-traumatic stressors for both professional groups. 122 midwives and 91 NICU nurses of two Swiss university hospitals completed quantitative measures (Secondary Traumatic Stress Scale, STSS; Hospital Anxiety and Depression Scale, HADS; Maslach Burnout Inventory, MBI) and one qualitative question in an online survey. When controlling for socio-demographic variables, NICU nurses had a higher STSS total score and higher STSS subscales scores and less HADS anxiety subscale scores than hospital midwives. Work-related stressors were classified into five themes: "Working environment," "Nursing/midwifery care," "Dealing with death and dying," "Case management" and "Others." Forty-six (46.3%) percent of these were classified as traumatic work-related stressors. NICU nurses reported more traumatic stressors in their working environment but no other differences between professional groups regarding the total number of work-related traumatic vs. non-traumatic stressors were found. Measures, such as teaching strategies to amend the subjective appraisal of the traumatic stressors or providing time to recover in-between frequently occurring work-related traumatic stressors might not only improve the mental health of professionals but also decrease sick leave and improve the quality of patient care.

Keywords: anxiety, depression, secondary traumatic stress, burnout, professional, stressor, midwives, nurses

INTRODUCTION

Work-related psychosocial stress is one of the most concerning issues of occupational health in industrialized countries (1). Stress, experienced by approximately 45% of working Europeans, is seen as the second most important threat posed by the working environment (after musculoskeletal problems), and costs approximately 25 billion euros per year (2). Fourteen percent of persons suffering from work-related health difficulties report stress, depression or anxiety as their severest health problem (2). As a result, reducing the burden of work-related mental health problems and psychiatric sickness absence is a key priority for the World Health Organization (3). Among hospital workers, patient-care professionals are more vulnerable than other professionals to develop mental health difficulties (4). Their mental health problems are linked to high quantitative, emotional, sensorial and cognitive demands at work, a high rhythm of work, and a demand for hiding emotions (4).

The present study focuses on staff working with the perinatal population in a hospital environment: midwives working in a maternity department and nurses working in a neonatal intensive care unit (NICU). For midwives, insufficient time to do what needs to be done and inability to change work-based decisions (made by midwifery colleagues or doctors) were identified as the two major types of stress (5). In one study, the majority of midwives considered their job as stressful and thought that lack of work resources and poor organization at work caused the most stress (6). Furthermore, midwives working in hospitals felt less supported than independent midwives (7). They struggled between being with the women and meeting service needs (8). Midwives also reported insufficient support from co-workers (9). Approximately two third of midwives tend to suffer from burnout (10, 11). Midwives in developing countries are frequently faced with maternal death. Within a population of Ugandan midwives who experienced maternal death, 20% reported high anxiety (12).

Nursing in neonatal intensive care is very demanding and linked with moral distress (13). Intensive care staff is regarded as particularly vulnerable compared to other healthcare professionals, as they encounter additional stressors compared to those working in other areas, regularly face ethical dilemmas concerning patient care management, and the threat of committing errors that may have serious consequences (14, 15). Acute stressors such as dealing with dying and with death, dealing with young patients and responding to critical situations are frequent (16) and staff often have to move from one traumatic event to another, leaving little time for recovery (17, 18). Even though a previous study indicated that NICU nurses caring for the dying newborn and the newborn's parents learn to deal with those difficult situations and seek strategies to limit their suffering (16), there is very limited evidence and research investigating the mental health of NICU nurses is lacking.

We propose that work-related stressors, which hospital midwives and NICU nurses frequently encounter, can be classified into *traumatic* stressors, defined by direct or indirect exposure to death, threatened death, actual or threatened serious

injury, actual or threatened sexual violence (18–20) and *non-traumatic* stressors, such as the lack of regular shifts, a heavy workload, and limited resources.

Being exposed to work-related traumatic stressors may render midwives and NICU nurses vulnerable to developing secondary traumatic stress disorder (STSD) symptoms following “repeated or extreme indirect exposure to aversive details in the course of professional duties” (21). Secondary traumatic stress disorder is diagnosed when the professional is exposed to the first hand trauma experiences of a patient and is characterized by re-experiencing, avoidance, and hyperarousal symptoms (22). The symptoms of STSD are the same as those of posttraumatic stress disorder (PTSD) in the fourth edition of the Diagnostic and Statistical Manual of Psychiatric Disorders (DSM-IV-TR; (23)). However, unlike PTSD, STSD is due to indirect exposure in a professional context. It was not included in DSM-IV-TR as a formal psychiatric diagnosis. In DSM-5 (21), the new traumatic stressor criterion A4 highlights professional responsibilities as potential traumatic stressors that could trigger PTSD.

Midwives and NICU nurses are both vulnerable to developing STSD because they both encounter traumatic work-related stressors. Midwives regularly have to manage traumatic births and other traumatic perinatal events (24), which can cause secondary traumatic stress (25) and post-traumatic stress disorder (PTSD) (26). A postal survey in the UK found that over 95% of midwives had been directly or indirectly exposed to a traumatic event at work (11). Midwives' principal fears are related to death (of the baby or the mother), medical emergency and being the cause of a negative birth experience (27). In addition, it has been argued that due to their close relationship with the women, they are vulnerable to compassion fatigue, which is also linked with STSD (25). What is more, evidence shows that high empathy in midwives is associated with a higher risk of PTSD Sheen et al. (11). Whilst research focusing on STSD specifically in NICU nurses is lacking, some studies in ICU nurses have reported STSD and PTSD symptoms (17, 18, 28).

Therefore, the aims of our study were (a) to assess the prevalence rates of mental health symptoms in NICU nurses and midwives working in a hospital environment, (b) to compare those groups regarding their mental health symptoms, and (c) to identify and compare work-related traumatic and non-traumatic stressors for both professional groups.

METHODS

Participant Consent and Recruitment

The study took place in two university hospitals in the French-speaking part of Switzerland using the same recruitment procedure: midwives and NICU nurses were informed about the study during staff meetings and by flyers. All eligible participants were systematically paid an extra hour of work to encourage their participation. Staff accessing the anonymous online survey [LimeSurvey (version 2.0) (29)] found a detailed information sheet before giving informed consent. The survey consisted of five questionnaires and took approximately 30 min to complete. All eligible participants received one reminder e-mail before the survey closed. Ethical approval was obtained from the

ethics committee of the Canton de Vaud, Switzerland (study nr: 237/2013).

Procedure

Of the 209 eligible midwives, 125 participated (59.8% response rate). One-hundred and 22 (58.4%) completed a sufficient number of items to allow the replacement of missing data (see data analysis for more details). All but one midwife (122, 99.2%) responded to the qualitative question. Of the 170 eligible NICU nurses, 91 participated (53.5% response rate). Of those, 84 (49%) completed a sufficient number of items of the questionnaires to allow replacement of missing data. Forty-nine (54%) NICU nurses responded to the qualitative question.

Design

A concurrent triangulation mixed methods cross-sectional design including quantitative and one qualitative question in an online survey was employed (30). Qualitative and quantitative data were collected concurrently. They were analyzed separately and then combined (30).

Instruments

Quantitative Approach

Secondary traumatic stress was measured using the Secondary Traumatic Stress Scale (STSS) (22), a self-report questionnaire specifically designed for professional caregivers, with the instruction and the stems of eight stressor-specific items referring explicitly to “client exposure” as traumatic stressor. Based on the definition of PTSD in DSM-IV-TR, the STSS consists of three subscales: intrusion (5 items), avoidance (7 items), and arousal (neurovegetative activation; 5 items) in a total of 17 items with a Likert scale of five points (1 “*never*” to 5 “*very often*”). The time period of measured symptoms is the last seven days. The total score is calculated by adding the total of the three subscales, with a high score indicating a higher level of symptoms (31, 32). A score below 28 corresponds to “little or no secondary traumatic stress,” a score between 28 and 37 means “mild secondary traumatic stress,” between 38 and 43 “moderate secondary traumatic stress,” between 44 and 48 “high secondary traumatic stress,” and beyond 49 “severe secondary traumatic stress;” the score of 38 is used as critical threshold indicating secondary traumatic stress disorder (19). This questionnaire has good psychometric properties (33). The scale was recently validated in a sample of Swiss midwives (Jacobs et al., under review). In this study, using the recently validated version, the Cronbach’s alpha was $\alpha = 0.903$.

Anxiety and depression symptoms were measured using the French version of the Hospital Anxiety and Depression Scale (HADS) (34–37), which is a 14-item self-report questionnaire measuring state anxiety (7 items) and depression (7 items) with good psychometric properties. The time period of measured symptoms is the last seven days. Each item is calculated from 0 to 3, with higher scores indicating higher anxiety and/or depression. For both, the anxiety and depression subscale, a score between 8 and 10 indicates a possible clinical disorder, and a score between 11 and 21 indicates a probable clinical disorder (38, 39). The HADS can also be used as scale of anxiety or depression symptom

severity, ranging from normal (0–7), low (8–10), moderate (11–14), and severe (15–21), with a critical threshold at 11 for both subscales. In this study the Cronbach’s alpha was $\alpha = 0.814$.

Burnout was measured using the Maslach Burnout Inventory (40) which is a self-report questionnaire with 22 items rated on a Likert scale from 0 “*never*” to 6 “*always*”. The items are organized into three subscales; “emotional exhaustion” (i.e., feeling emotionally overextended and exhausted by one’s work; 9 items), which is the core dimension (41, 42), “depersonalization” (i.e., impersonal response toward recipients of one’s service or care treatment; 5 items), and “personal achievement” (i.e., feeling competent and successful in one’s work; 8 items). The timeframe of experienced burnout measured is not indicated (general frequency, from never to every day). Scores are calculated separately for each subscale (9). A score >30 on the first subscale is considered as a severe burnout, severe depersonalization is considered with a score >12, and severe deficiency in personal achievement with a score <33 and critical thresholds are the moderate levels for each subscales (43). The validated French version of this questionnaire was used (44). In the present study the Cronbach’s alpha were, 0.872 for the emotional exhaustion subscale, 0.643 for the depersonalization subscale and 0.678 for the personal achievement subscale.

In addition, participants responded to questions regarding their gender, age, country of origin, years of work experience (less or more than 10 years), form of employment (full-time or part-time work), and marital status.

Qualitative Approach

Participants were asked to list examples of traumatic situations they had experienced at either in the NICU or on the labor ward in the past year. (“Please describe briefly work-related stressors you have encountered at work in the past year”).

Data Analysis

Quantitative Approach

Quantitative questionnaire data were analyzed with IBM SPSS statistics 22 software (Statistical Package for Social Sciences). Missing data analysis was performed (45) when less than 50% of the items per subscale were missing (46). For each subscale the null hypothesis of random missing data distribution was tested using Little’s MCAR test (45). If the null hypothesis was not rejected, we proceeded to imputation calculation using the Expectation-maximization of missing value process. However, if $\geq 50\%$ of the items per subscale were missing, missing data were not replaced. Descriptive statistics were calculated for each scale. The percentage of missing data not replaced (when 50% or more of the item of a subscale were missing) varied between 7.7 and 9.9% for NICU nurses and between 1.6 and 2.5% for midwives. The group differences analyses were repeated without replacement of the missing data and no main differences were found (data not shown).

Given that not all NICU nurses in the sample responded to the qualitative question concerning work-related stressors and in order to detect potential biases, responders and non-responders were compared regarding socio-demographic variables and mental health symptoms. Chi-squared analyses were performed for categorical variables across professional

groups (gender, age, country of origin, years of work experience, work participation, relationship status), *t*-tests were performed for normally distributed continuous variables (MBI emotional exhaustion and personal achievement subscales). Finally, Mann-Whitney rank tests were performed for non-normally distributed continuous variables (HADS anxiety and depression subscales, STSS total, STSS intrusion, avoidance and arousal subscales as well as MBI depersonalization subscale).

Normality was tested for continuous variables using Kolmogorov-Smirnoff criteria. To compare professional groups, independent samples *t*-tests were performed with continuous variables that were normally distributed (MBI subscales “emotional exhaustion” and “personal achievement”) and non-parametric independent-samples Mann-Whitney *U*-tests were performed for variables not normally distributed (STSS, STSS subscales, HADS-anxiety, HADS-depression, and MBI subscale “depersonalization”). Chi-squared tests were run to compare categorical variables between groups. All reported *p*-values are 2-tailed and the effect size for the Mann-Whitney *U*-test was calculated as follows: $U/(n_{\text{NICUnurses}} * n_{\text{midwives}}) (47)$.

When sample characteristics differed significantly between groups, stepwise regression analyses were run to control the influence of these variables on mental health symptoms that differed between professional groups.

Qualitative Approach

For the qualitative question, a content analysis based on the manifest content of the written examples of work-related stressors provided by both midwives and NICU nurses was performed by two independent raters (CF, LJdC) (48). Coding categories were created and their frequency was counted, with the entire interview used as a coding unit (49). Firstly, the raters read each answer in order to obtain a general impression. Secondly, each given example was condensed, then organized into sub-categories (based on similarities and differences of condensed given examples). Once the raters agreed on the sub-categories, they independently sorted them into categories and then looked for agreement on these. Following this, a second classification was performed sorting each given example into the following two categories: “traumatic work-related stressor” if the given example met the diagnostic DSM 5 criterion A for PTSD (21) and “non-traumatic work-related stressor” if it did not respond to this criterion. Therefore, categories could contain traumatic as well as non-traumatic work-related stressors. Descriptive statistics analyses were run for both classifications as well as comparisons between midwives and NICU nurses. Chi squared analyses were run to compare group distributions within each categories as well as distributions between “Traumatic work-related stressor” and “non-traumatic work-related stressor.”

RESULTS

Sample

For both professional groups, the majority of participants were women. About half of the midwives and the majority of NICU nurses were aged between 26 and 40 years. Most midwives worked part-time, whereas most NICU nurses worked full-time.

Approximately 40% of midwives and 55% of NICU nurses had 10 years or less experience, whereas ~60% of midwives and 43% of NICU nurses had more than 10 years of experience. More socio-demographic details are presented in **Table 1**. Group comparisons revealed no differences regarding gender or country of origin, but significant differences for age ($p < 0.001$), years of work experience ($p = 0.024$), work participation ($p < 0.001$), and relationship status ($p = 0.003$).

Group Comparisons Regarding Mental Health Symptoms

Table 2 presents mean scores and standard deviations of mental health symptoms in midwives and NICU nurses. Group comparisons revealed that NICU nurses had a higher STSS total score than midwives ($p < 0.001$), and also higher scores for all three STSS subscales: intrusion ($p = 0.002$), avoidance ($p < 0.001$), and arousal ($p = 0.002$). Similarly, NICU nurses were more likely to reach higher STSS severity (high and severe) levels ($p < 0.001$). No significant group differences concerning MBI subscales scores and severity levels were found, but NICU nurses were more likely to have severe global burnout than midwives ($p = 0.016$). On the other hand, midwives had a higher HADS anxiety score ($p = 0.004$), were more likely to reach a high HADS anxiety severity level ($p = 0.012$), and had a higher HADS depression score ($p = 0.041$). However, no group difference was found regarding the HADS depression severity level ($p = 0.098$).

Figure 1 presents the percentages of each professional group affected by mental health symptoms.

Multiple regression analyses were conducted (see **Table 3**) to see if socio-demographic variables that were significantly different between professional groups (age category, years of experience, work participation, and relationship status) predicted STSS total and subscale scores or the HADS subscale scores. Using the stepwise method, it was found that only the professional group explained a significant amount of the variance of the STSS total score of the STSS avoidance subscale score, of the STSS arousal subscale score and of the HADS anxiety subscale score. Age category and professional group together influenced the STSS intrusion subscale score. Finally, a last regression analysis showed that the HADS depression subscale score was influenced by age category and work participation and that the professional group had no significant influence.

In summary, when controlling for socio-demographic variables, NICU nurses had a higher STSS total score and higher STSS subscales scores and less HADS anxiety subscale scores than hospital midwives.

Responders vs. Non-responders to Qualitative Question

One-hundred-and-eleven midwives gave 516 examples of work-related stressors, one midwife did not answer the question and 10 responded that they had no example to cite (response rate: 99.2%). As only one midwife did not respond, no comparisons between responders and non-responders were run. One hundred-twenty-three examples of work-related stressors were given by 49 (54%) NICU nurses. Comparing NICU nurses

TABLE 1 | Demographic sample characteristics and group comparisons.

	NICU nurses (<i>N</i> = 91)		Midwives (<i>N</i> = 122)		Group differences analyses*		
	<i>n</i>	%	<i>n</i>	%	$\chi^2_{(df)}$	<i>p</i>	Effect size ϕ
Gender					$\chi^2_{(1)} = 1.32$	0.250	
Men	5	5.5	3	2.5			
Women	84	92.3	116	95.1			
Missing values	2	2.2	3	2.5			
Age					$\chi^2_{(3)} = 16.26$	<0.001	0.280
18 to 25 years old	8	8.8	3	2.5			
26 to 30 years old	24	26.4	21	17.2			
31 to 40 years old	40	44	41	33.6			
> 40 years old	18	19.8	53	43.4			
Missing values	1	1.1	4	3.3			
Country of origin					$\chi^2_{(3)} = 5.61$	0.132	
Switzerland	36	39.6	59	48.4			
Other EU countries	43	47.2	57	46.7			
Non-EU countries	11	12.1	6	4.9			
Missing values	1	1.1	0	0			
Years of work experience					$\chi^2_{(1)} = 5.13$	<0.050	0.157
≤ 10 years	50	54.9	48	39.3			
> 10 years	39	42.9	71	58.2			
Missing values	2	2.2	3	2.5			
Work participation					$\chi^2_{(1)} = 31.40$	<0.001	0.386
Part-time	34	37.4	92	75.4			
Full-time	56	61.5	29	23.8			
Missing values	1	1.1	1	0.8			
Relationship status					$\chi^2_{(3)} = 13.86$	<0.010	0.255
Single	42	46.2	38	31.1			
Partnered	49	53.8	84	68.9			

*Group differences are examined estimating chi square (χ^2) differences. Bold: $p < 0.05$.

who gave at least one example of a work-related stressor with the ones who did not, showed no significant differences regarding socio-demographic variables (gender, age category, country of origin, years of work experience, work participation, or relationship status). Regarding mental health symptoms, there were significant differences: NICU nurses who gave at least one example of a work-related stressor had higher symptoms than those who did not provide an example for STSS total scores ($p = 0.018$) and STSS intrusion subscale ($p = 0.011$). NICU nurses who gave at least one example of a work-related stressor reported higher symptoms on the MBI subscale “emotional exhaustion” than those who did not provide an example ($p = 0.023$), as well as higher symptoms on the HADS depression subscale ($p = 0.049$). No other differences regarding mental health outcomes were found (all $p = \text{ns}$). Details are provided in **Table S1** in Supplementary Data.

Work-Related Stressors

The written manifest content analysis of the work-related stressors resulted in five categories: “Working environment,” “Nursing/midwifery care,” “Dealing with death and dying,”

“Case management,” and “Others” (**Tables 4, 5**). The largest category “Nursing/midwifery care” contained 231 situations (36.1%) in total. This category contained situations concerning care procedures and patients’ medical situations (pathology, care procedure, medical errors, ethical concerns about care) as well as professional competences, e.g., “*Obstetric situation with difficult outcome, e.g., cesarean emergency with poor recovery of the fetal heart rate.*” The second largest category “Working environment” included 205 situations (32.1%) in total. These situations were related to the organization of work and relations with medical staff (physicians, co-workers, workers from other wards, as well as superiors) or were seen as consequences of a lack of work-organization or poor relationships among staff, e.g., “*Work overload and lack of personnel.*” The category “Dealing with death and dying” comprised 118 situations (18.5%). It contained situations linked with the death of patients, taking care of dying patients, assistance for grieving patients. e.g., “*Quick death of a patient without possibility of help.*” The category “Case management” consisted of 75 situations (11.7%). It included situations related to difficulties in relationships with patients or patients’ relatives, and the management of difficult psychosocial

TABLE 2 | Mean scores and standard deviations of psychopathological symptoms and group comparisons.

	NICU nurses (<i>n</i> = 84*)			Midwives (<i>n</i> = 120*)			Group differences analyses		
	Mean	SD	%	Mean	SD	%	$\chi^2_{(df)}$; <i>U</i> or <i>t</i> _(df)	<i>p</i>	Effect size**
HADS Anxiety total scores	6.3	3.2		7.7	3.8		<i>U</i> = 3775.5	<0.010	0.382
HADS Anxiety severity level							$\chi^2_{(3)} = 10.974$	<0.050	0.233
Normal			74.7			52.9			
Low			13.3			27.7			
Moderate			10.8			14.3			
Severe			1.2			5.0			
HADS Depression total scores	3.9	3.4		5.1	3.8		<i>U</i> = 4107.0	<0.050	0.416
HADS Depression severity level							$\chi^2_{(2)} = 4.642$	0.098	
Normal			84.3			71.4			
Low			8.4			16.8			
Moderate			7.3			11.8			
Severe			0			0			
STSS total scores	38.7	10.9		31.8	9.7		<i>U</i> = 3116.0	<0.001	0.319
STSS intrusion total scores	11.1	4.0		9.5	3.7		<i>U</i> = 3635.5	<0.010	0.373
STSS avoidance total scores	15.1	4.7		11.7	3.7		<i>U</i> = 2810.5	<0.001	0.285
STSS arousal total scores	12.4	4.0		10.6	3.7		<i>U</i> = 3706.0	<0.010	0.375
STSS severity level							$\chi^2_{(4)} = 20.764$	<0.001	0.321
Little or none			17.1			43.7			
Mild			32.9			29.4			
Moderate			22.0			16.8			
High			8.5			4.2			
Severe			19.5			5.9			
MBI severe burnout on all MBI subscales							$\chi^2_{(1)} = 5.781$	<0.050	0.169
Yes			4.8			0			
No			95.2			100			
MBI emotional exhaustion scores	23.0	9.9		20.7	8.7		<i>t</i> ₍₂₀₁₎ = 1.758	0.080	
MBI emotional exhaustion severity level							$\chi^2_{(2)} = 5.032$	0.081	
Low			31.0			35.3			
Moderate			47.6			54.6			
High			21.4			10.1			
MBI depersonalization scores	4.8	4.1		4.8	3.8		<i>U</i> = 4931.0	0.870	
MBI depersonalization severity level							$\chi^2_{(2)} = 3.075$	0.215	
Low			64.3			63.0			
Moderate			29.8			35.3			
High			6.0			1.7			

(Continued)

TABLE 2 | Continued

	NICU nurses (n = 84*)			Midwives (n = 120*)			Group differences analyses		
	Mean	SD	%	Mean	SD	%	$\chi^2_{(df)}$; U or t _(df)	p	Effect size**
MBI personal achievement scores ^a	31.6	5.5		32.9	4.1		t ₍₂₀₁₎ = 1.771	0.078	
MBI personal achievement severity level							$\chi^2_{(2)} = 1.089$	0.580	
High			3.6			6.7			
Moderate			35.7			37.0			
Low			60.7			56.3			

*Due to missing values on some of the items, n varied between 82 and 84 for NICU nurses, respectively between 119 and 120 for midwives.

HADS, Hospital Anxiety and Depression Scale; STSS, Secondary Posttraumatic Stress Scale; MBI, Maslach Burnout Inventory.

bold: p < 0.05.

**Effect size calculations depend on variable type: ϕ for categorical variables; d for normally distributed continuous variables; ρ for not normally distributed ordinal variables.

^aA low score indicates low personal achievement and is an indicator of burnout.

FIGURE 1 | Importance of mental health symptoms by professional group. Severity levels and critical thresholds are defined by authors of each test as follows: HADS anxiety and HADS depression: moderate or severe symptoms. STSS: moderate, high or severe symptoms. MBI: moderate or high symptoms.

situations, e.g., “Never happy, very demanding and difficult parents, who see us as servants, even after all the effort we made for them.” Finally, the category “Other” contained 10 situations (1.6%). These were situations that did not occur on the actual ward but stemmed from work experiences in other departments, e.g., “Resuscitation of a one-year old child who nearly drowned and who died later.”

Traumatic vs. Non-traumatic Work-Related Stressors and Group Comparisons

Categorizing these 639 work-related stressor examples into traumatic vs. non-traumatic work-related stressors (according to DSM 5) resulted in 296 (46.3%) traumatic work-related stressors, e.g., “Death of patient. We believe that the experience is stored in a closet but the door opens regularly under excess pressure and all the memories of other deaths reappear.”, and 343 (53.7%) non-traumatic work-related stressors, such as “Not being able to accompany patients, and especially the parents, for lack of time.” “Nursing/midwifery care” contained the highest number

of traumatic work-related stressors ($n = 145$), and “Working environment” the highest number of non-traumatic work-related stressors ($n = 194$; see **Tables 4, 5** for more details and examples) as well as the lowest number of traumatic stressors ($n = 11$). Group comparisons regarding the total number of traumatic vs. non-traumatic stressors showed no significant difference between professional groups [$\chi^2_{(1)} = 0.655$; $p = 0.418$]. However, a difference between midwives and NICU nurses concerning the number of traumatic vs. non-traumatic work-related stressors for one category, the “Working environment,” was found, with NICU nurses reporting more traumatic work-related stressors than midwives [$\chi^2_{(1)} = 13.28$; $p < 0.001$] within this category.

DISCUSSION

This study assessed and compared mental health symptoms in hospital midwives and NICU nurses, and identified and compared work-related traumatic and non-traumatic stressors

TABLE 3 | Multiple regression analyses.

	STSS total score β	STSS avoidance β	STSS arousal β	STSS intrusion β	HADS anxiety β	HADS depression β
Age	0.001	0.118	0.085	-0.189**	0.032	0.254**
Years of experience	-0.040	0.072	0.017	-0.139	-0.036	0.031*
Work participation	0.049	-0.014	0.038	0.039	0.023	0.175*
Relationship status	0.039	0.075	0.058	0.057	0.083	0.032*
Professional group	-0.335***	-387***	-0.236**	-0.169*	0.165*	0.134
R^2	0.112	0.150	0.056	0.080	0.027	0.050

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Bold: $p < 0.05$.**TABLE 4 |** Categorization of work-related stressful situations.

	Traumatic situations			Non-traumatic situations		
	NICU nurses n (%)	Midwives n (%)	Total n (%)	NICU nurses n (%)	Midwives n (%)	Total n (%)
Working environment	7 (11.5%)	4 (1.7%)	11 (3.7%)	35 (56.4%)	159 (56.6%)	194 (56.6%)
Nursing/ midwifery care	20 (32.8%)	125 (53.2%)	145 (49.0%)	17 (27.4%)	69 (24.6%)	86 (25.1%)
Dealing with death and dying	28 (45.9%)	90 (38.3%)	118 (39.9%)	0	0	0
Case management	4 (6.6%)	16 (6.8%)	20 (6.7%)	6 (9.7%)	49 (17.4%)	55 (16.0%)
Others	2 (3.3%)	0	2 (0.7%)	4 (6.5%)	4 (1.4%)	8 (2.3%)
Total	61	235	296 (46.3%)	62	281	343 (53.7%)

*Percent within professional groups.

for both professional groups. Results showed that midwives and NICU nurses respectively reported high levels of secondary traumatic stress, burnout and anxiety symptoms. Interestingly, NICU nurses reported more secondary traumatic stress than midwives but midwives suffered from more anxiety. Midwives' and NICU nurses' work-related stressors were categorized into "Working environment," "Nursing/midwifery care," "Dealing with death and dying," "Case management," and "Others." However, there were no differences between professional groups regarding the total number of work-related traumatic vs. non-traumatic stressors, except for "Working environment," where NICU nurses reported more traumatic situations.

Prevalence rates of STSD symptoms in our study were significantly different between professional groups, with 26.9% of midwives and 50% of NICU nurses reporting symptoms above the critical threshold. This difference remained when controlling for socio-demographic variables. Our prevalence rates of midwives are comparable to other studies in which approximately one-third reported STSD (19, 50, 51). So far, prevalence rates of STSD for NICU nurses have not been reported but studies focusing on emergency nurses found a lower prevalence (e.g., 15%) (17). It appears that NICU nurses are at a higher risk of developing STSD than midwives because they encounter more frequent traumatic work-related stressors (14, 17, 28, 52–54). Staff working in intensive care units (ICUs), like NICU nurses, are regarded as particularly vulnerable compared

to other healthcare professionals, as they encounter additional stressors than those working in other areas: regularly face ethical dilemmas concerning patient care management, are regularly confronted to patients dying as well as medical errors that can have serious consequences (14, 15).

In order to examine the nature of the stressors in more detail, we analyzed the type of work-related stressors encountered by both professional groups. We found that 46.3% of all stressors could be classified as traumatic work-related and 53.7% as non-traumatic work-related stressors according to the DSM 5 definition. Interestingly, there were no differences between professional groups regarding the total number of work-related traumatic vs. non-traumatic stressors, except for "Working environment" where NICU nurses reported more traumatic situations. Nevertheless, only few traumatic situations fell within the category "Working environment" (11.5%). A recent publication including midwives showed that the subjective interpretation of the stressors as well as the receipt of support following the stressors had more impact on the mental health than the objective nature of the stressor. There is also some evidence that NICU nurses have little time to recover and to seek support between their frequent encounters of traumatic events (16–18). This might partly explain our results and future research should assess both the subjective interpretation of the stressors as well as the role of social support. However, our results need to be interpreted with caution, as NICU nurses

TABLE 5 | Examples of traumatic and non-traumatic work-related stressors.

	Traumatic situations		Non-traumatic situations	
	NICU nurses	Midwives	NICU nurses	Midwives
Working environment	Resuscitation in the delivery room of a newborn at term (in connection with poor management of childbirth)	A long and significant deceleration of the fetus' heartbeat during the ultrasound without the possibility of calling for help or stopping the current examination because no nearby alarm	Unable to support (help) patients and especially the parents for lack of time	Lack of staff for emergencies
Nursing/midwifery care	Emergency intubation - very difficult	Neonatal resuscitation	Fear of having to take care of a case that is too difficult, not to be in control of the situation, not to observe important signs that should make me worry about the state of health of the patient	Shoulder dystocia
Dealing with death and dying	Death of a term baby due to asphyxia	Maternal death	–	–
Case management	Resuscitation of a child of 6 months, deceased (child shaken by the father)	Death threats made by the husband of a patient giving birth	A parent who becomes aggressive	Having to manage a complex patient living in social and psychological precariousness
Others	Massive digestive hemorrhage when working with adults	–	Clinical teaching (teaching and evaluation at the same time)	Waiting to manage a situation that was announced without being able to act (receiving a telephone call and waiting that the patient arrives)

who responded to this question had higher HADS depression symptoms, STSS symptoms, and higher symptoms on the MBI subscale “emotional exhaustion” than non-responders.

Anxiety symptoms were significantly higher in midwives than in NICU nurses (with 19.3 and 12% respectively, scoring above the critical threshold); this difference also remained when controlling for socio-demographic variables. The rate of anxiety symptoms we found for NICU nurses is consistent with previous research on ICU nurses (18, 28, 55). Comparisons regarding anxiety levels in midwives with other studies were not possible due to a lack of published studies. However, one Ugandan study showed that having witnessed maternal death was a predictor of death anxiety in midwives (12). These results can, of course, not easily be transposed to our European context where maternal death is rare with a ratio of five maternal deaths per 100'000 live births in Switzerland against 343 in Uganda (56). Still, the examples of work-related traumatic stressors in our study showed that when a maternal death happened, it also likely affected midwives who had not directly been involved with the case. The death of an adult more than the death of a newborn might trigger anxieties linked to one's own death (12) and might therefore be linked to higher anxiety symptoms in midwives compared to NICU nurses. Indeed, midwives' principal fears are related to death (of the baby or the mother), medical emergency and being the cause of a negative birth experience (27). It is

also likely that factors related to their professional role and working environment [such as a low level of perceived control (57)] make midwives more vulnerable to developing anxiety symptoms. The essence of midwives' professional role is to “be with the woman” (7) and hospital midwives working under the dominant biomedical model struggle to maintain this primary professional value while responding to service pressures (7, 8). Indeed, a recent study identified that the fear of being watched and criticized was one of the most prevalent fears in midwives (27).

In addition, midwives also reported a higher total mean score of depressive symptoms than NICU nurses but this difference disappeared when controlling for socio-demographic variables. Indeed, regression analyses showed that the association to the HADS depression score was larger to age and percentage of work more than to professional group. However, our sample of NICU nurses had a lower depression score than published samples of emergency (28), ICU (18) or other nurses (18, 55, 58). To our knowledge, depression in midwives has not previously been measured and more research is therefore needed.

Burnout levels were similar in midwives and NICU nurses respectively: emotional exhaustion (64.7, 69%), depersonalization (37.0%, 35.7%), and low personal achievement (56.3, 60.7%). However NICU nurses were more likely to reach the severe threshold for the three subscales. The emotional

exhaustion subscale is known to reflect the impact of work-related chronic stress (59) and these results are in line with previous literature on hospital midwives (10, 11) and ICU nurses (60). Our findings concerning low personal achievement in NICU nurses are in line with findings in Scottish ambulance personnel (52); regarding midwives, our scores are higher than previously found, with 10 or 30% reporting low personal achievement (10, 11). Those important percentages seem to reveal a deeper problem linked with job satisfaction likely caused by a chronically stressful working environment. Indeed, significant correlations between the three MBI subscale scores and job satisfaction in nurses have previously been published (61).

The results of this study add to the existing literature on the mental health of healthcare professionals, as research on NICU nurses in particular is scarce. The study also adds to the knowledge of the exact nature of the work-related stressors that these professional groups encounter in terms of traumatic vs. non-traumatic stressors. Another strength is the mixed-methods research design and the use of valid and reliable instruments. Our study has some limitations, notably, the lack of measurement of frequency and subjective appraisal of work-related stressors, as well as of protective factors, such as coping strategies, resilience, and social support. We had a low response rate with regards to the open-ended question within the NICU nurses sub-sample. Finally, the cross-sectional design of this study does not allow for any attributions of causality.

Future research would benefit from implementing a semi-structured interview to gain more detailed information about traumatic and non-traumatic work-related stressors. Furthermore, a prospective study with a comparison group would allow understanding the longer term impact of working in a chronically stressful working environment on the development of psychopathological symptoms. Finally, investigating protective factors, such as resilience, social support, and coping strategies would be helpful.

Our results have important implications. High prevalence rates of anxiety, and burnout symptoms found in our sample of hospital midwives adds evidence to the known dilemma they face between their primary professional value of “being with the woman” and the stressors present in the hospital environment. A stronger focus during their professional training and ongoing supervision on developing strategies that enable midwives to

balance these different demands seems important. In addition, given the high prevalence of STSD symptoms in this population, the teaching of coping strategies summarized under the acronym “CORES” shown to be effective to deal with anxiety linked with maternal death, represents an interesting avenue to explore (12). Given the high prevalence of STSD and burnout symptoms in NICU nurses, strategies to change the subjective appraisal of the traumatic stressors could be taught and giving them time to recover in-between frequently occurring traumatic events needs to be ensured. For both professional groups, measures taken to increase the social support at work, such as by introducing a peer support system as well as professional mediation and other resources, are likely to protect against the development of mental health symptoms. A regular screening for psychopathological symptoms might be helpful and access to professional help should be provided if necessary. These measures might not only improve the mental health but also decrease sick leave and improve the quality of patient care.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of Swissethics, ethics committee of the Canton de Vaud, Switzerland. The protocol was approved by the ethics committee of the Canton de Vaud, Switzerland (study nr: 237/2013). All subjects gave written informed consent in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

AH conceived of the study and its design, coordinated the data collection, participated in the data analysis, and co-wrote the manuscript. CM, J-FT, FL, SG-N, and VB participated in the conception and coordination of the study, and commented on the manuscript. CF and LJ conducted the data collection and data analysis and co-wrote parts of the manuscript. All authors read and approved the final manuscript.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2018.00364/full#supplementary-material>

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Sense of Coherence and Stress-Related Resilience: Investigating the Mediating and Moderating Mechanisms in the Development of Resilience Following Stress or Adversity

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Background: Trauma, stress, and adversity are well-known for having lasting negative effects on health. Yet, not all individuals go on to develop psychopathology or impaired health. However, little is known about the underlying mechanisms which influence the development of stress-related resilience. Sense of coherence-revised (SOC-R) may play a role in this process, as it is formed through overcoming stress or adversity. It may also influence the steeling effect, which suggests that previous exposure to moderate adversity increases resilience to later adversities.

Objectives: This study aimed to examine the mediating and moderating roles of SOC-R in the relationship between stress or adversity, and psychological health and well-being. It further aimed to investigate the role of SOC-R in steeling processes.

Methods: The study used a longitudinal design, with data collection at baseline and one-year follow-up. Participants included ($N = 238$) Swiss older adults ($M_{\text{age}} = 68.3$ years). Standardized questionnaires assessed early-life adversity, recent chronic stress, SOC-R, and current health and well-being. Mediation and moderation analyses examined the mechanisms underpinning stress-related resilience and curvilinear associations assessed steeling.

Results: Results showed that the Manageability subscale of SOC-R significantly moderated the relationship between chronic stress and general mental health ($b = 0.04$, 95% CI [0.007, 0.082], $t = 2.32$, $p < 0.05$). Furthermore, SOC-R significantly mediated the relationship for general mental health (GMH) and satisfaction with life (SWL) with childhood emotional neglect (GMH: $b = -0.056$, 95% BCa CI [-0.126, -0.002]; SWL: $b = -0.043$, 95% BCa CI [-0.088, -0.004]), childhood physical neglect (GMH: $b = -0.100$, 95% BCa CI [-0.232, -0.002]; SWL: $b = -0.081$, 95% BCa CI [-0.181, -0.002]), and chronic stress (GMH: $b = -0.052$, 95% BCa CI [-0.100, -0.001]; SWL: $b = -0.055$, 95% BCa CI [-0.097, -0.020]). No curvilinear associations were observed between stress or adversity and SOC-R.

Conclusions: This study expands on the limited research on stress-related resilience by examining the role of SOC-R in the interactions between adversity, stress, and health. Future research should examine SOC-R in samples with a greater range and different types of adversity. Overall, findings suggest that SOC-R is an important mechanism underpinning the development of stress-related resilience.

Keywords: sense of coherence-revised, stress-related resilience, resilience mechanisms, psychological health, mediating factor

INTRODUCTION

Trauma, adversity, and stress exposure can have lasting negative effects on psychological health and well-being. In particular, early-life adversity (such as trauma, maltreatment, or neglect) has been shown to lead to long-term health-related problems and the development of mental health disorders (1, 2). For instance, a large-scale study by the World Health Organization (WHO) examined the prevalence of mental health disorders across 21 countries. Findings revealed that 38.8% of participants had experienced some form of early-life adversity, such as maltreatment and neglect, family violence, or physical abuse. It further revealed that such experiences of early-life adversity accounted for 29.8% of psychological disorders in adulthood (3). In addition, stress exposure is also associated with long-term negative outcomes, with chronic stress in particular being detrimental to health. Continuous or repeated exposure to stress can result in cumulative adverse effects on physiological health (4, 5). This “wear and tear” on the body has been shown to lead to an increased susceptibility to the development of stress-related mental health problems, such as depression, anxiety, and post-traumatic stress disorder (6, 7). However, while stress or adversity can lead to long-term negative outcomes, not all individuals go on to develop psychopathology or impaired physical health.

Many individuals are able to adapt to stress or adversity and maintain good health and quality of life (8, 9). Such heterogeneity in response to stress or adversity can be explained by the concept of “resilience.” Resilience refers to the ability to adapt to experiences of stress or adversity and maintain a stable trajectory of healthy psychosocial and physical functioning (10). For example, with regard to chronic stress, a study by Sharpley et al. (11) examined the relationship between chronic stress, resilience, and depression in 104 cancer patients. Results indicated that at low to moderate levels of chronic stress, individuals showed higher levels of resilience and lower levels of depression. In relation to early-life adversity, one notable example of longer-term outcomes of trauma and adversity is the recent longitudinal project by Maercker and colleagues. This research examined psychopathological and resilient outcomes in an adult sample of former indentured child laborers in Switzerland (i.e., the so-called *Verdingkinder*). Many former *Verdingkinder* experienced high levels of exposure to trauma and maltreatment in childhood, including physical, emotional, and sexual abuse, as well as physical and emotional neglect (1, 12). Findings showed that some former *Verdingkinder* had

developed mental health disorders in later life: 23% major depressive disorder, 26.3% posttraumatic stress disorder, and 7.8% generalized anxiety disorder (13, 14). Nevertheless, despite the experiences of early-life trauma and adversity, results showed that many former *Verdingkinder* had no mental health disorders and some also showed indications of resilience in later life (15).

Despite the increasing research interest on resilience in the aftermath of stress or adversity, there is a lack of information on the underlying mechanisms which influence the development of this stress-related resilience. The interplay between risk and resilience factors needs to be further explored in order to better understand resilience processes and interindividual differences in psychological health and well-being. One factor which may play an important role in the development of stress-related resilience is the recently revised Sense of Coherence (SOC-R) concept. The SOC-R concept and scale was developed by Bachem and Maercker (16) as a revision of the original Sense of Coherence (SOC), which had shown conflicting results with regard to its psychometric properties (17–19). The original SOC refers to a way of viewing the world which facilitates successful coping with stressors and is comprised of three components: (1) *Comprehensibility*, that stimuli are perceived as structured, predictable, and explicable; (2) *Manageability*, that adequate resources are available to meet demands; and (3) *Meaningfulness*, that demands are viewed as worth investing in and engaging with (20, 21). While the revised SOC-R concept builds on Antonovsky’s research, it assumes a more neutral position on the predictability of events and instead focuses on dealing with the ambiguity of life experiences (16).

SOC-R refers to an individual’s ability to integrate and balance both positive and negative experiences in order to maintain and develop health and well-being (16). This ability is proposed to develop through the successful coping with and overcoming of experiences of stress or adversity (21). It may therefore be considered an indicator of stress-related resilience aspects. Similar to the original SOC, the SOC-R concept and scale is comprised of three theoretical dimensions and also includes the manageability dimension: (1) *Manageability*, the ability to come to terms and deal with difficult situations. However, two new dimensions were developed to reflect the revised concept: (2) *Reflection*, the ability to consider different perspectives and understand connections, and (3) *Balance*, the ability to balance positive and negative experiences and feelings (16). Regarding the theoretical assumptions of SOC-R, it is suggested that through these three aspects of SOC-R, individuals are able to mobilize available and appropriate resources in order to cope

with stressors and adversity. Furthermore, SOC-R is assumed to be relatively stable later in life and a strong SOC-R is assumed to facilitate healthy aging through the maintenance of psychological health and well-being (16, 22).

Initial research with the SOC-R examined its role in overcoming minor adversities (in the form of daily hassles), as well as major adversities (16). Participants included a bereaved sample ($n = 334$) and a control sample from the general population ($n = 157$). Results of this study indicated that SOC-R may be a useful coping mechanism for both minor adversities and extreme stressors. This study also compared the original SOC and SOC-R. With regard to total scores, lower SOC-R was observed in the bereaved sample in comparison to the general population sample. These results were consistent with the findings for the original SOC scale. In addition, construct validity was improved in the SOC-R scale, as SOC-R showed lower correlations than the original SOC with measures of psychological well-being, such as optimism, neuroticism, and self-efficacy (16). These initial findings suggested that the SOC-R scale may be a suitable alternative to the original SOC scale. Further studies have examined the moderating role of SOC-R on the association between adversity health outcomes. One such study examined the influence of SOC-R on the relationship between early-life adversity (in the form of emotional neglect) and mental health in later life (23). Results showed that SOC-R significantly moderated this relationship and acted as a buffer against the negative effects of emotional neglect, with stronger SOC-R associated with better mental health. A more recent study also investigated the interaction between SOC-R and value orientations in predicting posttraumatic growth in bereaved parents (24). Results found a significant interaction between SOC-R and the value self-transcendence, with stronger SOC-R associated with higher levels of posttraumatic growth.

The above research suggests that the strength of an individual's SOC-R can influence their ability to cope with stress or adversity, with stronger SOC-R associated with better outcomes. However, thus far no research exists on the potential mediating role of SOC-R. Previous research with the original SOC construct has shown that SOC can mediate the relationship between adversity and health. For instance, a study with $N = 193$ participants from the general population found that the relationship between adversity (as indicated by worry, anxiety, and stress) and psychological well-being (as indicated by satisfaction with life) was best explained through the significant mediation of SOC (25). Additionally, a more recent longitudinal study examined the mediating role of SOC in $N = 162$ cancer patients. Results showed that following a diagnosis of breast cancer, SOC significantly mediated the change in health-related quality of life over a 6-month period, as indicated by factors such as global quality of life and cognitive, social, and emotional functioning (26). Based on these findings, it is anticipated that SOC-R would also act as a mediator between stress or adversity and indicators of psychological health and well-being. However, the mediating role of SOC-R remains unclear and further research is needed in this area.

Furthermore, as the development of SOC-R is closely linked to the experiences of stress or adversity, the strength and influence

of SOC-R may therefore differ depending on the type and severity of the adversity, as well as the stage in the lifespan at which it occurs (23, 27). The majority of the research on SOC-R to-date has focused on early-life adversity and event-specific adversity (e.g., bereavement). Research is therefore needed to examine the role of SOC-R with different types and severities of adversity.

Related to severity is the concept of "steeling." The steeling effect suggests that previous exposure to some or moderate amounts of stress or adversity can strengthen an individual by increasing their resilience and resistance to later stress (28). In comparison, extreme stress or adversity may be too overwhelming to facilitate successful coping, and minimal stress or adversity may not be sufficiently challenging to necessitate the development of coping abilities. Moderate stress or adversity is therefore proposed to be more beneficial than extreme or even minimal stress or adversity (28, 29). Thus, in accordance with the steeling effect, a non-linear, quadratic (i.e., U-shaped) relationship should exist between stress or adversity and well-being (29). Studies have therefore focused on testing the steeling effect theory by assessing curvilinear (i.e., non-linear) rather than linear models of adversity. Results have demonstrated curvilinear relationships between different types of stress or adversity and indicators of health and well-being. For example, some studies have shown optimal health outcomes at moderate levels of early-life adversity [e.g., (30)], lifetime adversity [e.g., (31)], and perceived stress [e.g., (32)]. In addition, a recent study examined the underlying factors involved in steeling by investigating the relationship between early-life adversity, mental health, and successful aging (33). Findings supported the steeling effect and showed optimal levels of successful aging at moderate levels of early-life adversity and that mental health was a significant mediator of this relationship. These studies provide initial evidence for a steeling effect. However, it is a relatively new and emerging area of resilience research and little is known about the underlying mechanisms which may influence the steeling effect. Given the function of SOC-R in overcoming stress or adversity, it may also play a role in steeling processes. Further research is required to clarify the role of SOC-R in the development of stress-related resilience and, in turn, its influence on health and well-being.

Therefore, to address the gaps identified in the literature, the main aim of the current study was to examine the potential mediating and moderating roles of SOC-R in the relationship between stress or adversity and indicators of psychological health and well-being. As recommended by Fossion et al. (27) and Mc Gee et al. (23), and to build on the existing research with SOC-R, the current study assessed two types of stress or adversity, occurring at different stages in the lifespan: early-life adversity (i.e., childhood trauma and maltreatment) and recent chronic stress. Related to this main aim, two hypotheses were tested: First, based on the theoretical assumptions of SOC-R and the existing empirical evidence, it was hypothesized that SOC-R would significantly moderate the relationship between stress or adversity and indicators of psychological health and well-being (i.e., general mental health, satisfaction with life). It was expected that individuals with a strong SOC-R would show better psychological health than individuals with weaker SOC-R, even

with high levels of stress or adversity. Second, it was hypothesized that SOC-R would significantly mediate the relationship between stress or adversity and indicators of psychological health and well-being (i.e., general mental health, satisfaction with life). Finally, an additional aim of this study was to conduct an exploratory analysis to investigate the steeling effect and the role of SOC-R in steeling processes. It was therefore expected that moderate levels of stress or adversity would be associated with stronger SOC-R, which in turn would lead to optimal psychological health and well-being (i.e., general mental health, satisfaction with life).

MATERIALS AND METHODS

Study Design and Procedure

The current study was part of an overarching, longitudinal research project on the steeling effect (“Healthy Aging Against the Odds—Mechanisms behind the Steeling Effect”). A quantitative survey composed of standardized questionnaires was used in this study to assess positive and negative experiences, stress or adversity, current health and well-being, and resilience-related resources. The study was organized and conducted in the University of Zurich and was conducted with the informed consent of all participants in accordance with the Declaration of Helsinki. The protocol was approved by the Swiss ethics committee of the Canton of Zurich (ID 2015-00135) and the Ethics Committee of the Faculty of Arts and Social Sciences in the University of Zurich, Switzerland.

Participants

Eligible participants were those who met the following inclusion criteria: adults aged 50 years or older, and native Swiss-German speakers. G*Power software was initially used to calculate the statistical power analysis. In addition, empirical research recommendations for mediation and moderation analyses were also taken into consideration in determining the required sample size. A minimum sample of $N = 224$ was required in order to detect small to medium effect sizes, with a significance level of $p = 0.05$, and statistical power ($1 - \beta$) of 0.80 (34–36).

Measures

Sense of Coherence Scale—Revised [SOC-R; (16)]

The SOC-R scale assesses an individual’s ability to perceive and integrate both positive and negative life experiences in order to maintain and develop health (16). As SOC-R is assumed to develop within the context of adversity, it was used in the current study as an indicator of a stress-related resilience resource. The SOC-R scale is comprised of 13 items rated on a five-point Likert scale and yields a single score. The three dimensions which comprise the scale are: *Manageability* (e.g., “One can always find a way to cope with painful things in life”), *Balance* (e.g., “In my thoughts and actions I take into account that things often have two sides: good and bad ones”), and *Reflection* (e.g., “Normally I can consider a situation from various perspectives”). It is available in German and English, and results from the German version show high internal consistency of between $\alpha = 0.75$ and 0.81 for the total scale, and sufficient internal consistency of between

$\alpha = 0.54$ and 0.77 for the subscales (16, 23). The SOC-R scale has also been shown to have high test-retest reliability, with an $r = 0.85$ over a 1-month period, and $r = 0.74$ over an interval of 15 months (16).

Childhood Trauma Questionnaire [CTQ; (37)]

The CTQ measures trauma and adversity experienced early in life. It is comprised of 28 items rated on a five-point Likert scale. It is composed of the following five subscales, with each subscale assessed by 5 items: emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect. It also includes a three-item minimization-denial scale to detect false-negative trauma reports. The German version shows sufficient internal consistency across all subscales, with a Cronbach’s alpha of between $\alpha = 0.55$ and 0.96 (38, 39).

Screening Scale of Chronic Stress [SSCS; (40)]

The SSCS is a screening subscale of the Trier Inventory for the Assessment of Chronic Stress (TICS) and measures perceived stress over the previous 3-month period. It assesses five domains of stress: chronic worrying, work-related overload, social overload, excessive demands, and lack of social recognition. It consists of 12 items rated on a five-point Likert scale and yields a single score. The German version shows high internal consistency of $\alpha = 0.87$ (41).

36-Item Short Form Health Survey Version 2 [SF-36 V2; (42, 43)]

The SF-36 measures current mental and physical health. It consists of 36 items and is comprised of eight subscales which combine to form the two distinct component summary scores for mental and physical health. The physical component consists of four subscales: physical functioning, role-physical, bodily pain, and general health; and the mental component consists of four subscales: vitality, social functioning, role-emotional, and mental health (43). To calculate the component summary scores, population- and gender-specific norms for means, standard deviations, and factors loadings are used. As country-specific norms are currently unavailable for Switzerland, German norms were used in the current study (44, 45). The mental health component was used in the current study as an indicator of psychological health. The German version shows high internal consistency across the eight subscales, with a Cronbach’s alpha of between $\alpha = 0.81$ and 0.94 (43).

Satisfaction With Life Scale [SWLS; (46)]

The SWLS measures subjective well-being in relation to global life satisfaction (47). It consists of five items rated on a seven-point Likert scale and yields a single score. The German version shows high internal consistency of $\alpha = 0.92$ (48).

Procedure

A longitudinal study was conducted in the German-speaking regions of Switzerland. The study consisted of two assessment time points: baseline assessment at T1 (summer 2016) and a follow-up assessment 12 months later at T2 (summer 2017). Study participants were recruited using advertisements on websites, in newspapers and magazines, posted flyers, and radio

interviews with the authors. Participants were also recruited through the University Research Priority Program “Dynamics of Healthy Aging” in the University of Zurich. The survey was available as an online survey or in pen-and-paper format. Individuals who were interested in taking part contacted the research team and were either emailed a link to the online survey or were posted a pen-and-paper survey package. A study incentive was provided at each assessment point, with participants who completed the survey being entered into a raffle for 10 shopping vouchers.

The online survey was programmed using *Unipark* software (49). After following the link to the online survey, participants were provided with the study information sheet and then the informed consent form. Participants provided informed consent online by ticking the corresponding box to indicate their consent to participate in the study. Only if they provided informed consent could participants go on to complete the questionnaires. The pen-and-paper survey package also contained an information sheet, an informed consent form, and the questionnaire survey, as well as a free-post return envelope. At T2, participants were provided with either the online survey link or the pen-and-paper survey package depending on their preference at T1. Both survey formats were randomized at the scale level for each participant in order to avoid sequence and order effects. All assessment instruments were repeated at T2, except for the CTQ. As the CTQ assessed trauma and adversity experienced in childhood, this data was collected at baseline (T1) and the scale was then removed from the survey at T2 to reduce participant burden. Only data for which informed consent had been provided was included in the dataset and analyses.

Statistical Analysis

IBM Statistical Package for Social Sciences (SPSS) version 25.0 and PROCESS version 3.0 macro for SPSS were used to analyze the data (50, 51). For each instrument, less than 1% missing values were observed. Little's missing completely at random (MCAR) test suggested that most of the values were MCAR and were therefore replaced using the Expectation-Maximization algorithm (52, 53). For values not missing at random, the means on the subscale level were calculated for each participant.

The mediating and moderating roles of SOC-R were examined in the relationship between past and recent adversity and psychological health and well-being. According to the conceptual framework for longitudinal research proposed by Collins (54), the theoretical model of the anticipated change should be considered in the operationalization of the statistical model. Regarding the current study, according to the theoretical assumptions of SOC-R, SOC-R should be relatively stable later in life (16, 20). Therefore, as the current sample consisted mainly of adults and older adults, it was anticipated that SOC-R would not change significantly over the two assessment points. A paired-samples *t*-test was conducted to test this assumption. In line with the theoretical assumption, the results showed that SOC-R scores did not differ significantly [$t_{(237)} = 1.61$, $p = 0.11$; $r = 0.10$] at T1 ($M = 50.61$, $SD = 5.72$) and T2 ($M = 50.12$, $SD = 5.62$). Therefore, baseline SOC-R was used for the longitudinal mediation and moderation analyses with

the CTQ subscales. In order to examine the influence of more recent stress, T2 variables were assessed with chronic stress as the predictor.

Mediation analyses (model 4) and moderation analyses (model 1) were conducted using the PROCESS version 3.0 macro for SPSS (50). Socio-demographic variables (i.e., age and education) which showed significant correlations with the predictor and outcomes variables were included as covariates in these analyses to control for potential confounding. Where effects were not observed for total SOC-R, analyses were conducted with the SOC-R subscale level in order to probe potential underlying effects from the dimensions which comprise and ultimately influence SOC-R. Regarding the moderation analyses, a “regions of significance” analysis was also conducted using the Johnson-Neyman procedure (55). This procedure provides additional information on the significance regions for the effect of the predictor (early-life adversity and chronic stress) on the outcome (general mental health and satisfaction with life) at specific values of a continuous moderator (SOC-R). In addition, in order to investigate the role of SOC-R in steering processes curvilinear (i.e., non-linear) associations, specifically quadratic relationships, must be assessed. To examine these potential curvilinear relationships, the linear stress and adversity terms must first be controlled for by including these variables as covariates in the model. The quadratic (i.e., squared) terms for early-life adversity (CTQ²) and chronic stress (SSCS²) were then implemented into the mediation model (29, 56). Within this model, a steering effect is indicated by a significant relationship between the quadratic adversity and stress terms and the mediator (i.e., SOC-R), and with the health and well-being indicators of general mental health and satisfaction with life.

RESULTS

Sample Characteristics

A total of 337 participants were recruited at T1. From this, 260 participants completed both assessments (T1 and T2) and 77 participants dropped out after T1. Participants who completed both T1 and T2 assessments showed a higher SOC-R score ($M = 50.5$, $SD = 5.79$), than those who dropped out after T1 ($M = 48.6$, $SD = 6.93$). An independent samples *t*-test showed that this difference, 1.93, BCa 95% CI [0.217, 3.64], was significant $t_{(328)} = 2.44$, $p = 0.03$, with a small effect size ($r = 0.13$). From the 260 participants at T2, $n = 17$ participants were excluded from the analyses due to data missing at the total scale or subscale level and a further $n = 5$ multivariate outliers were removed. The final sample consisted of $N = 238$ participants, with a mean age of 68.31 years ($SD = 8.96$, age range = 50–92 years). The sample was comprised of 175 females (73.5%) and 63 males (26.5%). The online survey was completed by 160 participants (67.2%, $M_{\text{age}} = 65.94$ years, $SD = 8.27$) and the pen-and-paper survey was completed by 78 participants (32.8%, $M_{\text{age}} = 73.17$ years, $SD = 8.39$). The majority of participants indicated that vocational training (33.2%) was their highest level of education, followed by university-level education at university of applied sciences (18.5%) and university (16.0%). Regarding employment status, 110 participants (46.2%) were

retired, 65 (27.3%) were employed, 38 (16.0%) were involved in voluntary activities, and 7 (2.9%) were unemployed. Regarding relationship status, the majority of participants were married (35.3%), followed by widowed (16.4%), and divorced (15.5%). See **Table 1** for an overview of the sample characteristics. With regard to early-life adversity, participants reported higher levels of emotional neglect ($M = 13.60$; $SD = 5.55$) and emotional abuse ($M = 10.43$; $SD = 5.49$), followed by physical neglect ($M = 8.41$; $SD = 3.12$), physical abuse ($M = 7.15$; $SD = 3.43$), and sexual abuse ($M = 7.08$; $SD = 3.76$). However, levels of experienced early-life adversity were low for most categories, with a high percentage of participants reporting none to low levels of adversity: sexual abuse (73.9%, $n = 176$), physical abuse (84.5%, $n = 201$), physical neglect (71.4%, $n = 170$), emotional abuse (70.2%, $n = 167$), and emotional neglect (59.7%, $n = 142$).

Moderation Analysis

Moderation analyses were conducted to examine the influence of SOC-R on the strength of the relationship between different indicators of stress or adversity (i.e., early-life adversity, chronic stress) and current psychological health and well-being (i.e., general mental health, satisfaction with life). With regard to early-life adversity, no significant interaction effects were observed at the SOC-R total or subscale level for the CTQ subscales (physical, sexual, emotional abuse, and physical or emotional neglect).

Regarding chronic stress, no significant interaction effects were shown for total SOC-R. However, on the subscale level, a significant interaction effect was observed for general mental health and the manageability subscale of SOC-R ($b = 0.04$, 95% CI [0.007, 0.082], $t = 2.32$, $p < 0.05$). This suggests that the manageability dimension of SOC-R significantly moderates the relationship between chronic stress and general mental health (see **Table 2** for the predictors of general mental health and the interaction effect).

Additionally, a significant negative relationship was observed between chronic stress and general mental health at low ($b = -0.696$, 95% CI [-0.842, -0.551], $t = -9.43$, $p < 0.01$); mean ($b = -0.607$, 95% CI [-0.738, -0.477], $t = -9.19$, $p < 0.01$); and high levels of manageability ($b = -0.519$, 95% CI [-0.674, -0.363], $t = -6.58$, $p < 0.01$). High and low levels refer to one standard deviation above and below the mean of the moderator (i.e., SOC-R Manageability). However, the decrease in effect (i.e., b -values) suggested a buffering effect of manageability. Supporting this, results of the Johnson-Neyman procedure showed that as manageability increased, the strength of the relationship between chronic stress and general mental health changed from a strong negative effect ($b = -0.963$) to a small negative effect ($b = -0.341$). This indicates that the stronger the manageability, the weaker is the negative effect of chronic stress on general mental health. Visual inspection of the interaction plot also indicated a buffering effect. Individuals with a higher level of manageability had higher scores of general mental health across all levels of chronic stress in comparison to individuals with mean and low levels of manageability. This difference was particularly evident when levels of chronic

TABLE 1 | Sample characteristics.

Sample Characteristics	Total ($N = 238$)		Male		Female	
	M	SD	n	%	n	%
Age (years; age range = 50–92 years)	68.31	8.96	–	–	–	–
	n	%				
Gender (% female)	175	73.5	–	–	–	–
Education level:						
Primary school	5	2.1	1	1.6	4	2.3
Secondary/High school	18	7.6	4	6.3	14	8.0
Vocational training	79	33.2	18	28.6	61	34.9
Specialized vocational training	36	15.1	8	12.7	28	16.0
University of Applied Sciences	44	18.5	13	20.6	31	17.7
University	38	16.0	14	22.2	24	13.7
Other	18	7.6	5	7.9	13	7.4
Employment status: ($n = 228$)						
Employed	65	27.3	14	22.2	51	29.1
Unemployed	7	2.9	3	4.8	4	2.3
Voluntary work	38	16.0	4	6.3	34	19.4
Retired	110	46.2	40	63.5	70	40.0
Other	8	3.4	1	1.6	7	4.0
Marital status: ($n = 231$)						
Single	36	15.1	7	11.1	29	16.6
Committed relationship	29	12.2	8	12.7	21	12.0
Married	84	35.3	32	50.8	52	29.7
Separated	6	2.5	–	–	6	3.4
Divorced	37	15.5	8	12.7	29	16.6
Widowed	39	16.4	5	7.9	34	19.4

stress were high. See **Figure 1** for the graph of the significant moderation and interaction effects.

Mediation Analysis

Mediation analyses investigated whether SOC-R acts as a mediator of the relationship between stress or adversity (i.e., early-life adversity, chronic stress) and current psychological health and well-being (i.e., general mental health, satisfaction with life). With regard to early-life adversity, a significant indirect effect was observed for the CTQ subscales emotional neglect and physical neglect, for both general mental health and satisfaction with life. No significant indirect effects were observed for the abuse subscales of the CTQ (emotional, physical, sexual abuse). With regard to chronic stress, a significant indirect effect was also observed for both general mental health and satisfaction with life.

CTQ: Emotional Neglect

Regarding emotional neglect, a significant negative total effect was initially observed ($b = -0.309$, 95% CI [-0.524, -0.094], $t = -2.83$, $p < 0.01$), explaining 4.23% of the variance in general mental health. However, when SOC-R was included as a mediator in the model, a significant direct effect emerged, explaining a

TABLE 2 | Predictors of general mental health and the significant interaction effect, with SOC-R Manageability as the moderator.

Predictor	<i>b</i> [CI]	<i>SE B</i>	<i>t</i>	<i>p</i>
Constant	51.98 [44.88, 59.07]	3.60	14.44	0.000
SOC-R Manageability (centered)	0.912 [0.525, 1.300]	0.197	4.64	0.000
Chronic stress (centered)	−0.603 [−0.734, −0.473]	0.066	−9.10	0.000
SOC-R Manageability x Chronic stress	0.044 [0.007, 0.082]	0.019	2.32	0.021

$R^2 = 0.46$; *b* = unstandardized beta; *SE B* = standard error for the unstandardized beta; *t* = *t* test statistic; *p* = *p*-value.

greater percentage of the variance (9.11%). A significant indirect effect was also observed, indicating that SOC-R significantly mediated the relationship between emotional neglect and general mental health. See **Figure 2A** for the full mediation model.

Similarly, a significant negative total effect was initially observed for satisfaction with life ($b = -0.259$, 95% CI $[-0.388, -0.129]$, $t = -3.93$, $p < 0.01$), explaining 8.67% of the variance. However, when SOC-R was included as a mediator in the model, a significant direct effect emerged, explaining a greater percentage of the variance (16.13%). A significant indirect effect was also observed, indicating that SOC-R significantly mediated the relationship between emotional neglect and satisfaction with life. See **Figure 2B** for the full mediation model.

CTQ: Physical Neglect

Regarding physical neglect, a significant negative total effect was initially observed ($b = -0.746$, 95% CI $[-1.125, -0.367]$, $t = -3.88$, $p < 0.01$), explaining 6.92% of the variance in general mental health. However, when SOC-R was included as a mediator in the model, a significant direct effect emerged, explaining a greater percentage of the variance (11.32%). A significant indirect effect was also observed, indicating that SOC-R significantly mediated the relationship between physical neglect and general mental health. See **Figure 3A** for the full mediation model.

In addition, a significant negative total effect was initially observed for satisfaction with life ($b = -0.407$, 95% CI $[-0.640, -0.173]$, $t = -3.43$, $p < 0.01$), explaining 7.31% of the variance. However, when SOC-R was included as a mediator in the model, a significant direct effect emerged, explaining a greater percentage of the variance (14.93%). A significant indirect effect was also observed, indicating that SOC-R significantly mediated the relationship between physical neglect and satisfaction with life. See **Figure 3B** for the full mediation model.

SSCS: Chronic Stress

Regarding chronic stress, a significant negative total effect was initially observed ($b = -0.756$, 95% CI $[-0.880, -0.632]$, $t = -12.04$, $p < 0.01$), explaining 39.38% of the variance in general mental health. However, when SOC-R was included as a mediator in the model, a significant direct effect emerged, explaining a greater percentage of the variance (41.45%). A

significant indirect effect was also observed, indicating that SOC-R significantly mediated the relationship between chronic stress and general mental health. See **Figure 4A** for the full mediation model.

A significant negative total effect was also initially observed for satisfaction with life ($b = -0.359$, 95% CI $[-0.443, -0.275]$, $t = -8.38$, $p < 0.01$), explaining 26.01% of the variance. However, when SOC-R was included as a mediator in the model, a significant direct effect emerged, explaining a greater percentage of the variance (31.93%). A significant indirect effect was also observed, indicating that SOC-R significantly mediated the relationship between chronic stress and satisfaction with life. See **Figure 4B** for the full mediation model.

Steeling Effect

Additionally, to examine the role of SOC-R in steeling processes, the quadratic terms for early-life adversity (CTQ²) and chronic stress (SSCS²) were implemented in the mediation model to assess potential curvilinear relationships (29). To detect evidence of steeling, a curvilinear relationship should exist between adversity and stress and SOC-R, and between adversity and stress and the health and well-being outcomes (i.e., general mental health, satisfaction with life). However, results showed no significant indirect effects through SOC-R, and no significant quadratic relationships were observed between adversity and stress and SOC-R. This suggests that highest level of SOC-R was not shown in participants with moderate levels of adversity or stress, and that SOC-R did not significantly mediate the curvilinear relationship between adversity and stress and the indicators of psychological health and well-being.

DISCUSSION

The purpose of the current study was to examine the moderating and mediating roles of SOC-R in the development of stress-related resilience, and to investigate its potential role in steeling processes. Results showed that the Manageability subscale of SOC-R significantly moderated the relationship between chronic stress and psychological health. Results further showed that SOC-R was a significant mediator of the relationship between certain early-life adversities (i.e., physical and emotional neglect), as well as chronic stress, and psychological health and well-being. Finally, results revealed no curvilinear relationships between adversity or stress and SOC-R, indicating no evidence for a steeling effect.

Regarding moderation, total SOC-R was not shown to moderate the relationship between early-life adversity and health or well-being. This finding is in contrast to previous research, which examined the moderating role of SOC-R in a Swiss sample (23). Findings showed that total SOC-R moderated the relationship between emotional neglect in childhood and current mental health (23). One explanation may be that the sample in the current study was somewhat older than in the previous study by Mc Gee et al. (23). It may be that with increasing age, the focus of health-related resources, such as SOC-R, shifts toward more immediate health concerns such as physical or functional health (57). In relation to the original SOC,

FIGURE 1 | Significant interaction between chronic stress and general mental health at different levels of the moderator (SOC-R manageability). High and low levels refer to one standard deviation above and below the mean of the moderator (i.e., SOC-R Manageability).

FIGURE 2 | Mediation model of the relationships between emotional neglect (predictor) and general mental health (outcome variable, **A**), and satisfaction with life (outcome variable, **B**), significantly mediated by SOC-R (mediator).

studies often found a weaker relationship with physical health in comparison with mental health (58). For example, recent research by Gison et al. (59) examined the predictive effect of SOC on psychological and physical outcomes in participants with Parkinson's Disease. Results showed that SOC was predictive of health-related quality of life and emotional distress, but not physical disability. However, the influence of SOC-R on physical health has not yet been assessed and future research is required to further examine this relationship across various age groups with a diversity of physical health statuses.

SOC-R (total) was also not found to moderate chronic stress and health or well-being. However, the Manageability subscale

was shown to be a significant moderator. This would tentatively suggest partial support for the first hypothesis (i.e., that SOC-R would significantly moderate the relationship between stress or adversity and indicators of psychological health and well-being). Individuals with strong Manageability showed better general mental health scores than individuals with weaker Manageability, even when levels of chronic stress were high. Furthermore, similar to the moderation results of the study by Mc Gee et al. (23), a buffering effect was observed so that as Manageability increased, the negative effect of chronic stress on general mental health decreased. The Manageability dimension of SOC-R refers to the ability to come to terms and deal with difficult situations

(16). These findings may therefore indicate that the ability to manage stress over prolonged periods is an important aspect of successful coping, over and above the influence of the Reflection or Balance dimensions. In support of this, the importance of Manageability for coping was highlighted in the initial evaluation study of SOC-R by Bachem and Maercker (16). Results found that the Manageability dimension explained the largest proportion of variance in the bereaved sample. Bereavement is a major adversity, which would (similar to a chronic stressor) require long-term coping management abilities.

With regard to mediation, SOC-R (total) was shown to be a significant mediator for some types of early-life adversity and chronic stress. While no significant mediations were observed with the abuse subscales (of early-life adversity), this is not entirely unexpected, given the low number of reported physical and sexual abuse in the general population sample. In line with previous general population studies in Germany [see Glaesmer (60)], experiences of neglect were more prevalent in the current study than experiences of abuse. However, in support of the second hypotheses (i.e., that SOC-R would significantly mediate the relationship between stress or adversity and indicators of psychological health and well-being), the results suggest that

SOC-R was a significant mediator for general mental health and satisfaction with life, in relation to childhood physical neglect, childhood emotional neglect, and recent chronic stress. Although no previous research exists on the mediating role of SOC-R, findings are consistent with and expand upon the empirical research indicating a mediating influence with the original SOC (58, 61). The finding that SOC-R may explain the relationship between stress or adversity and psychological health and well-being also supports the assumption that SOC-R may be an integral mechanism underpinning the development of stress-related resilience.

In contrast to expectations, results did not support a steeling effect (i.e., that moderate levels of stress or adversity would be associated with stronger SOC-R, which in turn would lead to optimal psychological health and well-being). This is also inconsistent with recent research, which found significant curvilinear relationships between early-life adversity and quality of life outcomes, including general mental health (33). This may suggest that moderate levels of adversity are not “optimal” for the development of a strong SOC-R. However, another explanation may be due to differences in the adversity indicator, as the operationalization of early-life adversity in the study

by Hölzge et al. (33) differed to that in the current study. Nevertheless, before definitive conclusions can be drawn, further research is required to assess SOC-R and the steeling effect in larger, representative samples, with a greater range of adversity. Although a steeling effect was also not observed for chronic stress, this was consistent with previous research. Similar to the current study, research by Dooley et al. (62) found evidence of a linear relationship (i.e., as in the mediation analysis of the current study) but not a curvilinear (steeling) relationship between chronic stress and well-being. One explanation may be that prolonged stress experiences have often been shown to lead to increased sensitization to later stress rather than an increased resistance to later stress ((4, 7, 28). Nevertheless, these findings highlight the importance of considering the type and severity of the stressor and adversity in the interplay between risk and resilience factors, and the resulting resilience or psychopathology (23, 27).

Limitations and Future Directions

Directions for future research can be identified by addressing some limitations of the current study. First, the retrospective nature of the study design may have led to recall bias, particularly in relation to the more distant experiences of early-life adversity (63). Similarly, the use of self-report assessments may also have led to biased reporting. To more accurately capture the influence of stress or adversity exposure, future research should use prospective, longitudinal designs, and include objective measures of stress or adversity, such as cortisol activity in response to stress-tests [e.g., (32)]. Another limitation of this study was the low levels of adversity, particularly early-life adversity, in the current sample. For instance, in relation to early-life adversity, the large-scale, cross-national study by Kessler et al. (3) found that in a sample of $n = 20,652$ participants from high-income countries (from the same World Bank classification as Switzerland), 38.4% reported having experienced childhood adversity. Furthermore, in relation to childhood sexual abuse, a recent nationally-representative survey of $N = 6,787$ adolescents was conducted in Switzerland (64). Results showed that 40.2% ($n = 1,282$) of girls and 17.2% ($n = 610$) of boys reported having experienced at least one form of child sexual abuse. While the prevalence of adversities was generally lower in the current study, the highest reported adversities were emotional and physical neglect. However, this may be expected in a general population sample and the lower levels of adversity in the other categories may explain the lack of significant results. Related to this is self-selection bias, which may have influenced the composition of the sample, as individuals who experienced less adversity may be more likely to choose to participate in the study (65). Similarly, differences observed in SOC-R between participants and drop-outs may indicate a selection bias. Those who dropped out after T1 showed a significantly lower SOC-R score than those who completed both assessment points. It may be that individuals with a higher SOC-R are more likely to initially volunteer to take part in a study and to persevere with it at T2. To improve confidence in the findings, future research should replicate these analyses using different sampling techniques in both clinical and

non-clinical samples with a greater range of SOC-R, as well as stressor and adversity severities.

Another limitation is the relatively small sample size, which may restrict the generalization of results to the general population. Nevertheless, research from large-scale studies on resilience support the finding that resilience can buffer the negative effects of stress or adversity. For instance, a recent study with a representative German community sample ($N = 2,508$) found that resilient coping was not only associated with lower levels of distress, but also buffered the negative effects of childhood adversities on distress (66). Comparable results were shown in the population-based, longitudinal study: the Virginia Adult Twin Studies of Psychiatric and Substance Use Disorders. Results from $N = 7,463$ participants showed that high levels of resilience at baseline buffered against the development of psychopathology, even in the presence of high levels of stressful life events (67). Similarly, a longitudinal Swedish cohort study of $N = 237,879$ participants found that participants with lower stress resilience to chronic stress showed an increased risk of stroke (68). However, SOC-R has yet to be assessed as an indicator of stress-related resilience aspects on such a large scale. Therefore, to increase confidence in the results, it is recommended that future research assess the buffering effect of SOC-R with a large sample size. Furthermore, another sample-related limitation is the broad age range (50–92 years) used in the current study, which may have masked specific age group effects or patterns in SOC-R (69). Future studies could also examine SOC-R across different age groups.

In addition, studies should investigate the different types of adversity (e.g., acute versus chronic stress, cumulative lifetime adversity, event-specific adversities), which may influence the strength of SOC-R and in turn, its impact on health and well-being (16, 23). Finally, the current study investigated the role of SOC-R in steeling processes using a simple mediation model of curvilinear associations. However, SOC-R is assumed to promote the development of stress-related resilience through the appropriate use of resources (16, 22). Future studies may therefore benefit from including resources into the model with SOC-R, such as in the form of moderated mediation (29). This is supported by a review of studies on resilience in stress-related disorders (70). Thirteen studies were included which investigated predictors of resilient outcomes following stress exposure. Results indicated that resilience is a dynamic process, involving the interaction of multiple separate resilience-related factors (70). Similarly, in relation to resilience in older adults, research has shown that a combination of mental, social, and physical factors is important for resilience. In particular, a recent review identified optimism, adaptive coping, positive emotions, social support, and social connectedness as important factors in the maintenance of high levels of resilience in older adulthood (71). In relation to future moderation and mediation analyses with SOC-R, as indication for which resources to include, studies can also draw on previous research by Mc Gee et al. (23), which examined convergent and discriminant correlations between SOC-R and related psychological concepts. Similar to the recommendations by MacLeod et al. (71), results showed moderate to strong correlations between SOC-R and a number

of resources, including general self-efficacy, social support, and optimism.

CONCLUSION

By investigating the moderating and mediating roles of SOC-R, the current study provides a meaningful contribution to the research on stress-related resilience. It addresses a gap in the literature, as it is the first study to examine the mediating role of SOC-R in the relationship between stress or adversity and health and well-being. It also builds on previous studies by assessing chronic stress, as well as early-life adversity. While evidence of a steeling effect was not observed, the results suggest that SOC-R may still be a crucial underlying mechanism in the development of resilience. In conclusion, the findings suggest that in overcoming stress or adversity, an individual's SOC-R (and the strength of their SOC-R) plays an important role in fostering resilience and in turn, psychological health and well-being.

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All authors made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation

of data for the work; and drafting the work or revising it critically for important intellectual content; and final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Emotion Transfer, Emotion Regulation, and Empathy-Related Processes in Physician-Patient Interactions and Their Association With Physician Well-Being: A Theoretical Model

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Physicians experience many emotionally challenging situations in their professional lives, influencing their emotional state through emotion contagion or social appraisal processes. Successful emotion regulation is crucial to sustain health, enable well-being, foster resilience, and prevent burnout or compassion fatigue. Despite the alarmingly high rate of stress-related disorders in physicians, affecting not only physician well-being, but also outcomes such as physician performance, quality of care, or patient satisfaction, research on how to deal with emotionally challenging situations in physicians is lacking. Based on extant literature, the present article proposes a theoretical model depicting emotions, emotion regulation, and empathy-related processes and their relation to well-being in provider-client interactions. This model serves as a basis for future research and interventions aiming at improving physician well-being and professional functioning. As a first step, interviews with 21 psychiatrists were conducted. Results of qualitative and initial quantitative analyses provided detailed descriptions of the model's components confirming its usefulness for detecting mechanisms linking emotion regulation and well-being in psychiatrist-patient interactions. Additionally, results lend preliminary support for the validity of the model, suggesting that successful regulation of emotions (i.e., achieving a desired emotional state) elicited by cyclical transfer processes in provider-client interactions is associated with both short- and long-term well-being and resilience. Furthermore, empathy-related emotions and their regulation seem to be linked to well-being. Based on the results of the present study, a prospective longitudinal study is under preparation, which is intended to inform effective interventions targeting emotion transfer, empathy-related processes, and emotion regulation in physicians' professional lives. The model and results are also potentially applicable to other health care and social services providers.

Keywords: emotion transfer, emotion regulation, empathy, stress, well-being, health, resilience, physicians

INTRODUCTION

In the daily routine of a hospital or a private practice, there are many situations that can elicit emotions in physicians. For instance, breaking bad news to a patient is often perceived as stressful by physicians, and is associated with both increased physiological arousal and difficulties in handling resulting emotions such as sorrow, guilt, or the feeling of failure (1–4). Dealing with demanding patients may also evoke feelings of anger, and experiencing their suffering or death may result in sadness or distress. Yet, in order to prevent emotions from interfering with medical decisions, to stay calm and maintain a professional attitude toward the patient, and to provide high quality care, physicians need to carefully regulate such emotions. Emotional involvement could for example disrupt medical objectivity, resulting in poor judgment and leading to a tendency to over-treat patients (5–8). It has also been shown that physicians downregulate their pain whilst watching visual stimuli depicting physically painful situations (9, 10). The authors have argued that this downregulation is necessary in order to be able to perform painful medical treatments. Thus, emotional detachment has long been a desired emotional state for physicians (5, 11). Through role models and clinical practice, medical students and residents learn to suppress their emotions. In fact, several studies have reported a decline in empathy during medical school and residency [(12, 13); but there are also contradictory findings, see (14–18)]. Furthermore, studies have shown that physicians tend to respond in an informative and biomedical rather than an emotional manner to their patients (19, 20).

However, emotional engagement and especially empathy is of great importance to the patient and to clinical outcomes, as it has been associated with clinical competence and performance [e.g., (21–24)], as well as with the quality of the physician-patient relationship: Patients with an empathetic physician have reported more illness-specific information and concerns, improving diagnostic accuracy (25–28). Physician empathy has also been found to increase patients' participation in, adherence to, and satisfaction with treatment, thus rendering it more effective (26–29). Moreover, empathy has been associated with greater patient enablement, improved communication skills, better decision making, better disease management, better health, less anxiety, and higher quality of life in patients (25, 26, 28, 30–33). In two randomized controlled trials, physician empathy has even been shown to increase patients' immune responses, and to shorten the duration and lessen the severity of a common cold (34, 35). It is not only the patients and the health care system that may benefit from physician empathy, but also the physicians themselves: Empathy has been associated with health, compassion satisfaction, and quality of life, although the causal direction is not yet clear (36–38).

Yet, in their extreme forms, both emotional detachment and emotional engagement take their toll. Emotional over-involvement and exposure to high levels of negative emotions can lead to personal distress, compassion fatigue, emotional exhaustion, and burnout (36, 39–41). For example, it has been shown that the intensity of physicians' regret over difficult

patient situations is associated with poor self-rated health, and that adaptive emotion-focused coping strategies protect against the effects of healthcare-related regrets (42). Over-involvement might also result in personal sacrifices such as neglecting one's personal time, hobbies, and family obligations in order to help the patient (8). Personal detachment and unexamined feelings on the other hand may lead to a loss of a professional sense of meaning, objectification of patients, or cynicism, contributing to burnout and depression (5, 6, 43). Therefore, several researchers have highlighted the importance of finding a balance between emotional involvement and emotional detachment (5, 11, 25).

Thus, research has shown that emotionally challenging situations in combination with maladaptive coping strategies can have deleterious effects for physicians, patients, and the health care system. Compared to the general population, stress-related disorders including burnout, depression, substance abuse, and suicide are considerably more prevalent in physicians. Emotionally charged social interactions are thought to be one of the reasons for the alarmingly high prevalence of these disorders. In turn, diminished physician well-being has negative consequences for several clinical outcomes such as physician performance, quality of care, patient satisfaction, and treatment adherence (44–48). These findings further emphasize the importance of facilitating physicians' selection of strategies to cope with emotionally challenging situations in order to enhance their well-being and foster resilience.

However, studies on these topics are scarce. Qualitative studies from the US have examined the types of emotions that clinicians experience, how they manage these emotions, and how these emotions affect the care they provide (49–52). Their results have shown for example that interactions with patients trigger both unpleasant (e.g., anxiety, sadness, frustration) and pleasant emotions (e.g., happiness) which affect the perceived provision of care. Emotion management involves strategies such as self-care (e.g., distraction, relaxation) or seeking social support (e.g., consulting colleagues). However, these findings have not yet been linked to outcomes such as emotional distress, burnout, and well-being. Emotional labor [regulation of emotions or emotional expression to display professionally desired emotions, e.g., (53)] has been associated with lower job satisfaction and adverse health consequences such as stress and burnout in health care personnel, including physicians (54–58). There are also cross-sectional studies, showing that self-reported emotional intelligence in physicians (i.e., the ability to perceive, integrate, understand, and regulate emotions to promote personal growth) is related to higher job satisfaction (57, 59). Moreover, the capacity to self-regulate (emotions, behavior, and other aspects) has been associated with physician well-being (60). However, because these studies used global construct measurements based on self-report rather than behavior, they may only predict the outcomes of emotion regulation in clinical settings to a limited extent. Apart from these methodological issues, the mechanisms linking emotion regulation with positive physician outcomes have not been assessed.

Because empathy is considered a core variable in high-quality patient care, studies linking empathy to burnout and well-being are more common. However, there is no consensus on the

definition of empathy, and the causal direction of the relationship between burnout and empathy remains unclear (5, 61, 62). Several approaches to enhancing empathy and interpersonal or communication skills in physicians have been developed, and such programmes have been shown to be effective (63–65). However, as empathy can have negative effects on physician well-being, these programmes might potentially also have harmful consequences. This further highlights the need to examine the mechanisms linking empathy-related processes to negative outcomes.

In order to achieve a better understanding of these mechanisms and thereby facilitate resilience and well-being among physicians, research on how to regulate emotions, on how to be empathic without increasing the risk of vicarious distress, and ultimately on how to find the right balance between emotional involvement and detachment is needed. Here, we aim to contribute to that goal by establishing a theoretical model for understanding emotions and emotion regulation in provider-client interactions. This model can potentially be applied not only to physicians, but also to other professionals working in health care or social services, such as psychologists, nurses, or pastors.

After discussing evidence relating to emotions, emotion regulation, and empathy in the extant literature, a model based on this evidence will be proposed in the following section, which will then be tested and discussed in a qualitative study with additional quantitative data conducted on a sample of psychiatrists.

THEORY OF EMOTIONS, EMOTION REGULATION, AND WELL-BEING

Emotions and Emotion Transfer

Emotions are elicited by external or internal events and have behavioral and neurobiological correlates, allowing a coordinated reaction to the emotion-evoking event spanning experience, behavior, and physiology (66, 67). Consider for example a physician performing a difficult surgical operation. If the surgery threatens to fail (external event) or if the physician anticipates the consequences of failure (internal event), the physician might feel fear or stress [i.e., a subset of negative emotions, see (68, 69)]. This in turn can lead to the physician increasing his or her effort levels (behavior) and releasing additional adrenaline, thereby becoming more alert and prepared for potential complications (neurobiological correlate).

There are several ways in which the social environment can influence and be influenced by emotions. When interacting with an angry patient, the physician might infer from the patient's anger that the treatment is not working as it should, which could then lead to anger about treatment progress on the side of the physician (appraisal 1). Or the physician might perceive the patient's anger as a sign of the patient's inability to cope with the situation and feel sorry for the patient (appraisal 2). The patient's anger might also elicit guilt if the physician thinks that the patient is angry because he or she made a mistake during treatment (appraisal 3). The physician's expression of his or her emotional response may in turn affect the patient, eliciting for example even more anger in the patient, if he or she does not feel understood.

In their work on interpersonal emotion transfer, Parkinson et al. differentiate two basic ways in which the expression of emotions can influence other people [e.g., (70–74); for similar conceptions, see (75–77)]. The first way is through social appraisal processes: Other people's emotions can serve as a source of information regarding an object in the shared environment (as in the example with appraisal 1). Parkinson et al. call this *object-directed transfer*. Others' emotions can also serve as a source of information about the other person (appraisal 2), denoted as *person-directed transfer*. In addition, we argue for a *self-directed transfer*, where an individual uses the emotion of another person as a source of information about himself or herself (as in appraisal 3). These transfer processes need not depend on explicit interpretation but can happen unconsciously, e.g., through conditioning.

A second way in which emotions can be transferred is through emotion contagion. Feelings can spread to another person who then feels the same or a very similar emotion. Through mimicry (matching expression) or mirror representations in the brain (mirror neurons) of what one sees or hears, one can catch the observed emotion. These processes are mostly automatic and non-conscious [e.g., (70–74)]. In contrast to an emotion elicited by conscious or unconscious social appraisal processes, one caught through mimicry or mirror representations need not depend on prior cognitive evaluation or be directed at any specific target (object, person, self). However, it can still influence our appraisal of the shared environment and thereby affect our reaction (71). Parkinson et al. call this *non-directed transfer*.

The transfer of emotions lies at the core of empathy. Even though there is no consensus on how to define empathy, or for that matter sympathy and compassion, a growing body of research concludes that there are at least two components: an affective component (sharing of another's emotions, as in emotion contagion) and a cognitive component (understanding of how another person feels, which can elicit an emotion such as feeling sorry, as in social appraisal). Research in social neuroscience suggests that these processes act in concert and should not be considered in isolation (78–82). For clarity's sake and because the processes related to empathy (as well as to sympathy or compassion) seem to be covered sufficiently by Parkinson et al. conception, our proposed model will not treat empathy-related processes separately, but as forms of interpersonal emotion transfer.

Emotions can help us to respond adaptively to a situation. In a social environment, emotions play an important role regarding affiliation, and social functioning. For example, emotion transfer allows us to bond with other people, to understand their reactions and modulate ours, to pursue shared goals, and to act prosocially. However, there is also a downside to this, namely when emotion transfer impedes social processes such as relational goal pursuit, or when one is over-exposed to negative emotions from others (75, 76, 83). Therefore, it is crucial to regulate emotions.

Emotion regulation itself can also have a social dimension. We can regulate our own emotions to modulate their influence on others. In addition, we can regulate others' emotions (interpersonal emotion regulation), which affects the other person and ourselves in return (70, 84).

Emotion Regulation Strategies and Abilities

People may use many different strategies to regulate emotions (including stress-related emotions), and these strategies can be classified in many different ways [e.g., (85–87)]. Parkinson and Totterdell, for example, differentiate between cognitive and behavioral strategies, which might either involve some form of diversion (avoiding the situation or the emotion) or engagement [addressing the situation or the emotion, (88)]. Research has shown that some strategies tend to be either adaptive or maladaptive, especially if used dispositionally [e.g., (66, 89)].

However, as Gross (66, 67) and Aldao et al. [e.g., (90)] have pointed out, searching for the optimal strategy regardless of circumstances is misleading. Rather, it might be the flexibility to blend, change, and use strategies in a situationally appropriate way, and the range of available strategies, that are at the core of successful emotion regulation (67, 90, 91). Importantly, it is not always necessary to change emotions in order to respond adaptively to a situation. Acceptance, tolerance, and willingness to approach an emotion without changing it may be equally important in handling emotions. These and other factors such as emotional awareness, beliefs about the mutability of emotions (emotion regulation self-efficacy), or skills covered by the concept of emotional intelligence (92) might help to regulate emotions (90, 93–96). Therefore, researchers now differentiate between emotion regulation strategies (e.g., avoiding the emotion-eliciting situation) and emotion regulation abilities [e.g., variability of the repertoire, flexibility, tolerance, emotional awareness, emotion regulation self-efficacy, (86, 90)].

Research on emotion regulation strategies and abilities underlines the importance of the person-situation-strategy interaction in the success or failure of emotion regulation. This interaction is at the core of the personalized emotion regulation framework proposed by Doré et al. (97). In this framework, features of the person (such as his or her emotion regulation abilities, emotional reactivity, personality, motivations, developmental stage, or biology) interact with features of the situation (such as the type and intensity of the emotion, the modifiability, controllability, and social context of the situation) and with features of the strategy (such as its implicit or explicit deployment, the temporal stage at which it is deployed, the demands a strategy poses, or implementation circumstances), and determine the short-term success of emotion regulation (i.e., whether and to what extent it brings about a desired emotional outcome) but also longer-term well-being.

Emotion Regulation Success, Well-Being, and Resilience

In our view, successful emotion regulation in itself (which we understand as the attainment of a desired emotional state through emotion regulation) is important for but does not guarantee optimized well-being. For example, achieving the goal of detachment from an unpleasant emotional situation may bring longer-term costs for the regulator (e.g., depersonalisation).

By contrast, facing an unpleasant situation may serve longer-term needs. Although experiencing generally more pleasant and less unpleasant emotions is usually associated with well-being, research suggests that having contextually useful or desired emotions, even if they are perceived as unpleasant, may likewise improve individual functioning and well-being [e.g., (98, 99)]. Therefore, in addition to successful emotion regulation, it is important to balance the needs of maintaining current well-being and long-term well-being.

Researchers commonly distinguish two aspects of well-being. First, subjective well-being involves a positive affective and cognitive appraisal of life in the sense of satisfaction with life and the presence of positive affect (hedonic approach). Second, psychological well-being involves positive functioning in the sense of personal growth, self-acceptance, environmental mastery, autonomy, optimism, engagement, positive relationships, and purpose and meaning in life [eudaimonic approach, (100–104)]. Hence, an emotional state enables well-being when it allows a positive appraisal of life and positive functioning in the current moment and in the long run.

Along the same lines, emotion regulation might be crucial for resilience, i.e., the maintenance of mental health in the face of severe psychological or physical adversity. Resilience has become an important goal in research oriented at preventing stress-related disorders both generally (105) and for physicians and other health care professionals in particular [e.g., (106–108)]. Kalisch et al. see resilience as involving “a dynamic process of adaption to the given stressful life circumstances” [(105), p. 786]. According to this formulation, emotion regulation in a stressful situation is one example of a resilience process. In light of this definition and especially with regard to emotion regulation deficits as transdiagnostic markers in psychiatric disorders (109, 110), emotion regulation may foster resilience and thereby help to prevent stress-related disorders and enhance mental health.

Theoretical Model for Emotions and Emotion Regulation in Provider-Client Interactions

Based on the discussed literature, we propose the following model for assessing emotions and emotion regulation in provider-client interactions:

When a provider and a client interact with each other, both bring their own emotions, including those elicited by internal or external events related or unrelated to the interaction, and those based on more general moods (referred to as *incidental emotions*, E_{inc}). While interacting with each other, both get affected by the other's emotions through social appraisal processes and emotion contagion. This may result in emotions elicited by *object-directed* (E_{od}), *person-directed* (E_{pd}), *self-directed* (E_{sd}), and *non-directed* (E_{nd}) interpersonal emotion transfer. All of the resulting emotions contribute to the *emotional state* of the provider (P_{ES}) and the client (C_{ES}) (**Figure 1**).

Specific emotions and emotional state more generally can also be influenced by emotion regulation. For example, the provider can influence the degree to which emotion transfer takes place or its selectivity, or can mitigate or

enhance already transferred emotions (whereby an emotional state characterized by exclusively downregulated emotions corresponds to emotional detachment and upregulated or unregulated intense emotions to emotional over-involvement). The failure to regulate emotion transfer successfully can result in potentially harmful emotional states, such as having high levels of unpleasant emotions, or emotions which are not useful or desired in a given situation. Also, some kinds of emotion directedness may be more harmful than others [e.g., more self-directed than situation-directed unpleasant emotions, as suggested by Abramson et al. reformulated learned helplessness theory, (111)]. However, transferred emotions might not pose a risk factor at all if regulated (i.e., influenced or embraced) successfully, regardless of their directedness.

The provider (and conversely also the client) can aim to regulate his or her own emotions (referred to as *intrapersonal emotion regulation*, ER_{intra}), the client's emotions (*interpersonal emotion regulation*, ER_{inter}), or both. Regulating his or her own emotions changes the provider's emotional state and thus the client's as well. Regulating the client's emotions changes the client's emotional state, which in turn influence the emotional state of the provider.

The client may also be directly affected by the emotion regulation strategies of the provider (e.g., the provider may avoid looking at the client to prevent being affected by emotions, which in turn may be disturbing for the client). It is also important to note that the regulation strategies that are deployed by either

party do not necessarily affect both parties positively. They might serve the interests of one party, but fail to influence or negatively influence the other party. For example, the provider may downregulate his or her compassion to prevent emotional over-involvement but thereby give the client the impression of being cold and disinterested.

The elicitation and regulation of emotions is thus a cyclical process [see (112)], where provider and client constantly influence each other.

It is important to note that the emotional state of both parties is continuously changing, consisting of constantly varying emotions and being constantly influenced by emotion regulation. Even if the emotional state is regulated successfully, well-being may be enhanced only in the short run (i.e., state well-being), in the long run (i.e., trait well-being), or not at all. The emotional state is optimally regulated if regulation is successful (i.e., if the desired emotional state is achieved) and enables a balanced maintenance of both state well-being and trait well-being as well as health (Figure 2, path 1).

Emotion regulation itself is influenced by features of the strategy (e.g., tactics applied, energy demands), the situation (e.g., course of the interaction, presence of other people) and the provider (e.g., emotion regulation abilities, path 2). The situation and the personal abilities and traits of the provider influence his or her emotional state as well as his or her state or trait well-being and health in their own right (not only via emotion regulation, path 3). Moreover, state and trait well-being influence each other,

FIGURE 2 | Model for emotions and emotion regulation in provider-client interactions, part 2: Emotion regulation, well-being, and influencing factors. E_{od} , emotions elicited by object-directed interpersonal emotion transfer; E_{pd} , emotions elicited by person-directed interpersonal emotion transfer; E_{sd} , emotions elicited by self-directed interpersonal emotion transfer; E_{nd} , emotions elicited by emotion contagion (non-directed); E_{inc} , emotions elicited otherwise (incidental).

as state well-being in the long run contributes to trait well-being and trait well-being shapes the experience of the present moment (path 4).

Hypotheses

We propose the following hypotheses based on the theoretical model:

1. The ratio between unpleasant and pleasant emotional activation is negatively associated with state and trait well-being. These associations are moderated by emotion regulation (path 1).
2. A lower level of self-perceived useful or desired emotions is negatively associated with state and trait well-being. These associations are moderated by emotion regulation (path 1).
3. Different kinds of emotion directedness (object-, person-, self-, and non-directed emotions) are differently associated with state and trait well-being. These associations are moderated by emotion regulation (exploratory hypothesis, path 1).
4. Successful emotion regulation (i.e., achieving the desired emotional state) is positively related to state and trait well-being and negatively related to indicators of impaired physical and/or mental health. However, we expect these relationships to be of medium size, since emotion regulation success does not guarantee well-being (path 1).
5. Different kinds of emotion regulation strategies are differently related to successful emotion regulation (exploratory hypothesis, path 2).
6. Emotion regulation abilities are positively related to successful emotion regulation (path 2).

7. Emotion regulation abilities are positively related to state well-being, trait well-being, and health, and negatively related to indicators of impaired physical and/or mental health (path 3).
8. State well-being is positively related to trait well-being and health, and negatively related to indicators of impaired physical and/or mental health (path 4).

In order to accurately describe, test, and if necessary revise the assumptions and proposed hypotheses of this theoretical model for research on provider-client and especially physician-patient interactions, a series of qualitative and quantitative studies are currently being prepared and conducted. In the following section, we present data from our first study.

EMPIRICAL SUPPORT

We conducted in-depth qualitative interviews with psychiatrists and psychiatric residents, each lasting approximately 2 h. We chose psychiatrists because of their insights into, and sensitivity to, their own emotional processes, resulting from their specialist training. The main aim of these interviews was to establish a basis for describing the model more accurately, but also to obtain preliminary evidence regarding the proposed hypotheses, using a series of quantitative questionnaires to assess well-being, emotion regulation abilities, and mental health. Due to the small sample size, we did not test hypothesis 2 or 5, or the moderation effects predicted as part of hypotheses 1 to 3. We also restricted our measurements of (impaired) physical and/or mental health to indicators of burnout, depression, and anxiety. In addition, we measured perceived stress over the past month as an indicator of a prolonged state of unpleasant emotions, which was hypothesized to be negatively related to

TABLE 1 | Sample characteristics.

	<i>n</i>
Total	21
Women	11
Men	10
Psychiatrists	16
Psychiatric residents	5
Working in a psychiatric hospital	11
Working in a private practice	10
THERAPEUTIC ORIENTATION	
Psychodynamic	9
Cognitive-behavioral	9
Systemic	5
Other	2

trait well-being and positively related to burnout, depression, and anxiety. As confirmed by the local ethics committee in Zurich, ethical authorisation was not required, as this study does not fall within the scope of the Swiss Human Research Act. Nevertheless, this study was carried out in accordance with the Swiss Human Research Ordinance (i.e., under strict confidentiality and privacy, with coding of health-related personal data). All participants received written and oral information on the nature, purpose and procedure of the project (especially on potential risks), their right to withhold or revoke their consent at any time, or their right to receive information, and gave written informed consent in accordance with the Declaration of Helsinki.

Material and Methods

Participants

By spreading the word, 21 psychiatrists and psychiatric residents were consecutively recruited from several psychiatric hospitals and private practices in the German-speaking part of Switzerland. There were no eligibility criteria in terms of educational stage, therapeutic orientation, or job position. Sample characteristics are listed in **Table 1**. Interviewees were between 28 and 73 years old ($M = 51.15$, $SD = 13.12$), and the extent of their professional experience ranged from 1 to 45 years ($M = 19.57$, $SD = 13.41$).

Interviews

The interviews took place between March and May 2018. After providing written informed consent, interviewees were asked to recall a psychotherapy session with a highly distressed patient during the last 2 weeks. This allowed us to standardize the emotion-eliciting situation to a certain degree and compare the reactions between interviewees. Three interviewees selected a session further back than 2 weeks (i.e., in the past 1–6 months), as they did not recall a distressed patient in the specified time period. Most of the recalled therapeutic sessions were held with a patient suffering from either depression ($n = 8$), personality disorders ($n = 6$), mostly narcissistic personality disorder, or posttraumatic stress disorder ($n = 4$). Patients' distress was usually due to a break-down or a personal crisis and

many patients were perceived as being demanding toward the interviewees.

Together with the interviewer (SW), interviewees retrospectively explored their own emotions and emotion regulation processes during and after the therapeutic session and the influence these had on themselves and on the patient. Interviews involved asking participants four general open-ended questions, which were followed up with specific questions to obtain fuller information if necessary:

1. Which emotions did you experience while interacting with the patient (type, intensity, valence, trigger, target / directedness)?
2. Did you regulate your emotions (i.e., did you do anything to change or influence your emotions)? If yes, how (tactic and its manner of functioning, perceived effectivity, target, time point of deployment)?
3. What kind of emotional state did you want to attain by regulating your emotions? To what extent did you attain this state?
4. Do you think that your emotions and your emotion regulation influenced the patient or the course of the therapy session? If yes, how?

Some follow-up questions requested a rating (see section Measurement of Model Components). Interviewees were also asked to complete standardized questionnaires on state and trait well-being, emotion regulation abilities, stress, burnout, depression, and anxiety (see below for further details). Out of these interview questions and questionnaires, data on the components of the model (**Figures 1, 2**) were compiled to exemplify and test it. All interviews were audio-taped and coded by SW. Coding followed a predefined procedure, where the directedness of reported emotions and the strategies behind reported emotion regulation tactics were assigned to previously determined categories (see section Measurement of Model Components). Secondary codings were undertaken by CC except for four interviews, which only allowed for partial coding, due to technical issues (i.e., audio recorder break down). Also, one interview was used to train coding. For each reported emotion or tactic, coding resulted in a pattern of categories. Patterns were compared, and differences discussed and resolved. Interviewees received a small gift (chocolate, worth CHF 20) as compensation for participating.

Measurement of Model Components

Emotions and emotional activation

Interviewees described their emotions during the therapeutic session. They rated the intensity of each emotion from 1 = "very low" to 10 = "very high," and indicated whether it was pleasant, unpleasant, or ambivalent (pleasant and unpleasant or neither pleasant nor unpleasant). A sum score for intensity ratings of pleasant and unpleasant emotions was calculated, indicating the levels of pleasant and unpleasant emotional activation. Interviewees were also asked to indicate the trigger and target of each emotion, which was coded by SW and CC according to the theoretical model (object-directed, person-directed, self-directed, emotion contagion, incidental emotion, other emotion type or direction not indicated by the model as depicted in **Figure 1**).

Congruence between raters was excellent with $\kappa = 0.93$ (186 observations), using Cohen's Kappa unweighted.

Stress

The level of stress as an unpleasant emotional state in the past month was assessed by the 10-item *Perceived Stress Scale* [PSS-10, (113), validated German version by Klein et al. (114)]. The PSS-10 measures how often one feels overwhelmed and unable to cope with stressors on a 5-point Likert scale (0 = "never" to 4 = "very often"). All items were summed together to yield a total score, with higher scores indicating higher levels of stress. Cronbach's alpha was 0.892.

Emotion regulation success

Interviewees described the emotional state they wished to achieve through emotion regulation, and the degree to which they achieved this desired emotional state during and after the therapeutic session as well as later in the evening (1 = "not at all," 10 = "fully"). These scores served as an indicator of emotion regulation success, with higher scores indicating more successful emotion regulation.

Emotion regulation strategies and their effectiveness

Interviewees described tactics they had used to regulate their emotions during and after the therapeutic session and rated the effectiveness of each tactic from 1 = "very low" to 10 = "very high." A score for the mean effectiveness of all tactics was calculated, with higher scores indicating higher effectiveness. The strategies behind each tactic were coded by SW and CC according to Parkinson and Totterdell's classification (83) of affect regulation strategies (cognitive or behavioral avoidance, distraction by means of thinking (cognitive) or doing (behavioral) something relaxing, pleasant, or demanding, cognitive or behavioral problem solving, reappraisal, vent feelings, social support, other strategy). Congruence between raters was substantial with $\kappa = 0.70$ (94 observations), using Cohen's Kappa unweighted.

Emotion regulation abilities

Abilities to regulate emotions were measured by the 27 items of the prolonged state version ("within the past 2 weeks...") of the *Emotion Regulation Skills Questionnaire* [ERSQ, a German questionnaire devised by Berking and Znoj, (94)]. This questionnaire measures abilities such as the awareness, identification, understanding, and acceptance and tolerance of emotions, the perceived ability to modify emotions, the willingness to confront distressing situations, or self-support on a 4-point Likert scale (1 = "not at all," 4 = "almost always"). Mean scores across all 27 items were calculated, with higher scores indicating higher abilities. Cronbach's alpha was 0.776.

State well-being

To assess whether the emotional state immediately after the session enabled state well-being, two questionnaires were used: First, the *Flourishing Scale* [FS, (115), validated German version by Esch et al. (116)], which measures psychological well-being (meaning, positive relations, engagement, social contribution, mastery, self-acceptance, optimism) with 8 items on a 7-point

Likert scale (1 = "strongly disagree" to 7 = "strongly agree"). Second, the three subjective well-being scales (life satisfaction, positive feelings, negative feelings) from the *Comprehensive Inventory of Thriving* [CIT, (104), validated German version by Hausler et al. (117)] with 3 items for each scale which were answered on a 5-point Likert scale (1 = "strongly disagree" to 5 = "strongly agree"). Items of the CIT were slightly adapted to fit the purpose of measuring a specific state in the past (i.e., the formulation "most of the time" in some of the items was omitted). Interviewees indicated to what degree the items of the FS and CIT scales were true for their emotional state immediately after the session. A total score for the FS and a mean score for the CIT scales were calculated for each interviewee, with higher scores indicating higher state psychological and subjective well-being. Cronbach's alpha was 0.891 for the FS scale and 0.894 for the CIT scale.

Trait well-being

Again, the FS and the subjective well-being scales of the CIT were used. This time, interviewees indicated their agreement with the items in general. Cronbach's alpha was 0.900 for the FS scale and 0.872 for the CIT scale. All participants completed the state version of the well-being questionnaires during the interview and the trait version afterwards.

Indicators of mental disorders

Burnout risk was assessed by the *Maslach Burnout Inventory—General Survey* [MBI-GS, (118), German translation by von Känel, 2016] with 16 items on the scales emotional exhaustion, depersonalization, and personal accomplishments rated on a 7-point Likert scale (0 = "daily," 6 = "never"). Mean scores were calculated, with higher scores indicating higher burnout risk. Depressive symptoms were assessed by the 9-items depression module of the *Patient Health Questionnaire* [PHQ-9, (119), translated by Löwe, 2015] and anxiety by the 7-items *Generalized Anxiety Disorder Scale* [GAD-7, (120), translated by Löwe, 2015] from the PHQ on a 4-point Likert scale (0 = "not at all," 3 = "almost every day"). Scores were summed together with higher scores indicating higher depressivity and anxiety. Cronbach's alpha was 0.812 for the MBI, 0.483 for the PHQ-9, and 0.785 for the GAD-7.

Statistical Analysis

Due to the small sample size and the fact that variables were not normally distributed, nonparametric tests (i.e., Spearman correlations and Wilcoxon tests with corresponding effect sizes r) were conducted. Because the directions of the expected associations between variables were predefined, one-tailed correlations were calculated for all hypotheses except for hypothesis 3, which was exploratory and therefore tested with two-tailed correlations. Because one interviewee did not experience pleasant emotions, hypothesis 1 and parts of hypothesis 3 were calculated with a sample size of $n = 20$. The same applies to parts of hypotheses 4 and 6, because one interviewee could not rate emotion regulation success in the evening. We did not correct for multiple comparisons to avoid the possibility that truly important associations are deemed

TABLE 2 | Number of emotions and extent of emotional activation.

	Mean	SD	Range
Number of pleasant emotions	4.19	2.84	0–10
Pleasant emotion intensity (sum score)	26.86	21.37	0–78
Number of unpleasant emotions	7.52	4.15	1–17
Unpleasant emotion intensity (sum score)	43.14	30.12	5–130.5

Emotional intensity ratings were summed together for each interviewee, indicating their emotional activation.

statistically non-significant, also given limited power of our analyses. Statistical analyses were conducted with IBM SPSS Statistics, Version 25.

Results

Emotions During Psychiatrist-Patient Interactions

Interviewees reported between 5 and 27 emotions which were mostly pleasant or unpleasant, except for a few cases ($n = 7$) where they were ambivalent or neither pleasant nor unpleasant. The number of pleasant and unpleasant emotions and the extent of pleasant and unpleasant emotional activation is presented in **Table 2**. Interviewees experienced significantly more unpleasant than pleasant emotions ($z = -0.2.967$, $p = 0.001$, $r = 0.66$) and their unpleasant emotional activation as measured by sum scores of emotion intensity ratings was significantly higher than scores for pleasant emotional activation ($z = -2.203$, $p = 0.013$, $r = 0.49$).

The pleasant and unpleasant emotions reported by interviewees are listed in **Table 3**, grouped according to Shaver et al. classification (121). All emotions could be assigned to one of the categories of our theoretical model (**Figure 1**). Among the most frequently reported object-directed emotions were emotions of irritation (e.g., annoyance because of difficult therapy situations or circumstances of the patient), emotions of nervousness (e.g., fear that the therapy might take a bad turn, or uncertainty about how the situation of the patient would develop), and emotions of optimism (e.g., confidence in the therapy or the therapeutic alliance). The most frequently reported person-directed emotions were emotions of affection for the patient (e.g., compassion or benevolence), emotions of irritation (e.g., being annoyed by the patient's behavior), or emotions of nervousness (e.g., being worried that the patient might relapse). By far the most frequently reported emotions were self-directed emotions belonging to the nervousness sub-category. Interviewees reported being stressed or feeling insecure about their own performance. They were also apprehensive that they might lose control over the course of the therapeutic session and their own emotions, or that they might fail in treating the patient. However, they also frequently reported emotions of optimism such as confidence in their skills. The emotions that were most frequently caught by the interviewees concerned the patient's nervousness (tension, helplessness, etc.). Two interviewees reported participating involuntarily in the patient's emotional carousel. Emotions changed over the course of the interaction, with many interviewees reporting having more

pleasant emotions toward the end of the therapeutic session as the patient's condition improved.

It is important to mention that interviewees used the terms "compassion," "empathy," and "sympathy" interchangeably to describe the same phenomena, namely empathy-related processes such as sharing or understanding the patient's distress. Some of the interviewees perceived these processes as pleasant ($n = 9$), some as unpleasant ($n = 3$), and some as ambivalent ($n = 4$). Many of the interviewees reported sharing components (emotion contagion) as being unpleasant, and understanding components (social appraisal) as being pleasant. Apart from empathy-related emotions, other emotions (e.g., anger directed at the situation) were also perceived as unpleasant by some interviewees, while others perceived them as pleasant (usually because it enabled them to better connect with the patient).

In some cases, incidental emotions were reported. For example, the case of one patient triggered a childhood memory in an interviewee, who then felt sadness. Moreover, emotions related to the therapy session were not only reported to be present during the session itself, but also before and after (e.g., anticipation or relief). These emotions are not discussed further here.

Emotion Regulation

Interviewees reported using between 2 and 10 different strategies to regulate their emotions ($M = 6.71$, $SD = 2.61$) during and after the therapy session. Most of the reported tactics served several strategies at the same time (e.g., speaking to colleagues often served the strategies of cognitive problem solving, venting feelings, and social support). While most emotion regulation tactics served strategies described by Parkinson and Totterdell (88), participants reported some tactics for which strategies had to be added to the original classification. Strategies and examples of corresponding tactics are reported in **Table 4**.

A group of tactics deployed by three quarters of the interviewees that could not be assigned to one of the strategies of Parkinson and Totterdell's classification (88) was what we call boundary management. Several interviewees reported that they stepped out of their role as therapist (either intentionally or more implicitly) in order to feel themselves more clearly. They used tactics such as diverting their gaze from the patient and centering awareness on their own body (during the session), changing the room, or performing everyday activities, e.g., watering the plants or drinking coffee (after the session), in order to reconnect with their private selves. Others reported stepping deliberately back into their role as therapist when they felt that they were swept away by feelings, for example by moving their body into an upright position or by using typical therapeutic techniques such as psychoeducation to remind themselves and the patient of their role. Moreover, several interviewees used symbolic boundaries between their private selves and their roles as therapists or between themselves and the patient, such as physical space, doors between the therapy room and their private room, or imaginary walls. When they felt overwhelmed by the patient's emotions and / or their own reactions, they reported setting boundaries e.g., by enlarging physical space or by strengthening imaginary walls between them to gain emotional distance and

TABLE 3 | Object-directed, person-directed (i.e., patient), self-directed, and non-directed (i.e., emotion contagion) emotions grouped according to the categories and subcategories of Shaver et al. (121).

Category	Sub-category	Object-directed Emotions	n
Joy	Cheerfulness (2)	<i>Joy</i>	2
		<i>Excitement, interest, challenge</i>	3
	Contentment (2)	<i>Drive</i>	1
		<i>Contentment</i>	1
		<i>Gratitude</i>	1
	Optimism (8)	<i>Confidence</i>	6
		<i>Hope</i>	1
		<i>Sense of purpose</i>	1
		<i>Relief</i>	3
	Relief (3)	<i>Relief</i>	3
Surprise	Surprise (1)	<i>Astonishment</i>	1
Anger	Irritation (12)	Annoyance	6
		Disinclination	2
		Impatience, Agitation	2
		Strain	2
		Frustration	3
Sadness	Rage (1)	<i>Anger</i>	1
	Sadness (7)	Resignation, Futility, Hopelessness	3
		Powerlessness	2
		Despair	2
	Disappointment (6)	Disappointment	4
Fear	Nervousness (12)	Dismay	2
		Fear	4
		Insecurity, Uncertainty	4
		Helplessness	3
		Tension	1
Category	Sub-category	Person-directed Emotions	n
Affection	Affection (19)	<i>Compassion</i>	9
		<i>Benevolence</i>	5
		<i>Liking</i>	4
		<i>Connectedness</i>	1
Joy	Cheerfulness (2)	<i>Joy</i>	2
	Zest (5)	<i>Curiosity, Interest</i>	5
	Contentment (1)	<i>Gratitude</i>	1
	Pride (1)	<i>Pride</i>	1
	Optimism (5)	<i>Hope</i>	4
Surprise	Relief (1)	<i>Relief</i>	1
	Surprise (2)	<i>Astonishment</i>	2
	Anger	Annoyance	11
Anger	Irritation (14)	Disinclination	2
		Impatience	1
		Disgust (2)	1
		Disliking	1
		Hopelessness	1
Sadness	Sadness (2)	Despair	1
		Disappointment (5)	3
	Sympathy (3)	Dismay	2
		Pity	3

(Continued)

TABLE 3 | Continued

Category	Sub-category	Person-directed Emotions	n
Fear	Nervousness (10)	Worry	9
		Uncertainty	1
Category	Sub-category	Self-directed Emotions	n
Affection	Affection (1)	<i>Compassion</i>	1
Joy	Cheerfulness (2)	<i>Joy</i>	2
	Contentment (7)	<i>Contentment</i>	4
	Pride (4)	<i>Ease</i>	3
		<i>Pride</i>	3
	Optimism (9)	<i>Feeling Flattered</i>	1
	Optimism (9)	<i>Confidence</i>	4
		<i>Hope</i>	2
		<i>Sense Of Purpose</i>	2
	Relief (4)	<i>Courage</i>	1
		<i>Relief</i>	4
		Annoyance	3
Anger	Irritation (3)	Despair	1
Sadness	Sadness (3)	Depletion	1
		Futility	1
		Disappointment (2)	2
	Shame (5)	Guilt	3
		Shame	2
		Insult	4
	Neglect (4)	Pity	1
		Sympathy (1)	1
	Nervousness (46)	Tension, Stress	13
Fear	Nervousness (46)	Insecurity, Uncertainty, Doubt	12
		Apprehension	9
		Incompetence, Insufficiency	6
		Overextension, Helplessness	5
		Cluelessness	1
Category	Sub-category	Non-directed Emotions	n
Anger	Irritation (2)	Annoyance	2
Sadness	Suffering (4)	Suffering	4
	Sadness (4)	<i>Sadness</i>	3
	Shame (2)	<i>Despair</i>	1
		Shame	1
		Guilt	1
Fear	Neglect (1)	Insult	1
	Nervousness (8)	Tension	4
		Helplessness	1
		Insufficiency	1
		Doubt	1
		Distress	1

In order to better fit the data, the category name "love" was replaced by "affection." Emotions which were reported as being pleasant are in italic. The number in bracket denotes the frequency of reported emotions per sub-category.

regulate the transfer of emotions. Even though these tactics are similar to distraction or disengagement, boundary management is distinct from diversion strategies as the goal is not to avoid

TABLE 4 | Emotion regulation strategies according to Parkinson and Totterdell (88) with examples of corresponding tactics used during (^d) and after (^a) therapy sessions from the present interviews (italics), and number of participants who reported having deployed the respective strategy.

	<i>n</i>	Cognitive	<i>n</i>	Behavioral
DIVERSION				
Disengagement	1	Avoid thinking about the problem	1	Avoid problematic situation (e.g., leave the room ^d)
Distraction	8	Think about something pleasant (e.g., holidays ^d , hobbies ^d , activities later on that day ^d)	14	Do something pleasant (e.g., hobbies ^a , every-day activities ^a)
	3	Think about relaxing thoughts (e.g., color blue ^d , mountains ^d)	15	Do something relaxing (e.g., breathe ^d , calming body exercises ^a , hot shower ^a)
	0	Think about something that occupies attention	10	Perform a demanding activity (e.g., hobbies ^a , every-day activities ^a)
Other*			3	Suppress emotions*
ENGAGEMENT				
	16	Reappraise (e.g., accept emotions as being legitimate ^{d,a} , reinterpret situation ^{d,a} , saying to oneself one did the best one could ^{d,a})	9	Vent feelings (e.g., playing music ^a , speaking with colleagues ^a , laughing together with patient ^d)
	5	Think about social support* (e.g., think about help from supervisor ^d)	9	Seek help or comfort from others (social support) (e.g., speaking to colleagues or spouse ^a , supervision ^a , case review ^a)
	12	Think about how to solve problem (e.g., analyzing situation and plan next steps ^{d,a})	15	Take action to solve problem (e.g., using therapeutic techniques to change the course of the therapeutic session ^d , taking an observer-perspective ^d , change body posture ^d)
	6	Self-compassion* (e.g., soothe oneself ^{d,a})	15	Boundary management* (e.g., setting symbolic boundaries between one's roles as therapist or private person ^{d,a} , deliberate changing of one's roles ^{d,a})

Strategies marked with * were added to the original classification.

the situation or emotion, but to actively (dis)connect with one's roles in order to deal with the situation or emotion. Thus, it is an engagement strategy. Since it does not involve addressing an emotion-eliciting situation or emotion itself as in reappraisal and problem-solving, but rather delineates the framework or domain in which emotions are allowed to unfold, we see it as a new, distinct strategy.

Approximately three quarters of the interviewees used the engagement strategies of reappraisal and cognitive and behavioral problem-solving as means of regulating their emotions. A frequently reported behavioral problem-solving tactic characteristic of the therapeutic setting was taking an observer-perspective to distance oneself from the situation, enabling a new and neutral look on one's own emotions and the patient. Reappraisal included acceptance tactics such as deliberately embracing the presence of unpleasant emotions as being legitimate or important (and other related processes). Imagined social support (e.g., thinking about helpful others or about what helpful others would say) or real social support were used by half of the interviewees. Frequently used diversion strategies were behavioral distraction by doing something pleasant, relaxing, or demanding, which most often referred to leisure time activities such as sports and hobbies. Distraction strategies typically targeted the emotional state as a whole, whereas other strategies such as reappraisal

usually targeted a single emotion or several specific emotions together.

Interviewees rated the mean effectiveness of their tactics as 7.52 ($SD = 1.25$, highest possible score = 10). In some cases, interviewees indicated that tactics they used might also have affected their emotional state in the opposite direction to the intended one, and there were indeed tactics that had positive short-term effects, but no or even negative effects in the long run. For example, one interviewee reported that educating the patient helped him to regain control and security in the situation very effectively, but did not improve his general emotional state. On the contrary, it drained him of energy and had a negative overtone.

Not all tactics were chosen intentionally. Some interviewees reported using opportunities presented to them fortuitously by the situation to regulate their emotions. For example, one interviewee left the room to get a medical device for the patient and used the chance provided by this physical movement to feel herself again. Another interviewee reported being swept away by emotions and took the chance to distance himself and regain his own composure when the patient went to stand by the window. Interviewees also seemed to deploy many tactics automatically, and only became aware of their implementation when reflecting about the session afterwards.

TABLE 5 | Subjective and psychological well-being scores.

	State		Trait	
	Mean	SD	Mean	SD
Life satisfaction	3.94	0.65	4.13	0.52
Positive affect	3.64	0.98	4.19	0.63
Negative affect (reversed)	3.89	0.90	1.51	0.49
Total subjective well-being	3.82	0.75	4.27	0.45
Psychological well-being	46.93	6.10	48.81	5.00

Highest possible score for subjective well-being scales is 5, for psychological well-being 56.

Emotion regulation abilities were rated on average at 3.65 ($SD = 0.20$, highest possible score = 4).

Adjectives most often used to describe the emotional state that interviewees aimed to achieve were “at ease” / “balanced” ($n = 16$), “content” / “cheerful” / “good” ($n = 14$), and “in control” / “competent” ($n = 4$). On average, interviewees achieved their desired emotional state to the extent of 5.62 ($SD = 2.64$) during the therapeutic session, 6.50 ($SD = 2.06$) after the session, and 8.43 ($SD = 1.73$) in the evening, with a highest possible score of 10.

Even though the extent to which interviewees achieved their desired emotional state (i.e., emotion regulation success) improved significantly from the session to immediately afterwards ($z = -1.941$, $p = 0.027$, $r = 0.42$) and from immediately after the session to the evening ($z = -0.3220$, $p < 0.001$, $r = 0.72$), three interviewees indicated that their emotional state immediately after the session was somewhat lower than it had been during the session. The reason for this decline was that they allowed themselves to have doubts about their performance only after the session and not while it was happening.

All interviewees felt that their own emotions and emotion regulation had an influence on the patient and the session. They used this influence for example by confronting the patient with their own emotions as a therapeutic technique or by regulating their own emotions to display professionally desirable emotions such as tranquility (emotional labor). In many instances, this served as a means of changing the patient’s emotional state (interpersonal emotion regulation). One interviewee took the patient for a walk to calm him down and renew his focus, which is an interpersonal emotion regulation strategy. As a consequence this tactic also lifted her own spirit.

Well-Being and Mental Health

Scores on state and trait subjective and psychological well-being are reported in **Table 5**. Scores on state and trait measures of both subjective and psychological well-being differed significantly, with trait scores being higher than state scores ($z = -3.235$, $p < 0.001$, $r = 0.71$ for subjective well-being and $z = -2.065$, $p = 0.019$, $r = 0.45$ for psychological well-being). This indicates that our measures were sensitive to state variations.

Burnout, anxiety and depression scores are reported in **Table 6**. Regarding burnout, three interviewees had scores

TABLE 6 | Mental health scores.

	Mean	SD
Burnout symptoms	0.91	0.48
Anxiety symptoms	3.76	2.64
Depressive symptoms	3.10	1.79

Highest possible score for burnout symptoms is 6, for anxiety symptoms 21, and for depressive symptoms 27.

indicating an increased risk for burnout, all others were in the no-risk group. Four interviewees had mild depression scores, all others reported minimal scores. Four interviewees had mild anxiety scores, one had moderate anxiety scores, all others reported minimal scores.

Relations Between Emotions, Emotion Regulation, Well-Being, and Mental Health

Although sample size and statistical power were low, initial statistical analyses were run to gain preliminary insights into potential relationships between model components.

Hypothesis 1. The ratio of unpleasant to pleasant emotional activation (quotient of sum intensity ratings of unpleasant emotions and of pleasant emotions) was significantly negatively associated only with state subjective well-being ($\rho = -0.496$, $p = 0.013$) and state psychological well-being ($\rho = -0.433$, $p = 0.028$), but not with trait well-being.

Hypothesis 2. was not tested.

Hypothesis 3. For pleasant and unpleasant emotions separately, intensity ratings within each emotion direction (object-, person-, self-, and non-directed) were summed together, to yield scores for the emotional activation of each emotion direction. A ratio was calculated by dividing emotional activation of each direction by total pleasant or unpleasant emotional activation. Results showed that higher non-directed unpleasant emotional activation (i.e., more emotion contagion) relative to total unpleasant emotional activation was associated with lower state subjective well-being ($\rho = -0.569$, $p = 0.007$). By contrast, higher object-directed unpleasant emotional activation relative to total unpleasant emotional activation was related to more positive state psychological well-being ($\rho = 0.443$, $p = 0.044$). Higher person-directed pleasant emotional activation relative to total pleasant emotional activation was significantly associated with more positive state subjective well-being ($\rho = 0.500$, $p = 0.025$) and marginally associated with more positive state psychological well-being ($\rho = 0.401$, $p = 0.080$). Moreover, higher object-directed pleasant emotional activation relative to total pleasant emotional activation was negatively associated with trait subjective well-being ($\rho = -0.501$, $p = 0.024$).

Hypothesis 4. Successful emotion regulation (i.e., the extent to which interviewees achieved their desired emotional state) during the therapeutic session was significantly positively associated with state subjective well-being ($\rho = 0.609$, $p = 0.002$) and state psychological well-being ($\rho = 0.523$, $p = 0.007$). Since state well-being was measured in connection with the time point immediately after the session, relations between state well-being and emotion regulation success after the session and in

the evening were not tested. Emotion regulation success in the evening was significantly associated with higher trait subjective well-being ($\rho = 0.480, p = 0.016$) and trait psychological well-being ($\rho = 0.776, p < 0.001$). Moreover, emotion regulation success during the session ($\rho = -0.394, p = 0.038$) and after the session ($\rho = -0.377, p = 0.046$) was significantly associated with lower burnout scores, and emotion regulation success in the evening was marginally associated with lower burnout ($\rho = -0.317, p = 0.087$), anxiety ($\rho = -0.327, p = 0.080$), and depression scores ($\rho = -0.370, p = 0.054$).

Hypothesis 5. was not tested.

Hypothesis 6. Emotion regulation abilities were significantly positively related to emotion regulation success during the session ($\rho = 0.385, p = 0.042$), after the session ($\rho = 0.373, p = 0.048$), and in the evening ($\rho = 0.685, p < 0.001$).

Hypothesis 7. Emotion regulation abilities were significantly positively associated with state psychological well-being ($\rho = 0.506, p = 0.010$), trait psychological well-being ($\rho = 0.681, p < 0.001$), and trait subjective well-being ($\rho = 0.448, p = 0.021$). Although the correlations between emotion regulation abilities and burnout, depression, and anxiety were all negative, none of them were statistically significant.

Hypothesis 8. State subjective well-being was significantly positively related to trait subjective well-being ($\rho = 0.564, p = 0.004$) and significantly negatively related to burnout ($\rho = -0.587, p = 0.003$). State psychological well-being was significantly positively related to trait psychological well-being ($\rho = 0.717, p < 0.001$), and significantly negatively related to burnout ($\rho = -0.579, p = 0.003$) and depression ($\rho = -0.501, p = 0.010$). All other correlations were in the expected direction, but not significant.

The average level of perceived stress over the past month was 11.14 ($SD = 5.71$, highest possible score = 40). Stress was significantly negatively related to trait subjective well-being ($\rho = -0.624, p = 0.001$) and marginally related to trait psychological well-being ($\rho = -0.317, p = 0.081$), and significantly positively related to anxiety ($\rho = 0.615, p = 0.002$), but not to burnout and depression.

Discussion

The main aim of this study was to assess whether our theoretical model is applicable to physician-patient interactions and to provide a basis for describing its operation more accurately. Results generally confirm the usefulness of our model for understanding physician-patient interactions. Regarding the first part (**Figure 1**), all emotions elicited by the interaction could be assigned to the categories specified in the model. Generally, interviewees experienced more unpleasant than pleasant emotions, which comes as no surprise, given that they were asked to focus on a therapeutic interaction with a highly distressed patient. By far the most commonly reported emotions were self-directed and in the category of nervousness, containing emotions such as stress, insecurity, and apprehension regarding the interviewees themselves or their performance. Emotions changed over the course of the therapeutic session, often shifting toward more pleasant emotions as the patient's condition improved. Furthermore, all interviewees believed that

their emotions influenced the patient and reported that they used this influence as a therapeutic technique (e.g., being calm in order to calm the patient down). This is strongly in line with the proposed cyclical process of emotion transfer in our model.

Also in line with the model, interviewees regulated their emotions at several stages. Some emotion regulation tactics helped to regulate emotion transfer itself, while others regulated already transferred emotions, either targeting specific emotions or the emotional state as a whole. Interpersonal emotion regulation (i.e., regulation of patients' emotions) was seldomly reported. However, as lending help to regulate emotions is an integral part of psychotherapy, this may not have been interviewees' explicit focus of attention in this specific sample.

Boundary management was one of the strategies that helped in the regulation of emotion transfer, preventing interviewees from becoming emotionally over-involved. Boundary management tactics such as switching between interviewees' roles or preventing emotions from being taken into their private sphere also helped to regulate emotions that had already been transferred. Indeed, boundary management was one of the most frequently used strategies confirming the importance of keeping boundaries for well-being in order to enable or prevent positive and negative spill-over from one domain into the other [e.g., work and home, (122)]. Another strategy that was frequently used to regulate already transferred emotions was reappraisal, which included acceptance of unpleasant emotions as being legitimate or important. Acceptance is one of the core emotion regulation abilities [e.g., (93, 94)] and its importance in reducing stress and enhancing well-being is also evident in the effectiveness of acceptance or mindfulness based interventions [e.g., (123, 124)]. Problem-solving and distraction by doing something pleasant, relaxing, or demanding in terms of leisure time activities were used equally often, mostly to regulate emotional state as a whole. Research has shown that detachment from work and recovery through meaningful off-job activities are particularly important to well-being (122, 125).

The second part of our model (**Figure 2**) was also supported by the data from the present study. Emotions and emotional state were significantly related to well-being: Having higher unpleasant emotional activation than pleasant emotional activation was associated with lower state well-being. Although trait well-being was not related to emotions experienced in a single session, being repeatedly in emotionally difficult situations seems to be linked with well-being and health in the long run, as indicated by the positive association with chronic stress. These findings point to the importance of regulating emotion transfer and already transferred emotions, enhancing pleasant emotions and embracing or mitigating unpleasant emotions. Indeed, successful emotion regulation (i.e., bringing about a desired emotional state) may protect against the effects of harmful emotional states during the session, as suggested by the positive association between emotion regulation success during the session and state well-being. For long-term well-being, a successfully regulated emotional state in the evening rather than during the day may be crucial, as suggested by the strong association between trait well-being and emotion regulation success in the evening. Importantly, successful emotion regulation was also related to

lower burnout scores and, marginally, to lower anxiety and depression scores, indicating a protective effect on mental health.

As proposed by our model (Figure 2), higher emotion regulation abilities such as emotion regulation self-efficacy were related to well-being in the short and in the long run. Higher state well-being was associated with higher trait well-being and less burnout symptoms. Taken together, these results lend preliminary support to the validity of our model as a whole, suggesting that emotions elicited by cyclical transfer processes in provider-client interactions are linked to short-term well-being. Over time, they may accumulate and influence longer-term well-being. It thus seems likely (but needs to be tested by longitudinal studies) that successful emotion regulation is important for maintaining both state and trait well-being and fostering resilience. However, larger sample sizes are needed to confirm these associations.

A striking finding was that object-, person-, self-, and non-directed emotions had different associations with state well-being, indicating that not all pleasant emotions are equally beneficial, and not all unpleasant emotions equally harmful. Despite their preliminary nature, our data provide initial insights into mechanisms that may link emotion transfer and well-being in physicians. Higher patient-directed pleasant emotional activation relative to total pleasant emotional activation seemed to be positively associated with state well-being. Most of the pleasant emotions directed at the patient were empathy-related emotions (i.e., compassion resulting from understanding the patient's distress). Interestingly, experiencing higher non-directed unpleasant emotional activation (i.e., emotion contagion, most often of the patient's distress) was significantly negatively associated with state well-being. This finding underlines the crucial importance of empathy-related emotion transfer for state well-being, suggesting that sharing the patients' emotions may be harmful, whereas feelings based on understanding the patients' emotions may have beneficial effects. Also supporting this finding, interviewees perceived empathy-related emotions based on emotion-sharing as rather unpleasant and empathy-related emotions based on understanding as rather pleasant. Although these interpretations are tentative, they correspond well to other research on empathy-related processes. Recent studies from a social neuroscience perspective clearly highlight the importance of maintaining self-other distinction in empathy-related processes in order to prevent compassion fatigue and sustain well-being. Thus, feeling *with* the other person (i.e., emotion-sharing) is potentially harmful, whereas feeling *for* the other person (i.e., understanding the other's situation) is not [e.g., (81)]. This general principle has also been discussed in relation to physicians [e.g., (36, 62, 80)].

Furthermore, experiencing higher unpleasant emotional activation directed at the situation (object-directed) seems to be positively associated with well-being. Many of the unpleasant emotions directed at the situation involved irritation or nervousness corresponding to the patient's own emotions regarding the situation. These emotions often helped with the process of connecting with the patient, which might explain their positive association with state well-being. Indeed, this again seems to highlight the importance of an emotional bonding with

the patient for state well-being. Therefore, empathy-related and similar emotions might prove important mechanisms linking emotions and emotion regulation with well-being.

Strengths, Limitations, and Future Research

The interviews were first and foremost qualitative, serving the purpose of describing the model more accurately. In order to be able to describe emotion transfer processes and their effects on interviewees in as much detail as possible, interviews focused on one specific therapeutic session in the last 2 weeks. By contrast to previous studies, which have asked physicians very generally about their emotions and emotion regulation strategies, this design enabled us to record the myriad of emotions elicited by one interaction more exactly, together with their triggers, targets, interconnectedness and effects on physician and patient. Furthermore, we tracked the regulation of these emotions and how regulation affected interviewees' state well-being. The main strength of this study thus lies in the rich description of our model, providing important insights into the outlined processes and highlighting key target variables (e.g., boundary management and the complex interconnectedness of empathy-related emotions) for future research.

However, our interview schedule was informed by theory, resulting in a predominantly top-down approach. Although we used open questions to assess whether there were emotions or emotion regulation strategies that did not fit to our model, there was only limited scope for the interviewees to inform theory (bottom-up) in order to test the content validity of the model.

Further, as interviews were retrospective, our findings may have been affected by recall bias. Indeed, the reconstruction of emotional experiences in the past is known to be biased by several factors, and this fact has stimulated the use of experience sampling methods for assessing emotional experiences in daily life [e.g., (126, 127)]. For example, research demonstrates that memory of emotional episodes draws on the moment of the highest emotion intensity and the end of the episode, as suggested by the peak-and-end rule (128). Thus, as emotions of interviewees have often improved toward the end of the therapeutic session, negative emotional experiences during the session may have been underestimated, just to name one example of a potential bias.

Third, the recalled interaction might not have been representative of the interviewees' typical emotions and emotion regulation during physician-patient interactions and their influence on more general well-being and health. Moreover, these reports might only be generalisable to other therapeutic situations and physicians of other disciplines to a limited extent. Also, it remains unclear whether our model is applicable to more complex physician-patient interactions involving additional people such as the patient's family or other health care personnel. As the literature implies, team climate and senior physicians may exert a particularly important influence on the physician's emotions and emotion regulation (5, 44, 47, 48). Research has so far shown that the same emotional transfer processes (social appraisal and emotion contagion) are at work in groups, resulting in a group affective tone. These processes have been shown to influence social functioning of the group similarly to

the one-to-one setting, whereby leaders and followers exert a different influence (129). Such variables are lacking from the model and need at least to be considered as situational variables influencing emotions and emotion regulation (Figure 2, paths 2,3).

Fourth, interviewees could only report on what they had consciously experienced and done. Emotions which had automatically been suppressed, emotions that the interviewees were unaware of, or tactics which had been deployed implicitly may have had substantial effects on the therapists' emotional state, emotion regulation success and well-being, constituting extraneous variables that we could not measure or control.

Interview questions and questionnaires also allowed us to generate quantitative data, providing preliminary evidence regarding the proposed hypotheses. However, the sample size was in many cases too small to detect significant effects. Finally, the cross-sectional design did not allow to assess causal relationships between variables.

Future studies should target a wider range of physician-patient interactions prospectively, using momentary assessments (e.g., psychophysiological measurements) to prevent recall bias and enable the detection of more implicit emotions and emotion regulation. However, before applying the model to such prospective studies, further validation studies are needed, including both qualitative studies of physicians of other specialties (e.g., in primary care disciplines) and quantitative studies with larger sample sizes. Results of the present study indicate that investigating effects of the directedness of emotions might be especially useful for detecting mechanisms linking emotions and emotion regulation to well-being. Furthermore, future studies should examine the effectiveness of emotion regulation strategies, additional emotion regulation abilities such as flexibility and repertoire variability, and the influence of the presence of other people and related situational variables, which we did not assess.

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In order to further investigate emotion transfer and emotion regulation in provider-client interactions, validation studies for our model as well as a prospective longitudinal study with experimental and momentary assessments (e.g., psychophysiological measurements) are under preparation. Results may inform effective interventions targeting emotion transfer, empathy-related processes, and emotion regulation on an everyday basis in physicians' professional lives. Moreover, our model and results may also prove to be applicable in other health care and social services contexts.

AUTHOR CONTRIBUTIONS

SW reviewed the literature, developed the theoretical model, and design of the study, conducted interviews, performed the data analysis, and wrote the manuscript. MP and US contributed substantially to the conception of the model as well as the study design and conduction. CC coded all interviews. BP and RvK provided substantial input on all stages of conception and study design. All authors contributed to manuscript revision, read, and approved the submitted version.

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Burnout, Psychological Symptoms, and Secondary Traumatic Stress Among Midwives Working on Perinatal Wards: A Cross-Cultural Study Between Japan and Switzerland

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The aim of this study was to explore cross-cultural differences in symptoms of burnout, anxiety, depression, general psychological distress, and secondary traumatic stress between Asian (Japan) and European (Switzerland) midwives. One hundred seventy midwives participated in the study. There were significant differences in age group [$\chi^2(3) = 24.2, p < 0.01$], marital or relationship status [$\chi^2(2) = 28.4, p < 0.01$], and years of experience [$\chi^2(2) = 17.8, p < 0.01$] between the two countries. The Japanese staff were younger, more often unmarried, and had less experience than the Swiss staff. The mean score of depersonalization was significantly higher in Switzerland (4.8 ± 3.8) than in Japan (3.2 ± 3.7 ; $|z| = 2.71, p < 0.01$). The mean score of general psychological distress in the Swiss sample (12.8 ± 6.5) was significantly higher than that in the Japanese sample (10.3 ± 6.2 ; $|z| = 2.04, p = 0.04$). In addition, the mean score of secondary traumatic stress was higher in the Swiss sample (31.8 ± 9.7) than in the Japanese sample (24.1 ± 8.6 ; $|z| = 4.56, p < 0.01$). These results may reflect cultural differences such as working conditions or family environment between Japan and Switzerland.

Keywords: burnout, secondary traumatic stress, midwives, cross-cultural study, depression, anxiety

INTRODUCTION

The present study aimed to explore cross-cultural differences in symptoms of burnout, anxiety, depression, general psychological distress, and secondary traumatic stress between Asian (Japan) and European (Switzerland) midwives. Changes in obstetric practices, such as an increase in the proportion of childbearing women that are defined as high risk (1), may impact the well-being of midwives who face difficulties with patients at highly specialized wards or neonatal intensive care units. In particular, staff in intensive care units have been described as vulnerable compared with other healthcare professionals (2, 3). Burnout is a psychological syndrome with increased feelings of emotional exhaustion (EE), development of depersonalization (DP); i.e., negative, cynical attitudes and feelings about one's patients; and reduced personal

accomplishment (PA) (4). The potential risk factors for burnout are years in the profession, workload, working long hours, shift work, demanding patient relations, lack of occupational autonomy, and work environment (1, 5–8). Studies in different countries have reported high levels of burnout among midwives, varying from 19.1% in Norway to 65% in Australia (1, 5, 7–12). Despite this strong variation in the prevalence of burnout between countries, there are to our knowledge no cross-national studies on burnout among midwives at present. Our research interest was whether there are cross-cultural differences in job-related psychological burden, including burnout, between Eastern and Western countries, because it has been reported that the levels of burnout in Japan are higher than Western countries (see below). A large-scale study examining the relationship between nurse burnout and ratings of quality of care in 53,846 nurses from six countries (USA, Canada, UK, Germany, New Zealand, and Japan) showed that nurses in Japan had the highest mean scores on EE and DP, and the lowest mean scores on PA, whereas nurses from Germany had the lowest burnout levels based on all three MBI subscales (13). This study showed that higher levels of burnout were associated with lower ratings of quality of care independently of nurses' ratings of practice environments across the countries. Although the authors of this study did not mention the reasons for the differences among the six countries, the sociodemographic data showed that the Japanese nurses were the youngest, had less nursing experience, had worked in the unit for a shorter period of time, and had the highest percentage of full time work (13). However, it remains unclear whether these findings of higher burnout scores and socio-demographic specificities will also be found in Japanese midwives. If the relationship between burnout and socio-demographic specificities was to be found in the present study, it might be useful to improve the quality of care in obstetric practices.

Psychological distress, such as anxiety and depression, is often linked to the burden of work (14). A recent review of work-related risk factors revealed that an imbalanced job design, occupational uncertainty, and lack of value and respect at the workplace explained how work may contribute to the development of depression and/or anxiety (14). In a study of Australian midwives, 17.3% reported depression, 20.4% reported anxiety, and burnout was positively correlated with depression and anxiety (10). Another study conducted in New Zealand that examined anxiety and depression showed higher levels of anxiety symptoms in employed midwives than self-employed midwives (6). So far, depression and anxiety have not been investigated in Japanese midwives.

Secondary traumatic stress is a syndrome including intrusion, avoidance, and arousal resulting from indirect traumatic exposure in a professional context (e.g., caring for traumatized patients) (15). According to a meta-analysis, the presence of secondary traumatic stress was reported in forensic nurses, emergency department nurses, oncology nurses, pediatric nurses and hospice nurses in the United States with a reported prevalence of between 25 and 38% (16). Potential risk factors were the frequency of exposure to traumatic events, history of traumatic experiences, empathy with traumatized patients, heavy

workloads, increased contact with patients and long work hours (17). About one-third of labor and delivery nurses reported moderate to severe levels of secondary traumatic stress (18). Additionally, using a qualitative approach the authors performed content analysis of descriptions of experiences at traumatic childbirths and found six themes; magnifying the exposure to traumatic births, struggling to maintain a professional role while with traumatized patients, agonizing over what should have been, mitigating the aftermath of exposure to traumatic births, haunted by secondary traumatic stress symptoms, and considering foregoing careers in labor and delivery to survive (18).

The aim of this study was to explore cross-cultural differences in symptoms of burnout, anxiety, depression, general psychological distress, and secondary traumatic stress between Asian (Japan) and European (Switzerland) midwives. Although these two countries are classed as developed countries, working conditions, and psychosocial work factors are different. Previous studies on the working conditions of nurses in Japan reported that the main differences between Japan and Western countries concern taking leave and working overtime. For Japanese workers, it is often difficult to obtain sick leave, and it is uncommon to take leave to care for sick family members, even though relevant laws exist (19). In contrast, in Switzerland employees are often offered positions based on certain percentages of work time (e.g., a job offered at 100% means full-time, up to 45–50 h a week depending on the job sector) and sick leave is allowed under the law. Regarding paid leave, the length of paid leave in Japan is between 10 and 20 working days depending on the years of continuous employment, and is therefore shorter than that in Switzerland, where it is a minimum of 4 weeks. According to a large-scale study of Japanese midwives (9), only 8.6 % of the midwives took full-length or almost full-length paid annual leave in the course of a year. With regards to overtime, a survey of nurses in the European Union indicated that 27% had worked overtime (i.e., more than their contracted hours) on their last shift (20). In Japan, a survey by the Japanese Nursing Association in 2008 showed that one out of 23 persons work at a level considered to lead to death due to overwork (defined as shifts with overtime of more than 60 h per month) (Nursing in Japan, available from <https://www.nurse.or.jp/jna/english/nursing/index.html>).

Taken together, these studies suggest that the working conditions in Japan are less flexible compared with European countries. Therefore, we hypothesized that the psychological burden, including burnout, anxiety, depression, general psychological distress as well as secondary traumatic stress, of midwives and nurses in Japan would be greater than that of their counterparts in Switzerland.

MATERIALS AND METHODS

Participants

Midwives working on perinatal wards and in neonatal intensive care units (NICU) at four university hospitals were recruited. Two of the convenience (i.e., not randomized) samples were in Japan (pseudonym: university hospitals A and B), and

two in Switzerland (university hospitals C and D). In Japan, the questionnaires were sent by post and the completed questionnaires were anonymously returned by mail. The data were collected in February 2015 at hospital A, and of the 82 eligible staff 57 participated. The survey was conducted in February 2016 at hospital B, and of the 52 eligible staff 34 participated. Among Japanese participants (38 nurses, 51 midwives, 2 missing data), we used data of midwives (22 midwives from hospital A, and 29 midwives from hospital B) for this study. The comparison of the psychological burden between nurses and midwives is shown in **Supplementary Materials**. In Switzerland, an online survey was accessible during 4 months and all eligible staff received one reminder e-mail 1 month before it closed. One-hundred-and-nineteen midwives (of 209 eligible midwives) participated in Switzerland. The Swiss data reported here are part of a larger study investigating work-related well-being and mental health in midwives and NICU nurses [(21); Jacobs et al., under review]. Among sociodemographic characteristics, the Japanese participants were asked about their marital status, and the Swiss participants were asked about their relationship status. This difference is due to cultural backgrounds and we arranged the question to read naturally for each country.

Measures

Burnout Symptoms

Burnout symptoms were measured using the Maslach Burnout Inventory (MBI) (22). The MBI is a 22-item self-report questionnaire. Each item is rated on a Likert scale from 0 “never” to 6 “always.” All items are organized into three subscales; emotional exhaustion (9 items; MBI-EE), depersonalization (5 items; MBI-DP) and personal accomplishment (8 items; MBI-PA). The Japanese version of the MBI in this study was developed by Higashiguchi et al. (23), and showed moderate to high Cronbach's alpha coefficients; in this study, alpha coefficients were calculated after factor analysis ($\alpha = 0.87\text{--}0.90$ for frequency of the subscales, and $0.79\text{--}0.83$ for intensity of the subscales). The French version was validated by Dion & Tessier, and showed satisfactory psychometric properties ($\alpha = 0.90, 0.71$, and 0.79 , respectively for EE, PA, and DP) (24, 25). In our study, Cronbach's alpha coefficients were: 0.85 in Japan and 0.85 in Switzerland for MBI-EE; 0.76 in Japan and 0.67 in Switzerland for MBI-DP; 0.83 in Japan and 0.66 in Switzerland for MBI-PA.

Psychological Distress

The Hospital Anxiety and Depression Scale (HADS) (26) was used to assess general psychological distress. The HADS is a 14-item self-report questionnaire measuring state anxiety (7 items; HADS-A) and depression (7 items; HADS-D). Each item is calculated from 0 to 3, with higher scores indicating higher anxiety and/or depression. Cronbach's alpha for HADS-A varied from 0.68 to 0.93 (mean 0.83) and for HADS-D from 0.67 to 0.90 (mean 0.82) (27). The Japanese version of the HADS was validated by Higashi et al. (28) and Hatta et al. (29). The French version of the HADS was developed by Lepine et al. (30) and validated by Razavi et al. (31). In this study, Cronbach's alpha values for HADS-A were 0.93 in Japan and 0.76 in Switzerland,

and for HADS-D were 0.78 in Japan and 0.71 in Switzerland. These values indicate a good internal consistency of both versions of the HADS.

Secondary Traumatic Stress Symptoms

Secondary traumatic stress symptoms were measured using the Secondary Traumatic Stress Scale (STSS) (32). The STSS is a 17-item self-report questionnaire with a Likert scale of 5 points from 1 “never” to 5 “very often.” All items are organized into three subscales; intrusion (STSS-I), avoidance (STSS-A), and arousal (neurovegetative activation; STSS-NA). The original version of the STSS indicated very good internal consistency and reliability with coefficient alpha levels of 0.93 for the total STSS scale, 0.80 for the intrusion subscale, 0.87 for the avoidance subscale, and 0.83 for the arousal subscale (32). The French version of the STSS was recently validated [(21); Jacobs et al., under review]. The Japanese version of the STSS has not been validated, therefore we used a back-translated version with the permission of the original author (Dr. Bride). In this study, Cronbach's alpha values for STSS-I were 0.82 in Japan and 0.80 in Switzerland; for STSS-A they were 0.84 in Japan and 0.73 in Switzerland; for STSS-NA they were 0.86 in Japan and 0.77 in Switzerland.

Statistical Analysis

All analyses were performed using IBM SPSS Statistics version 21. In this study, bootstrapping (1,000 times) was used to estimate the 95% confidence intervals. Chi-Square test was used for testing relationships between categorical variables (country, age, marital status (in Japan) or relationship status (in Switzerland), and years of experience). The Shapiro-Wilk test was used to check normal distributions of the variables. In the Japanese sample, only the MBI-EE and HADS-A showed normal distribution. In the Swiss sample, only the MBI-EE and MBI-PA showed normal distribution. According to these results, we decided to use the non-parametric analyses. Mann-Whitney test was used for independent samples to test our hypotheses of a difference in burnout, anxiety, depression, general psychological distress, and secondary traumatic stress between the two countries. We used the Kruskal-Wallis and Steel-Dwass tests to compare the differences in the subscales of the HADS, STSS, and MBI among age categories and marital status (in Japan) or relationship status (in Switzerland) in the Japanese and Swiss samples independently. All tests were two-sided and based on a 0.05 level of significance.

Ethical Considerations

This study was approved by the Ethical Committee of Kurume University, Japan (study number 14175) and the ethics committee of the Canton de Vaud, Switzerland (study number 237/2013).

RESULTS

Sociodemographic Characteristics

Sociodemographic characteristics are presented in **Table 1**. All participants were female in Japan; in Switzerland 3 (2.5%) were male (3 missing). There were significant differences in age group

TABLE 1 | Sociodemographic characteristics of the study participants.

		Japan (N = 51)		Switzerland (N = 119)		χ^2	p
		N	%	N	%		
Gender	Female	51	100	113	95.0	1.3	0.2
	Male	0	0.0	3	2.5		
	No answer	0	0.0	3	2.5		
Age	18–25 years old	10	19.6	3	2.5	24.2	< 0.01
	26–30 years old	16	31.4	19	16.0		
	31–39 years old	16	31.4	41	34.5		
	40 or more	9	17.6	52	43.7		
	No answer	0	0.0	4	3.4		
Marital status (in Japan) or Relationship status (in Switzerland)	Unmarried or single	30	58.8	23	19.3	28.4	< 0.01
	Married or in relationship	21	41.2	82	68.9		
	Divorced	0	0.0	14	11.8		
	No answer	0	0.0	0	0.0		
Years of experience	0–5 years	23	45.1	30	25.2	17.8	< 0.01
	6–10 years	15	29.4	16	13.4		
	More than 10 years	13	25.5	71	59.7		
	No answer	0	0.0	2	1.7		

$[\chi^2(3) = 24.2, p < 0.01]$, marital or relationship status $[\chi^2(2) = 28.4, p < 0.01]$, and years of experience $[\chi^2(2) = 17.8, p < 0.01]$ between the two countries. For age group, residual analysis showed that significantly more staff in Switzerland were categorized into the “40 or more” age-group (45.2%) than those in Japan (17.7%). In contrast, significantly more staff in Japan were categorized into the “18–25” age group (19.1%) and the “26–30” age group (31.4%) than those in Switzerland (2.6 and 16.5%, respectively). Therefore, the Swiss sample was significantly older than the Japanese sample. For marital status or relationship status, significantly more staff in Japan were single (58.8%) than in Switzerland (19.3%). For years of experience, significantly more staff in Switzerland were categorized into the “more than 10 years” group (60.7%) than those in Japan (37.8%). In contrast, significantly more staff in Japan were categorized into the “0–5 years” group (45.1%) and the “6–10 years” group (29.4%) than those in Switzerland (25.6 and 13.7%, respectively). Therefore, the Swiss sample had more work experience than the Japanese sample.

Cross-Cultural Comparisons Regarding Work-Related Psychological Symptoms

The mean scores, standard deviations, and 95% confidence intervals using bootstrapping of burnout, anxiety, depression, general psychological distress as well as secondary traumatic stress are shown in **Table 2**. Regarding burnout, among the three subscales there were no significant differences in the mean score of the MBI-EE between the two countries. In contrast, the mean score of the MBI-DP in Switzerland was significantly higher than that in Japan ($|z| = 2.32, p = 0.02$). Finally, there was no significant differences in the mean score of the MBI-PA, however, there was a tendency for higher scores in Switzerland than in Japan ($|z| = 1.74, p = 0.08$). Because MBI-PA is a reverse

scored subscale, the burnout symptoms, as measured on this subscale, tended to be lower in Switzerland. The mean total HADS score in the Swiss sample (12.8 ± 6.5) was significantly higher than that in the Japanese sample ($10.3 \pm 6.2; |z| = 2.04, p = 0.04$). On the subscale level, there were no significant group differences in the mean HADS anxiety ($|z| = 1.52, p = 0.13$) and depression scores ($|z| = 1.72, p = 0.09$). The mean total STSS score was significantly higher in the Swiss sample (31.8 ± 9.7) compared with the Japanese sample ($24.1 \pm 8.6; |z| = 4.56, p < 0.01$). Similarly, the means for the STSS subscale scores were significantly higher in the Swiss sample: STSS-I ($|z| = 2.44, p < 0.015$), STSS-A ($|z| = 4.76, p < 0.01$), STSS-NA ($|z| = 4.55, p < 0.01$).

Comparison of Psychological Variables by Sociodemographic Characteristics

Because we found differences in some sociodemographic variables between the Japanese and the Swiss samples, we compared the differences in the HADS, STSS, and MBI subscales among age categories, marital status (in Japan) or relationship status (in Switzerland), and years of experience by each country independently. In the Japanese sample, we found significant differences in MBI-PA scores according to marital status. The Mann–Whitney test revealed that the MBI-PA score of those who were unmarried (27.2 ± 9.2) was lower than that for those who were married ($34.1 \pm 8.7; |z| = 2.20, p = 0.03$). In addition, there was a significant difference in the STSS-A scores according to age group $[\chi^2(3) = 8.4, p = 0.04]$. The Steel–Dwass test revealed that the STSS-A score of the 18–25 age group (10.3 ± 4.0) was higher than that of the 31–40 age group ($7.7 \pm 2.2; |z| = 2.65, p = 0.04$). In the Swiss sample, we found a significant difference in STSS-I scores according to years of experience $[\chi^2(2) = 6.4, p = 0.04]$. The Steel–Dwass test revealed that the STSS-I score

TABLE 2 | Comparison of psychological burden between Japan and Switzerland.

	Japan			Switzerland			z	p
	Mean	SD	Bootstrap 95% CI	Mean	SD	Bootstrap 95% CI		
BURNOUT								
MBI emotional exhaustion	20.1	9.9	17.07–23.20	20.7	8.7	19.23–22.22	0.40	0.7
MBI depersonalization	3.2	3.7	2.08–4.33	4.8	3.8	4.09–5.40	2.71	<0.01
MBI personal accomplishment	29.7	9.5	26.73–32.75	32.9	4.8	32.02–33.72	1.74	0.08
ANXIETY AND DEPRESSION								
HADS total	10.3	6.2	8.48–12.25	12.8	6.5	11.73–13.95	2.04	0.04
HADS anxiety	6.5	3.7	5.44–7.80	7.7	3.8	7.01–8.40	1.52	0.13
HADS depression	3.7	3.0	2.79–4.64	5.1	3.9	4.36–5.76	1.72	0.09
SECONDARY TRAUMATIC STRESS								
STSS total	24.1	8.6	21.55–26.93	31.8	9.7	30.18–33.80	4.56	<0.01
STSS intrusion	7.9	3.2	7.03–8.97	9.5	3.7	8.81–10.10	2.44	0.015
STSS avoidance	8.9	3.2	7.97–10.00	11.7	3.7	11.08–12.40	4.76	<0.01
STSS neurovegetative activation	7.6	3.5	6.69–8.88	10.6	3.7	9.97–11.3	4.55	<0.01

of the more than 10 years' experience group (8.9 ± 3.5) was significantly lower than that of the 6–10 years' experience group (10.6 ± 2.5).

DISCUSSION

In this cross-sectional study, we compared burnout, anxiety, depression, general psychological distress, and secondary traumatic stress of midwives working on the maternity ward or in the NICU at two Japanese and two Swiss University Hospitals. Comparison of sociodemographic characteristics showed that Swiss midwives were older, more often in a relationship, and had more work experience. Although we could not find a cross-national study of midwives, this tendency is in line with a cross-national study of nurses (13). In this study across six countries (USA, Canada, UK, Germany, New Zealand, and Japan), Japanese nurses (all wards) were also the youngest and had less experience, whilst at the same time reported the highest rate of full-time employment (95.5%). Our results suggest similar sociodemographic differences for midwives as the ones reported for nurses. These differences in sociodemographic factors may influence the psychological burden of their work. For example, a study in Japan reported that inexperienced nurses had higher odds of developing burnout symptoms (33).

However, our results did not support our hypothesis of a greater psychological burden on midwives in Japan than in Switzerland expressed by higher scores of burnout, depression, anxiety, general psychological distress and secondary traumatic stress in the Japanese sample. The burnout subscale of depersonalization, the total HADS scores and STSS scores were significantly higher in the Swiss sample than in the Japanese sample. These results may indicate a greater psychological burden on midwives in Switzerland. These results might be explained by the different certification systems of midwives in Japan and Switzerland. In Japan, a midwifery license applicant is required to have acquired certification as a nurse either prior to obtaining the midwifery license or simultaneously. In addition,

the person has to have studied midwifery for longer than 1 year at a college or training school (Japan Nursing Association. Midwifery in Japan, 2015. Available from <https://www.nurse.or.jp/jna/english/midwifery/pdf/mij2015.pdf>). In Switzerland, midwives are not necessarily also nurses. There are two education programs for the midwifery license; one is a course of 6 semesters plus 10 months of additional modules for persons without a nursing license. Another is a course of 4 semesters for persons with a nursing license (www.hebamme.ch). Interestingly, in Japan, nurses who were allowed to work in the same role as a midwife under the direction of obstetricians on perinatal wards and in the NICU showed significantly higher burnout, anxiety, and depression symptoms than midwives (see **Supplementary Materials**). Another Japanese study also demonstrated higher levels of burnout in nurses compared with midwives who were working on maternity and labor wards at 20 hospitals (34). According to these results, we speculate that midwives in Japan in this study may have had higher confidence in themselves given their longer professional training; this may have been one of the reasons as to why midwives working at university hospitals in Japan may have reported lower general psychological distress (as measured by the HADS total score) than that in Switzerland. Results from Japanese studies showing that job satisfaction of midwives was significantly higher than that of nurses (35), and that higher job satisfaction was related to lower burnout among midwives (9) may support our speculation.

In terms of burnout, a significant difference was only observed in depersonalization. Maslach et al. (4), who developed the MBI, stated “For both the Emotional Exhaustion and Depersonalization subscales, higher mean scores correspond to higher degrees of experienced burnout. Because some of the component items on each subscale had low loading on the other, exists a moderate correlation between the two subscales, which is in accord with theoretical expectations that these are separate, but related, aspects of burnout” p. 194 (4). We found few studies that mentioned the differences between emotional exhaustion and depersonalization. One of these was a recent

study on the structural validity of the MBI and the influence of depressive symptoms in bank employees (36). The authors found that emotional exhaustion highly correlated with depressive items; however, suicidal ideation tended to correlate more highly with depersonalization than emotional exhaustion. However, we cannot introduce any speculations about the discrepancies given this limited information.

Our results revealed that marital status in Japan influenced personal accomplishment. Mixed results were reported between marital status and burnout. In a previous study of Japanese midwives, marital status was associated with emotional exhaustion and depersonalization (unmarried midwives showed higher scores in both), but not with low personal accomplishment (9). Another study of Japanese nurses also showed that there was no association between marital status and burnout (37). However, one study of Japanese nurses showed that married nurses had lower emotional exhaustion, lower depersonalization, and higher personal accomplishment (38). A meta-analytic study examining the relationship between age and burnout among nurses revealed that marital status was a substantial moderator of age and burnout (39). The authors reported that married female nurses with high personal accomplishment may be better protected against loss of energy and enthusiasm for their profession.

As far as we know, this is the first study comparing secondary traumatic stress symptoms between Asian and European countries. Our results showed that the midwives in Switzerland reported more severe secondary traumatic stress symptoms than midwives in Japan. In addition, sociodemographic factors such as age (in the Japanese sample) and professional experience (in the Swiss sample) influenced the differences in secondary traumatic stress in our study. Older age and more education have been shown as protective factors for secondary traumatic stress in nurses (16, 40). However, in contrast, another study in Turkey reported that nurses who were over the age of 40 years were at greater risk of secondary traumatic stress (41).

This study has several limitations. First, the work environments of the target university hospitals within one country may be different. We employed only self-report scales and did not examine the work environments or conditions, such as working time, shift length, leave and holidays. If the work environments of the target hospitals differed extensively, these differences may not be cross-cultural but may reflect the particular work environments of the hospitals themselves. Second, there was a small number of participants in this study.

Third, this study was a cross-sectional study; therefore, we cannot discuss causality. Fourth, we did not ask about the number of traumatic experiences that participants had experienced either at their workplace or in their home life. Fifth, we did not consider family situations, except for sociodemographic factors. Sixth, the sample sizes were different between the two countries. Seventh, the impact of sociodemographic factors might be higher than the impact of cross-cultural issues.

Despite these limitations, this study has some strengths. We were able to use the same questionnaires and most of them had already been validated in both Japanese and French. All participants were working at university hospitals; therefore, there may be fewer differences in working conditions within the countries. Further, this is the first study that has focused specifically on midwives with a cross-cultural design.

In conclusion, this study revealed that the characteristics of the psychological burden on midwives were different in Japan and Switzerland. Future international studies on nurses and midwives examining the relationship among working conditions, family structures, and psychological burdens will be encouraged to understand cross-cultural issues.

AUTHOR CONTRIBUTIONS

MO, CF, AH, and CM-S conceived the original idea for the study. MO, CF, and AH collected the data. MO, TI, CF, and AH performed the analyses of the data. MO drafted the manuscript. TI, CF, AH, and CM-S contributed critical comments and edited the text. All of the authors approved the final version of the manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2018.00387/full#supplementary-material>

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Stressful Life Memories Relate to Ruminative Thoughts in Women With Sexual Violence History, Irrespective of PTSD

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More than one in every four women in the world experience sexual violence (SV) in their lifetime, most often as teenagers and young adults. These traumatic experiences leave memories in the brain, which are difficult if not impossible to forget. We asked whether women with SV history experience stronger memories of their most stressful life event than women without SV history and if so, whether strength relates to ruminative and trauma-related thoughts. Using the Autobiographical Memory Questionnaire (AMQ), women with SV history ($n = 64$) reported this memory as especially strong ($p < 0.001$), remembering more sensory and contextual details, compared to women without SV history ($n = 119$). They further considered the event a significant part of their personal life story. The strength of the memory was highly correlated with posttraumatic cognitions and ruminative thoughts, as well as symptoms of depression and anxiety (p 's < 0.001 , $n = 183$). A third (33%) of the women with SV history were diagnosed with posttraumatic stress disorder (PTSD), but PTSD alone did not account for the increase in memory strength (p 's < 0.001). These data suggest that the experience of SV increases the strength of stressful autobiographical memories, which are then reexperienced in everyday life during posttraumatic and ruminative thoughts. We propose that the repeated rehearsal of vivid stressful life memories generates more trauma memories in the brain, making the experience of SV even more difficult to forget.

Keywords: sexual violence, stress, trauma, PTSD, depression, rumination, memory, fear

INTRODUCTION

Sexual violence (SV) against women is common in today's world with numbers upward of 25% (1, 2). Most experiences occur during adolescence and young adulthood, when women are most vulnerable (3). The numbers are also high for women in college. Several years ago, the White House Task Force partnered with the Bureau of Justice to survey SV on nine college campuses. Of nearly 15,000 responders, ~10% reported SV during college (4). Other surveys suggest numbers closer to 25% (5, 6). Percentages are even higher (32%) for women in the same age group but not enrolled in college (6).

Memories of an extremely stressful life event tend to be easily recalled and are generally stronger than memories of normal-day experience (7–9). They also change with time as the memory is

rehearsed and/or avoided (10). When a memory is reactivated, it becomes associated with the new context (11). If the context is safe and/or neutral, the strength of the memory may lessen and its expression can extinguish. This process of “extinction” forms the basis of exposure therapy, the most accepted evidence-based intervention for people with trauma history (12). The memory is not erased from the brain but exposure therapy is effective because cues associated with the event are less likely to elicit the conditioned fear response. However, others theorize that rehearsing the trauma memory can strengthen the memory simply because it is being reactivated and reconsolidated over and over again. Because of these concerns, it is important to understand more fully how someone relives the memory of an extremely stressful life event, such as sexual violence. Does the person remember when and where the event took place more or less than the feelings associated with the event? Does he or she tend to remember discrete sensory details such as the sounds and smells or rather is the memory relived like a movie in sequence? Does he or she feel as if traveling back in time or is the memory experienced in the present moment?

Posttraumatic Stress Disorder (PTSD) is a mental illness characterized by persistent trauma-related thoughts after an extremely stressful life event (13). Most individuals who experience SV do not go on to develop PTSD but are at high risk. In fact, of all traumas, rape is the most likely to induce PTSD (13, 14). A diagnosis includes some combination of intrusive thoughts, flashbacks, avoidance behaviors, numbness or hyperarousal, along with disruption of normal life function (15). Although many people with PTSD suffer from symptoms of depression and anxiety (11, 16), trauma memories are the source of most problems (17, 18). According to Rubin and colleagues, “PTSD is defined in large part by changes that occur specifically in autobiographical memory” (19). To assess the strength of these memories, they developed the Autobiographical Memory Questionnaire (AMQ), which asks questions related to the details of an autobiographical memory, typically framed as a negative event in their past. In response to the AMQ, individuals with PTSD recalled negative autobiographical events with greater strength compared to people without PTSD, and the strength of the memory correlated with PTSD symptoms (9, 19–21). They interpret these and other findings to suggest that the repeated rehearsal of an intense memory experience may exacerbate PTSD symptoms over time and contribute to one’s life story (19). To our knowledge, the AMQ has not been used to assess the strength of stressful life memories in women who experienced the trauma of SV while adolescents and young adults, as it relates to the diagnosis of PTSD.

Rumination is defined as the repeated rehearsal of thoughts. These thoughts are usually autobiographical, negative in nature and about the past. They are also described as uncontrollable and involuntary. Historically, rumination was considered a trait and thus relatively stable. As such, the tendency to ruminate was considered a potential risk factor for PTSD (22, 23). However, more recent data suggest that rumination is malleable and can be decreased significantly by interventions, which target trauma memories (24–27). In general, ruminative thoughts have been most often associated with depression, although recent studies,

including our own, indicate a strong relationship to trauma (22, 28). But exactly *how* they relate to trauma is unclear. Minimally, they exacerbate trauma-related thoughts through the repetition of trauma memories (28) and as discussed, each time a memory is retrieved, a new memory is made through its association with the context in which it is expressed. Thus, at a neuroscience level, one could hypothesize that the repetitive and largely involuntary rehearsal of a trauma memory creates yet more memories of the trauma and related memories in the brain. A related theory, known as the “multiple trace theory” was developed by Nadel and Moscovitch to account for the persistence of memories (29–31). We extend their theory to suggest that the repeated rehearsal of a vivid autobiographical memory during rumination generates more trauma memories, thereby making the trauma more difficult to “forget.” The purpose of the present study was to investigate the relationship between rumination and the strength of autobiographical memories in women with SV history.

In the present study, we hypothesized that women with SV history would report autobiographical memories of a stressful life event as more intense than women without SV history, even in the absence of PTSD. It was hypothesized that women who ruminate more would also report stronger stressful life memories. We further hypothesized that the experience of SV history rather than the diagnosis of PTSD *per se*, would influence the expression of ruminative thoughts and intensity of stressful memories. Finally, we hypothesized that the relationship between the stressful life memory and rumination would relate to the numbers of trauma-related cognitions, as well as anxious and depressive symptoms. Adult women who experienced SV during and after puberty were evaluated because most women are assaulted during this time period and because memory processes for events that occur in childhood may be different from those acquired later (3). To test the hypotheses, we relied on statistical analyses of group differences between women with and without SV history as well as correlations among outcomes within individuals.

METHODS

Participants and Procedure

One hundred and eighty three college-aged women ($M_{\text{age}} = 20$ years, $SD = 2.67$, range 18–39 years; 33.2% Asian, 30.4% European/Caucasian/White; 16.8% African-American/Black/Caribbean; 9.8% Hispanic/Latina; 9.8% more than one race/other/unknown) participated in testing at a northeastern university. Participants were included if they were able and willing to provide written informed consent and excluded if they were over 40 years of age. Less than 10% of the participants were currently prescribed anti-anxiety medications or anti-depressants. Sixty four participants ($n = 64$) reported experiencing sexual violence, and one hundred nineteen participants ($n = 119$) did not experience SV and served as controls.

This study was carried out in accordance with the recommendations of the Institutional Review Board at Rutgers University. All participants provided written informed consent in accordance with the Declaration of Helsinki. Participants were

assessed for trauma history with a structured clinical interview, completed a series of questionnaires (described below) and then completed the working memory task (total session ~2 h). Afterwards, participants were debriefed and compensated (\$20 or research credits).

Materials

All participants were assessed for trauma history with the Structured Clinical Interview for DSM-5 (SCID; 15) by a doctoral psychology graduate student trained in conducting clinical interviews. Trauma exposure was defined according to the DSM-5 as direct exposure to “an event or events that involved actual or threatened death, serious injury or sexual violation to the self” (32). The age of participant at time of trauma was also recorded and used to select only those participants with trauma history during adolescence or young adulthood for analyses.

The *Autobiographical Memory Questionnaire* [AMQ; (33)] is a 19-item questionnaire that assesses qualities of an autobiographical memory. Given the breadth of the questionnaire, typically items are scored individually or in clusters, depending on the research question of interest (20). We were especially interested in the sensory details and vividness of details related to the memory rather than the accuracy of the memory itself. Therefore, we did not assess items concerning confidence of the memory or dating the event. We also wanted to protect their privacy and therefore, did not ask them to identify the event. Participants were told to respond to the questionnaire in relation to an autobiographical memory of *the most stressful event in your life*. We included 12 individual items which assessed the rehearsal of the memory, sensory details (“As I remember the event, I can hear it in my mind” or “see it in my mind”), temporal and spatial details (“As I remember the event, I know its temporal and spatial layout”), emotional intensity (“As I remember the event, I feel the emotions now that I felt then”), and significance (“the memory is significant in my life”). Total scores were calculated, with greater scores representing heightened vividness of details related to a stressful autobiographical memory. This task has been used in the past to distinguish between types of memory systems activated during recall, particularly in participants with PTSD symptoms (7, 19, 20, 34).

The *Symmetry Span Task* was used to assess working memory (35). Developed by Engle and colleagues, the computer task required participants to make assessments of symmetrical pictures while remembering the temporal order and spatial location of a series of squares individually displayed on a grid. Participants were shown a picture and were asked to respond whether it was symmetrical or not. Immediately following, a 1×1 square in a 4×4 grid appeared on the screen for 2-s. Pairs of pictures and squares were presented 2–5 times per trial, for 12 trials (3 blocks total). Following stimulus presentations, participants were asked to replicate the location of the squares in the order presented. The task required ~20 min to complete. Data from the working memory task yielded partial and absolute accuracy scores. A partial accuracy score was a sum of all correct responses. An absolute accuracy score was the sum of correct responses in completely correct trials, when the order and

location of all squares were correctly identified during the trial (all-or-none system).

The *Ruminative Responses Scale* [RRS; (36)] is a 22-item questionnaire that assesses thoughts and responses to depressed mood and affect. Examples of RRS items include “*thinking about how sad you feel*,” “*thinking about your shortcomings, failings, and mistakes*” or “*analyzing events to understand why you feel depressed or unmotivated*.” The RRS is scored as a summation of responses (min 22; max 88) as well as according to three subscales: (1) depressive ruminations, which relate to the rehearsal of depressive events, (2) brooding ruminations, which are often non-adaptive and emotion-laden, and (3) reflective ruminations, which are not as maladaptive but self-focused (37, 38).

The *Posttraumatic Cognitions Inventory* (PTCI) is a 33-item questionnaire that assesses altered cognitions related to traumatic life experiences (16). The PTCI is composed of three subscales: thoughts related to oneself (i.e., sees oneself as blameworthy, isolated, unreliable), others (i.e., sees them as untrustworthy), and the world (i.e., sees it as a dangerous place). The purpose of the PTCI is to assess the person’s reaction to the event after time has passed and includes items such as “*I have to be on guard all the time*,” “*I feel like I don’t know myself anymore*,” and “*I feel isolated*.” We altered the prompt to ask participants about their thoughts and feelings related to *the most stressful event of your life*. This way, women with no trauma history could also report their thoughts and feelings of a past event. We also wanted to use the same prompt as used for the AMQ. Higher PTCI scores are indicative of more negative posttraumatic cognitions and are generally associated with greater numbers of PTSD symptoms (24).

The *Beck Depression Inventory* [BDI; (39)] is a 21-item questionnaire that measures symptoms of depression. The *Beck Anxiety Inventory* [BAI; (40)] is a 21-item questionnaire that measures symptoms of anxiety. For both measures, total scores are computed by adding response choices. Scores greater than 20 on the BDI represent moderate to severe depression and scores greater than 20 on the BAI are consistent with moderate to severe anxiety. Both questionnaires are commonly used to assess cognitions associated with symptoms of depression and anxiety, respectively (41–43).

Statistical Analyses

Dependent variables were obtained from self-report scores from the respective questionnaires with independent variables based on violence, PTSD, or trauma history. Independent samples *t*-tests and analyses of variance (ANOVA) were used to test differences in mental health outcomes (AMQ, Working Memory task, RRS, PTCI, BDI, BAI) between groups without (no-SV, $n = 119$) and with history of SV (SV, $n = 64$). The sample was divided further to account for PTSD diagnosis: no-SV, SV-no PTSD ($n = 43$), SV+PTSD ($n = 21$). When analyzing groups based on SV history and PTSD diagnosis, ANOVAs and Fisher’s least significance difference (LSD) *post-hoc* test were used to uncover differences in the strength of autobiographical memories and ruminative thoughts between groups.

Relationships among all outcome measures are presented as Pearson *rho* correlations. Statistical analyses were assessed with SPSS version 24.0 (IBM Corp., 2017) and a significance level of $p < 0.05$ was used for all analyses, with Bonferroni corrections for the AMQ. Effect sizes are presented as partial eta-squared (η^2) in order to quantify meaningful differences in dependent outcomes between women with and without SV history. Typically, partial η^2 effect sizes are categorized as 0.01 (small), 0.09 (medium), and 0.25 (large) (44).

RESULTS

Sexual Violence History With and Without PTSD

Approximately one-third of women with SV history ($n = 21$) met diagnostic criteria for current PTSD according to SCID-5 criteria. Women with SV history regardless of PTSD diagnosis averaged seven current PTSD symptoms ($SD = 5$, range 0–19). Women with exposure to trauma other than SV ($n = 19$) averaged one current PTSD symptom.

Autobiographical Memory

The cumulative AMQ score from items 1–12 was calculated for women with SV history vs. women without SV history. Women with SV history reported a significantly stronger memory of their most stressful life event compared to women with no history of SV $F_{(1, 181)} = 11.75$, $p < 0.001$, Partial $\eta^2 = 0.06$

(Figure 1A). Women with SV and PTSD did not report higher AMQ scores than women with SV but no PTSD, $F_{(2, 180)} = 6.53$, $p > 0.05$, but they did report higher AMQ scores than no-trauma controls. Women with SV history but no PTSD reported stronger AMQ memory scores compared to women without SV history ($p < 0.05$).

Items on the AMQ were analyzed for group differences. To correct for multiple comparisons and avoid Type 1 Errors, Bonferroni corrections were applied to a p -value of 0.05 (0.05/11 comparisons of 12 AMQ items = 0.005). Therefore, a p -value less than 0.005 was necessary to establish significance. Group scores were significantly different for three items (Figure 1B). Women with SV history (1) reported more details related to seeing the event in their mind, $t_{(181)} = -3.73$, $p < 0.001$, (2) indicated more details related to the spatial layout of the memory $t_{(181)} = -3.35$, $p < 0.001$, and (3) reported the autobiographical memory as significantly more central to their life story, $t_{(181)} = -4.03$, $p < 0.001$. Group responses did not differ significantly on the other nine items assessed by the AMQ, $p > 0.005$, with the Bonferroni correction, although the overall AMQ score was significantly larger in women with SV history.

Working Memory

Data collected for spatial and temporal working memory with the Symmetry Span task were analyzed. Sixty five participants did not complete the task due to technical problems. Women with SV history ($n = 48$) did not significantly differ from women without

SV history ($n = 76$), on either partial accuracy, $t_{(122)} = 1.26$, $p > 0.05$, or absolute accuracy, $t_{(119,93)} = 1.29$, $p > 0.05$.

Ruminative Thoughts

Women with SV history reported ~15% more rumination as assessed with the Ruminative Responses Scale (RRS) compared to women without SV history, $F_{(1, 181)} = 12.15$, $p < 0.001$, Partial $\eta^2 = 0.06$ (**Figure 2A**). RRS subscales for the depressive, brooding and reflective thoughts were analyzed (**Figures 2B–D**). Women with SV history reported 17% more depressive rumination compared to women without SV history, $F_{(1, 181)} = 12.51$, $p < 0.001$. Women with SV history reported 11% more brooding compared to women without SV history, $F_{(1, 181)} = 5.54$, $p < 0.001$. Additionally, women with SV history also reported 14% more reflection compared to women without SV history, $F_{(1, 181)} = 8.32$, $p < 0.001$. Women significantly differed on RRS scores depending on PTSD diagnosis, $F_{(2, 180)} = 8.46$, $p < 0.001$, Partial $\eta^2 = 0.09$. Fisher's LSD *post-hoc* test revealed that women with SV and PTSD reported more rumination than women with SV but no PTSD, $p < 0.05$. Women with SV and no PTSD reported more rumination than women without SV, $p < 0.05$.

Trauma-Related Thoughts, Depression and Anxiety

Women with SV history reported 26% more posttraumatic cognitions as assessed on the PTCI compared to women without SV history, $F_{(1, 181)} = 38.42$, $p < 0.001$, Partial $\eta^2 = 0.18$ (**Figure 4A**). PTCI subscales of self, world and others were analyzed. Women with SV history significantly differed from the no-SV group on all three PTCI subscales of self-blame, negative thoughts about the world and of others (p 's < 0.01). Women significantly differed on PTCI scores depending on PTSD diagnosis, $F_{(2, 180)} = 24.87$, $p < 0.001$, Partial $\eta^2 = 0.22$. Fisher's LSD *post-hoc* test revealed that women with SV and PTSD reported more posttraumatic cognitions than women with SV but no PTSD, $p < 0.05$. Women with SV and no PTSD reported more posttraumatic cognitions than women without SV, $p < 0.01$.

Women with SV history reported 44% more depressive symptoms as scored on the BDI compared to women without SV history, $F_{(1, 181)} = 25.66$, $p < 0.001$, Partial $\eta^2 = 0.12$ (equal variances not assumed) (**Figure 4B**). Women significantly differed on BDI scores depending on PTSD diagnosis, $F_{(2, 180)} = 15.34$, $p < 0.001$, Partial $\eta^2 = 0.15$. Fisher's LSD *post-hoc* test revealed that women with SV and PTSD reported over 50% more depressive symptoms than women with SV and no PTSD, as well as women without SV, p 's < 0.05 . Women with SV and no PTSD also had more depressive symptoms than women without SV, $p = 0.001$.

Women with SV history reported twice as many anxiety symptoms as assessed on the BAI compared to women without SV history, $F_{(1, 181)} = 25.09$, $p < 0.001$, Partial $\eta^2 = 0.12$ (equal variances not assumed) (**Figure 4C**). Differences in anxiety depended on PTSD diagnosis, $F_{(2, 180)} = 16.59$, $p < 0.001$, Partial $\eta^2 = 0.16$. Fisher's LSD *post-hoc* test revealed that women with SV and PTSD reported over 70% more anxious symptoms than

women with SV and no PTSD, as well as women without SV, p 's < 0.05 . Women with SV and no PTSD had more anxious symptoms than women without SV, $p < 0.01$.

Individual Differences

As summarized in **Table 1**, women who reported more ruminative thoughts (higher RRS scores) reported a greater number of details surrounding an autobiographical memory of a past stressful event and more posttraumatic cognitions ($p < 0.001$; **Figure 3**). Relationships among depressive, anxious and posttraumatic symptoms across the entire sample were highly significant ($p < 0.001$).

DISCUSSION

In this study, we asked whether stressful life memories would be reported as more intense in women with a history of sexual trauma and if so, whether they would relate to posttraumatic cognitions and ruminative thoughts within individuals. We also asked whether these relationships would occur irrespective of

TABLE 1 | Pearson correlations coefficients among all measures.

	AMQ	RRS	RRS-D	RRS-B	RRS-R	PTCI	BDI
RRS	0.426**	—					
RRS-D	0.373**	0.962**	—				
RRS-B	0.501**	0.870**	0.775**	—			
RRS-R	0.279**	0.761**	0.609**	0.611**	—		
PTCI	0.400**	0.643**	0.633**	0.611**	0.395**	—	
BDI	0.360**	0.646**	0.665**	0.591**	0.352**	0.785**	—
BAI	0.349**	0.535**	0.517**	0.502**	0.361**	0.621**	0.758**

n = 183; ***p* < 0.001.

AMQ, Autobiographical Memory Questionnaire; RRS, Ruminative Responses Scale; RRS-D, RRS depressive subscale; RRS-B, RRS brooding subscale; RRS-R, RRS reflective subscale; PTCI, Posttraumatic Cognitions Inventory; BDI, Beck Depression Inventory; BAI, Beck Anxiety Inventory.

a PTSD diagnosis. Researchers have long been interested in questions such as these (20, 34, 45–47). The AMQ was developed by Rubin and colleagues to answer some of these questions (33). Through a series of studies, they established traumatic memory recall as part of a basic memory system rather than its own specific system. In other words, the processes through which autobiographical memories of stressful life events are recalled may not be substantively different from the way that other memories are recalled. We used their autobiographical memory questionnaire here to compare the strength of stressful life memories in women with and without SV history and further to compare responses in women who did and did not meet criteria for current PTSD. We predicted that women with SV history would report a stressful life memory as more intense compared to responses from women without SV history and this response would not depend on the concurrent diagnosis of PTSD. As predicted, SV in the past, irrespective of PTSD diagnosis, was associated with a stronger reported memory experience. Thus, SV is sufficient to establish an especially strong autobiographical memory of a very stressful life event upon recall.

In the present study, women with SV history not only reported a stronger stressful life memory, they reported specific details as being especially prevalent (**Figure 1A**). They were more likely to: (1) see the event in their mind, (2) recall its temporal and spatial layout, and (3) consider the memory a significant part of their life story (**Figure 1B**). They did not report the “feelings” associated with the memory as more intense, nor did they report more “reliving” of the memory, when compared to women without SV history reflecting on the most stressful event in their life. These differences in memory detail suggest that the memory for a SV event is experienced as watching a movie rather than a body response, *per se*. Of course, memories for trauma are experienced in the body—the participants just did not report it as more intense. One limitation of this study is that we did not ask participants to identify the event they were reflecting upon and therefore do not necessarily know whether women were recalling the sexually violent experience. Nonetheless, these data suggest that memories for stressful life events are especially vivid in sensory and contextual detail as

well as meaningful for women who have had a sexually violent experience.

Working memory is a learning process, which allows the brain to hold and manipulate information in short-term memory, usually in the service of completing a cognitive task or skill (48). Women with SV history performed a working memory task just as well as women without SV history. These findings are generally consistent with others (49). For example, college students with interpersonal trauma history performed just as well on tests of working memory and cognitive flexibility (using digit-span and card-sorting tasks) as students without trauma history (50). Another study compared the recall of autobiographical to nonautobiographical memories in individuals with PTSD. Whereas, autobiographical memories were more disorganized, nonautobiographical memories were not (51). These data and those we report here suggest that trauma and/or violence history is more likely to impact stressful life memories rather than general memory processes.

The psychological mechanisms through which SV and memory interact is not without controversy (45, 52). Many studies point to disorganization of memory (10, 51). Rape victims often describe their memories as emotionally intense but lacking coherence (53), whereas other victims report memories rich in detail. A recent study asked survivors of domestic violence to write a narrative about a traumatic event and a positive experience (54). The trauma narratives were detailed and more coherent than the memories of a positive experience, and were better predictors of PTSD. The underlying psychopathology, if present, is also important. For example, undergraduates with PTSD reported more sensory details of a traumatic event whereas undergraduates with depression recorded fewer details (55). Age also seems to matter. For example, children sometimes dissociate during trauma and as a consequence, may have difficulty remembering what happened (56). We only tested women who had experienced SV during or after puberty. Their responses suggest a strong detailed memory for their most stressful life event, which is consistent with some studies in adults (45, 57).

Ruminations

Ruminations generate intrusive memories which can extend the persistence of PTSD (58, 59). In the present study, women with SV history reported they tend to ruminate about 15% more than women without SV history (**Figure 2A**). These women also reported significantly more depressive, brooding and reflective ruminations. Rumination was further associated with posttraumatic cognitions, which are indicative of PTSD symptomology. These data are consistent with meta-analyses, indicating positive relationships between rumination and posttraumatic symptoms, even years after the trauma (57, 60–63). The mechanisms through which ruminative and posttraumatic thoughts interact are unknown. In one study, individuals with PTSD described their ruminations as uncontrollable thoughts about critical life events (28). In our study, women with SV history and PTSD reported more ruminations than women with SV history and no PTSD, who in turn reported more ruminations than women without SV

history. Therefore, PTSD symptoms are associated with a greater tendency to ruminate but exposure to SV on its own is sufficient to increase rumination. Of course, we cannot determine whether the tendency to ruminate predates trauma exposure and consequently exacerbates the development of trauma-related symptoms later in life, though other studies suggest this may be the case (22).

Relations Among Ruminative Thoughts and Stressful Life Memories

In general, participants who reported one outcome in this study were more likely to report another outcome (Table 1). Strong correlations among responses may not be especially surprising because the questions on the various questionnaires do overlap. But even so, the correlations were strong and pervasive. For this study, we focused primarily on the relationship between rumination and stressful life memories (Figure 3). The correlation between RRS and AMQ scores was highly significant across the entire sample, as shown in Table 1; the correlation between RRS and AMQ for SV without PTSD was significant, albeit less strong ($r = 0.33$; $p < 0.05$). To our knowledge, no study to date has reported a *positive* relationship between rumination and autobiographical memory detail in women with sexual trauma exposure but not necessarily experiencing PTSD. To interpret these results, we come back to the “multiple memory trace” hypothesis. Each time a memory is activated in a new context, additional details are incorporated into the memory and a new “hippocampal trace” memory is generated (29, 30, 64–66). These learning processes in the hippocampus can interact with stress as well. In one study, people watched a stressful film and later were exposed to cues, which reactivated the memory for the film. Those who did so under stressful conditions (high cortisol) reported more intrusive memories than those who did so under unstressed conditions (67). A similar process may be occurring

in women with SV history. According to their self-report surveys, they often rehearse trauma memories. The rehearsals are likely done under stressful conditions because the women are experiencing moderate levels of depression and anxiety. We propose these involuntary rehearsals generate new memories with new contextual details in the brain, which become more difficult to extinguish.

The positive relationship between rumination and memory reported here is different from other reports. Kleim and Ehlers (68) observed *less* detail for autobiographical memories in individuals with acute stress disorder (68). Moreover, the correlation between memory detail and rumination was negative. There are some key differences between studies. In theirs, memories were provoked with cues using the Autobiographical Memory Test (AMT) and thus different in content from “the most stressful life memory” retrieved during the AMQ. Also, their assessments were within weeks of the trauma and ours were generally much later. But interestingly, they conclude that an overgeneralized memory is not necessarily the result of trauma, *per se*, but rather a predisposition to depression, which arises as a result of trauma. The literature connecting trauma with autobiographical memory is extensive and implicates other factors such as avoidance behavior and executive control (17, 18, 69). Others studies propose even more complicated relationships (70–74). It is difficult to directly compare our results with these because of the methodological differences and because most of our participants did not have PTSD. In general, there does appear to be a strong relationship between rumination and the strength of autobiographical memory recall, but the direction of this relationship depends on the experimental question and procedures, as well as the presence of PTSD and/or other mental disorders such as depression.

Rumination is considered a risk factor for depression, in part because women tend to ruminate more than men do and are more often diagnosed with depression (75, 76). However,

FIGURE 4 | (A) Women with sexual violence history reported significantly more posttraumatic cognitions as assessed by the Posttraumatic Cognitions Inventory (PTCI), **(B)** more depressive symptoms as assessed by the Beck Depression Inventory (BDI), and **(C)** more anxiety symptoms as assessed by the Beck Anxiety Inventory (BAI) compared to women with no sexual violence history. * $p < 0.001$.

rumination *per se* does not necessarily account for the high incidence of depression in women (37). In one of our recent studies, both men and women with high numbers of depressive symptoms reported more ruminative thoughts, but there were no sex differences in the relationship. With that being said, because women are more likely to ruminate and more likely to experience sexual violence, it is reasonable to assume that these ruminations may exacerbate the symptoms of depression, as previously suggested (68). Of course, not all ruminations are maladaptive and some degree of reflection is necessary in order to learn how to recover from trauma (77).

Trauma-Related Thoughts and Symptoms of Anxiety and Depression

Women with SV history had PTCI scores greater than 120, which is relatively high (Figure 4A), especially because most of them were not diagnosed with PTSD (16). However, participants without trauma history also had relatively high PTCI scores (16). These differences are easily explained. We asked participants to reflect on the most “stressful event” in their lifetime, rather than the most “traumatic event.” We did this in order to compare responses between participants with and without trauma history but obviously, this procedure would increase PTCI scores across groups. Importantly though, women with SV history reported more trauma-related thoughts than women without SV history. And women with SV and PTSD reported more posttraumatic thoughts than women with SV history and no PTSD.

Most women with SV history did not meet diagnostic criteria for a depressive or anxiety disorder, as diagnosed by the SCID. As a group, their BDI scores were consistent with a mild mood disturbance (39) and BAI scores were consistent with mild anxiety (40). Overall, these data indicate a significant yet moderate elevation of anxiety and depressive symptoms in response to SV history. Others report similar findings in college students with violence history (78, 79). These results likely reflect

low level activation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis, both of which are associated with the persistent expression of symptoms of depression and anxiety (80–84).

Sex Differences

We concentrated on women and not men for several reasons. First, women are four times more likely to experience SV compared to men, and women between ages 12 and 34 are most likely to experience sexual assault (2, 6). Second, college-age women report sexual assault as the most traumatic event of their lifetime when compared to men (53% compared to 11%) (85). And third, women are more likely than men to develop assault-related and stress-related disorders such as PTSD, presumably because they are more frequently exposed to sexually violent events, but also perhaps due to biological differences in stress-related systems (86, 87).

The impact of SV on the human brain is difficult to study, in part because studies must be retrospective and variability between individual experiences is substantial (86, 88–90). To meet this need, we developed an animal model known as SCAR, which stands for Sexual Conspecific Aggressive Response. During this procedure, a young female rat in puberty is exposed to an adult sexually-experienced male each day for 30 min. As a result, female rats produced high levels of stress hormones and did not learn as well in standard laboratory training tasks. They also retained fewer new neurons in the hippocampus, a part of the brain necessary for many types of learning (91). These data suggest that the experience of sexual aggression can affect neuronal processes related to learning and memory, even neurogenesis. However, these results must be interpreted with caution; it is not possible to directly compare results from laboratory animal studies to women with SV history because the conditions surrounding the stressful events are different in many ways and levels of organization.

Learning to Recover

Sexual violence against women is an all too common occurrence and recent attention from the media is long overdue (1, 3). But this problem will not go away soon and we must keep our attention focused on prevention and justice for survivors. We must also find new ways to help women learn to recover. The most accepted course of treatment is Prolonged Exposure Therapy (PET) (12, 16, 24, 92), during which the client recollects the trauma memory during interviews, story-writing and even revisiting the traumatic location. After repeated exposure, the strength of the memory often lessens and the conditioned responses of fear and anxiety begin to extinguish (93, 94). Theoretically, the memory becomes less accessible in part because it has been updated and reconsolidated with other safer memories (95). Effective as it is, PET is time-consuming and can be expensive. Also, clients often drop out because it is emotionally painful to rehearse and relive the memory.

We recently developed a novel intervention to help women recover from the trauma of SV (26, 27, 96). The intervention is known as MAP Training because it combines “Mental And Physical” Training. Each session combines 30 min of mental training with silent meditation followed by 30 min of aerobic exercise. After 6 weeks of training, twice a week, women with SV history reported significantly fewer trauma-related cognitions and ruminative thoughts than women with SV history who were trained with meditation alone or exercise alone. Women who completed MAP Training also reported greater self-worth than the other training groups (26). It is unclear *how* this intervention works to reduce rumination and trauma-related thoughts. Women in the study completed the AMQ as well. Interestingly, scores did not change in women who completed training but increased in women who did not train. These data may suggest that fewer trauma-related and ruminative thoughts lessen the likelihood that the memory will strengthen over time.

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CONCLUSION

Women who experienced SV as adolescents or young adults reported intense memories for stressful life events, irrespective of PTSD. The strength of these memories was highly related to ruminative and trauma-related thoughts within individuals, as were symptoms of depression and anxiety. Theoretically, these data support the idea that ruminative thoughts and vivid memories of stressful life events coexist and are especially prominent in women who have experienced sexual violence. Thus, rumination may be an especially effective target for trauma recovery, because fewer ruminations would produce fewer vivid memories of trauma in the brain.

ETHICS STATEMENT

This study was carried out with written informed consent from all participants. IRB approval was obtained from Rutgers University for the study.

AUTHOR CONTRIBUTIONS

TS, EM, and HC designed project. EM and HC carried out the study. TS, EM, and HC analyzed results. TS, EM, and HC wrote the manuscript.

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Mental Health in Anesthesiology and ICU Staff: Sense of Coherence Matters

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Background: Hospitals, and particularly intensive care units (ICUs), are demanding and stressful workplaces. Physicians and nurse staff are exposed to various stressors: emergency situations, patients' deaths, and team conflicts. Correspondingly, several studies describe increased rates of PTSD symptoms and other mental health problems in hospital staff. Therefore, it is important to identify factors that lower the risk of psychopathological symptoms. High levels of sense of coherence (SOC) and general resilience as well as an internal locus of control (LOC) have already been identified as important health-benefitting factors in medical staff. The current study aimed to evaluate their unique impact in an ICU and an anesthesiology unit.

Method: The cross-sectional online survey investigated SOC, LOC, general resilience, general mental health problems as well as PTSD symptoms in nurses and physicians within an ICU and an anesthesiology unit ($N = 52$, 65.4% female). General mental health problems were assessed using the ICD-10-Symptom-Rating (ISR) and PTSD symptoms were measured using the PTSD Checklist for DSM-5 (PCL-5). The Sense of Coherence Scale (SOC-L9) assessed SOC, the Resilience Scale (RS-11) measured general resilience, and LOC was determined using a 4-item scale for the assessment of control beliefs (IE-4).

Results: As expected, SOC, $r = -0.72$, $p < 0.001$, general resilience, $r = -0.46$, $p < 0.001$, and internal LOC, $r = -0.51$, $p < 0.001$, were negatively correlated with general mental health problems while an external LOC showed a positive association, $r = 0.35$, $p = 0.010$. However, in a multiple regression model, $R^2 = 53.9\%$, $F_{(4, 47)} = 13.73$, $p < 0.001$, only SOC significantly predicted general mental health problems by uniquely accounting for 13% of the variance. For PTSD symptoms, which were highly correlated with general mental health problems, a similar pattern of results was found.

Conclusion: SOC was found to be the most important correlate of both general mental health problems and PTSD symptoms in an ICU and an anesthesiology unit. Thus, if further evidenced by longitudinal studies, implementing interventions focusing on an enhancement of SOC in training programs for ICU and anesthesiology unit staff might be a promising approach to prevent or reduce psychopathological symptoms.

Keywords: resilience, stress, hospital staff, intensive care, post-traumatic stress, PTSD, locus of control, sense of coherence

INTRODUCTION

Hospitals are highly demanding and stressful workplaces. Often, patients and their relatives find themselves in unsettling situations and the medical personnel need to respond appropriately and quickly to their medical needs. Further, hospital staff are exposed to various stressors including medical emergency situations, patients' deaths, time pressure, steep hierarchies, and team conflicts. Particularly in intensive or critical care units (ICUs), even minor errors could have fatal consequences, including cases of death. At the same time, the working conditions in hospitals in many countries are far from optimal: wards are understaffed (1–3), shiftwork is common, shifts tend to be too long (4), and especially nurses receive only little recognition for their demanding work (5).

Previous research shows that these poor and stressful working conditions are linked to relatively high rates of burnout and other symptoms of mental distress (6–10). Stress-related symptoms are especially present in ICU staff (11–14). For instance, a survey in the UK found that 12% of ICU physicians, compared to 5% of the general population (15), reported clinically relevant depressive symptoms and 3% were bothered by suicidal thoughts (16). Apart from depression, secondary traumatization represents a further potential consequence of working in an ICU: 18% of the nurse staff in a university hospital in the United States not only meet the criteria of burnout syndrome, but also exceed the cut-off criteria for post-traumatic stress disorder (PTSD) (17). The study further reports that particularly ICU nurses are additionally burdened by work-related nightmares. In line with the described findings, Domiguez-Gomez and Rutledge (18) find high rates of PTSD core symptoms (intrusion, avoidance, and arousal) in emergency nurses. Overall, the high prevalence of stress-related symptoms seems to be the consequence of ongoing exposure to unpredictable stressful events at work and difficulties in employing coping strategies. The occurrence of psychopathological symptoms is critical in two ways: Firstly, hospital personnel and especially ICU staff members are at serious risk of developing mental disorders. The presence of psychopathological problems further impedes the ability of these individuals to cope with their work-related stressors and aversive experiences and might also have a negative impact on the management of private stressors. Secondly, several studies describe that these problems subsequently impair the provided quality of care (3, 19, 20).

However, even though hospitals and especially ICUs are stressful workplaces, not all nurses and physicians respond equally to those strains. Notably, a substantial proportion of hospital staff is able to successfully deal with their demanding work environment over periods of many years (21). Given these differences, it seems crucial to identify factors relevant to successful coping processes at highly stressful workplaces.

In this context one of the frequently discussed concepts is Aaron Antonovsky's theory of salutogenesis (22). Contrary to other theories, which mainly center on the development of (psycho-)pathology, the salutogenesis model conceptualizes health as being at one end of a continuum from *ease* (absolute health) to *dis-ease* (absolute illness). In this regard, sense of coherence (SOC) describes a global orientation of confidence in one's ability to cope with and overcome stressful and challenging situations in life (23). SOC enables individuals to manage stressful experiences by mobilizing their internal as well as external resources to cope with specific problems and situations. Additionally, a strong SOC also comprises a feeling of meaningfulness that provides the individual with the belief that the demands and challenges of life are worth facing. Thereby, it allows individuals to move toward the *ease* end of the described continuum. Within the salutogenesis framework, SOC is described as a dispositional orientation, shaped by early life experiences between the ages of 0 and 30, rather than a state variable (24). This view was supported in longitudinal studies (25, 26), but see (27). In the context of stressful working environments, individuals who have developed a higher level of SOC should be more successful in dealing with stressors and demands and thus be more likely to maintain their mental health. Several studies already show that higher levels of SOC are associated with less stress-related and depressive symptoms in hospital staff (28–30) and paramedics (31).

However, SOC is not the only concept considered to be important in maintaining mental health in a challenging work environment. Another important—but partly overlapping—concept is general resilience. Resilience is a multidimensional construct that is defined as “the ability to adapt successfully in the face of adversity, trauma, tragedy or significant threat” ((32), p. 119). There is a continuing debate whether resilience is a personality trait or whether it develops in consequence of adversity (33): Conceptualizing resilience as a personality trait implies understanding it as a variable that inoculates individuals against the negative impact of aversive experiences. Its trait-based definition has the greatest overlap with SOC. In contrast, outcome focused approaches define resilience as a beneficial behavioral outcome in spite of aversive experiences. From this theoretical perspective, resilience may be the consequence of higher SOC levels. The conceptually wider process-based approaches understand resilience as an active process of recovering from aversive life events. With respect to this definition, SOC levels may modulate the recovery process. This heterogeneous conceptualization of resilience limits the comparability of research findings. However, several studies, which conceptualize resilience as trait, show a relationship between higher levels of resilience and less psychopathological symptoms in hospital staff (11, 21, 34).

One aspect of both SOC and resilience is locus of control (LOC), which is defined as the extent to which individuals feel they can control events in their environment (35). Several studies found that LOC is a unique concept that is important in dealing with aversive and traumatic experiences (36, 37). A stronger internal LOC is beneficial, while a more

Abbreviations: ICU, intensive care unit; ISR, ICD-10-symptom-rating; LOC, locus of control; NFI, normal fit index; PCL-5, PTSD checklist for DSM-5; PTSD, post-traumatic stress disorder; RS-11, resilience scale 11; RMSEA, root mean square error approximation; SOC, sense of coherence; SOC-L9, sense of coherence scale—short form; TLI, Tucker-Lewis index

external LOC represents a risk factor for the development of psychopathological symptoms (36, 38).

When contrasting these health-benefitting factors with each other, SOC can be described as a persistent global orientation mainly shaped during early years of life that allows individuals to move toward the end of *ease* by making use of their resources (39). Resilience (as an outcome), however, is the ability to bounce back after an aversive event. Lastly, LOC represents a core component of both SOC and resilience. As displayed in **Figure 1**, SOC might function as the central and underlying orientation that contributes to the development of resilience by recruiting internal and external resources (40) and that might simultaneously be reflected in a stronger internal and a weaker external LOC, at least in Western cultures (41). Thus, upon exposure to a stressful life event, SOC, general resilience, and LOC, should be linked to psychopathological symptoms by influencing both an individual's way of behavioral coping with stressful situations and cognitive appraisal processes. In line with these assumptions, several studies conducted in hospital settings show that all three concepts are related to psychopathological symptom severity (11, 29, 30, 42). However, to the best of our knowledge, all of these studies only investigated the impact of one or two aspects, SOC *or* resilience *or* LOC, on psychopathological symptoms and thereby fail to identify the unique influence of each concept. Thus, the current cross-sectional study aims to simultaneously investigate the impact of SOC, general resilience, and LOC on general mental health problems and stress-related symptoms in an ICU and an anesthesiology unit.

Based on previous findings that describe SOC as the strongest correlate of psychopathology symptoms compared to other variables (31, 43) and our theoretical framework, we expect SOC to be the strongest correlate of current general mental health problems and post-traumatic stress in an ICU and an anesthesiology unit. General resilience, which some research

suggests results from a well-developed SOC, should show a positive relationship with SOC while being negatively correlated with respondents' current symptom burden. The same pattern of correlations should also emerge for an internal LOC while a stronger external LOC should be positively linked to general mental health problems and post-traumatic stress. However, in a model containing all variables, we expect SOC as the central and most comprehensive concept to show the strongest association with the current symptom burden, and general resilience as well as an internal or external LOC to have a considerably lower unique influence.

MATERIALS AND METHODS

Sample Recruitment

The study sample was recruited at Saarland University Medical Center in Homburg, Germany. Medical staff of an ICU and an anesthesiology unit were asked to take part in the study via e-mail and by handing out flyers during team meetings. The respondents did not receive any payment for their participation. While the study was undertaken, approximately 100 nurses and physicians were employed in the two units. The study was reviewed and approved by the ethics committee of Saarland University (16-2). The survey was administered as an online version using SoSci Survey (44) and as paper and pencil version with a prepaid return envelope. The participation rate was 52.0% ($N = 52$), 47 respondents used the online version, five questionnaires were received by mail.

Sample Characteristics

Thirty-four women (65.4%) and 18 men (34.6%) participated in the study. This gender difference reflects the gender imbalance amongst the medical staff of both units. The mean age was 39 years ($SD = 10$ years, range: 23–57 years).

FIGURE 1 | Schematic illustration of the theoretical framework.

Twenty-seven respondents were part of the nursing team (70.4% worked full-time), while 25 worked as physicians (72.0% worked full-time). The average job experience was 14 years ($SD = 11$ years, range: 1–37 years). All respondents carried out shift work (night shifts included). The nursing team members reported a mean working time of 34.71 h per week while the physicians reported working 35.33 h a week.

Measures

Socio-demographic and occupational information. The questionnaire began with 20 questions on socio-demographic and occupational information (e.g., age, sex, working hours per week, work experience). Subsequently, a set of questionnaires on psychopathological symptoms and health-benefitting factors followed.

Health-Benefitting Factors

Sense of coherence. SOC was assessed using a German short version of the SOC scale developed by Antonovsky (SOC-L9 (45), English original scale (46)). SOC-L9 measures SOC using nine items which are rated on a bipolar seven-point scale. Cronbach's α was 0.81 and item-total correlations ranged between $r = 0.40$ and $r = 0.60$ supporting the reported good psychometric quality of the short scale.

General Resilience. The Resilience Scale 11 (RS-11 (47), English original (48)) assesses individual general resilience when an individual is faced with a stressful life event. RS-11 was developed as short version of the Resilience Scale 25. The current study employed the German short version (RS-11); its reliability was satisfying with a Cronbach's α of 0.89. The item-total correlations ranged between $r = 0.28$ and $r = 0.72$.

Locus of control. Internal and external locus of control were assessed using a brief scale for the assessment of internal and external control beliefs (IE-4 (49)). The instrument consists of two subscales measuring perceived internal and external control, each containing two items. All items are rated on a five-point scale. Items of both scales correlated as expected, $r_{\text{internal}} = 0.48$, $p < 0.001$, and $r_{\text{external}} = 0.58$, $p < 0.001$. The two scales were moderately negatively correlated, $r = -0.38$, $p = 0.006$.

Post-traumatic Stress and Psychopathological Symptoms

ICD 10 symptom rating. Mental health was assessed using the ICD 10 symptom rating (ISR (50)). All ISR items are derived from the ICD 10 diagnostic criteria and assess the symptoms of mental health difficulties on five syndrome subscales with three to four items each. An additional sixth scale covers 12 symptoms (one item each) which may occur within different syndromes. The individual items can also be taken as a first indication of a specific disorder, such as PTSD. All items are rated on a five-point scale. The total score can be used as an indicator of an individual's overall mental health problems (51). Psychometric qualities of the scale have been described as satisfactory (52). In the current study, its good internal consistency was reflected in an overall Cronbach's α of 0.86 for the total score.

Post-traumatic stress symptoms. Post-traumatic stress symptoms were assessed using the German version of the PTSD

Checklist (PCL-5 (53); English original: (54)) which relies on the diagnostic criteria of DSM-5 (55). The PCL-5 measures PTSD symptoms based on 20 items which are rated on a five-point scale. In the current sample, the PCL demonstrated excellent reliability reflected in a Cronbach's α of 0.91. Item-total correlations ranged between 0.39 and 0.74. According to Krüger-Gottschalk et al. (53) a total score of 33 can be used as cutoff criterion for a provisional PTSD diagnosis.

Data Analyses

Data collection was performed using SoSci Survey (44) or a paper and pencil version of the questionnaire. The paper questionnaires were manually entered using the online version of the questionnaire. All relevant data analyses were conducted using SPSS version 24 (56) with the exception of the reported path analyses which were carried out with SPSS Amos version 24 (57). Descriptive statistics included the computation of means, standard deviations, and frequencies. Missing data was $<5\%$ on the relevant scales and was replaced using scale means per subject.

To assess differences between nursing staff and physicians, MANOVAs and t -tests for independent samples were conducted on an exploratory basis. Bonferroni-Holm's correction was applied to control for the influence of multiple testing (58). Pearson bivariate correlation coefficients were used to characterize the relationship between general resilience, SOC, LOC, general mental health problems and post-traumatic stress symptoms. To determine to what extent the significant bivariate variables uniquely predict general mental health problems and post-traumatic stress symptom severity, multiple regression models were calculated. The regression residuals were normally distributed, and predictors were not multicollinear. To assess the unique amount of variance accounted for by one predictor, we calculated hierarchical regressions including all variables in the last step. The change in R^2 (ΔR^2) reflects the unique amount of variance explained by the variable included in the last step. The significance of ΔR^2 can be assessed by ΔF . Based on our theoretical assumptions and current findings from the multiple regression analyses, path analyses were conducted to visualize our findings and to test a mediating hypothesis on an exploratory basis. Parameters were attained by maximum likelihood estimations and multivariate normality was indicated by Mardia's test. Model fit was assessed based on χ^2 -values (α was set to 0.20 to control for type II errors). Since the small study sample might reduce the power of the χ^2 -test, other fit indices were used to assess the model fit. Specifically, Root Mean Square Error Approximation (RMSEA), Normal Fit Index (NFI), and Tucker-Lewis Index (TLI) were evaluated. A RMSEA below 0.06 as well as a NFI and a TLI ≥ 0.95 can be seen as indicators of well-fitted models (59).

RESULTS

Psychopathological Symptoms

General Mental Health Problems

With respect to general mental health problems as reflected in the ISR total score, only nursing staff showed a significantly increased

symptom burden compared to the cut-off score, $t_{(26)} = 3.96$, $p = 0.001$. Particularly depression, $t_{(26)} = 4.30$, $p < 0.001$, and eating disorder symptoms, $t_{(26)} = 4.01$, $p < 0.001$, were significantly higher than the cut-off (for a detailed overview, see **Table 1**). Differences between nurses and physicians were examined using the between-group effect in a MANOVA. After applying Bonferroni-Holm's correction to all tests, there were no significant between-group differences on any of the ISR scales.

TABLE 1 | Mean scores and standard deviations for general mental health problems in nurses and physicians.

	Physicians (n = 25)	Nursing staff (n = 27)	Total	Nurses vs. physicians		
				$F_{(1,50)}$	p	η^2_p
Depression	1.09 (0.95)	1.51 (0.93)*	1.31 (0.95)	2.66	0.109	0.05
Anxiety	0.67 (0.83)	0.87 (0.78)	0.76 (0.80)	0.84	0.365	0.02
Obsessive-compulsive	0.27 (0.62)	0.47 (0.65)	0.37 (0.64)	1.31	0.257	0.03
Somatic symptoms	0.08 (0.20)	0.38 (0.71)	0.24 (0.55)	4.25	0.044	0.08
Eating disorders	0.35 (0.59)	0.93 (0.78)*	0.65 (0.75)	9.05	0.004	0.15
Additional scale	0.35 (0.31)	0.60 (0.42)	0.48 (0.39)	5.66	0.021	0.10
Total score	0.45 (0.37)	0.77 (0.35)	0.62 (0.39)			

Statistically significant results compared to the ISR cut-off scores are marked * if $p < 0.05$ after applying Bonferroni-Holm's correction. F statistics, p -values and η^2_p relate to the between-group comparison of physicians and nursing staff.

However, in terms of the multivariate profile, nurses showed a significantly higher symptom burden, $F_{(6,45)} = 2.70$, $p = 0.025$, $\eta^2 = 0.27$, which was also reflected in a significantly higher ISR total score, $t_{(50)} = -3.15$, $p = 0.003$, $\eta^2 = 0.17$.

Post-traumatic Stress Symptoms

Descriptive statistics for PTSD symptoms are shown in **Table 2**. The nursing staff showed significantly higher scores than the physicians as indicated by the MANOVA between-group effect, $F_{(4,47)} = 2.77$, $p = 0.038$, $\eta^2 = 0.19$, and the PCL total score, $t_{(50)} = -3.08$, $p = 0.003$, $\eta^2 = 0.15$. Furthermore, regarding the subscales, nurses showed a significantly higher symptom burden only on the avoidance subscale. Based on a cut-off score of 33 (60), five cases were clinically relevant from which three were members of the nursing team.

Health-Benefitting Factors

Table 3 shows the descriptive statistics for the RS-11, SOC-L9, and IE-4. There were no differences with respect to resilience, nor SOC or LOC between physicians and nursing staff after applying the Bonferroni-Holm's correction. Moreover, no significant between-group differences were found in a MANOVA including all measures, $F_{(4,47)} = 1.18$, $p = 0.333$, $\eta^2 = 0.09$.

Bivariate Correlations

Bivariate correlations between health-benefitting factors and general mental health problems and post-traumatic stress symptoms are displayed in **Table 4**. SOC, resilience, and internal and external LOC were significantly correlated with both general

TABLE 2 | Mean scores and standard deviations for the PCL-5 scales and the total score.

	Intrusion	Avoidance	Negative alterations in cognition and mood	Alterations in arousal and reactivity	Total score
Physicians (n = 25)	1.60 (2.75)	1.24 (1.98)	3.44 (3.66)	2.88 (3.46)	9.16 (9.72)
Nursing staff (n = 27)	3.76 (4.09)	3.74 (3.95)	5.38 (5.38)	5.70 (4.31)	18.30 (11.50)
Total	2.72 (3.65)	2.54 (3.38)	4.62 (4.14)	4.03 (3.59)	13.90 (11.54)
$F_{(1,50)}$	4.90	8.12	4.13	5.35	
p	0.031	0.006*	0.048	0.025	
η^2_p	0.09	0.14	0.08	0.10	

Statistically significant results are marked * if $p < 0.05$ after applying Bonferroni-Holm's correction. F statistics, p -values and η^2_p relate to the between-group comparison of physicians and nursing staff.

TABLE 3 | Mean scores and standard deviations for resilience, SOC and LOC.

	Resilience (RS-11)	Sense of Coherence (SOC-L9)	Locus of control—internal (IE-4)	Locus of control—external (IE-4)
Physicians (n = 25)	58.76 (12.16)	47.32 (7.96)	4.04 (0.56)	2.30 (0.74)
Nursing staff (n = 27)	59.17 (10.62)	43.19 (9.63)	3.83 (0.88)	2.43 (0.93)
Total	58.97 (11.29)	45.18 (9.02)	3.93 (0.75)	2.37 (0.83)
$F_{(1,50)}$	0.02	2.82	0.99	0.29
p	0.896	0.099	0.324	0.592
η^2_p	0.00	0.05	0.02	0.01

F statistics, p -values and η^2_p relate to the between-group comparison of physicians and nursing staff.

TABLE 4 | Bivariate correlations of all relevant variables.

	1	2	3	4	5	6
ISR total score (1)	<i>0.86</i>					
PCL total score (2)	0.78**	<i>0.91</i>				
Sense of coherence (3)	-0.72**	-0.62**	<i>0.81</i>			
Resilience (4)	-0.46**	-0.33*	0.52**	<i>0.89</i>		
Locus of control—internal (5)	-0.51**	-0.47**	0.58**	0.28*	<i>0.48</i>	
Locus of control—external (6)	0.35*	0.44**	-0.54**	-0.07	-0.38**	<i>0.58</i>

* $p < 0.05$, ** $p < 0.01$. The italicized diagonal contains Cronbach's Alpha coefficients as a measure of internal consistency.

mental health problems as measured by the ISR total score and PTSD symptoms as assessed by the PCL-5 total score.

Regression Models

Regression models were calculated for general mental health problems and post-traumatic stress symptoms. **Table 5** displays the regression model of general mental health problems. The overall model predicted 53.9% of the variance (adjusted $R^2 = 50.0\%$) of general mental health problems, $F_{(4,47)} = 13.73$, $p < 0.001$. However, by accounting for 13.4% of the variance, only SOC was found to be a significant predictor of mental health problems, $t_{(47)} = -3.70$, $p < 0.001$. In comparison to the significant bivariate correlations (see **Table 4**), the regression weights for resilience, $\beta = -0.12$, $t_{(47)} = -1.00$, $p = 0.323$, internal LOC, $\beta = -0.15$, $t_{(47)} = -1.21$, $p = 0.234$, and external LOC, $\beta = -0.02$, $t_{(47)} = -0.17$, $p = 0.856$, were strongly decreased. The regression model for PTSD symptoms is also shown in **Table 5**. The overall model significantly predicted PTSD symptoms, $F_{(4,47)} = 8.29$, $p < 0.001$. Together, the variables SOC, resilience, and perceived internal and external control (LOC) accounted for 41.4% of the variance (adjusted $R^2 = 36.4\%$). However, again only SOC significantly predicted a unique amount of variance in symptom severity, $\Delta R^2 = 0.07$, $t_{(47)} = -2.30$, $p = 0.026$. As for general mental health problems, the regression weights for resilience, $\beta = -0.07$, $t_{(47)} = -0.48$, $p = 0.637$, internal LOC, $\beta = -0.16$, $t_{(47)} = -1.15$, $p = 0.255$, and external LOC, $\beta = 0.15$, $t_{(47)} = 1.11$, $p = 0.273$, were substantially lower compared to their bivariate correlations with PTSD symptoms (see **Table 4**).

Path Analyses

Based on the theoretical framework and the findings from the regression analyses, two path models were established to explain general mental health problems and severity of post-traumatic stress symptoms based on SOC and resilience, internal LOC, and external LOC as health-benefitting factors. **Figure 2** shows both path models including standardized regression weights as well as correlations between internal and external LOC and between resilience and internal LOC.

TABLE 5 | Multiple regression analysis of general mental health problems (ISR total score) and PTSD symptom severity (PCL total score).

	B	SE B	β	t	p	ΔR^2	ΔF
GENERAL MENTAL HEALTH (ISR TOTAL SCORE)							
Sense of coherence	-0.03	0.01	-0.58	-3.70	<0.001**	0.13	13.68
Resilience	0.00	0.00	-0.12	-1.00	0.323	0.01	1.00
Locus of control—internal	-0.08	0.06	-0.15	-1.21	0.234	0.01	1.45
Locus of control—external	0.01	0.06	-0.02	-0.17	0.865	0.00	0.03
PTSD SYMPTOMS (PCL TOTAL SCORE)							
Sense of coherence	-0.52	0.23	-0.41	-2.30	0.026*	0.07	5.29
Resilience	-0.07	0.14	-0.07	-0.48	0.637	0.00	0.22
Locus of control—internal	-2.45	2.13	-0.16	-1.15	0.255	0.02	1.33
Locus of control—external	2.13	1.92	0.15	1.11	0.273	0.02	1.23

* $p < 0.05$; ** $p < 0.01$. The columns reporting ΔR^2 and ΔF refer to hierarchical regression analyses in which each variable was included in the last step. p -values of the beta-weights and ΔF are equal and hence not reported twice.

The established model for general mental health problems explained 50.5% of the variance in symptom severity. Moreover, resilience, $\beta = 0.41$, $p < 0.001$, internal LOC, $\beta = 0.32$, $p = 0.001$, as well as external LOC, $\beta = -0.40$, $p < 0.001$, accounted for 59.0% of the variance in SOC. For the model of general mental health problems, the covariance matrix predicted by the model did not significantly differ from the observed covariance matrix, $\chi^2_{(4)} = 2.96$, $p = 0.564$. The Mardia's test remained non-significant, C.R. = 1.72 < 1.96, indicating multivariate normal distribution. RMSEA was 0.00 ($p_{\text{CLOSE}} = 0.624$), the NFI was 0.97, and TLI was 1.03. All estimated direct effects were significant. Additionally, as displayed in **Table 6** the indirect effects of resilience, internal LOC, and external LOC, on general mental health problems were significant and thus mediated by SOC. With respect to symptoms of post-traumatic stress, the model accounted for 37.1% of the variance in symptom severity. Furthermore, the covariance matrix implied by the model and the observed matrix did also not differ significantly, $\chi^2_{(4)} = 3.20$, $p = 0.525$. There was no evidence of a violation of multivariate normality in the Mardia's test, C.R. = 1.87 < 1.96. The fit indices showed a well-fitting model, RMSEA = 0.00 ($p_{\text{CLOSE}} = 0.587$), NFI = 0.96, TLI = 1.03. Moreover, the indirect effects of resilience, internal LOC, and external LOC mediated by SOC were significant (see **Table 6**).

DISCUSSION

In the current study, SOC emerged as the most important predictor for general mental health problems as well as post-traumatic stress symptoms in an ICU and an anesthesiology unit. In regression models based on SOC, general resilience, and LOC, 53.9% of the variance in general mental health problems and 41.4% of the variance in post-traumatic stress symptoms were explained. General resilience as well as internal and external LOC were significantly correlated with both general

TABLE 6 | Indirect effects (β) of general resilience and LOC on general mental health problems and post-traumatic stress symptoms.

	Resilience	LOC internal	LOC external
General mental health	-0.29^*	-0.23^*	0.28^*
CIs from bootstrapping	$-0.42 (-0.16)$	$-0.40 (-0.05)$	$0.16 (-0.43)$
Post-traumatic stress symptoms	-0.25^*	-0.20^*	0.24^*
CIs from bootstrapping	$-0.38 (-0.15)$	$-0.37 (-0.05)$	$0.12 (-0.41)$

$^*p < 0.05$. Significance of indirect effects was assessed using Bootstrapping based on 2,000 samples and bias-corrected 95% confidence intervals (CI).

mental health problems and post-traumatic stress symptoms but did not explain unique variance in the regression models when SOC was included. In comparison to the bivariate correlations the regression weights of general resilience and internal and external LOC were substantially lower in both models.

These results were further visualized in path analyses that also showed that SOC was the most important predictor of general mental health problems and post-traumatic stress symptoms, rendering the inclusion of direct paths from general resilience and LOC components redundant with regard to both symptom measures. However, general resilience as well as internal and external LOC had significant indirect effects on symptom severity measures mediated by SOC on symptom severity measures.

The current findings are in line with previous research identifying SOC as an important factor in dealing with work-related stress in hospitals (29, 30, 61). For instance, a study in nursing students demonstrated a moderating effect of SOC on the association between post-traumatic stress and quality of life

(28): only nursing students with low levels of SOC showed a negative association between stress and quality of life; for nursing students with medium and high levels of SOC no association emerged. Individuals with higher levels of SOC may be more efficient in dealing with aversive experiences and high levels of stress in everyday occupational life. In order to establish the temporal relationship between SOC and the development of psychopathological symptoms, longitudinal studies need to be conducted. If such studies support SOC's role as a crucial factor in the development and course of mental health problems, further longitudinal studies should establish by which (cognitive and behavioral) mechanisms SOC influences the development of psychopathological symptoms. Based on the salutogenesis theory it is plausible to assume that SOC as a global orientation may influence the perception of stressors as well as the use of (dys-)functional coping strategies. A recent qualitative study on highly resilient nurses identified three main factors for functional coping with occupational stressors (62): the presence of work-related and external support networks, individual factors, such as self-care and self-motivation, and the ability to organize work in a way that supports one's personal sense of fulfillment. One can assume that all these factors are positively related with SOC, as SOC enables individuals to mobilize different resources and to believe in their ability to effectively change problematical aspects of their work places. A stronger SOC might also allow individuals to experience their work as more meaningful, and thus, more satisfying. Thereby, high levels of SOC might prevent feelings of helplessness and unpredictability, which are highly related to perceived stress and, in turn, the development of psychopathological symptoms (63).

Even though SOC, general resilience and LOC were all significantly correlated with mental health outcomes, only SOC explained unique variance in the regression models. Correspondingly, a previous study in paramedics identified

SOC, but not general resilience, as a significant predictor of PTSD symptom severity (31). A further, larger study in a student sample found SOC to have incremental validity above general resilience and other health-benefitting factors (i.e., optimism, self-compassion) in predicting psychological distress (43). However, the current findings should not be taken to indicate that general resilience and LOC are irrelevant. Instead, the results underline the large conceptual overlap between the investigated concepts, rendering general resilience and LOC redundant in complex models. On a conceptual level, one might argue that high levels of SOC might be a predisposition formed during early life that results in high levels of general resilience and a rather internal LOC. From this perspective, the latter two might be understood as beneficial outcomes of an advantageous SOC development.

With respect to group differences between nurses and physicians, the nursing staff showed an overall higher symptom burden, which is consistent with previous studies in hospitals (9) and a recent study conducted in an ICU and an anesthesiology unit (64). Interestingly, no group differences were found between nurses and physicians regarding SOC, general resilience, and LOC. Due to the cross-sectional nature of the data, it is not clear if the considerable higher (stress-related) symptom burden in the nursing subsample might reflect a short-term stress situation in the nursing staff or if it hints at the presence of constantly higher levels of persistent work-related stressors in this group.

Limitations

The present study has several limitations: Firstly, the relatively small sample of 52 nurses and physicians limits the findings' representativeness. Moreover, it is plausible to assume that highly stressed staff members decided not to participate in the current study. Unfortunately, it was not possible to obtain any information on the staff members who did not participate in the study. Moreover, the small sample size limits the statistical power of all analyses. Specifically, in spite of the substantially lower regression weights, general resilience and LOC might have remained significant predictors of general mental health problems and PTSD symptoms in a larger sample.

Secondly, due to organizational guidelines it was not possible to differentiate between respondents working in the ICU and those who work in the anesthesiology unit.¹ Thus, the impact of the differing demands in an ICU and an anesthesiology unit could not be addressed, but they might have influenced the results by acting as a moderating variable. However, a recent study, which compared stress levels in ICU and anesthesiology staff, did not report any differences (64).

Thirdly, the current findings show that SOC, an internal LOC and general resilience are highly correlated aspects that all show significant relationships with the current symptom burden on a bivariate level. In regression analyses, SOC remained the only

significant predictor of general mental health problems and post-traumatic stress symptoms. The proposed mediator model is one potential explanation of the observed interrelationships but is—irrespective of its good fit—not the only possible interpretation, nor does the model allow for true causal conclusions. With respect to causality, the current findings seem to suggest that SOC plays an important role in the development of mental health problems in ICUs and anesthesiology units. However, the data could also be interpreted differently: For instance, it would be plausible to assume that low levels of SOC and general resilience as well as an external LOC might only reflect existing mental health problems and can be seen as correlates instead of influencing factors. Moreover, the central role of SOC could also indicate that current psychopathological symptoms affect SOC the most. Therefore, only longitudinal studies will give a greater insight into the causal and temporal development of mental health problems in ICUs and anesthesiology units as well as in hospital staff in general. Prospective research in larger samples should also include further measures of health-benefitting factors (e.g., dispositional optimism, self-efficacy or openness) and a broader assessment of health outcomes (e.g., burnout symptoms or measures of secondary traumatization).

Lastly, the current study did not have a control group of nurses and physicians not working in an ICU or an anesthesiology unit. Hence, it cannot be concluded that the reported levels of stress and the symptom burden arise from specific occupational characteristics in these units. They may reflect general occupational stress in medicine. However, our findings are in line with previous studies that reported particularly high levels of post-traumatic stress and burnout in ICU staff (13, 65).

Implications

Given that SOC seems to be an important correlate of nurses' and physicians' mental health, hospitals should consider offering training courses, especially if the assumed relationship is further supported by longitudinal data. Although SOC has been conceptualized as a stable concept, findings in various populations have shown that it can be influenced, even in later life (66–68). Therefore, several means by which to include the salutogenic approach in professional mental health care have been proposed (69). For example, two mindfulness-based intervention programs for nurses were successful in enhancing SOC (70, 71). Based on the current findings and further evidence by longitudinal studies, it might be useful to offer SOC training courses especially for ICU and anesthesiology unit staff members. Furthermore, in the context of prevention, it might be beneficial to already include such courses during nursing or medicine school. Lastly, previous research has further found SOC to be positively influenced by the nursing managers' recognition behavior (72). Therefore, enhancing nursing staff's SOC by training nursing managers' ability to recognize and appreciate their staff's work performance might constitute a useful and easily implemented intervention. However, to date there is still a strong need for further longitudinal studies investigating the influence of SOC on the development and course of psychopathological symptoms to provide evidence-based recommendations.

¹ Given the small total sample, the university hospital decided to exclude an item which would have allowed for the differentiation of ICU and anesthesiology staff members, since combined with other socio-demographic information, this might have limited the guaranteed anonymity of the survey.

Conclusion

The current study underlines the important role of SOC as a correlate of general mental health problems and post-traumatic stress symptoms in nurses and physicians in an ICU and an anesthesiology unit. Future research needs to further clarify the causal and temporal influence of general resilience, LOC, and particularly SOC in the development and course of mental health problems in hospital staff.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this manuscript will be made available by the authors, without undue reservation, to any qualified researcher.

AUTHOR CONTRIBUTIONS

SS coordinated the data collection, analyzed the data, interpreted the results, and wrote the first draft of the manuscript; JL-H designed the study, interpreted the statistical results, and gave

feedback during the manuscript writing process; HG, TV, and HB designed the study, supported the data collection process and interpreted the statistical findings; EH and AB designed the study, took part in the interpretation of the study results, and supported the manuscript writing; MS supported the data collection, conducted the statistical analyses together with SS and supported the manuscript writing as well as proof reading of the manuscript. TM contributed to the study design and supported data interpretation and manuscript writing. All authors read and approved the manuscript.

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Early Linguistic Markers of Trauma-Specific Processing Predict Post-trauma Adjustment

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Identifying early predictors for psychiatric disorders, such as post-traumatic stress disorder (PTSD), is crucial for effective treatment and prevention efforts. Obtaining such predictors is challenging and methodologically limited, for example by individuals' distress, arousal, and reduced introspective ability. We investigated the predictive power of language-based, implicit markers of psychological processes ($N = 163$) derived from computerized text-analysis of trauma and control narratives provided within 18 days post-trauma. Trauma narratives with fewer cognitive processing words (indicating less cognitive elaboration), more death-related words (indicating perceived threat to life), and more first-person singular pronouns (indicating self-immersed processing) predicted greater PTSD symptoms at 6 months. These effects were specific to trauma narratives and held after controlling for early PTSD symptom severity and verbal intelligence. When self-report questionnaires of related processes were considered together with the trauma narrative linguistic predictors, use of more first-person singular pronouns remained a significant predictor alongside self-reported mental defeat. Language-based processing markers may complement questionnaire measures in early forecasting of post-trauma adjustment.

Keywords: post-traumatic stress disorder, early predictors, cognitive processing, LIWC, text analysis, linguistic

EARLY LINGUISTIC MARKERS OF TRAUMA-SPECIFIC PROCESSING PREDICT POST-TRAUMA ADJUSTMENT

There is large heterogeneity in psychological responding following exposure to traumatic events [e.g., (1)]. Trauma impact and recovery are not randomly distributed. Many survivors show a high degree of resilience and ultimately (and sometimes quickly) return to normal lives whilst others develop psychological disorders, such as post-traumatic stress disorder (PTSD). These survivors could benefit from professional help to mitigate the long-term social, emotional, and health impact

of experiencing trauma (2). Fortunately, treatment options exist. Over the last decades, trauma researchers have made big strides in developing successful interventions and delivery of such interventions early after trauma has been shown to be effective (3).

A particularly important scientific question therefore is to identify early predictors of adjustment trajectories. To the extent that clinicians can reliably identify who is likely going to do well and who is at a high risk for developing chronic PTSD, limited therapeutic resources can be allocated to where they are most needed. In the context of trauma, identification of predictors at an early stage is an important objective. Survivors often have contact with professional services in the initial aftermath of a trauma, whereas such contact appears much more difficult to establish later, when disorders are chronic, often comorbid and more difficult to treat (4, 5).

Ideally, predictors of later chronic PTSD would be (a) early markers that can facilitate optimization of treatment initiation and resource allocation (b), naturally observable for clinicians—so that assessment burden can be kept to a necessary minimum at a distressing and vulnerable time for trauma survivors, and (c) trauma-specific—so that prediction errors are minimized. Finally, as the validity of self-report questionnaires may be undermined by factors such as high distress, emotional arousal, and limited introspective ability—factors that characterize information processing in the aftermath of a trauma—such markers would ideally be independent of the survivor's explicit self-report and could thus significantly complement such measures.

Natural language markers derived from individuals' spontaneous word use have recently received increased scientific attention (6). Use of certain words in individuals' writing or speech has been related to psychological aspects of their personal health and psychopathology [e.g. (7–10)]. Following trauma, maladaptive processing of traumatic memories may contribute to the development of PTSD. Linguistic features indexed in trauma survivors' personal accounts of their experience may offer more direct, “unfiltered” access to the way this experience is processed than self-report or interview measures. Unobtrusive indices of patterns of word use in such accounts may thus be good candidates to complement existing internal process measures for forecasting post-trauma adjustment [cf. (11, 12)]. Finally, linguistic measures reflect spontaneous behavior and thus do not share method variance with self-reported symptom outcomes, hence providing more unique and robust estimates of potential associations with PTSD symptoms.

Which trauma memory processing styles have been associated with later PTSD? According to cognitive models [e.g. (13, 14), survivors who engage primarily in surface-level processing of sensory and perceptual characteristics without elaboration of context and meaning of the event are more prone to develop PTSD than those who engage in more in-depth elaborate cognitive processing during trauma. Use of cognitive words in trauma narratives might reflect this elaboration process (15, 16). Peritraumatic mental defeat, a peritraumatic process, consisting of complete loss of inner resistance has also been

implicated in the development in PTSD (14, 17, 18) as well as perceived threat to life (19). Earlier studies have indexed the use of death-related words in trauma narratives as linguistic indicator and proxy of these processes, which was related to PTSD as expected (20, 21). A meta-analysis of PTSD predictors highlighted survivors' emotional response to the trauma, such as fear, helplessness, horror, guilt, and shame, during trauma as one of the strongest PTSD predictors (19), a process captured by the use of negative emotion words in trauma narratives (22, 23). Finally, the use of first-person singular pronouns (“I,” “me,” “my”), a proposed measure of self-immersed processing (24, 25) has emerged as a predictor of depression (9, 26, 27) and general psychopathology (28) in prior research. Whilst working through the trauma memory is beneficial for constructing an elaborated and organized perspective of the event, a narrow and self-immersed perspective and focus on recounting details and personal reactions might undermine adaptive self-reflection (29) as well as the resolution of initial post-traumatic stress reactions.

Whereas, some studies have investigated language use following exposure to national traumatic events in the general population (30, 31) or in smaller samples of indirectly exposed individuals (32), no study has yet investigated whether such linguistic markers indexed in the early aftermath of trauma predict later chronic PTSD in a large sample of trauma survivors and how specific such linguistic predictors are in forecasting trauma adaptation and PTSD, over and above self-report questionnaires, as well as in complement to such self-report measures.

The present study investigated four candidate linguistic predictors, assessed early after assault, a trauma with increased PTSD risk relative to other potentially traumatic events (4). We indexed linguistic measures in trauma narratives provided on average 18 days post-trauma by a large sample of directly exposed trauma survivors. Knowledge about such early predictors is sparse, although it may help identify those survivors that could effectively be treated to prevent later chronic PTSD. In order to establish process-specificity of linguistic characteristics, we indexed linguistic markers in trauma narratives, as well as in non-traumatic control narratives. Specifically, we hypothesized that linguistic measures of (1) less elaboration and cognitive processing, (2) more mental defeat and threat to life, (3) more negative emotionality, and (4) more self-immersed processing in early accounts of the assault would be associated with more PTSD symptoms at 6 months follow-up. We then determined the extent to which significant trauma-specific linguistic predictors complement corresponding self-report questionnaires in predicting PTSD.

METHOD

Participants and Procedures

The local ethics board approved the study. Participants were assault survivors who attended the Emergency Department of a large urban teaching hospital. Exclusion criteria, assessed by an initial screening interview, were current psychosis, alcohol dependence, ongoing domestic violence, and no memory of the

assault. Two hundred and twenty-two individuals were recruited and consented to participate in a research session conducted by a research psychologist, which took place around 18 days post-assault, $SD = 9.7$ days. During this session, 163 (67% male, mean age = 34 years, $SD = 11.4$) provided a narrative of their trauma and a negative, non-traumatic control event from around the same time of the assault. The latter was used to examine trauma-specificity of linguistic process measures^{1,2}. Participants were asked to remember both events as vividly and in as much details as possible and to provide a detailed verbal report of their trauma including sensory impressions and cognitions during trauma. Narrative length was highly variable between participants, with mean narrative length of 786 words ($SD = 584$) for the trauma and 211 words ($SD = 203$) for the negative event narrative. Nearly all assaults were physical assaults; only 2% were sexual assaults. See **Table 1** for descriptive statistics and correlations among study variables.

Measures

PTSD Symptoms

PTSD symptom severity at 2 weeks was assessed using the self-report Post-traumatic Diagnostic Scale [PDS, (35); $\alpha = .92$], symptom severity at 6 months was assessed with the PTSD Symptom Scale, a semi-structured interview with 17 items, each corresponding to one of the DSM-IV criteria for PTSD [PSSI, (36); interrater reliability, $\kappa = 0.82$]. We also indexed PTSD diagnosis using the PTSD Symptom Scale- Interview (PSS-I), a 17-item structured (36) and it was established that 18.9% of the sample fulfilled diagnostic criteria for PTSD at 6 months.

Verbal Intelligence

Participants also completed the National Adult Reading Test [NART, (37)], a widely accepted measure of verbal intelligence. The NART requires participants to read out loud a list of 50 irregularly spelled words in order of increasing difficulty. The number of words read correctly comprises the final score. The NART has excellent reliability and construct validity (38). It correlates highly with other measures of intelligence and allows the prediction of full-scale IQ scores (37).

Trauma-Specific and Non-specific Linguistic Markers

Verbatim transcripts of the narratives were analyzed using Linguistic Inquiry and Word Count [LIWC, (39)], an extensively validated computerized text-analysis tool. LIWC analyses texts by calculating the percentage of words in a given text that fall into a set of pre-defined psychological and grammatical categories. Based on prior research and cognitive PTSD theory, we limited our analysis to the categories *cognitive processes* (e.g., “cause,” “know,” “ought”) as an index of elaboration and cognitive processing, *death-related words* (e.g., “dead,” “kill,” “grave”) as an index of mental defeat and death salience, *negative emotions* (e.g., “angry,” “sad,” “cry”), as an index of negative

emotionality, and first *person singular pronouns* (e.g., “I,” “me,” “my”) as an index of self-immersed processing. To address the question of process specificity, we computed separate word-use variables for the trauma and negative event narratives. Sample excerpts illustrating these four language variables in both types of narratives are provided in the **Appendix**.

Self-reported Peri- and Post-traumatic Processing

Data driven processing was assessed as an index of lacking elaboration and cognitive processing with the 8-items data-driven processing subscale from the Cognitive Processing Scale (40). The scale assesses the extent to which individuals engage in surface-level, perceptual processing during the assault (“I could not think clearly,” “I was confused and could not fully make sense of what was happening”), each on a scale from 0 (not at all) to 4 (very strongly). Internal consistency in the present sample was good, Cronbach’s $\alpha = 0.87$.

The Mental Defeat Scale (41), an 11-items self-report questionnaire, was used to index mental defeat. Participants rated the extent to which statements such as “I no longer felt like a human being” or “In my mind, I gave up” applied to them at some time during the assault, each on a scale from 0 (not at all) to 4 (very strongly). Internal consistency in the present sample was high, Cronbach’s $\alpha = 0.90$.

The Negative thoughts about the self subscale of the Post-traumatic cognition inventory [PTCI, (42)] was used to index self-related thoughts in context of the assault, each on a scale from 1 (totally agree) to 7 (totally disagree). The PTCI indexes generalized negative appraisals of the trauma and its aftermath and has been shown to have good reliability and convergent validity (42). Internal consistency of the 21-items negative self subscale in the present sample was high, Cronbach’s $\alpha = 0.93$.

Data Analysis

We calculated a hierarchical linear regression analysis in order to determine whether trauma-specific linguistic markers predict PTSD symptom severity at 6 months, over and above initial PTSD symptoms, verbal intelligence and non-trauma linguistic variables. From the significant trauma-specific linguistic variables and corresponding self-report questionnaires, we determined the best set of variables to predict PTSD symptom severity using a stepwise linear regression and a forward selection method. All analyses were conducted using SPSS 20.0.

RESULTS

Results from the linear regression analyses are shown in **Table 2**. Less use of cognitive processing words in negative event narratives predicted PTSD symptom severity at 6 months after controlling for initial PTSD symptom severity and verbal intelligence. No other negative event linguistic characteristics predicted PTSD. However, when trauma-specific linguistic characteristics were introduced in the regression model, general cognitive processing from the negative event narrative was no longer significant. Instead, the linguistic trauma narrative characteristics, with exception of negative emotion words, significantly predicted later PTSD symptom severity. Less

¹Data are reported for those 136 participants who provided both narratives initially and who were reassessed at 6 months later. This subgroup did not differ from the total sample in terms of age, sex, or initial PTSD symptom severity.

²Other measures from the current sample are reported in (33, 34). None of these papers analyzed trauma or negative event narratives.

TABLE 1 | Descriptive statistics and correlations among study variables.

	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Initial PTSD symptoms (PDS)	18.9 (12.4)	–												
2 PTSD symptoms 6 months (PSS)	10.4 (10.0)	0.60***	–											
3 NART (number correct words)	23.9 (11.9)	–0.20**	–0.25**	–										
4 Cognitive processing NEN	18.0 (5.6)	0.15	–0.05	0.17*	–									
5 Cognitive processing TN	17.6 (3.3)	–0.16	–0.14	0.15	0.24**	–								
6 Negative emotions NEN	2.5 (1.8)	0.11	–0.06	0.08	0.18*	0.03	–							
7 Negative emotions TN	1.9 (1.0)	0.03	0.12	–0.06	0.01	0.09	0.09	–						
8 Death-related words NEN	0.05 (0.25)	–0.02	0.04	–0.05	–0.07	0.05	0.07	0.18*	–					
9 Death-related words TN	0.03 (0.09)	0.21**	0.27**	0.00	–0.01	0.01	0.12	0.04	0.07	–				
10 First person singular pronouns NEN	9.7 (3.7)	0.23**	0.14	–0.12	0.35***	–0.09	0.04	0.00	0.11	0.07	–			
11 First person singular pronouns TN	10.4 (2.7)	0.24**	0.29**	0.25**	–0.03	–0.02	0.10	0.06	–0.01	0.11	0.33***	–		
12 Data-driven processing (TPQ)	1.91 (1.05)	0.59***	0.46***	–0.29**	–0.14	–0.06	0.02	0.01	0.25**	–0.04	0.23*	0.20*	–	
13 Mental defeat (MD)	1.18 (0.98)	0.62***	0.54***	–0.28***	–0.14	0.09	0.05	0.04	0.18	0.07	0.07	0.23*	0.64***	–
14 Negative self-related thoughts (PTCI)	2.58 (1.27)	0.39**	0.43***	–0.02	0.05	0.14	0.17	0.08	0.12	–0.02	0.09	0.16	0.32***	0.45***

PDS, Posttraumatic Diagnostic Scale; PSS, Posttraumatic Symptom Severity Index; NART, National adult reading test; NEN, negative event narrative; TN, Trauma narrative; TPQ, Trauma processing questionnaire; MD, Mental Defeat scale; PTCI, Posttraumatic Cognition Inventory; Means and standard deviations for linguistic markers percentage scores (e.g., percentage of all words in a participant's narrative that were first person singular pronouns); * $p < 0.05$, ** $p < 0.005$, *** $p < 0.001$.

TABLE 2 | Trauma-specific linguistic markers predict posttraumatic stress disorder symptom severity at 6 months beyond initial symptom severity, verbal intelligence and non-specific linguistic markers.

	Step ΔR^2	β	p
Step 1 ^a : Test of control variables	0.31***		< 0.001
Initial PTSD symptom severity (PDS)		0.51	< 0.001
Verbal intelligence (NART)		–0.18	0.012
Step 2 ^b : Test of non-specific linguistic markers	0.04		0.119
Initial PTSD symptom severity (PDS)		0.55	< 0.001
Verbal intelligence (NART)		–0.13	0.093
Cognitive processing NEN		–0.18	0.025
Death-related words NEN		0.06	0.437
Negative emotions NEN		–0.05	0.487
First person singular pronouns NEN		0.08	0.316
Step 3 ^c : Test of trauma-specific linguistic markers	0.07**		0.007
Initial PTSD symptom severity (PDS)		0.50	< 0.001
Verbal intelligence (NART)		–0.07	0.367
Cognitive processing NEN		–0.10	0.198
Death-related words NEN		0.04	0.617
Negative emotions NEN		–0.07	0.342
First person singular pronouns NEN		–0.03	0.728
Cognitive processing TN		–0.19	0.012
Death-related words TN		0.14	0.048
Negative emotions TN		0.06	0.365
First person singular pronouns TN		0.17	0.034

Dependent Variable = PTSD symptom severity at 6 months; PDS, Posttraumatic Diagnostic Scale; NART, National adult reading test; NEN, negative event narrative; TN, Trauma narrative; Predictor multicollinearity was within an acceptable range for all predictors, i.e., range of tolerance = 0.73–1.0. ** $p < 0.005$, *** $p < 0.001$.

^a Step 1: $R = 0.55$, $F_{(2,134)} = 29.59$, $p < 0.001$.

^b Step 2: $R = 0.59$, $F_{(4,130)} = 11.37$, $p < 0.001$.

^c Step 3: $R = 0.64$, $F_{(4,126)} = 8.89$, $p < 0.001$.

cognitive processing, use of more death-related words and more first person singular pronouns in trauma narratives were predictive of more PTSD symptoms at follow-up. Together, the linguistic predictors from the trauma narrative accounted for 7% additional variance in later PTSD symptoms, over and above initial PTSD symptoms, verbal intelligence and general linguistic predictors from non-trauma narratives.

In a separate model, we determined the best predictors of later PTSD symptom severity from the three significant trauma narrative linguistic variables (cognitive processing, use of death-related words, first person singular pronouns) and the corresponding self-report questionnaire scores (data-driven processing, mental defeat, and negative self-related thoughts) using linear regression and a forward selection procedure. First person singular pronouns in trauma narratives significantly predicted PTSD at 6 months, $\beta = 0.17$, $p < 0.031$, alongside self-reported mental defeat, $\beta = -0.52$, $p < 0.001$. No other significant predictor emerged in this analysis. Together, the variables explained 34% of PTSD symptom severity, $R = 0.58$, $F_{(1,125)} = 31.92$, $p < 0.001$. There were no significant sex differences in magnitude in any of the linguistic predictors under study (all $p > 0.122$).

DISCUSSION

Linguistic markers of trauma-specific processing indexed in the early aftermath of a trauma uniquely predicted later chronic PTSD symptoms. Less cognitive processing words (as marker of less elaboration), use of more death-related words (as marker of mental defeat), use of more first person singular pronouns (as marker of self-immersed processing) assessed in the first 2 weeks after trauma predicted more severe PTSD symptoms at 6 months follow-up. Importantly, these linguistic predictors uniquely emerged from trauma-narrative competing against language markers of general emotional processing derived from non-traumatic, negative event narratives and predicted PTSD over and above established risk factors such as verbal intelligence and initial levels of PTSD symptoms.

The use of less cognition words in those with increased PTSD symptoms is in accord with cognitive theories of PTSD and the proposed beneficial nature of elaborative cognitive processing during trauma (13, 14) and complements earlier findings of increased cognition words predicting fewer distress symptoms following emotional events (15, 25). Although references to death were low overall, their relative frequencies predicted later PTSD, hence indicating the sensitivity of this index and its potential for clinical use. The finding is in line with studies showing perceived threat to life as an important aspect of trauma [for a review see (19)]. More reference to death and dying in trauma narratives may also reflect mental defeat and the result of giving up all efforts to retain one's identity as a human being during trauma. Negative emotion use in trauma narratives was, however, not predictive of later PTSD, a finding that replicates earlier results by Jones et al. (43) and may indicate limited usefulness of this index early post-trauma yet leaves open the possibility that PTSD-specific differences emerge gradually at a later time. Focus on specific emotional categories, such as shame or anger could be more predictive than a broad negative emotion category. Finally, more first-person singular pronoun use in trauma narratives predicted later PTSD and may indicate unmitigated self-immersion which may hamper emotion regulation and has been associated with greater impairment of mental and social functioning (9, 26).

Use of more first-person singular pronouns remained a significant predictor alongside self-reported mental defeat, when corresponding questionnaire measures were included. Assessment of such candidate early linguistic predictors, along with self-report questionnaires is thus one way to capture psychological processes after exposure to trauma and to predict later psychological adjustment. Self-report questionnaires may often provide practically the most efficient way of indexing psychological processing, despite their potential limitations when administered early after of trauma. However, patients routinely report on aspects of their trauma and such narratives could readily be subjected to automatic linguistic analyses as part of routine clinical practice.

The current study is not without limitations. Our sample consisted of assault survivors (who suffer a relatively high risk for chronic PTSD) and generalizability to other trauma types needs to be established. The potentially lower reliability of the negative event narrative markers due to their lower word count

might have to some extent constrained their regression weights. Yet, LIWC variables are based on proportions and 50 or less words have proven sufficient to yield reliable estimates in prior research (44). Although, some of the narratives were rather short, minimum requirements for establishing LIWC scores were met for those narratives at the lower end of the word count. The results should nevertheless be replicated in another sample and specificity established, as well as reliability of the linguistic markers. Moreover, the linguistic predictors were conceptualized as proxies of psychological processes (e.g., mental defeat), which usually only partially convergence with questionnaire scores [see also (45)], owing, in part, also to methodological differences between these two methods of measurement. A fruitful approach could thus be to use both measures in complement to forecast trauma adaptation and development of later PTSD.

Despite these limitations, our findings have important clinical implications. We identified early linguistic markers of later PTSD assessed in narratives provided by survivors at 18 days post-trauma and found that they predicted 7% of later variance in PTSD over and above initial symptom severity. Self-immersed processing assessed by a linguistic index and mental defeat indexed by self-report questionnaire emerged as the best set of early predictors of later PTSD in the present study. Linguistic markers can thus make a clinically significant contribution and help identify those individuals at risk of developing chronic PTSD. Early provision of trauma-focused psychotherapy for these individuals at risk can prevent chronic PTSD (3). Linguistic markers, assessed early after trauma, may complement self-report questionnaires and help identify those at risk that could effectively be treated with such early psychological treatment, and they predicted over and above initial symptom severity. Reducing dysfunctional self-focus, self-immersed processing and putting the experience of mental defeat in perspective, as well as working through the trauma memory to enhance elaboration and cognitive processing comprise useful targets for such interventions.

ETHICS STATEMENT

The protocol was approved by the IRB of King's College Hospital. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

BK and AE developed the study concept and the study design. Testing and data collection were performed by BK, BK, AH, and AE performed the data analysis and interpretation. BK, RK, AH, and MM drafted the paper, and AE and MM provided critical revisions. All authors approved the final version of the paper for submission.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2018.00645/full#supplementary-material>

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Psychiatric Symptom Profiles Predict Functional Impairment

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Objective: Mental illness often interferes with daily functioning and an individual's pattern of psychiatric signs and symptoms may predict risk of future disability. Understanding the linkage between psychiatric symptoms and impaired functioning is critical for accurate rehabilitation planning and legal assessment. Here, we investigated the stability of functional impairment measures over 18 months and their association with psychiatric symptoms. Moreover, we developed a clinical self-report measure that allows estimation of functional impairment levels over 18 month observation periods.

Methods: Consecutively treated outpatients and daycare patients ($N = 155$) from several psychiatric units in Switzerland completed the Dissociative Experiences Scale, Somatoform Dissociation Questionnaire, Multidimensional Inventory for Dissociation, Beck Depression Inventory, Brief Symptom Inventory, and WHO Disability Assessment Schedule at baseline, 6, 12, and 18 month follow-up examinations. The association between symptoms functional impairment over time was investigated using longitudinal linear mixed models. Penalized regression was used to identify questionnaire items that best predicted functional impairment.

Results: We found high stability in the extent of functional impairment over 18 months. Fear of negative evaluation, fatigue, concentration problems, negative alterations in mood, and dissociative symptoms showed the strongest association with functional impairment measures. The empirically derived scale for functional impairment prediction explained between 0.62 and 0.77 of the variance in disability across various life domains.

Conclusion: Given the capability for somatic and mental symptoms associated with social anxiety, depression, and dissociation to predict future disability, these symptoms have strong potential for guiding rehabilitation planning and prognostic evaluation in insurance medicine. The Functional Impairment Prediction Scale may serve as a valuable, empirical-based extension in legal assessments of how work capacity is affected by psychological factors.

Keywords: disability, functional impairment, insurance medicine, legal assessment, daily functioning, occupational health

INTRODUCTION

Mental illness often interferes with daily functioning and work ability. Worldwide, psychiatric disability accounts for the highest proportion of disability among all diseases (1). In Switzerland, 43% of disability payments newly granted in the last decade are associated with mental disorders (2). Data in other West European countries, America and Australia are similar, and in most countries an increasing percentage of disability payments are granted due to mental disorders. A study conducted by the Organization for Economic Cooperation and Development (OECD) in West European countries, America and Australia reported an overall increase of disability payments due to mental disorders from the mid-1990s through 2009. In 2009, the proportion of disability payments due to mental disorders were between 24.9% (Norway) and 44.2% (Denmark). In a majority of countries, this rate increased by more than a factor of two during the observation period. Only the Netherlands and the United States showed slightly decreasing rates of 0.89 and 0.95, respectively (3). Similar results have been reported by the Mental Health Economics European Network (MHEEN) (4) and in some country-specific studies. In the UK, for instance, government data from 1995 to 2014 showed a decrease of overall disability payments by 6.4%, but an increase in payments due to mental disorders from 21.4 to 45.4% (5). A cohort study conducted in the Netherlands between July 2010 and June 2011 revealed that 33% of men and 35% of women who received disability payments had a main diagnosis of a mental disorder (6). In the US, the Annual Statistical Report on the Social Security Disability Insurance of 2017 reported a rate of 35% of mental disorders among all disabled beneficiaries (7). The major challenges mental disorders represent for the health and social security systems of both developed and developing countries call for better insights into the mechanisms causing disability.

Ample evidence supports an association between mental disorders and functional impairment in various life domains. In a German cohort study, the risk for permanent disability was increased by a factor of 2.5 in individuals with depressive disorders, and by a factor of 1.3 in individuals with anxiety disorders (8). Among anxiety disorders, the highest correlations have been observed between the severity of obsessive-compulsive disorder and social anxiety disorder with levels of global disability (9). A Chinese study among patients with remitted or partially remitted major depression, residual symptoms of fatigue, psychomotor changes, sleep disturbances and weight/appetite disturbances were related to functional impairment (10). In a Spanish study of primary care patients, depressive symptoms were related to impaired social life, family life and work, anxiety was related to impaired family life, and somatization associated with impaired functioning at work. A study among Canadian outpatients with obsessive-compulsive disorder found that obsessions, checking behavior, and hoarding had the greatest impact on daily functioning (11). Not surprisingly, psychotic symptoms contribute to impairment in individuals with schizophrenia (12, 13), with negative symptoms accounting for up to 18% of the variance in functioning (9, 14).

Mental disorders are often heterogeneous in their phenomenology. This complexity is reflected in the lists of diagnostic criteria in the Diagnostic and Statistical Manual of Mental Disorders (DSM), where some diagnoses are characterized by a considerable number of signs and symptoms. It is unlikely that all signs and symptoms respond equally well to similar treatments or contribute equally to functional impairment. For instance, the DSM-5 (15) lists 20 distinct signs and symptoms for posttraumatic stress disorder (PTSD). Of these, re-experiencing and avoidance symptoms usually improve after successful exposure therapy (16), while irritability and sleep disturbances may be more effectively treated pharmacologically (17). Almost all previous studies have investigated disability at the disorder level. Moreover, it is largely unknown which signs and symptoms clustered within a diagnosis contribute to the observed associations between mental disorders and functional impairment. There are multiple factors contributing to functional impairment, including job characteristics, psychosocial factors and functioning capacity (18). Knowing the functionally most influential signs and symptoms, would allow tailoring treatment options to optimize chances for vocational rehabilitation. Detailed knowledge concerning the influence of psychiatric signs and symptoms on work disability is also needed to achieve the most accurate assessment of individual working capability.

In psychiatric legal assessments, it is the evidence for psychopathology, not diagnosis, that provides the basis for disability payment claims (19). Basing decisions on evidence of psychopathology seems reasonable, because there is vast variability in working capacity among individuals with the same psychiatric diagnosis. In this context, medical experts must provide plausible and evidence-based explanations concerning which signs and symptoms a claimant suffers could interfere with work performance. Moreover, diagnostic criteria in classification systems such as the DSM-5 are subject to change, while sign and symptom constructs are usually better established and stable over time. Hence, evidence regarding the strength of an association between specific signs and symptoms and functional impairment is more applicable in legal assessments than is evidence relating to specific mental disorders.

The primary objective of this prospective study in outpatient and daycare patients with a broad range of psychiatric disorders was to investigate the association of functional impairment with psychiatric signs and symptoms.

MATERIALS AND METHODS

Procedure

Participants between 18 and 65 years with sufficient fluency in the German language, who were in treatment for three or more sessions during 1/2009 to 12/2010, were eligible for study participation. Participants were recruited from two public psychiatric outpatient units, one private practice, and two psychiatric daycare units, all located in the counties of St. Gallen or Zurich in Switzerland. Exclusion criteria comprised acute psychosis, acute suicidal ideation, substance abuse with acute intoxication or withdrawal, mental retardation, and psychiatric

disorders due to an underlying medical condition. The study protocol was approved by the institutional review board of the county of St. Gallen, Switzerland. All participants provided written informed consent according to the Declaration of Helsinki. Study participation was compensated.

Measurements

Axis I and Axis II diagnoses were ascertained at baseline using the Structured Clinical Interview for DSM-IV Disorders Axis I (SCID-I) (20) and Axis II (SCID-II) (21). Dissociative disorders were ascertained using the Structured Clinical Interview for Dissociative Disorders (SCID-D-R) (22, 23). Inter-rater reliability of SCID-I and SCID-II is fair-to-excellent (24). The SCID-D-R is performed as a semi-structured interview. The categorical diagnosis of a Dissociative Disorder is based on the dimensional assessment of five dissociative symptoms “amnesia,” “depersonalization,” “derealization,” “identity confusion,” and “identity alteration” on a 4-point-Likert scale (1 = none, 2 = mild, 3 = moderate, 4 = severe). The interviewer rates the severity of each of the five dissociative symptoms according to specific behaviors and experiences reported by the patient as well as the observation of dissociative symptoms during the interview. The reliability and validity of SCID-D-R is good-to-excellent (25, 26). The assessments were performed by trained interviewers (with B.Sc. or M.Sc. degrees).

Symptom severity was measured using the German versions of the Dissociative Experiences Scale (DES), Somatoform Dissociation Questionnaire (SDQ-20), Multidimensional Inventory of Dissociation (MID), Beck Depression Inventory (BDI), and Brief Symptoms Inventory (BSI). The DES and SDQ-20 were collected at baseline only. The scales were chosen to collect a broad range of psychiatric symptoms including dissociative symptoms that were a focus of the main study (27–29).

The DES is one of the most commonly used questionnaires measuring psychological manifestations of dissociation in typical and clinical populations (30). Ratings for the 28 items of the DES are based on an 11-point scale with increments of 10 points ranging from 0 (“never”) to 100 (“always”), with higher scores representing more frequent dissociative symptoms. Although the authors of the DES derived three factors, including absorption, amnesia, and depersonalization/derealization, results from later studies suggested a single factor only (31, 32). The DES has sound psychometric properties (30, 33–35). The psychometric properties of the German adaptation of the DES (Cronbach’s $\alpha = 0.91$; test–retest reliability Pearson $r = 0.86$; good differentiation of psychiatric patients from healthy participants, and psychiatric patients with a DD from psychiatric patients without a DD and healthy participants) are comparable to the original version (36, 37).

The SDQ-20 (38) is a 20-item rating scale that measures somatoform manifestations of dissociation such as disruptions in sensation, movement and other bodily functions. The rating of the 20 items of the SDQ-20 is based on a 5-point scale ranging from 1 to 5, yielding a minimum score of 20 and a maximum score of 100, with higher scores representing greater levels of somatoform dissociation. Factor analyses have suggested

unidimensionality of the SDQ-20 (39). The psychometric properties of the SDQ-20 are good (38–40). The German adapted SDQ-20 shows excellent psychometric properties (Cronbach’s $\alpha = 0.91$; test–retest reliability Pearson $r = 0.89$; good differentiation between patients with vs. without DD) and cross-cultural validity (40).

The MID (41–43) is a comprehensive scale with 218 items (168 dissociation items, 50 validity items) for the measurement of pathological dissociation. It assesses 6 general dissociative symptoms (i.e., “memory problems,” “depersonalization,” “derealization,” “flashbacks,” “somatic symptoms,” “trance”), 11 consciously experienced intrusions from a dissociated self-state, and 6 fully-dissociated activities of another self-state. The items are rated on an 11-point scale that ranges from 0 (“never”) to 10 (“always”). The scale provides a summary score between 0 and 100 by calculating the mean score of the 168 dissociation items, multiplied by 10. The MID has demonstrated good reliability and validity (41). Preliminary data suggests sound psychometric properties of the German version of the MID (Cronbach’s alphas between 0.69 and 0.94; good differentiation between patients with vs. without a Dissociative Disorder) (44).

The BDI is an internationally used questionnaire with 21 items measuring depressive symptoms. The German version of the BDI shows good reliability (45). The items are rated on a 4-point scale ranging from 0 to 3, yielding a minimum sum score of 0 and a maximum sum score of 63 with higher scores representing greater levels of depression.

The BSI is a short version of the Symptom Checklist of Derogatis (SCL-90-R). The questionnaire is internationally used and contains 53 items capturing subjective impairment due to physical and mental symptoms. It allows measurement of the dimensions “somatization,” “obsession-compulsion,” “interpersonal sensitivity,” “depression,” “anxiety,” “hostility,” “phobic anxiety,” “paranoid ideation,” and “psychoticism.” The 53 items are based on a 5-point scale ranging from 0 to 4. In this study, the global severity index score was used, consisting of the mean of the 53 items. The reliability of the German version of BSI is fair, with restricted generalizability because of a predominance of anxiety patients in the reference sample (46).

Functional impairment was assessed using the World Health Organization Disability Assessment Schedule II (WHODAS II) (47), a standardized method for measuring disability levels based on the based on the International Classification of Functioning, Disability and Health (ICF) (48). The WHODAS II has replaced the Global Assessment of Functioning Scale (GAF) (49) for describing disability associated with symptoms and signs in DSM-5. At baseline, the interviewer administered version of the WHODAS II was used; at follow-ups, the self-rating version was used. Both versions used contain 36 questions covering six domains of assessment. These are based on the International Classification of Functioning, Disability and Health (48), a system that classifies impairments in body functions and structure; activity limitations; participation restrictions; and environmental factors caused by mental or physical illness. The items are based on a 5-point rating scale with the participant rating the level of difficulty experienced as none, mild, moderate, severe, or extreme, with higher scores reflecting higher functional

impairment. According to the WHODAS II manual, the participant's ratings are recorded without interpretation by the interviewers. The WHODAS II provides a total score and domain scores for the life domains "understanding and communicating" (cognition); "getting around" (mobility); "self-care" (attending to one's hygiene, dressing, eating, and staying alone); "getting along with people" (interpersonal interactions); "life activities" (domestic responsibilities, work); and "participation in society" (joining in community activities). The psychometric properties of WHODAS II are sound, with high interrater reliability (50–52).

Data Analysis

All item scores of symptom and functional impairment measures were centered and scaled. The items of each symptom questionnaire were assigned to corresponding DSM-5 (15) symptoms. Assignment was done by the first author (JT) and reviewed by the last author (CM-P). Chi-squared tests were used to compare categorical data, *t*-tests were used to compare dimensional data between recruited participants and decliners, and study drop-outs and completers.

To investigate the temporal stability of functional impairment, we conducted a separate mixed-effects linear model (53) on WHODAS total and dimension scores for each diagnostic category. Time (baseline, 6, 12, and 18 months), age, and sex were treated as fixed effects and subject as a random effect. Similar models on symptom scores (represented by the average score across the items that were assigned to DSM-5 symptoms within a diagnostic category) were conducted to investigate temporal stability of symptoms for each diagnostic category. Cook's distance scores were calculated for each model for estimating the influence of individual observations (54). The cut-off for Cook's distance was automatically calculated using measures of internal scaling. Because there were no significant interactions involving time (data not presented), interaction terms were omitted in the models.

To investigate the association between DSM-5 symptoms and functional impairment, we conducted separate mixed-effects linear models on WHODAS total and dimension scores for each symptom. Symptom scores (represented by the mean score of the items assigned to this DSM-5 symptom), time, age, and sex were treated as fixed effects and participant as a random effect.

Age and sex were included in the mixed-effects linear regression models to control for a potential confounding effect of these subject characteristics on the results of the regression models. We have conducted a separate model for each symptom (instead of conducting one model that includes all symptoms as predictors) for two reasons: (1) we aimed to investigate the "pure" effect of each symptom on functional impairment, controlling for other influences. Including all symptoms in one model might have influenced the parameter estimates for symptoms that are correlated with each other (e.g., depressed mood and diminished interest); (2) a high number of predictors in one model might result in instability of the resulting parameter estimates. A larger sample size would have been needed to mitigate these effects. Standardized parameter estimates (β) and 95% confidence intervals (CI) were used to estimate effect sizes for the association between symptom and functional impairment.

To develop a questionnaire that predicts functional impairment, a separate penalized lasso regression model (55) was conducted on WHODAS total and dimension baseline scores. The items of the MID, DES, SDQ-20, BDI, and BSI were entered as predictors. Items with an absolute standardized estimate of greater or equal 0.5 were selected for the questionnaire. Although a change of 0.5 may be below clinical relevance, such a conservative cut-off was used to prevent excessing elimination of items based on this relatively small sample. Explained variance in predicting WHODAS total and dimension scores across 18 months by this set of items was calculated using separate mixed-effects linear models with time, age, and sex treated as additional fixed effects, and participant as a random effect.

Because the results for WHODAS dimension scores were very similar (see **Supplemental Material**), only WHODAS total scores are reported in the paper. A critical threshold of $p = 0.05$ (two-sided) was used; statistical analyses were performed using R V.3.4.3 (56).

RESULTS

Participants

All 312 participants fulfilling study criteria were invited to participate. Of these, 136 (43.6%) declined to participate, yielding a pool of 176 recruited participants. There was no statistically significant difference between recruited participants and decliners regarding sex ($p = 0.5$), age ($p = 0.05$), and nationality ($p = 0.9$), suggesting good representativeness of our sample. Finally, data from 21 recruited participants (11.9% of the 176) were excluded from the analysis due to incomplete participation in the baseline assessment, diagnosis of a psychotic disorder (acute or remitted) or doubtful validity of the results as judged by the interviewer after discussion with the first author, e.g., suspected dissimulation or difficulties in understanding the questions. Participants with acute or stable psychotic disorder have been excluded from the study due to concerns of invalid self-reports at follow-up due to unrecognized psychotic relapse. Self-reports were completed from home without any further in-person evaluation. This procedure resulted in a final sample size of 155 participants. Participants were assessed at baseline ($N = 155$), after six ($N = 117$), 12 ($N = 82$), and 18 months ($N = 63$). Thirty participants (19.4%) had at study entrance a lifetime Axis I diagnosis, i.e., were in clinical remission; six of them had a current Axis II diagnosis. Sociodemographic and clinical characteristics at baseline and follow-up are presented in **Tables 1, 2**, respectively. Drop-outs did not differ significantly from study completers with respect to sociodemographic characteristics, diagnoses, and symptom severity ($p \geq 0.05$).

Temporal Stability of Functional Impairment and Symptom Severity

Functional impairment was stable across 18 months for participants within each diagnostic category (**Figure 1**), as evidenced by non-significant effects of time on mean WHODAS total scores ($p \geq 0.251$; **Table 3**). There were also no significant effects of time on any of the WHODAS dimension scores ($p \geq 0.076$; **Supplementary Tables 1–6**).

TABLE 1 | Sociodemographic and clinical characteristics at baseline of outpatient and daycare patients ($N = 155$).

	N	%
Female	105	67.7
Swiss nationality	110	71.0
PRIMARY SOURCE OF INCOME		
Own earnings	38	24.5
Earnings of partner, parents, or relatives	19	12.3
Retirement payments	3	1.9
Disability payments due to a mental disorder	30	19.4
Disability payments due to a physical disorder	6	3.9
Public welfare	35	22.6
Unemployment benefits	10	6.5
Other, e.g. savings	14	9.0
DIAGNOSTIC CATEGORIES^a		
Affective disorders	78	50.3
Substance use disorders	16	10.4
Anxiety disorders	80	51.9
Somatoform disorders	15	9.7
Dissociative Disorders	30	19.4
Personality Disorders	68	44.2
	Mean	SD
Age (years)	35.8	11.8
Education (years)	12.4	3.3
Number of axis I diagnoses	1.7	1.4
DES	14.5	13.7
SDQ-20	29.7	9.9

^aAccording to DSM-IV; DES, Dissociative Experiences Scale; SDQ-20, Somatoform Dissociation Questionnaire.

Symptom severity related to affective disorders, anxiety disorders, somatoform disorders, and dissociative disorders was stable across 18 months (Figure 2). This was as evidenced by non-significant effects of time on mean symptom scores within each diagnostic category ($p \geq 0.210$; Table 4).

Association Between Symptoms and Functional Impairment

As seen in Figure 3 and Table 5, mean functional impairment effect sizes across 18 months were highest for symptoms related to social anxiety disorder, conversion disorder, dissociative identity disorder, major depression, and depersonalization/derealization disorder. Mean functional impairment effect sizes were intermediate for symptoms related to PTSD, specific phobia, generalized anxiety disorder, agoraphobia, and panic disorder. Lowest effect sizes were found for symptoms related to dissociative amnesia and obsessive-compulsive disorder. Effect sizes and 95% CIs are also presented in Supplementary Tables 7–13.

With very few exceptions, all symptoms had a statistically significant effect on functioning. However, there was often high variability in the strength of the association between the various symptoms of a specific disorder and functional impairment. In major depression, fatigue or loss of energy, thinking or

concentration problems, and depressed mood were significantly higher than recurrent thoughts of death, suicidality, weight loss or weight gain. Although statistically not significant, sleeping problems seem to have a smaller effect on functioning than diminished interest or pleasure, feelings of worthlessness, guilt, and psychomotor agitation or retardation.

Among symptoms in posttraumatic stress disorder, dissociate reactions (e.g., flashbacks), diminished interest or participation in significant activities, and psychological distress at exposure to traumatic cues, had the strongest effects on functioning. In contrast, exaggerated startle responses and cognitive distortions had small effect sizes.

In panic disorder, derealization or depersonalization and breathing problems seem to have stronger effects on functioning than other mental and physical manifestations of fear. The observed differences may have occurred by chance, as indicated by the overlapping confidence intervals.

Questionnaire Items That Predict Functional Impairment

Of all 290 symptom items in the MID, DES, SDQ-20, BDI, and BSI, 47 predicted functional impairment (Table 5). Among the 47 items, 27 items referred to various type of dissociative experiences, 11 items to depressive symptoms, and 9 items to symptoms of anxiety. Explained variance (conditional R^2) of this final set of items was 0.77 for predicting WHODAS scores across domains, 0.68 for “understanding and communicating,” 0.62 for “getting around,” 0.64 for “self-care,” 0.74 for “getting along with people,” 0.72 for “life activities” and 0.68 for “participation in society”.

DISCUSSION

The main aim of this prospective study was to investigate the temporal stability of functional impairments and their association with psychiatric signs and symptoms. We found high stability in the extent of functional impairment across 18 months. Substantial relative differences were observed in the strength of the association of DSM-5 signs and symptoms and functional impairment measures both between and within disorders. Core symptoms of social anxiety disorder, major depression, conversion disorder and dissociative identity disorder had among the strongest relative effects on functioning.

Average levels of functional impairment in our sample remained stable across 18 months and diagnostic categories. This was accompanied by stable average levels of symptoms related to affective disorders, anxiety disorders, somatoform disorder, and dissociative disorders. Although symptom levels in major depression fluctuate over time, their course is often chronic (57). The same is true for generalized anxiety disorders (58) and PTSD (59). While some studies found that disability varies directly with the levels of depressive symptoms (60), others observed long disability even after remission of depressive symptoms (61).

Our finding that fear of negative evaluations (a core symptom in social anxiety disorder) has the highest adverse

TABLE 2 | Symptom severity and functional impairment across 18 months of outpatient and daycare patients.

	Baseline (<i>N</i> = 155)		6 Months (<i>N</i> = 117)		12 Months (<i>N</i> = 82)		18 Months (<i>N</i> = 63)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
MID	21.0	15.9	15.8	16.0	15.1	17.1	14.9	17.2
BDI	23.0	10.5	23.1	11.7	21.6	12.7	21.7	12.6
BSI	1.3	0.7	1.3	0.8	1.2	0.8	1.1	0.8
WHODAS II								
Total	35.7	20.2	35.4	20.0	35.0	21.4	33.6	22.0
Understanding and Communication	31.7	22.0	33.0	21.3	32.1	23.2	31.7	22.8
Getting Around	24.2	24.6	23.5	23.6	24.2	23.6	20.8	21.9
Self-Care	17.9	20.0	17.2	20.3	20.2	22.6	18.9	21.1
Getting Along with People	40.2	30.6	46.1	29.5	46.0	30.7	43.9	31.1
Life Activities	43.3	32.6	41.7	30.3	40.9	30.4	40.4	33.4
Participation in Society	48.1	24.8	41.6	24.3	38.6	24.0	36.8	25.4

MID, Multidimensional Inventory of Dissociation; BDI, Beck Depression Inventory; BSI, Brief Symptom Inventory; WHODAS II, World Health Organization Disability Assessment Schedule II.

FIGURE 1 | Functional impairment across WHODAS II domains during 18 months in outpatients and day-care patients (*N* = 155) by DSM-IV diagnostic category. The thick red line represents the mean functional impairment score and the associated ribbon the standard deviation. The colored thin lines represent functional impairment scores of individual cases. Higher scores represent higher impairment across life domains.

TABLE 3 | Results of linear mixed effect models on the 18-month course of functional impairment across WHODAS II domains of outpatient and daycare patients ($N = 155$).

Variable	β	95% CI	SE	df	t	p
AFFECTIVE DISORDERS (Conditional $R^2 = 0.67$, Cook's distance = 15/78)						
Intercept	-0.14	-1.01, 0.74	0.45	79.21	-0.312	0.756
Time	-0.04	-0.13, 0.04	0.04	81.57	-0.969	0.335
Age	0.00	-0.02, 0.02	0.01	76.59	0.073	0.942
Sex	0.29	-0.1, 0.68	0.20	74.41	1.462	0.148
SUBSTANCE DISORDERS (Conditional $R^2 = 0.87$, Cook's distance = 2/16)						
Intercept	-1.68	-3.59, 0.23	0.97	13.86	-1.728	0.106
Time	0.02	-0.17, 0.2	0.10	8.89	0.156	0.879
Age	-0.00	-0.05, 0.04	0.02	13.12	-0.122	0.905
Sex	0.95	0.16, 1.74	0.40	13.10	2.364	0.034
ANXIETY DISORDERS (Conditional $R^2 = 0.80$, Cook's distance = 14/80)						
Intercept	-0.65	-1.66, 0.35	0.51	79.31	-1.276	0.206
Time	-0.02	-0.09, 0.05	0.03	38.07	-0.628	0.534
Age	-0.00	-0.02, 0.02	0.01	78.16	-0.127	0.899
Sex	0.53	0.08, 0.99	0.23	76.85	2.297	0.024
SOMATOFORM DISORDERS (Conditional $R^2 = 0.88$, Cook's distance = 6/15)						
Intercept	0.03	-2.69, 2.76	1.39	12.59	0.024	0.981
Time	-0.08	-0.2, 0.04	0.06	8.24	-1.236	0.251
Age	0.01	-0.03, 0.05	0.02	12.25	0.438	0.669
Sex	-0.11	-1.45, 1.22	0.68	12.36	-0.166	0.871
DISSOCIATIVE DISORDERS (Conditional $R^2 = 0.81$, Cook's distance = 8/30)						
Intercept	1.15	-0.95, 3.24	1.07	26.85	1.074	0.292
Time	0.01	-0.1, 0.12	0.06	16.01	0.240	0.813
Age	0.01	-0.01, 0.04	0.01	27.01	0.967	0.342
Sex	-0.56	-1.49, 0.38	0.48	26.54	-1.168	0.253
PERSONALITY DISORDERS (Conditional $R^2 = 0.70$, Cook's distance = 10/68)						
Intercept	-0.53	-1.63, 0.57	0.56	68.39	-0.944	0.349
Time	-0.03	-0.11, 0.06	0.04	34.75	-0.637	0.528
Age	0.00	-0.02, 0.02	0.01	68.07	0.337	0.737
Sex	0.45	-0.03, 0.92	0.24	66.27	1.848	0.069

β , Standardized beta; diagnostic categories are related to DSM-IV. Cook's distance, Number of influential/total observations.

influence on the course of function across life domains supports a recent meta-analysis on anxiety disorders and functional impairment that found the highest correlation between global functioning and social anxiety disorder (9). Their observation of a high correlation of obsessive-compulsive disorder with global functioning contrasts with our finding of a relatively low effect of compulsive behavior on functioning. It might be that impaired functioning is primarily driven by obsessive thoughts and not compulsive behaviors. This finding needs to be explored further in future studies because we did not collect data regarding obsessive thoughts, and the meta-analysis did not discriminate between distinct symptoms of obsessive-compulsive disorder.

The relatively higher effect sizes we observed for symptoms of major depression compared to symptoms of anxiety disorders other than social anxiety is in line with previous evidence from primary care settings (62). Beyond that, our results suggest that disability in major depression may be primarily driven by fatigue, mood, and cognitive impairments and less by sleeping problems, suicidality or appetite/weight changes. Similarly, we found that PTSD signs and symptoms (i.e., dissociative reactions,

diminished interest or participation, psychological distress at exposure to trauma cues, and concentration problems) from three DSM-5 clusters (B, D, E) showed the highest association with functional impairment. This might explain inconsistencies in previous studies that investigated how PTSD clusters, but not distinct symptoms in the clusters, were associated with impaired functioning (63–65).

Four of the 10 symptoms that had the highest impact on functioning in our study (i.e., altered voluntary or sensory function, disruption of identity, flashbacks, and depersonalization) related to dissociation. This finding supports previous evidence showing the profound influence these symptoms may have on functioning (27, 66, 67). This relationship seems particularly relevant given the high scrutiny individuals with these disorders often encounter in the context of insurance medicine (68).

The 47 symptom items of the Functional Impairment Prediction Scale (FIPS), that we developed in this study, mostly refer to dissociative and depressive symptoms. This does not seem surprising given the high association we observed between

FIGURE 2 | Symptom severity during 18 months in outpatients and daycare patients ($N = 155$) by DSM-IV diagnostic category. The thick red line represents the mean score across symptoms belonging to this diagnostic category and the associated ribbon the standard deviation. The colored thin lines represent the mean score across subjects of each symptom belonging to this diagnostic category. Higher scores represent higher severity.

TABLE 4 | Results of linear mixed effect models on the 18-month course of symptom severity of outpatient and daycare patients ($N = 155$).

Variable	β	95% CI	SE	df	t	P
AFFECTIVE DISORDERS (Conditional $R^2 = 0.75$, Cook's distance = 17/78)						
Intercept	0.13	-0.45, 0.71	0.30	79.87	0.445	0.657
Time	-0.03	-0.1, 0.03	0.03	38.19	-1.028	0.310
Age	-0.00	-0.01, 0.01	0.01	76.88	-0.207	0.837
Sex	0.10	-0.15, 0.36	0.13	74.97	0.790	0.432
ANXIETY DISORDERS (Conditional $R^2 = 0.79$, Cook's distance = 17/80)						
Intercept	-0.34	-0.98, 0.3	0.33	78.49	-1.052	0.296
Time	0.00	-0.05, 0.06	0.03	30.62	0.165	0.870
Age	-0.00	-0.01, 0.01	0.01	76.74	-0.078	0.938
Sex	0.30	0.02, 0.59	0.15	75.67	2.073	0.042
SOMATOFORM DISORDERS (Conditional $R^2 = 0.70$, Cook's distance = 5/15)						
Intercept	-0.42	-1.57, 0.72	0.59	14.67	-0.724	0.480
Time	-0.06	-0.14, 0.03	0.04	11.70	-1.326	0.210
Age	0.00	-0.01, 0.02	0.01	13.62	0.194	0.849
Sex	0.25	-0.3, 0.81	0.28	14.01	0.888	0.390
DISSOCIATIVE DISORDERS (Conditional $R^2 = 0.85$, Cook's distance = 7/30)						
Intercept	0.56	-0.96, 2.07	0.77	22.66	0.717	0.481
Time	0.01	-0.1, 0.12	0.06	17.65	0.171	0.866
Age	0.00	-0.02, 0.02	0.01	24.35	0.205	0.839
Sex	-0.03	-0.7, 0.65	0.34	22.14	-0.078	0.938

β , Standardized beta; diagnostic categories are related to DSM-IV. Cook's distance, Number of influential/total observations.

functional impairment across life domains and DSM-5 symptoms related to conversion disorder, dissociative identity disorder and major depression. Although anxiety symptom items in the FIPS were weaker associated with WHODAS total scores, they predicted functioning levels in specific life domains, e.g., mobility. We are not aware of any empirically developed

measure that allows prediction of functional impairment from symptom profiles. Hence, the FIPS may be a valuable tool in legal assessments. The scale can add an additional level of empirically derived evidence to the evaluation of working capacity. Moreover, the combined application of the FIPS and WHODAS II would allow to compare predicted and

self-reported functional impairment, thereby contributing to the evaluation of consistency in legal reports. It is noteworthy, however, that the item selection of the FIPS need be considered as preliminary and requires validation in separate samples. The 47 questions used in FIPS and their rating scales are presented in **Supplementary Table 14**.

The findings from our study have several implications for legal assessments and rehabilitation. Medical experts in insurance medicine should be aware that psychiatric disability has a strong tendency to persist for long periods. Consequently, they should be realistic when considering the chances for functional improvement under treatment. Overly optimistic prognostication may undermine a claimant's entitlement to receive occupational disability benefits. Moreover, assessors should recommend treatment modalities that target signs and symptoms with strong influences on work functioning. Concentration problems showed the fourth-highest association with impaired function among PTSD symptoms in our study. Therefore, if a traumatized claimant has severe concentration problems and lower levels of traumatic re-experiencing, a treatment plan could benefit from inclusion of attention training (69), even if trauma exposure therapy is considered the standard treatment in PTSD (70). Finally, our results enhance the empirical basis for the work capacity evaluation in legal assessments, which is urgently required in insurance medicine (71). For instance, arguing an inability to work due to sleeping problems in the absence of other relevant symptoms would be difficult to justify given the relatively low

association we observed between sleeping disturbances and impaired functioning.

A strength of this study is the employment of a detailed and rigorous diagnostic characterization that included SCID-I, SCID-II, and SCID-D-R interviews for every participant enrolled. The use of consecutive recruitment by service providers allows better generalization of our findings to the population of general psychiatric patients seeking treatment. Eligible patients who refused to participate in this study and drop-outs are a potential threat to the generalizability of the results. However, study refusers and drop-outs did not differ in sociodemographic or clinical characteristics from study participants and study completers, respectively, which makes a recruitment and/or drop-out bias unlikely. Data presented in this paper have been retrieved as part of a study on global functioning in dissociative disorders (27–29), which has influenced the selection of the scales. The scales used in the study represent major, but not all, areas of psychopathology in general psychiatric outpatients. Consequently, we cannot preclude that there are other signs and symptoms which have contributed to functional impairment in this study. Given the low sample size in some diagnostic categories (e.g., substance disorder and somatoform disorder), some weaker associations with work disability may not have been detected. A positive association between signs, symptoms and functional measures does not necessarily imply causal relationships among them. Ultimately, causality in psychiatric disability needs to be investigated in experimental studies. Finally, the Functional Impairment Prediction Scale that was

TABLE 5 | Items in the Functional Impairment Prediction Scale derived from clinical and functional impairment measures of outpatients and daycare patients ($N = 155$).

Item text	Original measure—item no
Some people sometimes find that they are approached by people that they do not know who call them by another name or insist that they have met them before.	DES—6
Some people have the experience of being in a familiar place but finding it strange and unfamiliar.	DES—16
Some people find that when they are watching television or a movie they become so absorbed in the story that they are unaware of other events happening around them.	DES—17
Some people sometimes find that in certain situations they are able to do things with amazing ease and spontaneity that would usually be difficult for them (for example, sports, work, social situations, etc.).	DES—23
While watching TV, you find that you are thinking about something else.	MID—1
Feeling as if your body (or certain parts of it) are unreal.	MID—3
Having trance-like episodes where you stare off into space and lose awareness of what is going on around you.	MID—16
Thoughts being imposed on you or imposed on your mind.	MID—20
Being unable to remember your name, or age, or address.	MID—56
Being paralyzed or unable to move (for no known medical reason).	MID—60
Finding yourself lying in bed (on the sofa, etc.) with no memory of how you got there.	MID—64
Having difficulty walking (for no known medical reason).	MID—82
Hearing a lot of noise or yelling in your head.	MID—97
Re-experiencing body sensations from a past traumatic event.	MID—125
Feeling like you are “inside” yourself, watching what you are doing.	MID—133
Feeling distant or removed from your thoughts and actions.	MID—135
Reliving a past trauma so vividly that you see it, hear it, feel it, smell it, etc.	MID—145
Your thoughts and feelings are so changeable that you don’t understand yourself.	MID—146
Reliving a traumatic event so totally that you think that a present-day person is actually a person from the trauma (for example, being home with your partner, suddenly reliving being raped by your alcoholic uncle, and actually thinking that your partner is your uncle—that is, you see your uncle in front of you instead of seeing your partner).	MID—156
Feeling as if there is something inside you that takes control of your behavior or speech.	MID—161
Discovering that you have a significant injury (for example, a cut, or a burn, or many bruises), and having no memory of how it happened.	MID—170
Suddenly finding yourself somewhere (for example, at the beach, at work, in a nightclub, in your car, etc.) with no memory of how you got there.	MID—173

(Continued)

TABLE 5 | Continued

Item text	Original measure—item no
Some thoughts are suddenly “taken away from you.”	MID—198
Feeling a struggle inside you about what to think, how to feel, what you should do.	MID—210
I dislike smells that I usually like.	SDQ—9
I cannot see for a while (as if I am blind).	SDQ—12
I grow stiff for a while.	SDQ—20
I feel sad.	BDI—1
I put off making decisions more than I used to.	BDI—13
I get tired more easily than I used to.	BDI—17
My appetite is not as good as it used to be.	BDI—18
I am worried about physical problems like aches, pains, upset stomach, or constipation.	BDI—20
I am less interested in sex than I used to be.	BDI—21
Feeling afraid in open spaces.	BSI—8
Thoughts of ending your life.	BSI—9
Feeling blocked in getting things done.	BSI—15
Feeling blue.	BSI—17
Feeling no interest in things.	BSI—18
Difficulty making decisions.	BSI—27
Feeling afraid to travel on buses, subways, or trains.	BSI—28
Trouble getting your breath.	BSI—29
Feeling weak in parts of your body.	BSI—37
Feeling tense or keyed up.	BSI—38
Feeling very self-conscious with others.	BSI—42
Never feeling close to another person.	BSI—44
Spells of terror or panic.	BSI—45
Feeling nervous when you are left alone.	BSI—47

DES, Dissociative Experiences Scale; MID, Multidimensional Inventory of Dissociation; SDQ-20, Somatoform Dissociation Questionnaire; BDI, Beck Depression Inventory; BSI, Brief Symptom Inventory. The final questionnaire is available in the Supplemental Instructions regarding its application can be obtained from the corresponding author.

developed in this study needs to be cross-validated in an independent sample of psychiatric patients.

Taken together, this study provides novel insights concerning which signs and symptoms may be associated with functional impairment in mental disorders. Given the capability for somatic and mental symptoms associated with social anxiety, depression, and dissociation to predict future disability, these measures have strong potential for guiding rehabilitation planning and prognostic evaluation in insurance medicine. The high temporal stability of functional impairment also calls for therapeutic interventions, such as functional training (72), that go beyond the treatment of psychopathological symptoms. Confirmation of the validity of the Functional Impairment Prediction Scale in predicting disability in future studies will foster the scale as a valuable, empirical-based extension in legal assessments of working capacity.

AUTHOR'S NOTE

The work was carried out at the Psychiatric Services of the County of St. Gallen-North, Zurcherstrasse 30, 9500 Wil, Switzerland.

AUTHOR CONTRIBUTIONS

CM-P and MR designed the study that provided the data for this paper. CM-P, DW, and NP collected the data. JT, TZ, and CM-P conducted the analyses and wrote the paper.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2019.00037/full#supplementary-material>

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Short-Term Effects of a Multidimensional Stress Prevention Program on Quality of Life, Well-Being and Psychological Resources. A Randomized Controlled Trial

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It is well-documented that university students have an increased risk in developing psychological problems because they face multiple stressors. Cognitive, behavioral, and mindfulness-based stress prevention programs were shown to reduce symptoms of anxiety, depression, and perceived stress in university students. However, little is known of their effect on resource activation. Additionally, most validated interventions are unidimensional, i.e., including one stress-coping approach. In this study, we investigated the short-term effects of a multidimensional stress prevention program on students' quality of life, psychological symptoms and resources, and resilience factors against stress. Using an experimental design, 64 healthy undergraduate students (56 women), between 18 and 34 years old ($M = 21.34$, $SD = 2.53$), from the University of Fribourg, Switzerland, were randomly allocated either to the intervention or the wait-list control group. The intervention group participated in a multidimensional stress prevention program, integrating mindfulness-based activities, cognitive and behavioral strategies, social skills, and emotional regulation exercises. The program consisted of eight 2-h weekly sessions. Before and after the intervention, participants completed self-reported questionnaires evaluating quality of life; psychological symptoms such as depression, anxiety, social anxiety, and interpersonal problems; as well as psychological resources like self-efficacy, sense of coherence, self-compassion, and social support, presented online. A standardized clinical interview was performed at pre- and post-measurement times. To analyze the short-term effects of the program, we used mixed, two-factorial ANOVAs (per-protocol analyses). In accordance with our hypotheses, our results showed significant reduction of psychological symptoms, including anxiety, interpersonal problems, and symptoms of pain; a significant increase in quality of life, sense of coherence, and self-compassion in students who participated in the intervention program compared to the control group, (all $p < 0.05$). No significant results were found for symptoms of depression, social anxiety, self-efficacy, and social support. These preliminary findings indicate specific short-term effects of our multidimensional stress

prevention program on psychological symptoms and on quality of life as well as promising effects on psychological resources and factors associated with resilience against stress. Future studies should investigate the long-term effects of the intervention as well as the effects in clinical samples.

Keywords: stress, stress management, intervention program, psychological distress, anxiety, psychological resources, quality of life, university students

INTRODUCTION

University studies are a motivating step in life, yet at the same time students have to face new challenges and circumstances (1). The transition to university life requires them to adapt to a new academic environment with unfamiliar assessment rules and a heavier workload (2, 3). Additionally some students have jobs to make their financial needs meet or move away from friends and families in order to study in other cities (1, 2). Students therefore have more freedom and autonomy, but also other responsibilities and sometimes fewer resources (e.g., social support) (1, 2). According to recent studies, university students reported increased psychological distress in different countries worldwide. In particular, higher prevalence of psychological distress was reported in medical students in Germany (3–5), the US (6), and Egypt (7). According to the results of a survey of the American College Association (8), around half of the Canadian students reported depressive and anxiety symptoms during the last year. Studies in the UK, Spain, Jordan, and India indicated that nurses and dental students showed high levels of distress (9–12). Longitudinal studies in the US revealed that the first year of study is associated with particularly elevated psychological distress in college students (1, 13). Finally, university students were shown to experience higher psychological stress levels than their peers in the general population. For instance, in Australia, university students showed higher levels of distress than non-students (14), and than the general population (15). The most frequent stress factors cited by university students are related to their studies and academic demands (e.g., exams, assessments, assignments, practicum) (2, 16), personal and social expectation (17), living conditions, and financial situation (18, 19).

Psychological distress in university students is associated with increased mental health disorders [31.4% of 12-month prevalence of any mental disorder in first year students from eight countries (20)], such as depression (21–25), and anxiety (22, 25). Burnout (26), suicidal ideation (22, 27), suicide attempts, and self-injurious behavior (28) were also reported in this population. Somatic complaints (29, 30), and physical illnesses, such as skin symptoms (31) and functional gastrointestinal disorders (32) were also manifested by university students. Substance abuse, such as high consumption of alcohol (33, 34), tobacco (smoking), and cannabis (2) were also related with high levels of distress. Higher levels of psychological distress are negatively correlated with student's academic performance (35, 36), such as slipping grades. Poor quality of life (37) and well-being were also reported by university students (38). Sleep disturbances (30, 39–42), unhealthy lifestyle behaviors (e.g., poor nutrition,

physical inactivity) (43, 44), fewer leisure activities and less social support, especially during the preparation and examination period (45) were described by university students. Students also reported using more avoidance (46) and withdrawal coping strategies (2), and less adaptive coping strategies, like social support (2, 47), cognitive reappraisal, and planning (48).

Personal and psychosocial resources were found to have a protective role against stress in university students (3). High levels of self-efficacy in university students were associated with less burnout, emotional exhaustion (49), perceived stress (3), and also with positive effects on grades (50), a more proactive attitude, and a better use of available support (49). In a study with French college students, self-efficacy was one of the most important predictors of stress (25).

A strong sense of coherence is related to good stress management and has an impact on the quality of life in different populations (51), including university students (52). A high sense of coherence was negatively associated with perceived stress (53, 54) and positively related with better social support and performance (53), and the use of active coping (55) among university students. Self-compassion, being kind and understanding toward oneself in negative circumstances, predicted greater well-being (56) and correlated significantly with positive mental health outcomes, such as less depression and anxiety and greater life satisfaction in undergraduate students (57). Perceived social support has also been associated with fewer stress symptoms, anxiety, and depression and with higher levels of resilience among university students from different countries (Germany, Russia, and China) (21).

Although university students report increased levels of psychological distress, only a minority of them seek help (15, 58, 59). In the past few years however, diverse stress reduction interventions for university students have been proposed. In a review and meta-analysis, Regehr et al. (60) showed that cognitive, behavioral, and mindfulness-based interventions aiming at reducing stress in university students were associated with decreased symptoms of anxiety, depression, and cortisol levels. Twenty-four randomized controlled studies, including 1,431 students (24% male), were considered for the analysis. Taken together, the analyzed intervention had a significant impact in the reduction of symptoms of anxiety in the experimental groups compared to the control groups. Furthermore, both cognitive-behavioral (CBT) and mindfulness-based interventions showed an improvement in anxiety levels.

Mindfulness is characterized by paying attention in the present moment, non-judgmentally, with self-awareness, and is

related to the reduction of stress perception and stress-related symptoms (61). Mindfulness-based interventions were shown to have an impact on stress during the examination period (62, 63), as well as on perceived stress, mental distress, well-being and self-efficacy among medical students (64, 65), and self-compassion in undergraduates students (66). In some studies, however, mindfulness-based interventions had significant beneficial effects on psychological morbidity, but not on distress or coping (67). Other studies indicated that there were no significant differences between the effects of a mindfulness-based group compared to a physical activity program in reducing anxiety, depression and stress (68). With regard to the CBT interventions aiming at reducing stress, they are generally focused on awareness of automatic thoughts; on understanding of the relationship between thoughts and emotions, on cognitive restructuring, on problem-solving, on self-instructions, and on relaxation techniques. For these interventions, a significant impact on anxiety (69–72), on anger and neuroticism (69), on somatic symptoms and cortisol levels (70, 73), on hardiness, and on general self-efficacy (71) was reported in undergraduates students. A significant effect was found also on hope, but not on the amount of self-reported positive or negative affect (72). Finally, a strength-based CBT intervention showed significant improvements on distress, on protective factors, and on quality of life in first year psychology students (74). This specific intervention was focused on improving resilience skills, by activating personal strengths and talents. Other stress prevention programs included social cognitive methods, also including exercises on communication skills, and were shown to reduce psychological distress among university students (75). Relaxation-based interventions, focusing on autogenic training and progressive muscle relaxation, also demonstrated significant effects on cognitive and emotional burnout stress, on trait anxiety, and on mental health in university students (76–78). Finally, an intervention focusing on resources, the Resilience and Coping Intervention, showed significant beneficial effects on optimism, hope, stress, and on depression in undergraduate students (79). However, to our knowledge, only one stress reduction program for college students integrated a multidimensional program including psychoeducation, cognitive restructuring, emotional control exercises, and communication skills (80). This intervention showed a significant decrease in psychological distress, but no effects on coping strategies or on cortisol levels. In conclusion, to date, no stress prevention intervention for students integrates all dimensions of stress, i.e., behavioral, cognitive, emotional, and social at the same time; focusing not only on stress management mechanisms but also on improving stress protection resources.

In this study, we aimed to evaluate the short-term effects of a multidimensional stress prevention program integrating mindfulness-based activities, cognitive, and behavioral strategies, social skills and assertiveness activities, and emotional regulation exercises on indicators of quality of life, psychological symptoms, well-being, and psychological resources in university students. We compared the outcome variables in an intervention group and a wait-list control group before and shortly after the

end of the program (2 months later). We expected significant decreases in psychological symptoms, including depression, anxiety, pain, social phobia, and anxiety symptoms, a significant increase of quality of life and of psychological resources, including self-efficacy, sense of coherence, self-compassion, and social support in the intervention group compared to the control group.

MATERIALS AND METHODS

Participants

Participants were recruited at the University of Fribourg, Switzerland. Data collection was carried out between March 2015 and May 2017. The recruitment was made by e-mail, which were sent to all students of the university ($N = 10,000$), flyers, presentation of the study in diverse classes, webpages of the student's groups, and by word of mouth. The majority of students interested in participating in this study contacted us by e-mail. We answered all the questions and sent the students a document with all the detailed information about the study. Interested students were contacted by phone to explain the study in more detail. A first interview was scheduled as soon as the students accepted to participate in the study, during which exclusion and inclusion criteria were tested.

Initially, 201 students (around 2% of all university students) contacted us to participate in the study; and, to be eligible to the study, participants had to be a university student and understand French. Criteria for exclusion included the presence of an existing mental disorder or endocrinal disease, or brain injury or neurological disorder, and the use of psychotropic drugs. Moreover, participants were excluded if they underwent any type of therapy or coaching at the moment of the study (11 students). After the interview (14 students) withdrew from the study due to lack of time. **Figure 1** shows the participants flow diagram of the study.

The final sample was composed of sixty-four university students aged between 18 and 34 years ($M = 21.34$, $SD = 2.53$); 87.5% were women and 68.8% were native French speakers or spoke French fluently (see **Table 1**). The majority of the participants studied psychology (79.7%) and the other fields of studies were pedagogy (4.7%), law, economy, history, social work, Slavic studies, informatic, French, neurobiology, nursing care, and business communications. Only one person was married, the majority single, 68% were alone and 25 % living with a partner. The majority of participants (49%) were in a medium socioeconomic position, according to the IPSE Index (81). Four cohorts of 16 participants were recruited in each semester. No significant differences were found in the sociodemographic variables between the participants of the wait-list control group and of the intervention groups (all $p > 0.05$) [age: $t_{(62)} = -0.393$, $p = 0.696$; sex: $X^2(1) = 0.571$, $p = 0.450$; socioeconomic position: Cramer's $V = 0.135$, $p = 0.769$; studies (psychology and other): $X^2(1) = 0.097$, $p = 0.756$]. Eight students reported past psychopathological problems. None of the participants was receiving a treatment (neither drug or psychological) at the time of the study.

TABLE 1 | Characteristics of participants ($n = 64$).

	Intervention group $n = 32$	Wait-list control group $n = 32$
Age Mean (SD)	21.22 (2.27)	21.47 (2.8)
Gender (Females)	29 (90.6 %)	27 (84.4%)
Mother tongue (French)	21 (65.6%)	23 (71.9 %)
Marital status (single)	25 (78.1%)	19 (59.4%)
Single with partner	6 (18%)	10 (31%)
Living with partner	1 (3.1%)	2 (6.3%)
IPSE score [36–80] (middle class)	23 (76.67)	26 (81.25%)
Studies (Psychology)	26 (81.3 %)	25 (78.1 %)
Bachelor students (First year)	11 (34.4%)	13 (40.6%)
M.I.N.I. DIAGNOSTIC (LIFETIME)		
Past Depression	1 (3.1%)	4 (12%)
Panic Disorder	1 (3.1%)	1 (3.1%)
PTSD		1 (3.1%)

SD, Standard Deviation. Age in years. IPSE, Indice de position socioéconomique; BA, Bachelor; M.I.N.I., Mini-International Neuropsychiatric Interview; PTSD, Post-traumatic stress disorder.

Procedure

Using a randomized-controlled design, this study compared an intervention group who participated in a multidimensional

stress intervention program with a wait-list control group. The control group underwent the same measurements at the same measurement times as the intervention group but did not follow the program, nor did they receive another treatment. The outcome variables were assessed before (T1) and after (T2) participation in the program in both groups. The study's protocol was accepted by the Ethics Committee of the Cantons of Vaud and Fribourg (Protocol 261/14). All participants received detailed information about the purpose and the study's process and signed a written informed consent. Confidentiality was guaranteed and participants could withdraw from the study at any time. This research followed the ethical principles of the Declaration of Helsinki (82) and local regulatory law. For this protocol, we also followed the guidelines SPIRIT (83). This study was registered in the research register of the University of Fribourg FUTURA (Project number 6239; <http://admin.unifr.ch/futura/content/projects/6239>) as well as in the Clinicaltrial Register (<https://clinicaltrials.gov>. NCT03861013).

After having signed the written informed consent, students participated in a structured interview, the Mini-International Neuropsychiatric Interview [M.I.N.I., (84). French version, (85)], conducted by a psychologist or by trained masters students in psychology, which took between 30 and 60 min. When consent was given, the interviews were filmed. The interviewers were blinded to the group allocation. Following the interview, self-reported online questionnaires were sent and the participants

had to complete them in the following days. The participants received a link to access to online questionnaires in an e-mail, and they received their participant's code in a separate text message. When completing the questionnaires using the survey program (LimeSurvey GmbH, Hamburg, Germany. <http://www.limesurvey.org>), the participants had to enter their codes. The online questionnaires took the participants ~1 h, with the possibility to take breaks whenever needed. Pre-measurements were completed at no more than 2 weeks before the beginning of the study (T1). After that, participants were randomly distributed in the intervention or the wait-list control group. The randomization was done using a free available software, i.e., www.randomization.com and was archived in an electronic document saved separately. After randomization had been done and due to the design of the study, investigators and participants were not blinded about group allocation. The duration of the program was 2 months. Post-measures were taken after a maximum of 2 weeks after the end of the intervention (T2) and included a structured interview and the self-reported online questionnaires. In all cohorts, T2 measurements were always performed at the end of the semester. For their participation, the students received money (CHF 100) or experimental hour compensation (for psychology students). All the data collected were deidentified with a code and confidentiality guaranteed. Participants did not have a dependent relationship with the research team, as the researchers were not involved in teaching of bachelor students. Once the study was completed, participants in the wait-list control group were given the possibility to participate in the program if they wished so, but finally none of them participated, because of lack of time.

INTERVENTION

A multidimensional stress prevention program integrating mindfulness-based activities, cognitive and behavioral strategies, social skills exercises, and emotional regulation was proposed to the students. This intervention was composed of eight modules and integrated validated techniques from different approaches (Freiburger Training gegen Leistungsstress (86) including cognitive behavioral techniques; RFSM-e-MOTION (RFSM, Réseau Fribourgeois de Santé Mental, i.e., Fribourg Mental Health Network). The RFSM-e-MOTION intervention is a validated online program for relatives of individuals with mental disorders that focuses on the emotional aspects of the family members' experiences and their relationship with the suffering person [(87), see <http://rfsm-e-motion.ch>]. This program is based on Dialectical behavioral therapy (88).

The intervention consisted of eight 2-h weekly group sessions. The groups were composed of a maximum of eight students and were led by two trained clinical psychologists. Homework between sessions was also proposed. Participants received the activities printed or on a CD. During the first session, participants presented themselves, the rules of the group functioning were discussed and a confidentiality document was signed. Then, personal experience of stressful situations, triggered emotions, coping strategies, and their efficacy were discussed. The participants' experience with stress was the basis to introduce

TABLE 2 | Content of the program.

Session	Content
1	Organizational matters and program overview. Stress, triggers, and coping strategies
2	Cognitive and body techniques, mindfulness-based exercises
3	Cognitive and body techniques
4	Cognitive techniques
5	Emotion and emotion regulation
6	Emotion regulation
7	Social skills and assertiveness
8	Social skills and assertiveness. Evaluation of the program and personal goals

theoretical information about the topic. Each session followed the same structure. From the second to the last, we always started with a brief breathing exercise. A summary of the former meeting and the objectives of the new session were presented. Afterwards, a review of the homework was done before starting with the new content. At the end of each session, homework was proposed and participants answered questionnaires about group cohesion and the therapeutic alliance. Sessions 2 to 4 addresses behavioral and cognitive techniques (e.g., breathing exercises; planning and cognitive restructuring) and also mindfulness-based exercises (e.g., awareness of breath meditation; exercises for living at the present moment). Sessions 5 and 6 addressed the topic of emotions and emotion regulation. Sessions 7 and 8 integrated assertiveness training and social skills components (e.g., validating communication; interpersonal conflict resolution) (see **Table 2** for a session overview).

The objective of this program is not only to experiment several techniques to prevent and to cope with stress, but also to increase resources of being more resilient against stress that the participants could use as psychological tools in their everyday life. The intervention was intended to be as experiential as possible. Participants sometimes worked alone, in pairs, in subgroups or in plenum. They performed written exercises, discussions, and role playing in personal or fictive situations. Different types of material and triggers were also used, such as videos, audio, and visual supports. At the end of each exercise, a plenary discussion and a short theoretical link was made. The program was manualized, and each session was protocolled by a masters-level student to ensure compliance with the program. Throughout the entire program, external psychotherapists were available for supervision when needed.

Measures

All students participated in a structure diagnostic interview the Mini-International Neuropsychiatric Interview [M.I.N.I., (84). French version, (85)] in order to exclude participants with *psychopathological disorders*. This short-structured interview assesses DSM-IV (89) and ICD-10 (90) psychiatric disorders. At T1 we used the lifetime version, and at T2, the current one.

Psychological symptoms and quality of life were measured with the following self-reported instruments that were presented

online using LimeSurvey® (LimeSurvey GmbH, Hamburg, Germany. URL <http://www.limesurvey.org>)

Sociodemographic information. At first, participants were asked to report age, sex, marital status, nationality, languages (mother tongue and the language used at home), studies, and grade level. They also answered the *Indice de position socioéconomique* (81) which provides an index on the socio-economic position of the participant in relation to the Swiss population.

A screening for *mental health problems* was done with the French version of the Symptom Checklist [SCL-27-plus, (91)]. Composed of 27 items rated on a 5-point Likert-like scale, this checklist evaluates five dimensions: depressive, vegetative, agoraphobic, and social phobia and pain symptoms, and a global severity index. A lifetime assessment for depressive symptoms and a screening question for suicidality are also included. Cut-offs: social phobia = 1.86; vegetative = 1.54; pain = 1.77; agoraphobic = 0.93; actual depression = 1.28). Cronbach's alpha coefficient in this study were from 0.52 to 0.86.

Depression was measured with the Beck Depression Inventory - II [BDI-II, (92)]. Composed of 21 items, this inventory assesses the intensity and severity of depressive symptoms over the past 2 weeks. Items are rated in majority on 4-point Likert-like scale, from zero to three. Higher scores indicate severe depressive symptoms. Score thresholds from 12 to 19: mild = depression, 20 to 27 = moderate depression, and >27 = severe depression. In this study the Cronbach's alpha coefficient was 0.84.

The State-Trait Anxiety Inventory [STAI, (93). French version translated by Schweitzer and Paulhan (94)] was used to assess the presence and severity of *anxiety* symptoms. The state anxiety subscale is composed of 20 items rated on a 4-point Likert-like scale from 1 "not at all" to 4 "very much so" and the trait-anxiety, with also 20 items, from 1 "almost never" and 4 "almost always." Higher scores indicate severe anxiety. Cut-offs STAI-S: mild between 36 and 45, median: 46–55, high: 56–65, very high: > 65. Cronbach's alpha for both subscales were 0.91.

Social anxiety was assessed using the Liebowitz Social Anxiety Scale self-reported version [LSAS-SR, (95)]. Validated in French by Yao et al. (96), this 24-item scale measures social phobia through two subscales: fear triggered and the avoidance of social situations considering the previous week. Items are rated on 4-point Likert-like scale. A total score can be also calculated by adding the score in each subscale. Higher scores indicated higher levels of social anxiety. Scores: low social anxiety: 56–65, marked: 65–80, severe: 80–95 and very high: > 95. Cronbach's alpha coefficients in this study was 0.88.

The Outcome Questionnaire [OQ®-45.2, (97). French validation by Flynn et al. (98)] was used to evaluate the progress of the course of therapy and the following termination. Composed of 45 items rated on 5-point Likert-like scale, ranging from 0 "Never" to 4 "Almost always," this questionnaire contains three subscales: Symptom Distress (SD), evaluating depression and anxiety, Interpersonal Relationships (IR), assessing loneliness, conflict with others and marriage and family difficulties, and Social Role (SR), evaluating the difficulties in the workplace, at school or home duties. A total score can be also calculated. Higher scores suggesting higher functional problems.

In the present sample Cronbach's alpha were between 0.77 and 0.95.

Quality of life was measured using the World Health Organization Quality of Life [WHOQOL-BREF, (99)]. This 26-item version, rated on a 5-point Likert-like scale, assesses quality of life. Global score and four domains: physical (PHYS), psychological (PSYCH), social (SOC), and environmental (ENVIR) quality of life can be calculated. Higher score means higher perception of quality of life. Cronbach's alpha coefficients in this study were ranged from 0.66 to 0.80 for the subscales and 0.48 for the score global.

Psychological resources were measured using the following instruments presented online with LimeSurvey®.

Participants evaluated their perceived *self-efficacy* with the General Self-Efficacy Scale [GSES, (100). French translation and validation by Dumont et al. (101)]. This 10-item scale assesses the general self-efficacy, optimistic self-beliefs to cope with a variety of difficult demands in life. The items are rated on a 4-point-Likert-like scale going from 1 "not at all true" to 4 "exactly true." A higher score indicates a better general self-efficacy. Cronbach's alpha in this sample was 0.94.

Sense of coherence was assessed with the 13-item Sense of Coherence Scale [SOC-13, (102). French validation by Gana and Garnier (103)]. Items are rated on a 7-point Likert-like scale, ranging from 1 "Never have this feeling" to 7 "always have this feeling." Three components can be distinguished: comprehensibility, manageability and meaningfulness. A high score expresses a strong sense of coherence. Cronbach's alpha in this sample was 0.85.

Self-compassion was evaluating using the Self-compassion scale Short Form [SCS-SF, (104). French translation and validation by Kotsou and Leys (105)]. Composed of 12 items, rated on a 5-point Likert-like scale from 1 "almost never" to 5 "almost always," this scale measures through 6 subscales individual's level of self-kindness, self-judgement, common humanity, isolation, mindfulness, and over-identification. A total score, can be also computed. A total score is calculated by taking the mean of the 12 items after reverse scoring negatively worded items. Higher scores suggesting higher level of self-compassion. Cronbach's alpha in this study was 0.86.

The Multidimensional Scale of Perceived Social Support [MSPSS, (106)] was used to assess *perceived social support*. This 12 items scale evaluated three dimensions: Family, Friends, and Significant others. The items are rated on a 7-point Likert-like scale from 1 "very strongly disagree" to 7 "very strongly agree." A total score can be calculated, the higher the score the higher the perceived social support. Cronbach's alpha in this study was 0.93.

Statistical Analysis

Determination of Adequate Sample Size

To determine the optimal sample size, we performed an a priori power analysis using G*Power [Version 3.1.9.2, (107)] and computed an expected medium effect size based on the meta-analysis of Regehr et al. (60) for an ANOVA with 2 measurement points, 2 groups and between and within factors interaction. We obtained a sample size of $N = 54$. In addition, we estimated a drop-out rate of 15% based on the results of similar

intervention program (80), leading to an adequate sample size of 64 participants.

Analyses of Intervention Effects

The statistical analyses were computed with IBM® SPSS® Statistics 25 (IBM Corp. Released 2017). Two-way mixed ANOVAs were computed. The within and between independent variables were, respectively, time (pre/T1 vs. post/T2), and group (intervention vs. control), both with two levels. The dependent variables are the different outcome scores of psychological symptoms, quality of life and psychological resources.

We analyzed our data using the per-protocol (PP) approach (108). In that respect, we calculated the ANOVA analyses but only with data from participants who participated in at least five of the eight intervention sessions and who answered the post-treatment measures. Considering the completion of post-treatment measures and according to the dependent variable considered, the sample of post-treatment participants for the PP-analyses varies from 56 to 60. *Post-hoc t*-tests were used to analyze the significant effects related to the a priori hypotheses. Effect sizes (Cohen's *d*) were also calculated, using <https://www.psychometrica.de/effektstaerke.html>.

To increase the confidence of our results, we performed the same analyses considering an intention-to-treat approach (ITT). In the ITT analyses, all randomized participants who completed the pre-treatment assessment (T1) were taken into account, including non-completing participants and those with missing outcomes. Missing data at post-treatment assessment (T2) were dealt by using the last observation carried forward method (LOCF), which in this case correspond to the pre-treatment measure (T1) (108). A total of 64 participants were taken account for these analyses. The differences between the two analyses are reported in the results' section related to the concerned outcomes.

RESULTS

Participants present in the sessions varies from 5 (1 person) to all session (11 students), a majority of students (70%) attended 7 or 8 sessions, 25% of students were present at 6 and all of them finished the treatment.

Means and standard deviation (*SD*) of total scores and sub-scores are presented in **Table 3** for the outcomes variables evaluating the psychological symptoms, quality of life and psychological resources for the PP- sample.

Pre-post Treatment Analyses

Psychological Symptoms and Quality of Life

Results of the mixed ANOVAs for the psychological symptoms and the quality of life (**Figure 2**), showed a significant interaction effect between time and intervention in the trait anxiety levels measured with the STAI [$F_{(1,56)} = 4.87, p = 0.031, \eta^2 = 0.08$]. *Post-hoc* paired *t*-test revealed that students who participated in the intervention group reported significantly less anxiety traits at T2 in comparison to T1 ($p < 0.001; d = -0.68$). No other significant effects were found (all $p > 0.05$).

The ANOVA analyses for the SCL-27-plus showed a significant interaction effect (time x intervention) for the pain dimension [$F_{(1,58)} = 4.80, p = 0.033, \eta^2 = 0.08$] evaluated by *post-hoc* independent *t*-tests indicated that the mean score on the pain perception in the intervention group was significantly lower at T2 in comparison to the wait-list control group ($p = 0.008; d = 0.73$). Furthermore, paired *post-hoc t*-test, revealed that the students who participated in the intervention revealed significantly less pain symptoms at T2 than at T1 ($p < 0.001; d = -0.85$), but also the wait-list control ($p = 0.002; d = -0.40$). For the other dimensions, significant effects of time were found for the agoraphobic [$F_{(1,58)} = 4.27, p = 0.043, \eta^2 = 0.69$], and vegetative symptoms [$F_{(1,57)} = 16.33, p < 0.001, \eta^2 = 0.22$]. These results indicated that the agoraphobic and the vegetative symptoms scores were significantly lower in both groups at T2 than at T1. Larger significant time main effect was found for the dimension of social phobia [$F_{(1,57)} = 17.33, p < 0.001, \eta^2 = 0.23$], and moderate for group main effect [$F_{(1,57)} = 5.56, p = 0.022, \eta^2 = 0.09$], indicating that the scores at T2 were significantly lower than at T1, and that the intervention group had significantly lower scores than the wait-list control group in this dimension.

The ANOVA analyses of the outcome questionnaire (OQ-45.2) showed a significant interaction effect between time and intervention for the IR sub-scores [$F_{(1,55)} = 4.71, p = 0.034, \eta^2 = 0.08$]. *Post-hoc* paired *t*-tests revealed that participants of the intervention group report significant lower difficulties in interpersonal social relationships at T2 than at T1 ($p = 0.021; d = -0.39$). A significant main effect of time was found for the sub-score of SD [$F_{(1,55)} = 13.05, p = 0.001, \eta^2 = 0.19$] and for the total score [$F_{(1,55)} = 8.17, p = 0.006, \eta^2 = 0.13$]. No other significant effects were found.

With regard to the quality of life (WHOQOL-BREF), the results of the ANOVAs indicated a significant interaction effect between time and intervention for the dimensions psychological [$F_{(1,55)} = 4.65, p = 0.035, \eta^2 = 0.08$] and social of the quality of life [$F_{(1,55)} = 4.81, p = 0.033, \eta^2 = 0.08$]. *Post-hoc* independent *t*-tests revealed that the mean score in the dimension psychological quality of life was significantly higher in the intervention group at T2, compared to the wait-list control group ($p = 0.045; d = -0.56$), and paired *t*-test showed also that the intervention group revealed significantly higher scores at T2 compared with T1 ($p = 0.032; d = 0.42$). No simple effects were found for social health quality ($p > 0.05$). A significant moderate main effect was found for time in the physical dimension [$F_{(1,55)} = 5.55, p = 0.022, \eta^2 = 0.09$], the scores in this dimension were significant higher at T2 in comparison with the score at T1 for both groups. No other significant effects were found in the analysis of the other dimensions (physical and environment) and in the global score of quality of life (all $p > 0.05$).

The ANOVA analyses for the BDI-II and the LSAS-SR showed no significant interaction effects between time and intervention for the scores of depression [$F_{(1,57)} = 1.91, p = 0.173$] or social anxiety. A significant main effect was found for time [$F_{(1,56)} = 6.74, p = 0.012, \eta^2 = 0.10$], but not for group [$F_{(1,56)} = 1.02, p = 0.317$] for social anxiety. No other significant results were found.

TABLE 3 | Descriptive statistics for outcome variables evaluating psychological symptoms, quality of life, and psychological resources.

Variable	T1				T2				Statistics	
	Intervention group		Wait-list control group		Intervention group		Wait-list control group		t	p
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
PSYCHOLOGICAL SYMPTOMS AND QUALITY OF LIFE										
BDI-II	5.96	4.19	6.22	5.50	4.63	4.37	6.69	5.49	t(25)=4.11 ^b	ns
STAI-S	31.19	7.42	32.06	9.12	30.33	10.04	34.00	12.35		ns
STAI-T	38.85	7.56	38.97	10.87	33.85	7.24	37.47	9.63		<0.001
LSAS-SR - Total	38.27	19.72	41.44	25.15	31.12	22.05	39.91	24.97		ns
SCL-27-PLUS										
Social phobia	1.30	0.75	1.68	0.93	0.90	0.74	1.48	0.86	t(58)=−2.77 ^a	ns
Vegetative	1.07	0.55	1.23	0.56	0.76	0.55	1.04	0.50		ns
Pain	1.43	0.71	1.61	0.66	0.88	0.57	1.34	0.69		0.008
Agoraphobic	0.45	0.53	0.61	0.51	0.39	0.52	0.48	0.50		ns
Current depression	0.52	0.47	0.62	0.61	0.50	0.75	0.71	0.61		ns
OQ45.2 - Total	41.08	20.60	45.35	23.82	32.65	15.40	42.39	23.71	t(25)=2.47 ^b	ns
SD	21.96	11.27	25.55	13.63	16.27	8.19	22.97	14.08		ns
IR	10.00	6.70	9.61	6.80	7.61	5.49	9.97	6.14		0.021
SR	8.50	4.00	9.30	5.11	8.19	4.27	8.52	4.87		ns
WHOQOL-Bref - Global	17.15	1.97	17.19	2.59	17.62	2.40	17.25	2.68	t(55)=2.05 ^a	ns
PHYS	16.56	1.89	16.09	2.52	17.12	1.97	16.54	2.50		ns
PSYCH	14.62	2.24	14.48	2.42	15.46	1.77	14.31	2.32		0.045
SOCIAL	15.36	2.83	16.17	2.93	16.33	2.73	15.74	3.41		ns
ENVIR	16.83	2.03	16.34	2.32	17.37	1.20	16.74	2.29		ns
PSYCHOLOGICAL RESOURCES										
SOC - Total	65.89	9.95	66.28	12.44	71.04	8.04	67.09	11.70	t(25)=−0.48 ^b	0.002
SCS-SF - Total	3.09	0.51	3.09	0.85	3.49	0.59	3.16	0.98	t(24)=−0.61 ^b	0.001
GSES	31.40	6.05	31.78	7.35	34.72	3.37	33.25	5.05		ns
MSPSS	6.05	0.83	6.04	0.94	6.21	0.68	5.82	1.31		ns

Mean (SD) value at pre- (T1) and post-treatment (T2) by treatment condition (intervention group vs. wait-list control group) in the PP-sample (*n* = between 56 and 60)

SD, Standard Deviation; BDI-II, Beck Depression Inventory-II; STAI-S and STAI-T, Spielberger State-Trait Anxiety Inventory; LSAS-SR, Liebowitz Social Anxiety Scale; SCL-27-plus, Symptom Checklist; OQ45.2, The Outcome Questionnaire 45.2; SD, Symptom Distress; IR, Interpersonal Relationships; SR, Social Role; WHOQOL-Bref, World Health Organization Quality of Life-Bref; PHYS, Physical; PSYCH, Psychological; SOC, Social; ENVIR, Environmental; SOC, Sense of Coherence Scale; SCS-SF, Self-compassion Scale Short Form; GSES, General Self-Efficacy Scale; MSPSS, Multidimensional Scale of Perceived Social Support.

^aPost-hoc independent *t*-test

^bPost-hoc paired *t*-test

**p* < 0.05.

Results analyses of the psychological symptoms and quality of life outcome variables using the ITT-sample were similar as the findings in the PP-sample only for the interaction effects between time and intervention for the Interpersonal relationship (IR) subscore of the outcome questionnaire (OQ-45.2) [$F_{(1,62)} = 4.08$, $p = 0.048$, $\eta^2 = 0.06$], and for the dimensions psychological [$F_{(1,60)} = 4.08$, $p = 0.048$, $\eta^2 = 0.06$] and social [$F_{(1,60)} = 4.48$, $p = 0.038$, $\eta^2 = 0.07$] quality of life (WHOQOL-BREF). Similar to the analyses in the PP-sample no significant effects were found in the ANOVA analyses of the BDI-II, and the LSAS-SR in the ITT-sample. However, contrary to the analyses in the PP-sample, the analyses of the ITT-sample for the trait anxiety (STAI) and for the pain dimension of the SCL-27-plus, showed no significant interaction effects between time and intervention (for details see **Supplementary Material**).

Psychological Resources

The ANOVA analyses of the SOC-13 and SCS-SF, yielded a significant interaction effect between time and intervention for sense of coherence [$F_{(1,56)} = 5.50$, $p = 0.023$, $\eta^2 = 0.09$] and self-compassion [$F_{(1,54)} = 4.64$, $p = 0.036$, $\eta^2 = 0.08$]. *Post-hoc* paired *t*-tests indicating that the participants of the intervention group showed significant higher levels of sense of coherence and of self-compassion at T2 than at T1 ($p = 0.002$; $d = 0.57$; $p = 0.001$; $d = 0.72$, respectively) (**Figure 3**).

With regard to self-efficacy, the ANOVA analyses of the GSES revealed no significant interaction effect between time and intervention [$F_{(1,55)} = 1.35$, $p = 0.251$] but a large significant main effect for time [$F_{(1,55)} = 9.01$, $p = 0.004$, $\eta^2 = 0.14$] but no for group. The score of self-efficacy was significant higher after the treatment for both groups,

FIGURE 2 | Results of the interaction effects (time $\times$ intervention) in psychological symptoms and quality of life: **(A)** Anxiety trait: the intervention group reported significantly less anxiety trait at T2 compared with T1. **(B)** Pain symptoms: the intervention group reported significantly lower pain symptoms at T2 in comparison to the wait-list control group; both groups showed also significantly less pain symptoms at T2 than at T1. **(C)** Interpersonal relationships: the intervention group reported significantly lower interpersonal difficulties at T2 than at T1. **(D)** Psychological quality of life: the intervention group reported significantly higher scores in the psychological quality of life perceived at T2, compared to the wait-list control group. The intervention group showed also significantly higher scores at T2 than at T1. Errors bars represent standard errors. $P < 0.05$.

FIGURE 3 | Results of the interaction effects (time $\times$ intervention) in psychological resources: **(A)** Sense of coherence: the intervention group reported significantly higher levels of sense of coherence at T2 than at T1. **(B)** Self-compassion: the intervention group revealed significantly higher scores in self-compassion at T2 compared with T1. Errors bars represent standard errors. $P < 0.05$.

in comparisons with the scores at T1. ANOVA analyses of the MSPSS showed no significant interaction effects or main effects for time and group for the perceived social support (all $p > 0.05$).

Considering the ANOVA analysis of the psychological resources taken into account in the ITT-sample, the results are similar to the PP-sample results (for details see the **Supplementary Material**).

DISCUSSION

This study aimed at evaluating the short-term effects of a multidimensional stress prevention program on psychological symptoms, well-being, and psychological resources in university students. The most remarkable results are the improvement in quality of life, and psychological resources, including sense of coherence and self-compassion, as well as the decrease of specific

psychological symptoms, such as anxiety, pain, and interpersonal problems, in the intervention group compared with the wait-list control group.

With regard to the psychological symptoms, we found, as expected, significant decrease in anxiety scores in the intervention group as compared to the wait-list control group. These findings are consistent with previous research analyzing stress prevention programs among university students (60, 109, 110). A meta-analysis about the evaluation of stress reduction interventions among medical university students, indicated that mindfulness-based stress reduction, meditation techniques and self-hypnosis are effective in reducing anxiety (111). Many studies have reflected the improvement of anxiety (60). Surprisingly, our findings reflected a reduction in trait-anxiety but not in state-anxiety. This could be explained by the composition of our sample, we included only participants without psychopathological complains, which could have affected their level of state anxiety. Furthermore, the post-intervention measurements were always at the end of the semester, during the review period, and they were closed to the exams. This could also have an effect on the levels of anxiety because it is known as an anxious and stressful period for students.

The significant reduction in pain symptoms in the intervention group is in line with our hypothesis of a diminution of psychopathological symptoms. This is particularly important as university students were shown to report increased psychosomatic symptoms (30). This is also interesting as other validated intervention programs in students did not find any effect on somatic and/or psychosomatic symptoms. We should also note that the control group reported a reduction in the pain score, but to a lesser extent. The lack of significant results for the other dimensions of the SCL-27-plus could be explained again by the fact that we included only asymptomatic participants, i.e., without clinically significant psychopathological symptoms. Therefore, it is not surprising that we did not find any significant changes on measures of psychopathological symptoms. This could also explain the lack of differences observed for the depression scores.

The intervention improves, as expected, the functional level of the participants, but only in the domain concerning the interpersonal problems in the intervention group, compared to the wait-list control group. These results are very relevant as recent researches indicated that psychosocial factors, such as perceived social support, and resilience, are protective factors of mental health in university students (21). Stress levels are related also with social isolation [e.g., among law students (112, 113)], and also with not having a satisfying relationship with the family and friends in university students (114). Interpersonal stress was also associated with depression, anxiety and somatization (115), and suicide risk (116, 117) in university students. To better adjust at the university context campus connectedness (118), family and peer support, and satisfying relationships are important (38, 119) for university students. These psychosocial factors are a mediator between stress and health consequences (120). Therefore, as predicted, we found an improvement in the quality of psychological health. These findings are consistent

with research indicating the link between stress and quality of life in university students, and the importance to reinforce the mediators between them, such as personal and psychological resources (54). Furthermore, in recent studies, the use of individual strength in university students showed benefits in mental health among students (121) and was positive related with positive affect, self-esteem, and vitality, and negatively with stress and negative affect (122).

Very interestingly, the short-term effects of our intervention indicate significant increases in specific psychological resources, including higher levels of sense of coherence and self-compassion after the intervention in the intervention group than the wait-list control group. These results are consistent with other findings suggesting that sense of coherence is an indicator of resilience and can be regarded as an attitude or predisposition promoting health and resilience by using different personal resources (123, 124). Higher sense of coherence was found to be associated with less stress and better quality of life in students (52, 54, 123, 125). In addition, improvement in the sense of coherence is interesting because this concept is comprised as an attitude or predisposition (126). In this sense, it is important because it will allow the participants to change their attitude toward future stressful events and other situations (124). Previous research indicates the relationship between self-compassion and psychological well-being in university students (127, 128). In view of previous research that showed the importance of personal resources (54), like optimism (129), self-efficacy, and resilient coping (3) related with decreased perceived stress, these results are important for an intervention aiming at reducing stress and increasing resources in a students' population. Nevertheless, further long-term studies have to be done to investigate the potential protective effect of these increased personal resources against stress.

Contrary to our expectations and previous studies, social support and self-efficacy are not improved after the participation in the program (130, 131). Self-efficacy is one the most important predictors of distress (25), but also an important personal resource to reduce the effects of stress in well-being (132), like social support (133, 134).

Taken together these results indicated promising short-term effects of our program. Specifically, because it increases some important resources against stress but also because the participation in the program have effects in psychological symptoms in an asymptomatic sample. The results are consistent with the objective of this multidimensional intervention, which is not only to focus on stress reduction, but also to improve some personal skills and psychological resources to prevent future stressful situations. The replication of the results across different samples, per-protocol and intention-to-treat, suggest that our program have an important short-effect on psychological symptoms and quality of life, particularly interpersonal relationship difficulties, psychological, and social quality of life, but also in personal resources (sense of coherence and self-compassion). Unfortunately, we cannot specify exactly which dimension of our program has a particular effect on which variable, but our results show that the entire program has an effect on psychological symptoms, well-being and psychosocial resources.

Some limitations deserve to be taken into consideration. First, the sample was composed by a majority of students of the University of Fribourg, females and studying psychology, which limits the generalization of our results. The gender disparity does not allow to compare the differences in the short-term effects of our program between men and females. Bachelor students in psychology had an additional motivation factor for their participation, they could receive experimental points instead of financial reimbursement in order to meet the requirements of the bachelor studies. A second limitation is the control group chosen, the wait-control list. A better control group would be an active one, in this sense it could be interesting to evaluate the effects of our program with an already well-validated stress intervention (i.e., cognitive, behavioral, or mindfulness-based), in order to distinguish more in detail, the effect of the multidimensionality. Third, the use of self-report instruments can lead to memory bias and greater subjectivity in the responses, specially the length of our online questionnaires (~1 h) may have led to less accurate answers due to fatigue, even if participants could take breaks. Fourth, the relatively small sample size can be also a factor to take into account in the limitations. Fifth, we did not control for past finished psychological or drug treatments. However, we controlled that none of the participants was receiving a treatment (neither drug or psychological) at the time of the study. A last limitation is that we cannot completely rule out that a person external to the study has filled the online questionnaires using the personal codes.

However, our study also has some specific strengths, including for instance the use of a randomized controlled design. There is also very little drop-out related to the intervention. It seems that the participants who engaged in the program also stayed until the end since all participants have completed the program; and 70% of them participated to all sessions. Future studies

have to analyze the medium and long-term effects of our program in a larger healthy sample, but also, evaluate the effects in clinical samples. Furthermore, it could be interesting to evaluate the effects of this program using biomarkers or daily life assessments.

In conclusion, our findings provide very promising preliminary evidence of the efficacy of our multidimensional stress prevention program, not only in the reduction of psychological symptoms, but also in the improvement of well-being and some important psychological resources increasing the resilience to stress. In that way, we can also define our program as a resource-activating intervention.

AUTHOR CONTRIBUTIONS

RR, CG, MG, and CM-S contributed to the conception and design of the study and were involved in the interpretation of the data. RR, CG, and MG contributed to the conception of the measurements and collection of data. RR performed the statistical analyses. RR and CM-S wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Resilience in Cancer Patients

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Background: Being diagnosed with cancer and undergoing its treatment are associated with substantial distress that can cause long-lasting negative psychological outcomes. *Resilience* is an individual's ability to maintain or restore relatively stable psychological and physical functioning when confronted with stressful life events and adversities. Posttraumatic growth (PTG) can be defined as positive life changes that result from major life crises or stressful events.

Objectives: The aims of this study were to 1) investigate which factors can strengthen or weaken resilience and PTG in cancer patients and survivors; 2) explore the relationship between resilience and PTG, and mental health outcomes; and 3) discuss the impact and clinical implications of resilience and PTG on the process of recovery from cancer.

Methods: A literature search was conducted, restricted to PubMed from inception until May 2018, utilizing the following key words: cancer, cancer patients, cancer survivors, resilience, posttraumatic growth, coping, social support, and distress.

Results: Biological, personal, and most importantly social factors contribute to cancer patients' resilience and, consequently, to favorable psychological and treatment-related outcomes. PTG is an important phenomenon in the adjustment to cancer. From the literature included in this review, a model of resilience and PTG in cancer patients and survivors was developed.

Conclusions: The cancer experience is associated with positive and negative life changes. Resilience and PTG are quantifiable and can be modified through psychological and pharmacological interventions. Promoting resilience and PTG should be a critical component of cancer care.

Keywords: cancer, resilience, coping, social support, distress, posttraumatic growth

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INTRODUCTION

For many cancer patients, receiving a diagnosis of cancer and undergoing its treatment together comprise an extremely stressful experience that can render individuals vulnerable to long-lasting negative psychological outcomes, including emotional distress, depression, anxiety, sleep problems, fatigue, and impaired quality of life (1–5). Cancer is commonly perceived as a life-threatening and potentially traumatic illness, perceptions exacerbated by its sudden onset and uncontrollable nature (6). Furthermore, cancer patients must deal with dramatic life changes to which they have to adapt throughout their treatment trajectory (7). Research published in recent decades has emphasized the traumatic characteristics of a life-threatening illness, like cancer, and demonstrated how cancer patients exhibit responses consistent with psychological trauma (8–11). While in the fourth edition

of the American Psychiatric Association's (12) *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* (13), life-threatening cancer was acknowledged to be a severe stressor that can trigger posttraumatic stress disorder (PTSD), in the newest edition, the *DSM-5*, "a non-immediate, non-catastrophic life-threatening illness," like cancer, is no longer qualified as traumatic, irrespective of how stressful or serious it is (14).

Interestingly, despite substantial distress that is associated with a cancer diagnosis and its treatment, many cancer patients manifest remarkable resilience (15, 16). Studies have shown that overcoming cancer and its treatment can be an opportunity for personal growth, as well as for enhanced mental and emotional well-being that could potentially be linked to better coping with disease-related demands (17–19). However, not everyone reacts to adversities in the same way, with some more resilient than others (20). Understanding which factors discriminate cancer patients, as well as cancer survivors who experience psychological growth from those who do not, might have important clinical implications and guide interventions to assist cancer patients and survivors with their psychological recovery from the cancer experience.

For this article, we reviewed the literature on resilience and posttraumatic growth (PTG) in cancer patients and survivors, so as to better understand which psychosocial, disease-related, and contextual factors yield better adjustment to the disease. The overall aims of this review were to 1) investigate which factors can strengthen or weaken resilience and PTG in cancer patients and survivors; 2) explore the relationships between resilience and PTG, and mental health outcomes; and 3) discuss the impact of resilience and PTG on the process of recovery from the disease, as well as the clinical implications of this impact.

For the purposes of this review, a literature search was conducted, restricted to PubMed articles from inception (1979) until May 2018, using the following search terms in various combinations: cancer, cancer patients, cancer survivors, resilience, posttraumatic growth, coping, social support, and distress. Only studies involving patients who were adults (≥ 18 years) were included. To be considered for the review, articles had to be peer reviewed and written in English (**Table 1**). The psychometric instruments used in the eligible studies are summarized in **Table 2**. From the literature reviewed, a two-pathway model of resilience in cancer patients and cancer survivors was drafted (**Figure 1**).

Over the last few decades, increasing evidence has been published that serious life events and life-threatening illnesses can lead not only to increased psychological distress but also to positive life changes (93, 138, 146). In this context, various research groups have established concepts pertaining to "benefit-finding" (21, 45, 135), personal growth through "constructive confrontation" (122), "stress-related growth" (109), "growth through adversity" (71), and "posttraumatic growth" (34). These concepts may be considered as indirect pathways of resilience because psychological adjustment is facilitated and accomplished by psychological processes. On the other hand, several theoretical and empirical concepts focus on the particular resistance against psychological distress that can arise in cancer patients [e.g., sense of coherence, optimism,

Connor-Davidson Resilience Scale (41)] and therefore can be considered direct pathways of resilience.

Resilience can be viewed as an individual's ability to maintain or restore relatively stable psychological and physical functioning when confronted with stressful life events and adversity (30). In the context of cancer, resilience refers to an individual's protective attributes and/or personal characteristics, which are thought to be modifiable and to promote successful adaptation to cancer, including, among others, meaning and purpose in life, sense of coherence, optimism, positive emotions, self-esteem, self-efficacy, cognitive flexibility, coping, social support, and spirituality (51, 63). Resilience is considered a dynamic mechanism that changes over time and can be affected by life circumstances, one's environment, and situational as well as contextual factors (92). Aversive and/or stressful experiences may cause transient perturbations, even in resilient individuals (e.g., constant mind-wandering, preoccupation, or restless sleep) (29). However, in cancer patients, there are multiple, sometimes unexpected, pathways to resilience (92). Although marked variation exists in how cancer patients cope with cancer as a disease, there is growing recognition that resilience to life-threatening situations, like cancer, is far more common than often believed (29). Many cancer patients can handle this extremely stressful experience with minimal to no effect on their daily functioning and may even experience positive emotional and personal growth (29). In addition to biological factors (e.g., gene-environment interactions) (72), individuals' personal factors (e.g., self-efficacy, coping, optimism, and hope) (66), and environmental factors, particularly social support (129), collectively account to their resilience and psychological adaptations to the cancer experience (51).

FACTORS FACILITATING RESILIENCE IN CANCER PATIENTS

Meaning Making

The first several months after someone is diagnosed with cancer is a critical period, during which they are confronted with a number of physical, psychological, social, spiritual, and existential changes imposed by the disease (80). This period is characterized by existential distress, worries about health and safety, and fears about dependency, lost autonomy, and death (88). These tumor-triggered existential concerns often confuse one's general sense that life has order and purpose and force many patients with cancer to search for new meaning in life, as they struggle to make sense of their cancer (73, 80).

Meaning making is a conceptual model that attempts to explain someone's adjustment to his or her cancer experience (108, 110). Contrary to Antonovsky's theory, recent literature provides evidence that conceptualizes "meaning" and "meaning making" as a behavioral process of adaptive adjustment, rather than a personality trait. Park and Folkman (111) postulated to distinguish between meaning as a coping process and a coping outcome. Meaning making as a coping process reflects attempts to balance a mismatch between situational meaning (meaning in the context of a specific event) and global meaning (global beliefs and goals) by reappraising and creating both the situational meaning and one's global beliefs and goals.

TABLE 1 | Summary of studies included in the review.

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
1 Affleck and Tennen (21)	Construing benefits from adversity: adaptational significance and dispositional underpinnings	Review article	–	–	Article summarizes the adaptive significance of finding benefits from major medical problems and examines how this process may be shaped by specific psychological dispositions such as optimism and hope and broader personality traits such as extraversion and openness to experience.
2 Afakseir et al. (22)	The role of psychological hardness and marital satisfaction in predicting posttraumatic growth in a sample of women with breast cancer in Isfahan	Cross-sectional study design	120 breast cancer patients	PTGI EMS Ahvaz Psychological Hardness Scale	The majority of breast cancer patients experienced posttraumatic growth. Psychological hardness, marital satisfaction, and longer time since cancer diagnosis predicted posttraumatic growth.
3 Amstadter et al. (23)	Personality, cognitive/psychological traits and psychiatric resilience: a multivariate twin study	Retrospective study design	–	SCL-90 Life Orientation Test Rosenberg Self-Esteem Scale	To determine the phenotypic relationships, and etiologic underpinnings, of cognitive/psychological traits (neuroticism, optimism, self-esteem, mastery, interpersonal dependency, altruism) with psychiatric resilience.
4 Andrykowski et al. (24)	Lung cancer diagnosis and treatment as a traumatic stressor in DSM-IV and DSM-5	Cross-sectional study design	189 lung cancer survivors	SF-36 HADS DTherm PSS PTGI Benefit Finding Questionnaire	Using the DSM-IV criterion, the trauma group (n = 70) reported poorer status than did the no trauma group (n = 119) on 10 of 10 distress indices (mean ES = 0.57 SD) and better status on all seven growth/benefit-finding indices (mean ES = 0.30 SD). Using the DSM-5 stressor criterion, differences between the trauma (n = 108) and no trauma (n = 81) groups for indices of distress (mean ES = 0.26 SD) and growth/benefit-finding (mean ES = 0.17 SD) were less pronounced.
5 Antonovsky (25)	Health, stress and coping	Book chapter	–	–	Antonovsky explains in greater detail how the sense of coherence affects health. He brings together recent studies on health and illness and shows their relationships to the sense of coherence concept. He presents a complete questionnaire that professionals can use to measure the sense of coherence and discusses the evidence for its validity. Moreover, he explores the neurophysiological, endocrinological, and immunological pathways through which the sense of coherence influences health outcomes.
6 Antonovsky (25)	Unraveling the mystery of health: how people manage stress and stay well	Book chapter	–	–	A classic study of what allows people to be resilient in the face of stress, a concept coined “salutogenesis.” Using clinical practice and qualitative research methods, Antonovsky shows in fact how people can overcome serious challenges and identified the resources that people employ to resist illness and maintain their health in a world where stressors are ubiquitous. A key factor in assisting people to manage stress and resist illness is a “sense of coherence.”

(Continued)

TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
7 Barskova et al. (26)	Post-traumatic growth in people living with a serious medical condition and its relations to physical and mental health	Systematic review	68 empirical studies	–	The majority of the studies investigated PTG and its relationships to health indicators after the diagnosis of cancer, HIV/AIDS, cardiac disease, multiple sclerosis, and rheumatoid arthritis. The review indicated that quality of social support, patients' coping strategies, and several indicators of mental and physical health were consistently associated with posttraumatic growth.
8 Bergerot et al. (1)	Course of distress, anxiety, and depression in hematological cancer patients: association between gender and grade of neoplasm	Prospective study design	104 hematologic cancer patients	DTherm Problem List HADS	Female patients reported more distress, anxiety, and depression than male patients did. Over the course of chemotherapy, the distress levels of patients with hematological cancer decrease over time.
9 Blank and Bellizzi (27)	After prostate cancer: predictors of well-being among long-term prostate cancer survivors	Cross-sectional study design	490 prostate cancer patients	MIDI Control Scale LOT-R HHI COPE PANAS CES-D IES	Although longer-term survivorship of prostate cancer patients does not appear to be a highly traumatic experience, personality factors and the use of coping strategies years after treatment were found to introduce variability to well-being in complex ways, differing in relation to positive and negative outcomes.
10 Boehmer et al. (28)	Coping and quality of life after tumor surgery: personal and social resources promote different domains of quality of life	Prospective study design (1 month and 6 months after surgery)	175 gastrointestinal, colorectal, and lung cancer patients	General Self-efficacy Scale Coping Scale Berlin Social Support Scale EORTC-QLQ-30	Structural equation models indicate that self-efficacy at 1 month after surgery exerted a positive direct effect on patients' physical, emotional, and social well-being of life at 6 months after surgery, but indirect effects through active and meaning-focused coping were also observed. Initial received support elevated later emotional well-being
11 Bonanno (29)	Loss, trauma, and human resilience: have we underestimated the human capacity to thrive after extremely aversive events?	Review article	–	–	The author reviews evidence that resilience represents a distinct trajectory from the process of recovery, that resilience in the face of loss or potential trauma is more common than is often believed, and that there are multiple and sometimes unexpected pathways to resilience.
12 Bonanno et al. (12)	Grief processing and deliberate grief avoidance: a prospective comparison of bereaved spouses and parents in the United States and the People's Republic of China	Prospective study design (4 and 18 months of bereavement)	68 US participants 78 PRC participants	13-item Grief Processing Scale 7-item Grief Avoidance Scale SCL-90	Both grief processing and deliberate grief avoidance predicted poor long-term adjustment for U.S. participants.
13 Bonanno et al. (30)	Resilience to loss and potential trauma	Review article	–	–	This review focuses on the heterogeneity of outcomes following aversive events, showing that resilience is not the result of a few dominant factors, but rather that there are multiple independent predictors of resilient outcomes. Typically, the most common outcome following posttraumatic events is a stable trajectory of healthy functioning or resilience.

(Continued)

TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
14 Breitbart et al. (31)	Individual meaning-centered psychotherapy for the treatment of psychological and existential distress: a randomized controlled trial in patients with advanced cancer	Prospective study design	321 patients with advanced cancer	FACT-Sp LAP-R MQOL HADS SAHD	Significant treatment effects (small to medium in magnitude) were observed for individual meaning-centered psychotherapy, relative to standard care, for quality of life, sense of meaning, spiritual well-being, anxiety, and desire for hastened death.
15 Brewin et al. (32)	Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults	Meta-analysis	85 articles	–	Three categories of risk factors emerged: 1) small predictive effect on PTSD: gender, age at trauma, race; 2) moderate predictive effect on PTSD: education, previous trauma, childhood adversity; 3) large predictive effect on PTSD: psychiatric history, reported childhood abuse, and family psychiatric history.
16 Bruscia et al. (33)	Predictive factors in the quality of life of cancer patients	Cross-sectional study design	49 patients with different cancer types	QOLS SOC-13	SOC multiple regressions showed that SOC was a significant predictor of QOL and that the demographic variables were not predictive of QOL, except when combined with SOC.
17 Calhoun et al. (34)	Handbook of posttraumatic growth: research & practice	Book chapter	–	–	Calhoun and Tedeschi bring together the leading theoreticians, researchers, and practitioners in the discipline of posttraumatic growth. The importance of this field is that it already includes a rich history of empirical research demonstrating that posttraumatic growth can be operationalized, assessed, and enhanced.
18 Campbell-Sills and Stein (35)	Psychometric analysis and refinement of the Connor-Davidson Resilience Scale (CD-RISC): validation of a 10-item measure of resilience	Cross-sectional study design	500 individuals	CD-RISC	The 10-item CD-RISC displays excellent psychometric properties with good internal consistency and construct validity and allows for efficient measurement of resilience.
19 Carver (15)	Resilience and thriving: issues, models and linkages	Review article	–	–	Thriving (physical or psychological) may reflect decreased reactivity to subsequent stressors, faster recovery from subsequent stressors, or a consistently higher level of functioning. Psychological thriving may reflect gains in skill, knowledge, confidence, or a sense of security in personal relationships and resembles other instances of growth.
20 Carver and Antoni (36)	Finding benefit in breast cancer during the year after diagnosis predicts better adjustment 5 to 8 years after diagnosis	Cross-sectional study design; follow-up between 4 and 7 years	230 early stages breast cancer patients	CES-D	Controlling for initial distress and depression, initial benefit finding in this sample predicted lower distress and depression at follow-up.

(Continued)

TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
21 Carver et al. (37)	How coping mediates the effect of optimism on distress: a study of women with early stage breast cancer	Prospective study design	59 breast cancer patients	LOT COPE POMS20	Optimism related inversely to distress at each point, even controlling for prior distress. Acceptance, positive reframing, and use of religion were the most common coping reactions; denial and behavioral disengagement were the least common reactions. Acceptance and the use of humor prospectively predicted lower distress; denial and disengagement predicted more distress.
22 Carver et al. (38)	Quality of life among long-term survivors of breast cancer: different types of antecedents predict different classes of outcomes	Prospective study design	163 early stage breast cancer patients	QLACS LOT ISEL	Initial chemotherapy and higher stage predicted greater financial problems and greater worry about appearance at follow-up. Being partnered at diagnosis predicted many psychosocial benefits at follow-up. Hispanic women reported greater distress and social avoidance at follow-up. Initial trait optimism predicted diverse aspects of better psychosocial QOL at follow-up.
23 Chan et al. (20)	The strength-focused and meaning-oriented approach to resilience and transformation (SMART): a body-mind-spirit approach to trauma management	Research article	–	–	The article introduces the Strength-focused and Meaning-oriented Approach to Resilience and Transformation (SMART) as a model of crisis intervention, which aims at discovering inner strengths through meaning reconstruction. Efficacy of the SMART model is assessed with reference to two pilot studies conducted in Hong Kong at the time when the SARS pandemic caused widespread fear and anxiety in the community.
24 Chan et al. (8)	Course and predictors of post-traumatic stress disorder in a cohort of psychologically distressed patients with cancer	Prospective study design	469 patients of various cancer types	HADS SCID-I	The overall rates of PTSD decreased with time, but one-third of patients (34.1%) who were initially diagnosed had persistent or worsening PTSD 4 years later.
25 Cohen et al. (39)	The association of resilience and age in individuals with colorectal cancer: an exploratory cross-sectional study	Cross-sectional study design	92 patients with colorectal cancer	The Wagnild and Young's Resilience Scale BSI-18 Cancer-related problem list	Older age, male gender, and less cancer-related problems were associated with higher resilience and lower emotional distress.
26 Connor (40)	Assessment of resilience in the aftermath of trauma	Review article	–	–	Resilience is a crucial component in determining the way in which individuals react to and deal with stress. A broad range of features is associated with resilience; these features relate to the strengths and positive aspects of an individual's mental state. In patients with posttraumatic stress disorder, resilience can be used as a measure of treatment outcome, with improved resilience increasing the likelihood of a favorable outcome.

(Continued)

TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
27	Cornor et al. (41) Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC)	Prospective study design	Community sample, primary care outpatients, general psychiatric outpatients, clinical trial of generalized anxiety disorder, and two clinical trials of PTSD	CD-RISC	The scale demonstrated good psychometric properties and factor analysis yielded five factors. The scale demonstrates that resilience is modifiable and can improve with treatment, with greater improvement corresponding to higher levels of global improvement.
28	Cordova et al. (42) Post-traumatic stress disorder and cancer	Qualitative review	–		Cancer-related PTSD has been documented in a minority of patients with cancer and their family members, is positively associated with other indices of distress and reduced quality of life, and has several correlates and risk factors (e.g., prior trauma history, preexisting psychiatric conditions, poor social support). Existing literature on cancer-related PTSD has used <i>DSM-IV-TR</i> diagnostic criteria; the revised <i>DSM-5</i> PTSD criteria have important implications for the assessment of cancer-related distress.
29	Cornio et al. (43) Posttraumatic growth and cancer: a study 5 years after treatment end	Cross-sectional study	540 long-term disease free cancer survivors	PTGI MSPSS Zung Self-Rating Depression Scale STAI-Y	The PTGI average total score was higher in more educated LCS, in those employed, in LCS with longer time from diagnosis, and in those with no comorbidities. In this study, PTG was not found correlated with distress, but it correlated with perceived social support, age, education, and employment.
30	Danhauer et al. (18) A longitudinal investigation of posttraumatic growth in adult patients undergoing treatment for acute leukemia	Prospective study design	66 leukemia patients	PTGI POMS-SF MDASI WHIIRS FACT-Sp Cancer-related Rumination Scale Core Beliefs Inventory	Findings suggest that these patients report PTG, and levels of PTG appear to increase over the weeks following leukemia diagnosis and induction chemotherapy. Variables associated with higher total PTG scores over time included greater number of days from baseline, younger age, and greater challenge to core beliefs. Variables associated with high.
31	Davidson et al. (44) Trauma, resilience and salivostasis: effects of treatment in post-traumatic stress disorders	Prospective study design	92 individuals with chronic PTSD	CD-RISC	Changes in resilience following treatment were statistically significant. Items that showed the greatest change related to confidence, control, coping, knowing where to turn for help and adaptability. Treatment of PTSD significantly improved resilience and reduced symptoms in this sample. Further controlled studies are indicated.
32	Davis et al. (45) Making sense of loss and benefiting from the experience: two construals of meaning	Prospective qualitative study design	280 bereaved individuals	Semi-structured interview	Results indicate that making sense of the loss is associated with less distress, but only in the first year postloss, whereas reports of benefit finding are most strongly associated with adjustment at interviews 13 and 18 months postloss.

(Continued)

TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
33 Di Giacomo et al. (46)	Breast cancer and psychological resilience among young women	Prospective study design	82 breast cancer patients	PDI STAXI STAY BDI-II	Results highlight the psychological resilience in young women that have to deal with the breast cancer diagnosis and treatment. Young patient seem more emotional resilient.
34 Diehl and Hay (47)	Personality-related risk and resilience factors in coping with daily stress among adult cancer patients	Prospective study design (diary design + phone interviews)	24 men with prostate cancer; 31 women with breast cancer	SCI PWB CES-D NEO-FFI Rosenberg Self-esteem Scale	The findings from this study show the complex associations between risk and resilience factors and daily emotional well-being in a sample of adults who were affected by a life-threatening illness.
35 Dong et al. (48)	The mediating role of resilience in the relationship between social support and posttraumatic growth among colorectal cancer survivors with permanent intestinal ostomies: a structural equation model analysis	Cross-sectional study design	164 colorectal cancer survivors	PTGI CD-RISC PSSS	Perceived social support ($r = 0.450$) and resilience ($r = 0.545$) were significantly positively correlated with PTG. Structural equation modeling analysis showed that resilience mediated the relationship between perceived social support and PTG in which the indirect effect of perceived social support on PTG through resilience was 0.203 ($P < 0.001$).
36 Duan-Porter et al. (49)	Physical resilience of older cancer survivors: an emerging concept	Prospective study design	65 cancer survivors of different cancer types	BMI Endurance exercise Social support Adverse events	The majority of older cancer survivors exhibited physical resilience; this was associated with high baseline health, physical function, self-efficacy, and social support.
37 Ebright and Lyon (50)	Understanding hope and factors that enhance hope in women with breast cancer	Prospective study design	73 breast cancer patients	Lazarus' Appraisal Components and Themes Scales HHI Rosenberg's Self-Esteem Scale Personal Resource Questionnaire 85-Part 2 Helpfulness of Religious Beliefs Scale	Self-esteem and helpfulness of religious beliefs influence women's appraisals regarding the potential for coping; appraisals and antecedent variables relevant for differentiating hope are beliefs about the potential for coping, self-esteem, and social support.
38 Eicher et al. (51)	Resilience in adult cancer care: an integrative literature overview	Review article	11 articles	–	Resilience is a dynamic process of facing adversity related to a cancer experience. Resilience may be facilitated through nursing interventions.
39 Engel et al. (52)	Resilience in patients and spouses faced with malignant melanoma. A qualitative longitudinal study	Prospective qualitative study design	8 patients with malignant melanoma and their partners	Semistructured interview	There were no significant differences between the responses of patients and their partners. The most significant theme that emerged was manageability of disease, with distraction the most commonly utilized coping skill. The comprehension and meaning themes were far less prevalent. Hence, support should focus on disease and situational manageability.

(Continued)

TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
40 Eriksson and Lindstrom (53)	Antonovsky's sense of coherence scale and the relation with health: a systematic review	A systematic review	458 articles	–	SOC is strongly related to perceived health, especially mental health. This relation is manifested in study populations regardless of age, sex, ethnicity, nationality, and study design. SOC seems to have a main, moderating or mediating role in the explanation of health. Furthermore, the SOC seems to be able to predict health.
41 Erikson and Lindstrom (54)	Validity of Antonovsky's sense of coherence scale: a systematic review	A systematic review	458 articles	–	The SOC scale seems to be a reliable, valid, and crossculturally applicable instrument measuring how people manage stressful situations and stay well.
42 Frazier et al. (55)	Posttraumatic growth: finding meaning through trauma	Book chapter	–	–	The article suggests that those individuals who perceive growth shortly after a stressful life event experience better mental health and fewer posttraumatic symptoms later.
43 Gall et al. (56)	The relationship between religious/spiritual factors and perceived growth following a diagnosis of breast cancer	Prospective study design	93 breast cancer patients	Religious openness and participations Scale God Image Scale RCOPE	Religious involvement at prediagnosis was predictive of less growth at 24 months postsurgery, while a positive image of God had no association with growth.
44 Goldberg et al. (57)	Factors important to psychosocial adjustment to cancer: a review of the evidence	Review article	–	–	This report reviews clinically noted or theoretically derived factors THAT have been tested empirically for relationships with various aspects of psychosocial adjustment. Certain specific cancer sites have been noted to be associated with psychosocial problems. A specific biological basis for psychiatric problems associated with certain diseases has been proposed for multiple myeloma, lung tumors, and pancreatic cancer. A number of chemotherapy agents are now recognized as accounting for presumed psychiatric symptoms
45 Gouzman et al. (16)	Resilience and psychosocial adjustment in digestive system cancer	Cross-sectional study design	200 digestive system patients	Functional status, ECOG CD-RISC PANAS PTGI The Reported Behavior Changes Scale PAIS-SR	Resilience, positive affect and negative affect, and posttraumatic growth were related to adjustment and/or reported behavioral changes, and positive affect, negative affect, and posttraumatic growth mediated some of the effects of resilience on adjustment and/or reported behavioral changes.
46 Goarke et al. (58)	Post-traumatic growth in breast cancer: how and when do distress and stress contribute?	Prospective study design	253 breast cancer patients	Impact of Event Scale Perceived Stress Scale HADS Silver Lining Questionnaire	This study showing that early-stage higher cancer-specific stress and anxiety were related to positive growth supports the idea that struggle with a challenging illness may be instrumental in facilitating PTG, and findings show positive implications of PTG for subsequent adjustment.

(Continued)

TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
47 Gustavsson et al. (59)	Sense of coherence and distress in cancer patients and their partners	Prospective study design	123 cancer couples	OLQ SOC-13 BDI-14 EMAS-State	Strong SOC alleviated the development of distress. In addition, patient SOC tended to strengthen during the follow-up. All patient and partner variables at the 14-month follow-up were related to each other, but not at baseline. This could indicate a gradual crossover process of the shared experience.
48 Gustavsson et al. (60)	Predictors of distress in cancer patients and their partners: the role of optimism in the sense of coherence construct	Prospective study design	147 cancer couples	LOT-R BDI-14 EMAS-State	Optimistic patients and patients with strong SOC, as well as their partners, reported fewer symptoms of depression and anxiety than did less optimistic subjects and subjects with weaker SOC. Optimism partially explained the effect of SOC on distress and SOC seemed to be an independent factor in predicting distress.
49 Hamama-Raz (61)	Does psychological adjustment of melanoma survivors differs between genders?	Cross-sectional study design	300 malignant melanoma survivors (≥5 years)	MHI Adaptation questionnaire Kessler's Cognitive Appraisal of Health Scale Hardiness Scale Multi-Item Measure of Adult Attachment	Women revealed more distress and less secondary cognitive appraisal and were more secure in attachment styles. Men showed higher secondary appraisal and were more dismissing-avoidant in attachment.
50 Helgeson et al. (62)	Psychological and physical adjustment to breast cancer over 4 years: identifying distinct trajectories of change	Cross-sectional study design	287 women of breast cancer	SF-36 15-item Social Support Scale Rosenberg Self-Esteem Scale 14-item Body Image Scale Illness Ambiguity Scale	The majority of women showed slight and steady improvement in functioning with time, but subgroups of women were identified who showed marked improvement and marked deteriorations over time. Age distinguished different trajectories of physical functioning; personal resources (i.e., self-image, optimism, perceived control) and social support distinguished trajectories of mental and physical functioning.
51 Helmreich et al. (63)	Psychological interventions for resilience enhancement in adults	Review article	–	–	This is a protocol for a Cochrane Review (intervention). The objectives are as follows: to assess the effects of resilience-enhancing interventions in clinical and nonclinical populations.
52 Henry et al. (64)	The meaning-making intervention appears to increase meaning in life in advanced ovarian cancer: a randomized controlled pilot study	Prospective-study design	24 cancer patients; 12 controls	MOOL FACT-Sp HADS GSES	Compared to the control group, patients in the experimental group had a better sense of meaning in life at 1 and 3 months postintervention.
53 Hou et al. (65)	Resource loss, resource gain, and psychological resilience and dysfunction following cancer diagnosis: a growth mixture modeling approach	Prospective-study design	234 Chinese colorectal cancer patients	HADS	People in chronic distress were more likely to demonstrate loss in physical functioning and social relational quality but more likely to demonstrate stability/gain in optimistic personalities than those in delayed distress and resilient.

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TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
54 Hu et al. (66)	A meta-analysis of the trait resilience and mental health	Meta-analysis	60 studies included	–	Trait resilience was negatively correlated to negative indicators of mental health and positively correlated to positive indicators of mental health. Age, gender, and adversity moderated the relationship between trait resilience and mental health.
55 Hunter-Hernandez et al. (67)	Missed-opportunity: spirituality as a bridge to resilience in Latinos with cancer	Review article	–	–	For Latinos, spirituality is an important core cultural value. As such, it is crucial to pay close attention to how cultural values play a role in health-related concerns when caring for Latino cancer patients and to how spirituality, being an important aspect of Latino culture, influences how Latinos adjust and cope with cancer.
56 Husson et al. (68)	Posttraumatic growth and well-being among adolescents and young adults with cancer: a longitudinal study	Prospective-study design	169 cancer patients	PTGI PDS SF-36 BSI-18	This study indicates that posttraumatic growth is dynamic and predicts mental well-being outcomes but does not buffer the effects of posttraumatic stress.
57 Hwang et al. (69)	Factors associated with caregivers' resilience in a terminal cancer care setting	Cross-sectional study design	273 family caregivers	CD-RISC ECOG APGAR MOS-SSS CRA HADS	High FCs' resilience was significantly associated with FCs' health status, depression, and social support. Education programs might be effective for improving caregivers' resilience.
58 Jenewein et al. (70)	Quality of life and dyadic adjustment in oral cancer patients and their female partners	Cross-sectional study design	31 cancer patients and their female partners	WHOQOL-BREF HADS DAS EORTC QOL	Quality of life was remarkably high in patients and their partners. In patients, lower QoL was associated with more physical complaints and higher levels of psychological distress (HADS), whereas in wives, QoL was found to be related to marital quality (DAS) and levels of distress.
59 Joseph et al. (71)	Assessing positive and negative changes in the aftermath of adversity: psychometric evaluation of the changes in outlook questionnaire (CIOQ)	Review article	–	CIOQ	The CIOQ has much promise for research on responses to stressful and traumatic events.
60 Kaisch et al. (72)	A conceptual framework for the neurobiological study of resilience	Review article	–	–	The theory emphasizes the causal role of stimulus appraisal (evaluation) processes in the generation of emotional responses, including responses to potential stressors. On this basis, it posits that a positive (nonnegative) appraisal style is the key mechanism that protects against the detrimental effects of stress.
61 Kernan et al. (73)	Searching for and making meaning after breast cancer: prevalence, patterns, and negative affect	Prospective study design	72 breast cancer patients	PANAS 2 meaning questions	The analyses reveal that (a) there is great variability in the prevalence and pattern of searching for meaning in the aftermath of breast cancer and (b) searching for meaning may be both futile and distressing.

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TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
62 Kobasa (74)	Stressful life events, personality, and health: an inquiry into hardness	Prospective study design	161 individuals	Holmes and Rahe Schedule of Recent Life Events Wyer, Masuda, and Holmes Seriousness of Illness Survey	High stress/low illness executives show, by comparison with high stress/high illness executives, more hardness, that is, have a stronger commitment to self, an attitude of vigorousness toward the environment, a sense of meaningfulness, and an internal locus of control.
63 Kraemer et al. (75)	A longitudinal examination of couples' coping strategies as predictors of adjustment to breast cancer	Prospective study design	139 couples	COPE Emotional Approach Coping scales SF-36 Vitality subscale CES-D IES-R PTGI	Women's use of approach-oriented coping strategies predicted improvement in their vitality and depressive symptoms, men's use of avoidant coping predicted declining marital satisfaction for wives, and men's approach-oriented strategies predicted an increase in women's perception of cancer-related benefits. Patients' and partners' coping strategies also interacted to predict adjustment, such that congruent coping strategy use generally predicted better adaptation than did dissimilar coping.
64 Lam et al. (76)	Trajectories of psychological distress among Chinese women diagnosed with breast cancer	Prospective study design	285 early stage breast cancer patients	CHQ-12 TDM Breast Cancer Decision Making Questionnaire CLOT-R	Psychologically resilient women had less physical symptom distress at early postsurgery compared with women with other distress patterns. Compared with the resilient group, women in the recovered or chronic distress groups experienced greater TDM difficulties, whereas women in the delayed-recovery group reported greater dissatisfaction with the initial medical consultation. Women in the chronic distress group reported greater pessimistic outlook.
65 Lam et al. (77)	Distress trajectories at the first year diagnosis of breast cancer in relation to 6 years survivorship	Prospective study design	285 early-stage breast cancer	HADS Impact of Events Scale Chinese Social Adjustment Scale	Women who experienced chronic distress had significantly greater longer-term psychological distress, cancer-related distress, and poorer social adjustment in comparison to women in the resilient group.
66 Lechner et al. (78)	Curvilinear associations between benefit finding and psychosocial adjustment to breast cancer	Prospective study design	Two cohorts of 230 and 136 nonmetastatic breast cancer patient	CES-D Sickness Impact Profile	Compared with the intermediate benefit finding (BF) group, low and high BF groups had better psychosocial adjustment. Further analyses indicated that the high BF group reported higher optimism and more use of positive reframing and religious coping than the other BF groups.
67 Lechner et al. (79)	Do sociodemographic and disease-related variables influence benefit-finding in cancer patients?	Cross-sectional study design	83 cancer patients	PTGI-R The Perceived Threat Questionnaire NEO-FFI	Individuals with stage II disease had significantly higher BF scores than those with stage IV or stage I cancer. Time since diagnosis and treatment status (i.e., currently in treatment, completed treatment, or no treatment) were not related to BF.

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TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
68 Lee (80)	The existential plight of cancer: meaning making as a concrete approach to the intangible search for meaning	Review article	–	–	Mounting evidence suggests that global meaning—defined as the general sense that one's life has order and purpose—is a key determinant of overall quality of life. It provides the motivation for people with cancer to reengage in life amongst a bewildering array of physical, psychosocial, social, spiritual, and existential changes imposed by the disease.
69 Lee et al. (81)	Meaning-making intervention during breast or colorectal cancer treatment improves self-esteem, optimism, and self-efficacy	Prospective study design	74 breast or colorectal cancer patients	Rosenberg Self Esteem Scale LOT-R GSES	The experimental group participants demonstrated significantly higher levels of self-esteem, optimism, and self-efficacy compared to the control group.
70 Leloirain et al. (19)	Long-term posttraumatic growth after breast cancer: prevalence, predictors and relationships with psychological health	Cross-sectional study design	307 disease-free breast cancer patients	PTGI SF-36 The Brief Coping PANAS	Demographic and medical variables are poor predictors of posttraumatic growth. On the contrary, dispositional positive affectivity and adaptive coping of positive, active, relational, religious, and to some extent denial coping have a strong effect on posttraumatic growth.
71 Li et al. (82)	Effects of social support, hope and resilience on quality of life among Chinese bladder cancer patients: a cross-sectional study	Cross-sectional study design	365 bladder cancer patients	FACT-BL, Perceived Social Support Scale Adult Hope Scale Resilience Scale-14	Social support, hope, and resilience as a whole accounted for 30.3% variance of quality of life.
72 Lin et al. (10)	Risk factors of post-traumatic stress symptoms in patients with cancer	Cross-sectional study design	347 cancer patients	Davidson Trauma Scale	The top four scores on Chinese version of Davidson Trauma Scale were painful memories, insomnia, shortened lifespan, and flashbacks. The risk factors of posttraumatic stress symptoms were suicidal intention (OR = 2.29, 95% CI = 1.86-2.82), chemotherapy (OR = 2.13, 1.18-3.84), metastasis (OR = 2.07, 1.29-3.34), cancer-specific symptoms (OR = 1.21, 1.15-1.27), and high education (OR = 1.75, 1.10-2.78).
73 Lindblad et al. (83)	Sense of coherence is a predictor of survival: a prospective study in women treated for breast cancer	Prospective study design	487 breast cancer patients	SOC-13	This study provides evidence of SOC's predictive value for disease progression and BC-caused and all-cause mortality.
74 Linden et al. (2)	Anxiety and depression after cancer diagnosis: prevalence rates by cancer types, gender, and age	Cross-sectional study design	154 cancer patients	Psychosocial Screen for Cancer Questionnaire	Patients with lung, gynecological, or hematological cancer reported the highest levels of distress at the time point of cancer diagnosis. As expected, women showed higher rates of anxiety and depression, and for some cancer types, the prevalence was two to three times higher than that seen for men. Patients younger than 50 and women across all cancer types revealed either subclinical or clinical levels of anxiety in over 50% of cases.
75 Lindstrom and Erikson (84)	Salutogenesis	Review article	–	–	The aim of this paper is to explain and clarify the key concepts of the salutogenic theory sense of coherence coined by Aaron Antonovsky.

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TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
Linley and Joseph (85)	Positive change following trauma and adversity: a review	Review article	39 empirical studies	–	The review indicated that cognitive appraisal variables (threat, harm, and controllability), problem-focused, acceptance and positive reinterpretation coping, optimism, religion, cognitive processing, and positive affect were consistently associated with adversarial growth. Inconsistent associations were found between adversarial growth, sociodemographic variables and psychological distress variables.
Lipsman et al. (86)	The attitudes of brain cancer patients and their caregivers toward death and dying: a qualitative study	Cross-sectional qualitative study design	29 brain cancer patients; 22 partners	–	Participants found that their experiences, however difficult, led to the discovery of inner strength and resilience. Responses were usually framed within an interpersonal context, and participants were generally grateful for the opportunity to speak about their experiences.
Llewellyn et al. (87)	Assessing the psychological predictors of benefit finding in patients with head and neck cancer	Prospective study design	102 newly diagnosed head and neck cancer patients	HADS LOT-R COPE SF-12 EORTC-QLQ	Anxiety, depression, and quality of life were not related to benefit finding. Regression models of benefit finding total score and three new factor analyzed benefit finding scales indicated that use of emotional support and active coping strategies was predictive of finding more positive consequences. Optimism, living with a partner, and higher educational attainment were also found to have a protective effect on benefit finding.
Lo et al. (88)	Managing cancer and living meaningfully (CALM): phase 2 trial of a brief individuals psychotherapy for patients with advanced cancer	Prospective study design	50 patients with advanced metastatic cancer	PHQ-9 FACT-12 DADDS ECR-M16 PTGI	Analyses revealed reductions over time in depressive symptoms and death anxiety and an increase in spiritual well-being.
Lo et al. (5)	Measuring death-related anxiety in advanced cancer: preliminary psychometrics of the Death and Dying Distress Scale	Cross-sectional study design	33 patients with advanced metastatic cancer	DADDS	This distress was relatively common, with 45% of the sample scoring in the upper reaches of the scale, suggesting that the DADDS may be a relevant outcome for palliative intervention.
Loprinzi et al. (89)	Stress Management and Resilience Training (SMART) program to decrease stress and enhance resilience among breast cancer survivors: a pilot randomized clinical trial	Prospective study design	20 breast cancer patients	CD-RISC Perceived Stress Scale, Smith Anxiety Scale, and Linear Analog Self-Assessment Scale	A statistically significant improvement in resilience, perceived stress, anxiety, and overall quality of life at 12 weeks, compared with baseline, was observed in the study arm.
MacLeod et al. (90)	The impact of resilience among older adults	Review article	55 articles	–	Research studies have identified the common mental, social, and physical characteristics associated with resilience. High resilience has also been significantly associated with positive outcomes, including successful aging, lower depression, and longevity. Interventions to enhance resilience within this population are warranted, but little evidence of success exists.

(Continued)

TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
83 Maercker and Zoellner (91)	The Janus Face of Self-Perceived Growth: toward a two-component model of posttraumatic growth	Review article	–	–	In the article, a two-component model of posttraumatic growth is presented to better understand the fascinating phenomenon of posttraumatic growth.
84 Mancini and Bonanno (92)	Predictors and parameters of resilience to loss: toward an individual differences model	Review article	–	–	In this paper, we provide an operational definition of resilience as a specific trajectory of psychological outcome and describe how the resilient trajectory differs from other trajectories of response to loss.
85 Manne et al. (93)	Posttraumatic growth after breast cancer: patient, partner, and couple perspectives	Prospective study design	162 breast cancer patients and their partners	PTGI Impact of Events Scale COPE Emotional Processing Scale DAS	Posttraumatic growth increased for both partners during this period. Patient posttraumatic growth was predicted by younger age, contemplating reasons for cancer, and more emotional expression at time 1. Partner posttraumatic growth was predicted by younger age, more intrusive thoughts, and greater use of positive reappraisal and emotional processing at time 1.
86 Manne et al. (94)	Resilience, positive coping, and quality of life among women newly diagnosed with gynecological cancers	Cross-sectional study design	281 gynecological cancer patients	Block and Block's scale Emotional Expressiveness Questionnaire COPE FACT-G FACT-G	The findings suggested that resilient women may report higher quality of life during gynecological cancer diagnosis because they are more likely to express positive emotions, reframe the experience positively, and cultivate a sense of peace and meaning in their lives.
87 Markovitz et al. (95)	Resilience as a predictor for emotional response to the diagnosis and surgery in breast cancer patients	Cross-sectional study design	253 breast cancer patients, 211 healthy controls	PTGI HADS PANAS 2 happiness items	Higher levels of resilience were related to better emotional adjustment both in women with breast cancer and in control women, but this association was stronger within the sample of cancer patients.
88 Marosi and Köller (96)	Challenge of cancer in the elderly	Review article	–	–	The incidence of cancer is elevated 11-fold after the age of 65 years. Older adults present not only with the physiological decreases of organ functions related to age but also with an individual burden of comorbidities, other impairments, and social factors that might impact on their potential for undergoing cancer care.
89 Matzka et al. (97)	Relationship between resilience, psychological distress and physical activity in cancer patients. A cross-sectional observational study	Cross-sectional study design	343 cancer patients	CD-RISC MSPSS Rotterdam Symptom Checklist	Resilience was negatively associated with psychological distress and positively associated with activity level. The relationship between resilience and psychological distress was moderated by age but not social support.
90 Miller et al. (98)	Psychological distress and well-being advanced cancer: the effects of optimism and coping	Prospective study design	75 advanced cancer patients	LOT-R Ways of Coping Questionnaire MHI CARES	Optimism and coping were associated with psychological adjustment, even after controlling for functional status and prior adjustment. Optimism was strongly and positively associated with well-being and inversely related to distress.

(Continued)

TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
91 Mizuno et al. (99)	Adaptation status and related factors at two time points after surgery in patients with gastrointestinal tract cancer	Prospective study design	25 cancer patients	SOC-13 WHOQOL-26	Adaptation status 6 months (quality of life, sense of coherence, and illness related demands) after surgery improved compared with after discharge.
92 Moadel et al. (100)	Seeking meaning and hope: self-reported spiritual and existential needs among an ethnically-diverse cancer patient population	Cross-sectional study design	248 cancer patients	Self-developed needs assessment survey	Patients (n = 71) reporting five or more spiritual/existential needs were more likely to be of Hispanic (61%) or African-American (41%) ethnicity (vs. 25% White), more recently diagnosed, and unmarried (49%) compared with those (n = 123) reporting two or fewer needs. Treatment status, cancer site, education, gender, age, and religion were not associated with level of needs endorsement.
93 Molina et al. (7)	Resilience among patients across the cancer continuum: diverse perspectives	Review article	–	–	For all phases of the cancer continuum, resilience descriptions included preexisting or baseline characteristics, such as demographics and personal attributes (e.g., optimism, social support); mechanisms of adaptation, such as coping and medical experiences (e.g., positive provider communication); and psychosocial outcomes, such as growth and quality of life.
94 Mols et al. (101)	Well-being, posttraumatic growth and benefit finding in long-term breast cancer survivors	Cross-sectional study design	183 breast cancer survivors	PTGI Perceived Disease Impact Scale Center for Health monitor	Benefit finding showed a moderately positive correlation with posttraumatic growth. In addition, women who stated that their satisfaction with life was high reported higher levels of posttraumatic growth in comparison to women who did not. Women with a higher tumor stage at diagnosis experienced less benefit finding in comparison to women with a lower tumor stage at diagnosis.
95 Morris and Shakespear-Finch (102)	Rumination, post-traumatic growth, and distress: structural equation modeling with cancer survivors	Prospective study design	313 cancer patients	PTGI IES-R COPE	Trauma severity was directly related to distress, but not to PTG. Deliberately ruminating on benefits and social support was directly related to PTG. Life purpose rumination and intrusive rumination were associated with distress.
96 Mullen (103)	Sense of coherence as a mediator of stress for cancer patients and spouse	Prospective study design	42 cancer patients, 32 spouses	SOC-13 SCL-K-9 FACT-Sp	Sense of coherence (SOC) was the only significant direct predictor of psychological stress. However, spiritual resources and family strengths had significant indirect paths through SOC as the mediator.
97 Mulligan et al. (104)	Cancer as a criterion A traumatic stressor for veterans: prevalence and correlates	Cross-sectional study design	170 male patients	PC-PTSD	Approximately half—42.9% to 65.9%, depending on cut-score used—perceived cancer to be a traumatic stressor involving actual/threatened death or injury or threat to physical integrity as well as fear, helplessness, or horror.

(Continued)

TABLE 1 | Continued

	Author, date	Title	Study design	Sample size	Outcome measures	Outcome
98	Nuray and Aslı (105)	Variables related to stress – related growth among Turkish breast cancer patients	Cross-sectional study design	90 breast cancer patients	MSPSS WCI BDI SRGS	Social support and problem-solving coping strategies related to higher levels of stress-related growth.
99	Pai et al. (14)	Posttraumatic stress disorder in the DSM-5: controversy, change, and conceptual considerations	Review article	–	–	Changes to the diagnostic criteria from the DSM-IV to DSM-5 include the relocation of PTSD from the anxiety disorders category to a new diagnostic category named “Trauma and Stressor-Related Disorders,” the elimination of the subjective component to the definition of trauma, the explication and tightening of the definitions of trauma and exposure to it, the increase and rearrangement of the symptoms criteria, and changes in additional criteria and specifiers.
100	Paika et al. (106)	Personality variables are associated with colorectal cancer patients’ quality of life independent of psychological distress and disease severity	Cross-sectional study design	162 colorectal cancer patients	SCL-90-R SOC-29 Life Style Index Hostility and Direction of Hostility Questionnaire	In colorectal cancer patients, psychological distress and personality variables are associated with HRQOL independent of disease parameters.
101	Pan et al. (107)	Resilience and coping strategies influencing the quality of life in patients with brain tumor	Cross-sectional study design	95 brain tumor patients	EORTC QLQ-BN20 Resilience Scale Ways of Coping Checklist-Revised	Resilience accounted for 4.8% and the emotion-focused coping accounted for 10.20% of the variance in separately predicting the future uncertainty QOL.
102	Park (108)	Making sense of the meaning literature: an integrative review of meaning making and its effects on adjustment to stressful life events	Review article	–	–	Drawing on current theories, the author first presents an integrated model of meaning making. This model distinguishes between the two constructs “meaning-making efforts” and “meaning made.” Using this model, the author reviews the empirical research regarding meaning in the context of adjustment to stressful events.
103	Park et al. (109)	Assessment and prediction of stress-related growth	Review article	–	–	This article reports the development of the Stress-Related Growth Scale (SRGS). Significant predictors of the SRGS were (a) intrinsic religiousness, (b) social support satisfaction, (c) stressfulness of the negative event, (d) positive reinterpretation and acceptance coping, and (e) number of recent positive life events. The SRGS was also positively related to residual change in optimism, positive affectivity, number of socially supportive others, and social support satisfaction.
104	Park et al. (110)	Meaning-making and psychological adjustment following cancer: the mediating roles of growth, life meaning, and restored just-world beliefs	Prospective study design	172 cancer patients	Perceived Benefit Scale Medical Outcome Survey-Short Form	Cross-sectional and longitudinal path models of the meaning making process indicate that meaning making efforts are related to better adjustment through the successful creation of adaptive meanings made from the cancer experience.

(Continued)

TABLE 1 | Continued

	Author, date	Title	Study design	Sample size	Outcome measures	Outcome
105	Park and Folkman (111)	Meaning in the context of stress and coping	Review article	–	–	The authors present a framework for understanding diverse conceptual and operational definitions of meaning by distinguishing two levels of meaning, <i>global meaning</i> and <i>situational meaning</i> . The importance of meaning in the coping process and critical role of reappraisal is highlighted.
106	Petersen et al. (112)	Relationship of optimism-pessimism and health-related quality of life in breast cancer survivors	Retrospective study design	268 breast cancer patients	MMPI SF-36	Patients with a pessimistic explanatory style were significantly lower on all of the health-related QOL scores, compared to those with a nonpessimistic style.
107	Popa-Velea et al. (113)	Resilience and active coping style: effects on the self-reported quality of life in cancer patients	Cross-sectional study design	178 cancer patients	COPE RS-14 Rotterdam Symptom Checklist	Resilience correlated significantly with all quality of life components (global, physical distress, psychological distress, activity level), whereas active coping did it only indirectly, <i>via</i> resilience. Among other variables, occupational status and time from diagnosis correlated inversely to two of quality of life components, and TNM stage to all.
108	Post-White et al. (114)	Hope, spirituality, sense of coherence, and quality of life in patients with cancer	Systematic review	26 research article	–	Four major themes emerged: (a) exploring the level of hope in patients with cancer, (b) discovering how patients cope with a cancer diagnosis, (c) identifying strategies that patients with cancer commonly use to maintain hope, and (d) identifying nursing interventions used to assist patients with cancer in maintaining and fostering hope.
109	Rajandram et al. (115)	Interaction of hope and optimism with anxiety and depression in a specific group of cancer survivors: a preliminary study	Cross-sectional study design	50 cancer survivors	HADS Hope scale LOT-R	Hope was negatively correlated with depression and anxiety. Regression analyses identified that both hope and optimism were significant predictors of depression.
110	Richardson (116)	The metatheory of resilience and resiliency	Review article	–	–	Resiliency and resilience theory is presented as three waves of resiliency inquiry. Practical paradigms of resiliency that empower client control and choice are suggested
111	Rodin et al. (4)	Pathways to distress: the multiple determinants of depression, hopelessness, and the desire for hastened death in metastatic cancer patients	Prospective study design	406 patients with metastatic gastrointestinal or lung cancer	SOMC Rosenberg Self-Esteem Scale EOR FACT-SP-12 MSAS BPI Karnofsky Performance Status BHS BDI-II Schedule of Attitude Toward Hastened Death	High disease burden, insecure attachment, low self-esteem, and younger age were risk factors for depression. Low spiritual well-being was a risk factor for hopelessness. Both depression and hopelessness independently predicted the desire for hastened death and mediated the effects of psychosocial and disease-related variables on this outcome.

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TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
112 Roen et al. (117)	Resilience for family carers of advanced cancer patients. How can health care providers contribute?	Cross-sectional qualitative study design	14 carers of advanced cancer patients	–	Four main resilience factors were identified: (1) being seen and known by health care providers—a personal relation; (2) availability of palliative care; (3) information and communication about illness, prognosis, and death; and (4) facilitating a good carer–patient relation.
113 Rosenberg et al. (118)	Resilience, health, and quality of life among long-term survivors of hematopoietic cell transplantation	Cross-sectional study design	4643 adult survivors of hematopoietic cell transplantation	CD-RISC PTGI Cancer and Treatment Disease Measure SF-12	Lower patient-reported resilience was associated with chronic graft-versus-host disease of higher severity, lower performance scores, missing work because of health, and permanent disability.
114 Ruf et al. (119)	Positive personal changes in the aftermath of head and neck cancer diagnosis: a qualitative study in patients and their spouses	Cross-sectional qualitative study design	25 cancer patients and their partners	–	Qualitative content analysis revealed three different categories of growth: attitudes toward life, personal strength, and relationships. Partners reported significantly more positive changes in relationships, especially, within the partnership.
115 Ruini et al. (17)	Post-traumatic growth in breast cancer survivors: new insights into its relationships with well-being and distress	Cross-sectional study design	60 breast cancer patients; 60 healthy women	PTGI PWS Symptom Questionnaire Psychosocial Index	Breast cancer patients reported significantly higher levels of PTGI and distress and lower levels of PWB compared to healthy women. Breast cancer patients with high levels of PTGI showed increased levels of physical well-being and decreased distress.
116 Saboonchi et al. (3)	Changes in caseness of anxiety and depression in breast cancer patients during the first year following surgery: patterns of transiency and severity of the distress response	Prospective study design	715 breast cancer patients	HADS	The average decrease in caseness of anxiety and depression a year following surgery lends support to the view of distress as a transient non-pathological response. A subgroup of patients, however, displayed enduring or recurrent severe distress indicating the presence of potential disorder.
117 Saleh and Brockopp (120)	Hope among patients with cancer hospitalized for bone marrow transplantation: a phenomenologic study	Cross-sectional qualitative study design	Nine patients hospitalized for bone marrow transplantation	–	The findings showed that participants used six strategies to foster their hope during preparation for BMT: feeling connected with God, affirming relationships, staying positive, anticipating survival, living in the present, and fostering ongoing accomplishment. Religious practices and family members were the most frequently identified sources of hope.
118 Scali et al. (121)	Measuring resilience in adult women using the 10-items Connor-Davidson Resilience Scale (CD-RISC). Role of trauma exposure and anxiety disorders	Cross-sectional study design	122 breast cancer patients; 116 healthy women	CD-RISC Mini International Neuropsychiatric Interview Watson's Post-Traumatic Stress Disorder Inventory	Self-evaluation of resilience is influenced by both current anxiety disorder and trauma history. The independent positive association between resilience and trauma exposure may indicate a “vaccination” effect.

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TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
119 Schaefer and Moos (122)	Life crisis and personal growth. In: <i>Personal coping. Theory, research and application</i>	Review article	–	–	The article provides a better understanding of the positive consequences that can follow a life crisis and present a way to categorize health crisis and their consequences (divorce, physical illness, and bereavement), considering the environmental and personal determinants of positive outcomes and suggest ideas for research on the growth-promoting aspects of life crises.
120 Schofield et al. (123)	Hope, optimism and survival in a randomized trial of chemotherapy for metastatic colorectal cancer	Cross-sectional study design	429 patients with metastatic colorectal cancer	LOT-R State Hope Scale HADS EQ-5D	Depression and health utility, but not optimism, hope, or anxiety, were associated with survival after controlling for known prognostic factors in patients with advanced colorectal cancer.
121 Schumacher et al. (124)	Resilience in patients after allogeneic stem cell transplantation	Cross-sectional study design	75 patients after allogeneic stem cell transplantation	Resilience-Scale 25 HADS General Self-efficacy Scale EORTC QLQ-C30	Resilience is positively correlated with quality of life and social functioning, negatively with anxiety and depression. Dividing the sample at the median resilience score of 144 reveals that high-resilience patients report less anxiety and depression; higher physical, emotional, and social functioning; and a better quality of life than low-resilience patients.
122 Sears et al. (125)	The yellow brick road and the emerald city: benefit finding, positive reappraisal coping and posttraumatic growth in women with early-stage breast cancer	Prospective study design	60 early stage breast cancer patients	PTGI HADS	Positive reappraisal coping at study entry predicted positive mood and perceived health at 3 and 12 months and posttraumatic growth at 12 months, whereas benefit finding did not predict any outcome. Findings suggest that benefit finding, positive reappraisal coping, and posttraumatic growth are related, but distinct, constructs.
123 Siglen et al. (126)	The influence of cancer-related distress and sense of coherence on anxiety and depression in patients with hereditary cancer: a study of patients' sense of coherence 6 months after genetic counseling	Cross-sectional study design	96 patients referred to genetic counseling	SOC-29 HADS Impact of Event Scale	Sense of coherence is significantly associated with both anxiety and depression. The hypothesis of Sense of Coherence buffering cancer-related distress and the possible impact of these findings for genetic counseling are discussed.
124 Silver et al. (127)	Searching for meaning in misfortune: making sense of incest	Review article	–	–	Article evaluates a study of 77 women who were victimized as children. The author tries to understand the following: (1) How important is the search of meaning after a crisis? (2) Are victims able to make sense of their aversive life experiences over time? (3) Does finding meaning in one's victimization facilitate long-term adjustment to the event? (4) What are the implications of an inability to find meaning in life's misfortunes?

(Continued)

TABLE 1 | Continued

	Author, date	Title	Study design	Sample size	Outcome measures	Outcome
125	Solano et al. (128)	Resilience and hope during advanced disease: a pilot study with metastatic colorectal cancer patients	Cross-sectional study design	44 metastatic colorectal cancer patients	CD-RISC HHI Barthel Index	Depressive patients had lower resilience and hope, and higher scores of suffering. The association between resilience and hope kept stable after adjusting for age, gender, and presence of depression.
126	Somasundaram and Devamani (129)	Comparative study on resilience, perceived social support and hopelessness among cancer patients treated with curative and palliative care	Cross-sectional study design	66 cancer patients	Bharathiar University Resilience Scale Multidimensional Scale of Perceived Social Support Beck Hopelessness Scale	Resilience was significantly associated with less hopelessness and higher levels of perceived social support.
127	Strang and Strang (130)	Spiritual thoughts, coping and sense of coherence in brain tumor patients and their spouse	Cross-sectional qualitative study design	20 brain tumor patients; 16 spouses	–	Meaningfulness was central for quality of life and was created by close relations and faith, as well as by work. A crucial factor was whether the person had a “fighting spirit” that motivated him or her to go on. Sense of coherence integrates essential parts of the stress/coping model (comprehensibility, manageability) and of spirituality (meaning).
128	Strauss et al. (131)	The influence of resilience on fatigue in cancer patients undergoing radiation therapy	Prospective study design	108 cancer patients undergoing RT	Resilience Scale MFI SF-12	Fatigue was best predicted by the patients’ initial resilience scores. But resilience could not be determined as a predictor of changes in fatigue during RT.
129	Surtees et al. (132)	Sense of coherence and mortality in men and women in the EPIC-Norfolk United Kingdom prospective cohort study	Prospective study design	20’579 participants	SOC-13	A strong sense of coherence was associated with a 30% reduction in mortality from all causes, cardiovascular, and cancer, independent of age, sex, and prevalent chronic disease. The association for all-cause mortality remained after adjustment for cigarette smoking history, social class, body mass index, systolic blood pressure, cholesterol, hostility, and neuroticism. Results suggest that a strong sense of coherence may confer some resilience to the risk of chronic disease.
130	Swartzman et al. (11)	Posttraumatic stress disorder after cancer diagnosis in adults: a meta-analysis	Meta-analysis	11 research articles	–	PTSD, diagnosed according to DSM-IV criteria, is more common in survivors of cancer than it is in the general population.
131	Tagay et al. (133)	Protective factors for anxiety and depression in thyroid cancer patients	Cross-sectional study design	230 thyroid cancer patients	HADS SOC-13 F-SOZU	Our results support the thesis that low social support and low sense of coherence enhance vulnerability to depressive and anxiety symptoms.
132	Tang et al. (134)	Trajectory and determinants of the quality of life of family caregivers of terminally ill cancer patients in Taiwan	Prospective study design	167 family care givers	QQOLC	Taiwanese family care givers’ QOL deteriorated significantly as the patient’s death approached.

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TABLE 1 | Continued

Author, date	Title	Study design	Sample size	Outcome measures	Outcome
133 Taylor (135)	Adjustment to threatening events: a theory of cognitive adaptation	Review article	–	–	Proposes a theory of cognitive adaptation to threatening events. It is argued that the adjustment process centers around three themes: A search for meaning in the experience, an attempt to regain mastery over the event in particular and over life more generally, and an effort to restore self-esteem through self-enhancing evaluations.
134 Tedeschi and Calhoun (136)	Posttraumatic growth inventory: measuring the positive legacy of trauma	Validity and reliability study	–	–	The scale appears to have utility in determining how successful individuals, coping with the aftermath of trauma, are in reconstructing or strengthening their perceptions of self, others, and the meaning of events.
135 Tedeschi and Calhoun (137)	Posttraumatic growth: conceptual foundations and empirical evidence	Review article	–	–	The authors propose a model for understanding the process of posttraumatic growth in which individual characteristics, support and disclosure, and more recently, significant cognitive processing play an important role.
136 Tedeschi and Calhoun (6)	Trauma and transformation: growing in the aftermath of suffering	Book chapter	–	–	The authors use a cognitive framework to explore this finding, focusing upon changes in belief systems reported by trauma survivors. Tedeschi and Calhoun weave together literature from fields as diverse as philosophy, religion, and psychology and incorporate major research findings into the effect of trauma
137 Thornton and Perez (138)	Posttraumatic growth in prostate cancer survivors and their partners	Prospective study design	82 prostate cancer survivors; 67 partners	PTGI COPE PANAS IES SF-36	Higher levels of presurgery negative affect and coping by using positive reframing and emotional support were associated with higher levels of PTG 1 year following surgery. For partners, PTG 1 year after the patient's surgery was higher in partners who were partnered to employed patients, were less educated, endorsed higher cancer-specific avoidance symptoms of stress at presurgery, and used positive reframing coping. Quality of life was largely unrelated to PTG in survivors or partners.
138 Tomich and Helgeson (139)	Five years later: a cross-sectional comparison of breast cancer survivors with healthy women	Cross-sectional study design	174 breast cancer survivors; 328 healthy controls	World Assumption Scale FACT-SP SF-36 PANAS Four self-developed questions for assessing meaning in life	Survivors generally perceive the world as less controllable and more random compared to healthy women. Survivors also indicated that they derived some benefits from their experience with cancer, but these benefits had only a modest impact on quality of life. A continued search for meaning in life had a negative impact on quality of life. The strongest and most consistent correlate of quality of life for both survivors and healthy women was having a sense of purpose in life.

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TABLE 1 | Continued

	Author, date	Title	Study design	Sample size	Outcome measures	Outcome
139	Tugade et al. (140)	Psychological resilience and positive emotional granularity: examining the benefits of positive emotions on coping and health	Review article	Individual differences in psychological resilience are examined in two studies	–	Positive emotions can be an important factor that buffers individuals against maladaptive health outcomes. Finding ways to cultivate meaningful positive emotions is a critical necessity for optimal physical and psychological functioning.
140	Turner et al. (141)	Posttraumatic growth, coping strategies, and psychological distress in adolescent survivors of cancer	Cross-sectional study design	31 adolescent cancer survivors	PTGI COPE	Younger age at diagnosis and less use of avoidant coping strategies predicted lower levels of psychological distress. Adolescent cancer survivors who believe they are more prone to relapse and use more acceptance coping strategies are likely to have higher levels of posttraumatic growth.
141	Tzuh and Li (142)	The important role of sense of coherence in relation to depressive symptoms for Taiwanese family caregivers of cancer patients at the end of life	Cross-sectional study design	253 Taiwanese family caregivers of terminally ill cancer patients	CES-D SOC-13	Family caregivers scored high on the CES-D [mean (SD) = 22.24 (11.36)]
142	Vartak (143)	The role of hope and social support on resilience in cancer patients	Cross-sectional study design	115 cancer patients	Herth Hope Scale The Brief Resilience Scale Perceived social support scale	Hope and social support have a positive statistically significant impact on the resilience of cancer patients.
143	Wallston et al. (1447)	Social support and physical health	Review article	–	–	Article reviews the literature on social support and physical health, focusing on studies of illness onset; stress; utilization of health services; adherence to medical regimens; and recovery, rehabilitation, and adaptation to illness among human adults.
144	Walsh et al. (145)	A model to predict psychological- and health-related adjustment in men with prostate cancer: the role of post traumatic growth, physical post traumatic growth, resilience and mindfulness	Cross-sectional study design	241 prostate cancer patients	Physical-PTGI PTGI	P-PTGI predicted lower distress and improvement of quality of life, whereas conversely, the traditional PTG measure was linked with poor adjustment.
145	Weiss (146)	Correlates of posttraumatic growth in husbands of breast cancer survivors	Cross-sectional study design	72 husbands of breast cancer patients	PTGI SSQ Quality of relationship inventory	Significant predictors of husbands' posttraumatic growth were depth of marital commitment, wife's posttraumatic growth, and breast cancer meeting <i>DSM-IV</i> traumatic stressor criteria.
146	Wenzel et al. (147)	Resilience, reflection, and residual stress in ovarian cancer survivorship: a gynecologic oncology group study	Cross-sectional study design	49 ovarian cancer patients	QOL-CS SF-36 FACT-GOG/NTX	Disease-free early-stage sample enjoys a good QOL, with physical, emotional, and social well-being comparable to other survivors and same-aged noncancer cohorts. However, 20% of survivors indicated the presence of long-term treatment side effects, with a subset reporting problems related to abdominal and gynecologic symptoms, and neurotoxicity.

(Continued)

TABLE 1 | Continued

	Author, date	Title	Study design	Sample size	Outcome measures	Outcome
147	Westphal et al. (148)	Posttraumatic growth and resilience to trauma: different sides of the same coin or different coins?	Review article	–	–	This article attempts to place PTG within a broader framework of individual differences in response to potential trauma. The authors argue that many, if not most, people are resilient in the face of trauma and that resilient outcomes typically provide little need or opportunity for PTG.
148	Wortman and Silver (149)	The myths of coping with loss revisited. In: <i>Handbook of bereavement research: Consequences, coping, and care</i>	Book chapter	–	–	In this chapter, the authors reviewed numerous studies that provide support for the assumption that most individuals can and do cope with loss and grief, without professional intervention. The article tries to address the question why some individuals show little distress shortly after their loss and also fail to show delayed grief reaction.
149	Wu et al. (9)	Prevalence of posttraumatic stress disorder among breast cancer patients: a meta-analysis	Meta-analysis	34 articles included	–	About 9.6% of the breast cancer patients would develop the PTSD symptoms. Those who were younger, non-Caucasian, and recently completed treatment would be at a greater risk of developing PTSD.
150	Ye et al. (150)	Predicting changes in quality of life and emotional distress in Chinese patients with lung, gastric, and colon-rectal cancer diagnosis: the role of psychological resilience	Cross-sectional study design	276 cancer patients	Quality of Life Questionnaire Core 30 items Zung Self-Rating Anxiety Scale The Zung Self-Rating Depression Scale	The present study suggests that psychological resilience is positively associated with QOL and may comprise a robust buffer between depression and QOL in Chinese patients with cancer.
151	Yesilort et al. (151)	The evaluation of hopelessness and perceived social support level in patients with lung cancer	Cross-sectional study design	98 lung cancer patients	Beck Hopelessness Scale Multidimensional Scale of Perceived Social Support.	Findings indicate that patients with lung cancer have a high level of social support and only mild level of hopelessness. Social support can be a protective factor for hopelessness.
152	Zoellner and Maercker (152)	Posttraumatic growth in clinical psychology – a critical review and introduction of a two component model	Review article	–	–	This article aims at summarizing the most important theoretical models and conceptualizations of posttraumatic growth (PTG), i.e., positive psychological or personal changes in the aftermath of trauma, defined as the result of the struggle with highly stressful events.
153	Zou et al. (153)	Resilience and positive affect contribute to lower cancer-related fatigue among Chinese patients with gastric cancer	Cross-sectional study design	203 gastric patients	Cancer Fatigue Scale CD-RISC PANAS	Resilience was negatively associated with cancer-related fatigue. Mediation analysis showed that high resilience was associated with increased positive affect, which was associated with decreased cancer-related fatigue.
154	Zwahlen et al. (154)	Posttraumatic growth in cancer patients and partners—effects of role, gender and the dyad on couples' posttraumatic growth experience	Cross-sectional study design	224 couples of cancer patients	PTGI	Gender, role (patient vs partner), and the dyad significantly contributed to variation in PTGI total scores and subscales. Findings indicate that positive psychological experiences may be shared by partners affected by cancer in similar ways as have been shown for negative psychological effects.

TABLE 2 | Psychometric instruments used in eligible studies.

APGAR	Adaptation, Partnership, Growth, Affection, and Resolve
BDI	Beck Depression Inventory
BHS	Brief Hope Scale
BSI	Brief Symptom Inventory
CARES	Cancer Rehabilitation and Evaluation System
CES-D	Center for Epidemiologic Studies–Depression
CD-RISC	Connor–Davidson Resilience Scale
CIOQ	Changes in Outlook Questionnaire
CHQ-12	Chinese Health Questionnaire
CLOT-R	Six-item Chinese Revised Life Orientation Test
COPE	Coping Scale
CQOLC	Caregiver Quality of Life Index–Cancer
DADDS	15-item Death and Dying Distress Scale
DAS	Dyadic Adjustment Sale
DTherm	Distress Thermometer
ECOG	Eastern Cooperative Oncology Group Performance Status
ECR	Experience in Close Relationships
EMAS-State	Endler Multidimensional Anxiety Scale
EMS	Enrich's marital satisfaction
EORTC-QLQ-30	The European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire 30 Items
EQ-5D	EuroQOL five-dimension Health-related Quality of Life Questionnaire
FACIT-G	Functional Assessment of Chronic Illness Therapy–General health
FACIT-GOG/NTX	Functional Assessment of Chronic Illness Therapy Gynecologic Oncology Group–Neurotoxicity
FACIT-Sp	Functional Assessment of Chronic Illness Therapy–Spirituality
F-SOZU	Questionnaire of Social Support
GSES	The General Self-Efficacy Scale
HADS	Hospital Anxiety Depression Scale
HHI	Herth Hope Index
IES-R	The Revised Impact of Event Scale
ISEL	Interpersonal Support Evaluation List
LAP-R	The Life Attitude Profile–Revised
LOT	Life Orientation Test
MDASI	MD Anderson Symptom Inventory
MFI	Multidimensional Fatigue Inventory
MHI	Mental Health Inventory
MMPI	Minnesota Multiphasic Personality Inventory
MOS-SSS	Medical Outcome Study Social Support Survey
MQOL	McGill Quality of Life Questionnaire
MSAS	Memorial Symptom Assessment Scale
MSPSS	Multidimensional Scale of Perceived Social Support
NEO-FFI	Big Five Personality Traits–Five Factor Inventory–Extraversion–Neuroticism–Openness
OLQ	Orientation to Life Questionnaire
PANAS	The Positive and Negative Affect Schedule
PAIS-SR	The Short Psychosocial Adjustment to Illness Scale–Self Report
PHQ-9	Patient Health Questionnaire-9
PC-PTSD	Primary Care Posttraumatic Stress Disorder Screen
POMS	Profile of Mood States
PSS	Perceived Stress Scale
PSSS	Perceived Social Support Scale
PTGI	Posttraumatic Growth Inventory
PWB	Ryffs Short Psychological Well-being Scale
QLACS	Quality of Life in Adult Cancer Survivors
QOL-CS	The Quality of Life–Cancer Survivorship Inventory
QOLS	Quality of Life Scale
RCOPE	Religious Coping Scale
RS-14	14 Items Resilience Scale
SCID-II	Structured Clinical Interview for the <i>DSM-IV</i> Axis I Disorders
SCI	Self-Concept Incoherence
SF-36	The Rand 36-Item General Health Survey–Short Form

(Continued)

TABLE 2 | Continued

SOC-13	Sense of Coherence 13 Items Scale
SOMC	Short Orientation–Memory–Concentration Test
SRGS	Stress Related Growth Scale
SSQ	Social Support Questionnaire
STAI-Y	State-Trait Anxiety Inventory-Y
STAXI	State-Trait Anger Expression Inventory
TDM	The eight-item Perceived Treatment Decision Making Difficulties
WCI	Ways of Coping Inventory
WHIIRS	Women's Health Initiative Insomnia Rating Scale

Thus, meaning can be viewed as an outcome of a successful coping process, which itself is an important element of resilience.

Theorists assume that attempts at meaning making result in better adjustment to cancer, but only under circumstances wherein meaning is derived *via* the process (111). For instance, in a longitudinal study of cancer survivors, meaning-making efforts were found to be related to better adaptation to stress *via* the successful creation of meanings generated by the cancer experience (110). In contrast, meaning-making attempts and searching for meaning are commonly associated with elevated levels of distress, poorer mental functioning, and a less positive/more negative affect (73, 139). Evidence suggests that searching for meaning is only helpful when meaning is found (73). Conversely, unsuccessful meaning-making efforts present fruitless rumination, resulting in discomfort rather than adaptive adjustment (12, 149). Some authors even recommend accepting that one's experience has no meaning when sense cannot be made or meaning easily found and instead spend time and effort concentrating on enjoyable things and experiences and the potential for future growth (73, 127, 149).

POSTTRAUMATIC GROWTH

Posttraumatic growth (PTG) can be defined as subjective, positive psychological changes that arise when someone endures some major life crisis or traumatic event (137). Typically, these changes entail benefits, like increased life appreciation, renewed or altered life priorities, enhanced sense of personal strength, improved social relationships, perceived new possibilities, developing a deeper sense of spirituality and personal meaning (6, 136), increased bodily care, positive health behavior changes, and augmented feelings of personal control (137). Thus, with PTG, life becomes richer, more meaningful, and rewarding. However, it may not be implicitly associated with greater well-being or less suffering (152).

According to a theory proposed by Tedeschi and Calhoun (6, 136, 137), PTG emerges when an event is associated with a level of stress sufficient to threaten or even destroy a person's beliefs, life expectations, or even life itself (34). For instance, being forced to cope with a potentially life-threatening disease, like cancer, can cause enough stress that someone begins to critically scrutinize his or her place in it in the world and overall worldview. This approach assumes that the disruption and distress caused by the trauma trigger cognitive processing and restructuring of the event (post-trauma processing), resulting in new insights and revised beliefs to reflect the person's new reality (108, 125, 136). During the development of

PTG, successful coping following a traumatic event occurs when the affected individual's perception of self, others, and the meaning of the event can be reappraised and positively recreated (6, 136). In other words, deliberate rumination allows the individual to integrate the traumatic event and generate some new meaning (102).

Several authors have demonstrated that individuals who reported more stress and threat relating to a given stressful event experienced a greater degree of PTG (34, 85). The theoretic concept presumes that the more an individual reflects on the circumstances and consequences of the experience, actively tries to deal with the illness, and searches for its meaning, the more likely PTG will occur (6). Thus, PTG does not result from the trauma itself but through the struggles and efforts of dealing with the demanding situation. The literature regarding the time needed for benefit finding is inconclusive. Some authors suggest that PTG increases the longer the time interval from the traumatic event (43, 125). Contrary to these findings, in another study involving breast cancer patients, benefit-finding within the year following the diagnosis of cancer predicted better adjustment, including less distress and depression, 5 to 8 years after the initial diagnosis (36).

Connor–Davidson Resilience Scale

Resilience can be seen as a measure of an individual's stress-coping ability (40), an outcome that might also be of high relevance when treating cancer patients. Based on Richardson's model of biopsychospiritual balance ("homeostasis") (116), including several theoretical concepts (e.g., Kobasa, Rutter, Lyons), Connor

and Davidson developed the *Connor–Davidson Resilience scale* (CD-RISC) (41). It has both a long and a short version, consisting of 25 (41) and 10 items (35), respectively. Each item is scored on a 5-point Likert scale, with higher scores indicating higher levels of resilience. The CD-RISC has demonstrated considerable reliability and validity in several distinct population groups, including community samples, primary care outpatients, general psychiatric outpatients, patients in a clinical trial on generalized anxiety disorder, and PTSD patients in multiple clinical trials (41). In one study evaluating resilience in patients with PTSD, mean CD-RISC (resilience) scores ranged from 80.4 among individuals in the general population to 47.8 in patients with PTSD (41). Connor and Davidson et al. (44) found that greater resilience, as indicated by the CD-RISC scale, predicted higher recovery rates in PTSD patients. Most importantly, this same research group (41, 44) has demonstrated that either pharmacotherapy alone or combined pharmacotherapy and psychotherapy significantly promoted resilience in PTSD patients, up to a level close to that observed in the general population; such therapy also alleviated symptoms of depression and anxiety, indicating that resilience is both modifiable and treatment-responsive. These results underscore the utility of resilience, as quantified by the CD-RISC, in both clinical practice and research.

The *Connor–Davidson Resilience Scale* has also been administered in several studies evaluating resilience in cancer patients. Data obtained with the CD-RISC in cancer patients corroborate findings from Connor and Davidson, demonstrating that cancer patients who express greater resilience experience

less psychological distress and are more well adjusted to their cancer (48, 95, 97, 118, 121, 145, 150).

FACTORS DETERMINING RESILIENCE

Each phase of the cancer experience has a profound impact on the patients' lives (79). Many socio-contextual factors are believed to be associated with resilience in cancer patients. These characteristics refer to the strengths and positive aspects of an individual's state of mind (40). For all phases of a cancer's outcome trajectory, resilience is constructed from preexisting baseline characteristics, like sociodemographic and other personal attributes (e.g., social support, hope, optimism); adaptation mechanisms, like coping and medical care experience (e.g., relationships with healthcare providers); and psychosocial outcomes, like PTG and quality of life (7). Knowledge on how personal and socio-contextual resources may impede resilience to cancer is of clinical importance and may provide insights into long-term outcomes in cancer patients. The next section explores which factors promote resilience and PTG in cancer patients.

Demographic Factors

While studies on risk factors for PTSD and other psychiatric comorbidities have typically implicated female gender, minority ethnicity, less education, and, to a lesser extent, younger age (32), limited and rather inconsistent data exist on the association between sociodemographic factors and resilience in cancer patients. Some studies revealed better resilience outcomes in cancer patients who were younger, had higher levels of education and income, and were Caucasian (46, 49, 79, 87). However, studies examining the impact of gender, as well as of marital and socioeconomic status, on resilience in cancer patients have yielded ambiguous results and no consistent associations (57, 65, 79, 97). Older patients (>65 years old) account for more than 60% of cancer cases (96). Clinical data on the relationship between older age and resilience are ambiguous and conflicting. Although some authors have assumed that resilience weakens with age—due to the accumulation of risks and adversities, physical and cognitive declines, and reduced personal resources (90, 97)—some studies have uncovered increased resilience with older age (39, 65, 97). Other studies have identified a mediating effect of resilience on the relationship between age and psychological adjustment, with older individuals exhibiting better adjustment to cancer and less distress when resilience was rated high (39). These results indicate that there must be different trajectories of resilience in older individuals (90, 97).

Cancer-Related Variables

Some cancer-related variables, like disease severity and time since diagnosis, were not found to be related to cancer patients' resilience during our review of the literature. However, disease severity and time since diagnosis do appear to impact PTG and benefit finding during patients' experience with cancer, with higher- versus lower-stage tumors linked to reduced PTG (101). Other investigators have hypothesized that searching for meaning in life is most probably to occur in patients whose

cancer is moderately life-threatening (Stage II) and prognosis somewhat uncertain, whereas benefit finding was deemed less likely to occur in individuals with Stage I (presumed curable) and Stage IV (generally incurable) disease (79). In contrast, others have postulated that time since diagnosis and treatment status are not linked to benefit finding (19), while others have concluded that time alone is sometimes sufficient to promote growth (136).

Personality-Related Variables

The literature suggests that personality-related risk and resilience factors become particularly critical when one is challenged by a serious stressor, such as a life-threatening disease like cancer (47). Personality traits that are relevant to controlling and regulating mental and emotional states are likely central in resilience pathways. Among others, a coherent self-concept, self-esteem, optimism, positive emotions, and personal control have been discussed as being important personality-related factors that aid in building resilience in cancer patients (23, 29, 47, 74), whereas neuroticism and interpersonal dependency have been linked to diminished resilience (23, 79).

The personality trait "hardiness" can buffer exposure to extreme stress and may contribute to the recovery process (61). Hardiness has three dimensions: cultivation of a sense of peace and meaning in life; sense of control over one's experiences and outcomes; and learning and growing from life experiences, both positive and negative (74). Some evidence exists suggesting that hardiness is an important contributor to resilience and PTG in cancer survivors (22, 61). In one study of cancer survivors, hardy individuals were more likely to use active coping and social support than their less hardy peers, suggesting that hardiness helped them deal with the cancer-related distress they experienced (61). In contrast, in another study involving prostate and breast cancer patients, stressors experienced in the context of low control were more detrimental in individuals with an incoherent than coherent self-concept (47).

Several studies support the premise that the expression of positive emotions and laughter can help to reduce distress following a stressful life event and facilitate adjustments to cancer (140). In a recent study of women with newly diagnosed gynecological cancer, women who were more likely to express positive emotions (e.g., gratitude, interest, and love) reported higher resilience and better quality of life (94). Moreover, breast cancer patients who could express positive emotions during cancer treatment were more likely to reframe their cancer experience positively and feel a greater sense of peace and meaning in their lives (94).

Social Context

Social support refers to assistance provided by other people (family, friends, or others outside a professional support setting), as well as the perception that one is loved, esteemed, and valued by others (144). Evidence suggests a significant link between social support and health, with social support considered an important contributor to improving well-being and reducing distress in cancer patients (16). Family and friends may help cancer patients to process their cancer-related traumatic experiences and may be involved in meaning finding, efforts that could lead to improved

interpersonal relationships (26). Patients with different types of cancer who perceive a sustainable availability of social support appear to be more likely to report high levels of resilience and lower levels of distress (49, 129). More specifically, in a study of 365 bladder cancer patients, resilience, social support, and hope accounted for 30% of the variance in patients' quality of life (82). Similarly, among breast and head and neck cancer patients, having a partner was found to have a protective effect against anxiety and depression, relative to being single (38, 87). Furthermore, support-seeking behavior and the perception of received social support have been directly linked to PTG (48).

Coping Strategies

Coping is a critical element of resilience outcomes in cancer patients (19). Across several different studies assessing cancer survivors, those who used adaptive coping strategies (e.g., positive reappraisal, social support seeking behavior, problem-focused coping, and religious coping) reported better quality of life and indicated reduced distress (26, 28, 37, 75, 94, 107, 113), while individuals using nonadaptive coping strategies (e.g., substance use or self-blame) suffered from higher distress and impaired quality of life (62, 105). In addition, the results of several studies suggest that resilience mediates the relationship between the use of coping strategies and quality of life (94, 107, 113). These findings presume that resilient cancer patients may report higher quality of life, since they are more likely to express positive emotions, integrate their cancer experience positively, and feel a sense of peace and meaning in their lives (94). Thus, resilience and coping strategies are important in patients' quality of life. Coping strategies have also been found to play an important role in PTG. As demonstrated in a study in adolescent cancer survivors, the use of acceptance coping strategies, as opposed to avoidant coping strategies, predicted higher levels of PTG 2 to 10 years following cancer treatment (141).

Optimism, Hope, and Spirituality

Optimism is known to have protective effects when one is dealing with cancer. In a number of studies involving cancer patients, optimism was associated with better adjustment to cancer, enhanced well-being, and reduced distress, while being predictive of treatment challenge acceptance (37, 98). Conversely, pessimism predicted avoidance, denial, and impaired quality of life (37, 112). Similarly, among long-term prostate cancer survivors, those who reported being happy, hopeful, and positive in outlook had less negative treatment outcomes than those who were negative (27).

Optimism has been positively linked to resilience in cancer patients. In one sample of colorectal cancer patients, those with high reported resilience exhibited stability in optimism or even became more optimistic, relative to those with low self-reported resilience (65). *Vice versa*, optimism and favorable early postoperative treatment outcomes were predictive of resilience and lower distress in women diagnosed with breast cancer (76).

Hope is considered one of the most powerful coping styles when fighting against cancer (50). Fostering hope is an existential strategy for cancer patients to adjust to, and give meaning to their cancer experience, to maintain and improve well-being, and to

anticipate survival (100). Six strategies have been identified for facilitating hope during cancer treatment: building and sustaining meaningful relationships, staying positive, living in the present moment, promoting accomplishments, feeling a spiritual connection, and anticipating survival (120). One's level of hope can change over time and depends upon internal and external factors, including personality, relationships, and social support (82). Cancer patients can develop a sense of hopelessness when distress becomes overwhelming (143), and social support may be protective against hopelessness (151). Resilience was positively correlated with hope in a study on metastatic colorectal cancer patients, indicating that resilience may improve hope, thereby emphasizing the need for resilience-fostering interventions in palliative care (128). Furthermore, among cancer survivors, optimism and hope have been linked to better adjustment and growth (115). However, optimism and hope were not associated with overall survival or with progression-free survival in another study involving metastatic colorectal cancer patients (123).

Spirituality may help cancer patients to create meaning in life, and the roles of spiritual and religious beliefs in coping with cancer and fostering resilience have been widely acknowledged (67). In addition, it has been noted that many cancer patients sense spiritual growth after they are diagnosed with cancer (56, 114).

In summary, optimism, hope, and spirituality are likely to increase with preservation of resilience and recovery from psychological distress (65). Therefore, resilience-fostering interventions to nurture optimism, hope, and spirituality during cancer treatment could assist patients trying to cope with their cancer (100, 120).

Sense of Coherence

As one of the first researchers in this field, Antonovsky (155) developed in the 1970s a theoretical construct called "sense of coherence" (13) to explain differences in the way people cope with stressful life experiences. When Antonovsky studied a group of postmenopausal women who had survived concentration camps, he discovered that one third of the women had been able to remain both mentally and physically healthy. In further research, Antonovsky developed the sense of coherence (SOC) (13) model of health. The model comprises three main components, which Antonovsky described as follows: "The sense of coherence is a global orientation that expresses the extent to which one has a pervasive, enduring, though dynamic feeling of confidence that: (1) the stimuli deriving from one's internal and external environments in the course of living are structured, predictable and explicable; (2) the resources are available to one to meet the demands posed by these stimuli; and (3) these demands are challenges worthy of investment and engagement" (25).

Over the past several decades, increasing evidence has been gathered that supports Antonovsky's postulation that SOC is a health-promoting factor (53, 54, 84, 132). Although Antonovsky did not develop his model by studying cancer patients, current research has evidenced a strong inverse relationship between SOC and distress (59, 103) and particularly between SOC and anxiety and depression (126, 133, 142). Furthermore, several

studies found a positive correlation between quality of life and SOC in cancer patients (33, 99, 106, 134). In a more recent study, including 478 breast cancer patients and a median follow-up time of 10 years, patients with a higher SOC score had a 63% lower risk of cancer progression, an 80% lower risk of cancer-related mortality, and an 80% lower risk of all-cause mortality than patients with a lower SOC score (83).

Recent research revealed that SOC was a health-promoting factor also in cancer patients' partners. In one longitudinal, quantitative study involving cancer patients and their spouses (59), a higher SOC at the time of diagnosis was significantly associated with lower levels of anxiety and depression at 14 months of follow-up. In a more recent study of 147 cancer patients and their partners, participants' SOC was an independent and significant predictor of lower distress in both patients and their partners 6 months following cancer diagnosis (60).

In a qualitative study, our own research group used Antonovsky's theory to analyze the experience of a diagnosis of advanced melanoma in 10 patients and their significant others (52). We found that managing their current situation; applying several coping skills, including caring for one's relationships; and seeking social supports were the most important strategies utilized by the study participants. Of note, cancer patients and their partners reported to use these coping strategies shortly after diagnosis and at the 6-month follow-up interview. Interestingly, issues reflecting meaning and spirituality played only minor roles for patients and their partners. Distraction was one of the most important and coping mechanisms among our study participants. This finding is in accordance with previous results in the literature. For instance, a comparable study investigating patients with a brain tumor and their spouses highlighted the importance of keeping life going on as before, doing hobbies, going to work, and dealing with everyday matters in order to improve one's sense of situational meaning and the manageability of life and eventually to reduce suffering (130).

RESILIENCE, PTG, AND RECOVERY FROM CANCER

Resilience is an important area for cancer patients because it may provide a protection against the negative effects of stress by lessening or absorbing the shock of a cancer diagnosis, the impact of aversive events, and related life changes and thus improve mental health and treatment outcomes. A growing body of literature has conclusively linked resilience, in both cancer patients and cancer survivors, with better adjustment to cancer, higher quality of life, and better mental health and treatment outcomes (49, 97, 113, 118, 124, 147, 150). More specifically, in a study investigating resilience in cancer patients undergoing allogeneic stem cell transplantation, high-resilience patients reported less anxiety and depression; higher physical, emotional, and social functioning; and a better quality of life than low-resilience patients (124). In contrast, cancer patients who reported lower levels of resilience suffered from more distress, depression (150), and cancer-related fatigue (131, 153) and exhibited poorer social adjustment 6 years following their diagnosis (77). Similar

outcomes were observed for cancer survivors. For instance, low-resilience women suffering from early-stage breast cancer manifested greater distress and poorer psychosocial adjustment 6 years later (77). In another study involving older cancer survivors (≥ 65 years), those with high resilience scores showed higher physical functioning (49). Furthermore, in a large cross-sectional sample of 1,823 hematopoietic cell transplantation survivors, lower patient-reported resilience, as measured by the 10-item CD-RISC, was positively correlated with chronic-graft-versus-host disease of higher severity, poor performance status, more illness-related absences at work, and long-term disability (118). These results indicate that resilience is independently associated with health and psychosocial outcomes. As such, resilience should be acknowledged as a protective psychosocial factor in cancer patients.

Adjusting to cancer—while experiencing the diagnosis, treatment, adverse events, and related life changes—can lead to long-lasting negative health consequences, including distress, depression, (death-) anxieties, and adjustment disorders (4). Paradoxically, studies also have shown that overcoming cancer and its treatment may be an opportunity for personal growth, positive life changes, and improved social and emotional well-being, as a consequence of resilience (17). PTG is a process of personal change that may result from coping with a stressful event (17). It also is a complex phenomenon, with characteristics related to the type of trauma (cancer severity), context (social support and relationship with health care providers), and preexisting personal resources (self-enhancement, optimism, hope, etc.), during which positive changes and psychological distress may coexist (17). PTG is best illustrated by a curvilinear relationship, whereby stress is essential to initiate PTG, while too much stress has been found to hinder the process of PTG (29, 78).

There is a body of literature providing evidence for positives changes following cancer. In a study with breast cancer patients, most women viewed their cancer experience as more positive than negative (139). Furthermore, relative to healthy women, breast cancer survivors reported greater PTG, appreciation of life, and spiritual change (17, 101). Evidence from the literature suggests that those who perceive growth shortly after a stressful life event experience better mental health and fewer posttraumatic symptoms later (55). Furthermore, PTG has been linked to positive affect and improved life satisfaction (68). Other studies have documented relationships between PTG and improved quality of life (145), lower-level distress, greater self-esteem, and less anxiety (58).

In a qualitative study of our own (119), we investigated 31 patients with head and neck cancer and 25 female partners with regard to positive personal changes following a cancer diagnosis. Our results corroborate the concept of PTG developed by Tedeschi and Calhoun. We found that most cancer patients, as well as their female partners, reported positive changes following their cancer experience. Interestingly, the female spouses described positive changes significantly more often than patients did. Regarding quality of life and psychological distress, we found that marital satisfaction was an important moderating factor (70). In a further study of our own including 224 patients suffering from various

types of cancer, we investigated responses of both patients and their partners to the PTG inventory (PTGI) (154). In this study, we aimed at investigating the contributions of gender and role (patient or partner) and the individual couples (the dyad factor: belonging to any one of the 224 couples) to variability in PTGI scores. Our data revealed that all three factors—gender, role, and dyad—contributed to PTGI total score variability, while PTGI total scores as well as all PTGI subscales were higher for patients than for partners. Furthermore, “male patient–female partner pairs” exhibited greater PTG than “female patient–male partner pairs” did. Correlations also indicated a parallel posttraumatic growth in patients and partners, irrespective of the gender and role composition.

Robust evidence supports links between resilience and PTG in cancer patients. However, the strength and direction of their correlation is less clear. In some studies, resilience was directly associated with PTG among cancer patients and survivors (48), suggesting that resilient patients experience greater PTG in reaction to a stressful event. More specifically, Dong et al. (48) found a mediating effect of resilience on perceived social support and PTG, indicating that cancer patients with high levels of perceived social support showed greater resilience and thus experienced more PTG. Contrary to this study, however, other authors have argued that resilient individuals experience PTG to a lesser extent because they are not affected profoundly enough by the stressful event; as such, they fail to experience the degree of stress and mental pressure needed to act as a catalyst for cognitive processing and meaning making (29, 145, 148).

Another explanation for these contradicting empirical findings is that there might be two different cognitive components contributing to PTG, including a constructive and an illusory aspect (The Janus-Face model of PTG) (91). The latter, specifically, may not lead to actual growth and personal change.

It is important to note that there is an ongoing debate whether the diagnosis and treatment of cancer fulfills the criteria for a traumatic event according to *DSM-IV* (42). Moreover, the revision of the trauma criterion from *DSM-IV* to *DSM-5* (156) raises specific concerns regarding its applicability to cancer patients. The supporting text in *DSM-5* specifically states that “A life-threatening illness or debilitating medical condition is not necessarily considered a traumatic event. Medical incidents that qualify as traumatic events involve sudden, catastrophic events.” Independently from these criteria and the fact that many cancer patients do experience severe complications or extreme adverse events, the diagnosis of cancer represents an existential threat that is experienced by patients as traumatic (24, 104). According to the concept of PTG proposed by Tedeschi and Calhoun, this stress is sufficient to trigger the process of personal change.

From a theoretical point of view, we consider two different pathways of resilience (see **Figure 1**). The first, a direct pathway, allows affected subjects to bounce back from adversities by different personality traits (e.g., optimism, hope, hardiness, and SOC) or coping abilities (e.g., problem-focused coping, positive reappraisal, and social support seeking). The second way, which can be viewed as an indirect pathway, leads to psychological adjustment by a process of redefinition of the self, reappraisal of beliefs, and personal growth that allows patients to feel stronger.

PTG, for example, but also meaning making, reflects an indirect pathway of resilience. We postulate that the indirect pathway will be used in situations when the direct pathway was not successful or in subjects with lower individual sources of resistance (e.g., low optimism). However, further research is needed to confirm this hypothesis. It is important to note that issues of personal growth and meaning making can be specifically addressed by various psychotherapeutic approaches. Therefore, positive changes may be utilized as a foundation for the psychotherapeutic work, providing hope that the adverse experience can be successfully managed and overcome. Fostering resilience and PTG during cancer treatment may yield better psychological adjustment and psychosocial functioning during and following cancer therapy, thereby facilitating recovery from the cancer itself.

CLINICAL IMPLICATIONS

The clinical relevance of resilience has been noted for patients with life-threatening diseases like cancer. Tailoring targeted interventions to facilitate resilience in cancer patients, for instance by fostering certain baseline characteristics or improving coping and adaptation strategies, may help to foster patients’ inner strength and energy and, in turn, alleviate symptoms of psychological distress, depression, and anxiety and improve quality of life (7, 150). In fact, research has shown that resilience in cancer patients may buffer against psychological distress and improve quality of life during the disease’s trajectory (150). To date, few interventions designed to promote resilience in cancer patients have been developed and evaluated. For instance, *Stress Management and Resilience Training (SMART)* is a group-based cognitive behavioral therapy program developed to enhance resilience and well-being and relieve symptoms of distress and anxiety. The intervention focuses on cognitive restructuring of the stressful experience and on adjusting to it *via* the development of inner strength (e.g., gratitude, acceptance, purpose). Among breast cancer survivors, the SMART intervention resulted in improved resilience and quality of life and reduced symptoms of distress and anxiety, relative to the control group (89). Meaning-making interventions may indirectly promote resilience by improving dispositional and modifiable factors, like self-esteem, optimism, hope, and self-efficacy (81). More specifically, in one study, patients with advanced ovarian cancer who received a meaning-making intervention reported an improved sense of meaning and purpose in life relative to controls (64). Similar findings were observed in a study with breast and colorectal cancer patients, with improved optimism and self-efficacy demonstrated among study participants in the meaning-making intervention group (81). Another study found significant benefits of a meaning-centered psychotherapy and highlights the importance of addressing existential issues in cancer patients and survivors (31).

More recently, interest has increased in promoting resilience in palliative cancer patients: in particular, interventions to foster resilience in patients with advanced or terminal cancer who have given up hope could benefit from resilience-fostering interventions. In one study involving patients with

advanced-stage cancer, resilience was directly related to higher levels of perceived social support and less hopelessness (129). Similarly, among patients with metastatic colorectal cancer, resilience and hope were positively correlated, while depression was associated with lower resilience, less hope, and higher scores for suffering (128). Given that various factors of resilience can be modified and, in turn, improve hope and quality of life, resilience-fostering interventions in the palliative care setting are of great clinical value and therefore should be initiated early during the transition to palliative care. In addition, interventions to foster resilience in caregivers of patients with advanced and incurable cancer are equally important (69, 86, 117). This being said, only few studies on resilience in family caregivers of terminally ill cancer patients exist, and further investigation is needed to understand caregivers' support needs to develop strategies to improve coping and resilience in this population (69).

CONCLUSIONS

Resilience is an important protective factor against psychological distress and consequently is closely related to mental health. Biological (gene–environment), personal (e.g., sense of coherence, optimism, and hope), and, most notable, social (e.g.,

social support) factors contribute to the cancer patient's resilience and, therefore, to favorable psychological and treatment-related outcomes.

PTG as an indirect path of resilience is an important phenomenon during adjustments to cancer, and is linked to less distress, better mental health, and improved quality of life. Its theoretical foundation within the framework of resilience is only marginally investigated and not completely understood. Some studies have demonstrated a positive relationship between resilience and PTG, while others have found high levels of resilience to be associated with low PTG scores.

Improving resilience through targeted interventions that promote positive adaptations to cancer, while improving health outcomes by strengthening personal and social resources and enabling effective coping strategies, might be an effective intervention strategy to foster PTG in cancer patients. Promoting resilience through PTG should be an essential component of cancer care, and resilience-fostering factors can be improved throughout every stage of the cancer continuum.

AUTHOR CONTRIBUTIONS

AS and JJ wrote the manuscript. Both AS and JJ amended the manuscript.

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Validity, Reliability, and Factor Structure of the Secondary Traumatic Stress Scale-French Version

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Secondary traumatic stress (STS) is a syndrome including intrusion, avoidance, and arousal due to indirect trauma exposure (e.g., by caring for traumatized patients in a professional context or transgenerational transmission of trauma in familial or cultural systems). Bride et al. (1) developed the Secondary Traumatic Stress Scale (STSS), designed to measure these reactions of helping professionals who have experienced traumatic stress through their work with their traumatized clients. This study aimed to validate the French version of the STSS (STSS-F) by evaluating factorial and criterion validity. Furthermore, its reliability and other psychometric properties were evaluated. Two-hundred-and-twenty midwives at two university hospitals in the French-speaking part of Switzerland completed an anonymous online survey. Midwives were chosen as study population because STS represents a serious professional risk in this population. In a series of confirmatory factor analyses and exploratory structural equation modeling (ESEM), a model with two correlated ESEM factors (i.e., intrusion, avoidance-arousal) provided the best model fit, thus establishing factorial validity. Differential associations of the STSS-F total score to general distress and posttraumatic stress and the utility of the STSS-F total score to account for variance in core dimensions of burnout beyond general distress, posttraumatic stress, perceived stress, occupational reward, and efforts supported the criterion validity of the STSS-F. The full STSS-F and its subscales showed acceptable to good levels of reliability. Limitations include the relatively small and homogeneous sample and the lack of tests of factorial invariance of the STSS-F and the original STSS. In conclusion, the present study provides evidence for the reliability and validity of the STSS-F. It makes the STSS accessible to French speaking research contexts.

Keywords: STSS, midwives, ESEM, burnout, occupational efforts and rewards, posttraumatic stress, HADS

INTRODUCTION

Secondary traumatic stress (STS) or STS disorder (STSD) is a syndrome including intrusion, avoidance, and arousal (2). The symptoms of STSD are the same as those of posttraumatic stress disorder (PTSD) in the fourth edition of the Diagnostic and Statistical Manual of Psychiatric Disorders [DSM-IV; (3)]. But unlike PTSD, STSD is due to indirect exposure in a professional

context (e.g., caring for a traumatized patient)¹. Hence, STSD was not included in DSM-IV as a formal psychiatric diagnosis. In the current DSM-5 (5), the new traumatic stressor criterion A4 identifies professional responsibilities as potential traumatic experiences that could precipitate PTSD. However, the DSM-5 disregards the helping and empathic quality of the relationship between primary and secondary traumatized victims. This reveals an important gap in the definitions of STSD in the DSM-5 and in the STS literature (6). The assignment of STSD to PTSD might also promote the misconception that STSD can easily be measured with standard PTSD inventories that usually do not refer to a specific traumatic event. But Renshaw et al. (7) showed that PTSD inventories likely provide an ambiguous measure of STS that may also tap into traumatic events experienced in respondents' own lives. Renshaw et al. (7) concluded that a more rigorous assessment of STS requires an explicit reference to indirect exposure. A recent publication setting out a research agenda for STSD highlighted that many previous studies have not made the important distinction between primary and secondary exposure to traumatic events and have called for the validation of screening tools for STS (8). A lack of conceptual clarity regarding the underlying constructs of STS has been discussed in the international literature. In particular, some authors use compassion fatigue interchangeably with STS, while others speak of compassion fatigue when describing a broad range of symptoms that include STS as well as burnout (8). The authors have therefore called for research that can provide evidence for the operationalization of STS and compassion fatigue that allow the development and validation of measures sensitive to the underlying concept (8).

In line with this reasoning, Bride et al. (1) developed the Secondary Traumatic Stress Scale (STSS), designed to measure the reactions of helping professionals who have experienced traumatic stress through their work with their traumatized clients. Consistent with the definition of PTSD in DSM-IV, STS is operationalized by the factors *intrusion*, *avoidance*, and *arousal* in the STSS. To enable a rigorous assessment of STS, the wording of the instruction and the stems of eight stressor-specific items refer explicitly to "client exposure" as traumatic stressor.

In the last decade, the STSS became a standard tool for assessing STS in helping professionals such as social workers (9), nurses (10), mental health workers (11), midwives (12), and pediatric care providers (13). In an international context, the STSS has been validated in Chilean professionals treating traumatized victims (14) and Italian ambulance workers (15). However, no French version of the STSS is available yet. Thus, the current paper aims to introduce the STSS-French version (STSS-F) and to evaluate its reliability, factorial and criterion validity and other psychometric properties in a sample of French speaking midwives in Switzerland.

Midwives are at risk of developing STS because they frequently have to manage traumatic births and other traumatic perinatal events (16, 17). A recent study of British midwives reported that over 95% of midwives had been directly or indirectly exposed to a work-related traumatic event (18). Recently, authors called for more studies investigating the structural nature of STS among different professional groups, as this seems to vary across professions (19). Given the aforementioned reasons, this study thus focused on one professional group: midwives.

Only a few studies have so far tested the factorial validity of the STSS [e.g., (1, 19–21)]. Those studies utilized the independent cluster model of confirmatory factor analysis (ICM-CFA), in which each item loads only on the factor it purports to measure and all cross-loadings are constrained to be zero (22). Given the limited evidence on the factorial validity of the STSS, we will test a series of five ICM-CFA models. These five models are based on prior research on the factorial structure of the STSS [e.g., (21)] and related DSM-IV-based PTSD instruments [e.g., (23)].

Model 1 provides a test of the three correlated factors originally identified by Bride et al. (1) that parallel the PTSD symptom clusters in DSM-IV: Five intrusion items load on the intrusion factor, seven avoidance items load on the avoidance factor, and five arousal items load on the arousal factor. In prior research, this three-factorial ICM-CFA model fitted acceptably to the data [e.g., (1, 19–21)]. However, the factor correlation between avoidance and arousal often approaches unity [(19–21), (24) as cited in (21)] implying poor discriminant validity of the arousal and avoidance factors. Both factors might thus be pooled without substantial loss in model fit². *Model 2* therefore tests the idea that an intrusion factor and a pooled avoidance-arousal factor are preferred over *Model 1* due to parsimony and a comparable model fit. However, in the parallel DSM-IV based literature on PTSD instruments, little data support two-factor models (23). *Model 2* also differs from alternative two-factor PTSD models that consist either of a re-experiencing/avoidance and a numbing/hyperarousal factor or of a depression/avoidance and an anxiety/hyperarousal factor (25). In *Model 3*, a single STS factor will be specified. In Benuto et al. (19) and in Ting et al. (21), the χ^2 -difference test for *Model 1* and *Model 3* remained insignificant, suggesting that the unifactorial model might be a serious contender. But since the unifactorial model received no support in the parallel PTSD literature (23) and STSS intrusion usually correlates below .90 with avoidance and arousal (1, 20), a good fit for *Model 3* seems questionable.

To the best of our knowledge, two four-factorial models derived from the DSM-IV based literature on PTSD still need to be tested in the context of the STSS: In *Model 4* [*numbing model*; (26)], the avoidance factor of *Model 1* splits into narrower avoidance (two items) and emotional numbing (five items). This modification is justified by differential links of avoidance and numbing to external indices of treatment outcomes and psychopathology (27). *Model 5* [*dysphoria model*; (28)] retains the intrusion factor and King et al.'s (26) narrow avoidance

¹Although indirect exposure and secondary traumatization may occur within other contexts such as families or cultural systems as well [e.g., (4)], the current study is focused exclusively on work-related secondary traumatization (i.e., client exposure as traumatic stressor).

²The Italian version of the STSS (15) suggests a similar structure consisting of an arousal factor (9 items) and an intrusion factor (6 items). However, it only contains 15 out of the original 17 STSS items.

factor. Three non-specific arousal items (criteria D1–D3) and five numbing items (criteria C3–C7) are assigned to the new dysphoria factor and two items (criteria D4 & D5) formed the hyperarousal factor. The dysphoria model takes into account that PTSD comprises a constellation of symptoms that reflect general emotional distress and dysphoria that may also be found in other anxiety and mood disorders (28). In the DSM-IV based PTSD literature, meta-analytical evidence suggests that both four-factor models outperform one- to three-factorial models and that Model 5 is slightly superior to Model 4 (23). Accordingly, it seems warranted to assume that in the context of the STSS, Model 5 may yield the best model fit of all five ICM-CFA models as well.

The Models 1–5 specify highly restrictive ICM-CFA models. However, items may have multiple determinants due to substantive theory (29), common method biases (30), or they may be fallible indicators of a factor (22). Items with small cross-loadings are thus frequently encountered in applied research (31). Imposing a perfect simple structure on such complex data leads to misspecified ICM-CFA models with impaired model fit and upwardly biased factor correlations (31). In prior studies on the STSS, the model fit of Model 1 mainly remained below the thresholds typically regarded as good fit and factor correlations were remarkably high [e.g., (1, 19–21)], suggesting the presence of misspecification in Model 1.

In the present study, we aimed to overcome the potential limitations inherent in Models 1–5 by using exploratory structural equation modeling (ESEM) (22, 31), which is, to the best of our knowledge, new in the context of the STSS. ESEM combines the strengths of exploratory factor analysis and confirmatory factor analysis. It allows for complex structure (i.e., items load on various factors) and for direct comparisons with the parametrically simpler ICM-CFA model nested within the more complex ESEM model (31). Given the nearly perfect correlations between avoidance and arousal in prior research [(19–21); see also Footnote 2], we expected that two well-defined correlated ESEM factors (i.e., intrusion and avoidance-arousal) will provide a good fit to the data (*Model 6*). We also expected that the two-factorial ESEM solution yields a better fit than the ICM-CFA Models 2, 4, and 5, and less correlated, more divergently valid factors than in Model 2.

The current study also aimed to provide preliminary evidence for the criterion validity of the STSS-F. First, PTSD as well as STSD include non-specific negative affect which gives rise to substantial positive associations between PTSD, STSD and general psychological distress [e.g., (1, 7, 28)]. However, given the close theoretical and empirical nexus between STSD and PTSD (2, 13), it was expected that the STSS-F total score relates positively and stronger to PTSD symptoms than to general psychological distress. Second, burnout consists of depersonalization, emotional exhaustion, and low personal accomplishments, which occur in response to chronic work-related stress (32). General emotional distress, posttraumatic stress, perceived stress, occupational efforts and rewards have been identified as reliable predictors or correlates of burnout [e.g., (33–37)]. Recent meta-analytical evidence suggests that STS is an important correlate of burnout as well (38). It was thus expected that the STSS-F total

score will be related to the dimensions of burnout and that these relationships remain significant even when the effects of general psychological distress, posttraumatic stress, perceived stress, occupational rewards and efforts are statistically controlled for.

METHODS

Participant Recruitment and Procedure

The study took place at two university hospitals in the French-speaking part of Switzerland. Midwives were chosen as study population because STS represents a serious professional risk in this population (12). All midwives working at both hospitals were eligible to participate in exchange for a paid extra hour of work to encourage their participation. They were informed about the study during staff meetings and by flyers and all were invited to participate. Staff accessing the anonymous online survey (LimeSurvey 2.0) found a detailed information sheet before giving informed consent. The survey consisted of seven questionnaires (one questionnaire is omitted in the current study) and took approximately 30 min to complete. All eligible participants received one reminder e-mail before the survey closed. Ethical approval was obtained from the ethics committee of the Canton de Vaud, Switzerland (study nr: 237/2013). Of the 280 eligible midwives, $N = 220$ participated (78.6% response rate).

Measures

Secondary Traumatic Stress Scale (STSS) (1)

The STSS is a self-report inventory designed to assess the frequency of STS symptoms in professional caregivers. Respondents indicate on a 5-point Likert scale (1 = *never* to 5 = *very often*) how often they experienced each of the 17 STS symptoms during the last week. The wording of the instruction and eight items refer explicitly to client exposure as the traumatic stressor. The 17 items are organized in three subscales: intrusion, avoidance, and arousal. The STSS total score is calculated by summing up the item scores, with a higher score indicating a higher frequency of symptoms. A total score below 28 corresponds to “little or no STS,” a score between 28 and 37 means “mild STS,” between 38 and 43 “moderate STS,” between 44 and 48 “high STS,” and beyond 49 “severe STS” (9). In prior research, the STSS showed good psychometric properties (1, 9, 21). The STSS was translated into French using forward-backward translation and cultural adaptation (39).

Hospital Anxiety and Depression Scale—French Version (HADS) (40)

The HADS assesses anxiety and depression with two 7-item subscales. Each item is scored from 0 to 3, with higher scores indicating greater anxiety or depression. A recent meta-CFA revealed that a bi-factor structure with a strong general psychological distress factor and two small group factors reflecting depression and anxiety fits best to the HADS data (41). Norton et al. (41) concluded that the HADS may be appropriately used as a measure of general psychological distress. Hence, the

TABLE 1 | Descriptive statistics and Cronbach's α of study variables.

	<i>M</i>	<i>SD</i>	α
STSS-F Intrusion	9.16	3.63	0.84
STSS-F Avoidance	11.87	4.19	0.84
STSS-F Arousal	10.69	3.98	0.83
PSS total	35.85	7.98	0.89
PTSD-7	1.95	1.77	0.83
HADS Total	13.69	6.99	0.86
MBI Exhaustion	19.05	9.59	0.89
MBI Depersonalization	4.67	4.16	0.79
MBI Accomplishments	32.29	5.41	0.73
ERI Reward	2.77	0.53	0.88
ERI Effort	3.01	0.52	0.78

STSS-F, Secondary Traumatic Stress Scale; PSS, Perceived Stress Scale; PTSD-7, PTSD screening scale; HADS, Hospital Anxiety and Depression Scale; MBI, Maslach Burnout Inventory; ERI, Effort Reward Imbalance Inventory. Coefficient alpha was calculated using either the polychoric or tetrachoric correlation matrix.

current study drew on the HADS total score (ordinal Cronbach's $\alpha = 0.86$; for descriptive statistics see **Table 1**).

Posttraumatic Stress Disorder (PTSD-7) (42)

The PTSD-7 is a short screening scale for the DSM-IV posttraumatic stress disorder (3). The PTSD-7 assesses five symptoms from the avoidance and numbing symptom cluster and two symptoms from the hyperarousal cluster using a dichotomous *yes/no* response format. In the instruction, these symptoms were referred to more generally as reactions that people sometimes have after a stressful event. A score of 4 or greater indicates positive cases of PTSD with a sensitivity of 80% and specificity of 97%. In the current study, ordinal coefficient α was good, $\alpha = 0.83$.

Perceived Stress Scale-French Version (PSS) (43)

Perceived stress was measured with 14-items using a 5-point scale (1 = "never" to 5 = "very often"). Respondents indicated the degree to which they perceived their lives as overloaded and to which they appraised life events as unpredictable and uncontrollable during the last month. Correlations with other measures of objective or stress perception are positive, and adequate internal and re-test reliability have been reported (43). In the current study, the internal consistency of the PSS was good, ordinal $\alpha = 0.89$.

Maslach Burnout Inventory—French Version (MBI) (44)

The MBI is a self-report measure designed to assess three core dimensions of burnout (32): *emotional exhaustion* (i.e., feeling emotionally overextended and exhausted by one's work; nine items), *depersonalization* (i.e., impersonal response toward recipients of one's service or care treatment; five items), and *personal accomplishment* (i.e., feeling competent and successful in one's work; eight items). Each item was rated on a 7-point scale (1 = "never" to 7 = "every day"). The French MBI evidenced good psychometric properties (44). In the current study, ordinal coefficients α of the subscales ranged from 0.73 to 0.89.

Effort-Reward Imbalance Questionnaire-French Version (ERI) (45)

The ERI is a self-report questionnaire developed to measure work related *effort* (six items; e.g., time pressure, interruptions, responsibility, working overtime, increasing demands), *reward* (10 items; e.g., money, esteem, career opportunities) and *over-commitment* (this scale was omitted in the present survey) using a 4-point scale (1 = "strongly disagree" to 4 = "strongly agree"). Effort and reward are used to calculate an effort/reward imbalance-ratio (45). However, the current study utilized both subscale scores directly as reliable indicators of occupational resources and stressors (reward: ordinal $\alpha = 0.88$; effort: ordinal $\alpha = 0.78$).

Data Analysis

First, we elaborated the factorial validity of the STSS-F using a series of five ICM-CFAs: Model 1 consisted of the three factors originally identified by Bride et al. (1): intrusion (items 2, 3, 6, 10, 13), avoidance (items 1, 5, 7, 9, 12, 14, 17), and arousal (items 4, 8, 11, 15, 16). In Model 2, a pooled avoidance-arousal factor (12 items) was specified along with the intrusion factor. In Model 3, all 17 items loaded on a single STS factor. In Model 4 (numbing model), avoidance splits into narrow avoidance (items 12 and 14) and numbing (items 1, 5, 7, 9, and 17), leading to a four-factor model (intrusion, narrow avoidance, numbing, arousal). In Model 5 (dysphoria model), the narrow avoidance factor (items 12 and 14), a dysphoria factor (items 1, 4, 5, 7, 9, 11, 15, and 17), and a hyperarousal factor (items 8 and 16) were specified along with the intrusion factor. We also applied ESEM to the data (Model 6) (31). The number of factors to retain were determined via Velicer's (46) minimum average partial (MAP) test and via the Hull method based on the Common part Accounted For index (Hull-CAF) (47). The Hull-CAF aims to find the number of major factors that provides an optimal balance between number of parameters and model fit. The MAP test and Hull-CAF were based on polychoric correlations and they were carried out in FACTOR (48). The retained factors were target-rotated (22). Target rotation allows for more control on the expected factor structure. The target matrix was specified in a way that all intrusion items load on the expected intrusion factor, all avoidance and arousal items load on the expected avoidance-arousal factor and all estimated cross-loadings were targeted to be as close to zero as possible.

Factor analyses were carried out in Mplus 7 (49). Given that STSS scores are typically skewed (9) and that the rating scale might be regarded as five ordered categories, the data were modeled as ordinal using weighted least squares mean and variance-adjusted estimation (WLSMV). To evaluate the model fit, the conservative χ^2 -statistic of perfect fit was complemented by four fit indices: the normed χ^2 (acceptable fit ≤ 3 ; good fit ≤ 2), the root mean square error of approximation (RMSEA; acceptable fit ≤ 0.08 ; good fit ≤ 0.06), the comparative fit index (CFI), and the Tucker Lewis Index (TLI; CFI & TLI: acceptable fit ≥ 0.90 ; good fit ≥ 0.95) (50). Nested models were compared by consistent results in the change χ^2 -test (DIFFTEST-option in Mplus) and practical relevant decrease in model fit [i.e.,

$\Delta\text{TLI} = \text{TLI}_{\text{constr.}} - \text{TLI}_{\text{unconstr.}} < -0.01$; (29)]. Predictive fit indices (e.g., AIC) are not available under WLSMV estimation, which precluded the comparison of non-nested models.

Second, in order to safeguard the usage of the STSS-F total score, item statistics and reliability coefficients (ordinal Cronbach's α and McDonald's $\varpi_{\text{hierarchical}}$ and ϖ_{total}) will be reported. Coefficients ϖ (51) were estimated with R 3.3.2 (52) and the Psych-package (53) based on minres-factoring and polychoric correlations.

Third, divergent and convergent validity of the STSS-F total and subscale scores was established by calculating zero-order and partial correlations with general distress and PTSD symptoms. Correlations were compared with Steiger's (54) z test for dependent correlations.

Finally, the utility of the STSS-F total score to account for variance in core dimensions of burnout beyond perceived stress, general distress, posttraumatic stress, and work related effort and reward was tested. The STSS-F total score entered first and the remaining variables entered at the second step. The first step tested the criterion validity of STSS-F and the second step probed the incremental validity of STSS-F (i.e., the test of STSS-F's partial effect is equivalent to the test of ΔR^2 when the remaining mental health variables entered first and STSS-F total entered last). Standardized coefficients obtained for the STSS-F in the second step were compared with the coefficients of the remaining exogenous variables using the Wald test. The analyses were carried out in Mplus 7 based on z -scored variables and maximum likelihood estimation.

Due to $n = 1$ (HADS, PTSD-7) missing case, the effective sample sizes ranged from $N = 219$ to 220 in the analyses. Univariate outliers ($z > 3.29$, $p < 0.001$) were found for STSS-F total and depersonalization. To reduce their impact in correlation and regression analyses, three scores (depersonalization) and one score (STSS-F total) were altered prior to the analyses [i.e., extreme raw scores were assigned values one unit larger than the next most extreme value in the distribution; for details see (55)].

RESULTS

Establishing the Factorial Structure of the STSS-F

The model fit statistics obtained in the six factor analyses are presented in **Table 2**, item loadings, variance explained and factor correlations for the Models 1, 2, 5, and 6 can be seen in **Table 3**. For all models, perfect fit to the data was rejected (for χ^2 -test results see **Table 2**). In terms of approximate fit, the three-factor model showed an acceptable fit to the data (see **Table 2**, Model 1). All items showed substantial item loadings (median, $Mdn = 0.71$, range: 0.54 – 0.79 , all $p < 0.05$) and the explained item variances ranged from 29% to 63%. The high factor correlation between arousal and avoidance implied poor discriminant validity of both factors. The more restrictive Model 2 fitted acceptably to the data as well (see **Table 2**). Using the DIFFTEST-option in Mplus, Model 2 showed a significant drop in model fit when compared to Model 1, $\Delta\chi^2(df = 2) = 6.34$, $p = 0.042$. However, the small $\Delta\text{TLI} = -0.001$ implied no practically relevant loss in model

fit. Again, all items showed substantial item loadings ($Mdn = 0.70$, range: 0.53 – 0.79 , all $p < 0.05$) and the levels of explained item variances remained fairly the same (range: 28–63%). The unifactorial solution (Model 3) failed to reach acceptable levels of model fit. Compared to Model 2, the more constrained Model 3 yielded a poorer model fit in terms of $\Delta\chi^2(1) = 52.97$, $p < 0.001$, and $\Delta\text{TLI} = -0.054$. Thus, a single factor did not adequately account for the associations among the items. The test of Model 4 resulted in a non-positive definite PSI matrix, which rendered the solution uninterpretable. Model 5 reached the best fit indices of all ICM-CFA models (see **Table 2**). Compared to Model 2, Model 5 yielded a better fit in terms of χ^2 , $\Delta\chi^2(df = 5) = 24.76$, $p < 0.001$, but TLI change suggested a practically insignificant gain in model fit, $\Delta\text{TLI} = -0.008$. Compared to Model 1 and 2, Model 5 reached slightly higher loadings ($Mdn = 0.71$, range: 0.56 – 0.85) and explained item variance (range: 31–73%) (see **Table 3**).

Both the MAP test and the Hull-CAF suggested two factors to retain. All four fit indices suggested a good fit for Model 6 (see **Table 2**). Compared to the ESEM model, the more constrained Model 2 yielded a poorer model fit (Model 2: $\Delta\chi^2(df = 15) = 62.58$, $p < 0.001$, and $\Delta\text{TLI} = -0.023$). Model 5 is not nested under Model 6 which prevents a direct comparison of both models. However, Model 6 yielded better fit indices than Model 5 which is consistent with a better overall fit of Model 6³. Both ESEM factors jointly accounted for 27–68% of item variance ($Mdn = 52\%$). Inspection of the factor loadings in **Table 3** revealed that all primary loadings were on their expected factors, were statistically significant and, except for item 4 ($a = 0.37$), substantial in size ($Mdn = 0.66$; range: 0.37 – 0.88). Seven significant cross-loadings emerged. Except for item 16 ($a = 0.38$), all cross-loadings fell below a liberal standard of substantial loadings (i.e., $|a| < 0.30$), implying little or some influence of the respective factor on the construct relevant part of these indicators. Compared to Model 2, both ESEM factors were less correlated ($r = 0.70$ vs. $r = 0.56$) and demonstrated better discriminant validity. The correlated ESEM factor model is technically equivalent to a model including a substantial second-order STS factor (both second-order loadings constrained to be equal and estimated as $a = \sqrt{0.56} = 0.75$)⁴, which bolsters the utility of the STSS-F total score.

Descriptive Statistics and Reliability of STSS-F Variables

Means, standard deviations, and ordinal alpha of STSS-F variables were as follows: Full STSS-F ($M = 31.71$, $SD = 10.09$, range: 17–78, $\alpha = 0.92$), intrusion ($M = 9.16$, $SD = 3.63$, range: 5–23, $\alpha = 0.84$), and avoidance-arousal ($M = 22.55$, $SD = 7.67$,

³To substantiate this conclusion further we re-estimated both Models using robust maximum likelihood estimation (MLR). Model 6 yielded a lower Akaike Information Criterion, $\text{AIC} = 9323.87$, than Model 5, $\text{AIC} = 9329.31$, implying a better fit of Model 6 [cf. (50)].

⁴Strictly speaking, a 2-indicator factor is unidentified. But by either fixing both higher-order loadings to 1.0 or by fixing both loadings to be equal and fixing the second-order variance to 1.0, the higher-order part of the model becomes locally identified. However, testing the second-order part directly gains little additional insight because both fixed loadings are fully determined, and are a transformation of the factor correlation (loading $a = \sqrt{\text{correlation}}$).

TABLE 2 | Summary of model fit statistics from factor analyses of the STSS-F ($N = 220$).

Models	χ^2	df	χ^2/df	CFI	TLI	RMSEA	90%-CI
Model 1: Three correlated factors	242.30***	116	2.09	0.948	0.940	0.070	0.058–0.083
Model 2: Two correlated factors	246.72***	118	2.09	0.947	0.939	0.070	0.058–0.083
Model 3: One factor	364.80***	119	3.07	0.900	0.885	0.097	0.086–0.108
Model 4: Four correlated factors (King et al.) ^a	224.75***	113	1.99	0.954	0.945	0.067	0.054–0.080
Model 5: Four correlated factors (Simms et al.)	221.35***	113	1.96	0.956	0.947	0.066	0.053–0.079
Model 6: Two correlated ESEM factors	173.23***	103	1.68	0.971	0.962	0.056	0.041–0.070

χ^2 , χ^2 based on WLSMV estimation; df, degrees of freedom; χ^2/df , normed χ^2 ; CFI, comparative fit index; TLI, Tucker-Lewis index; RMSEA, root mean squared error of approximation and the respective 90%-CI; Model 1, three correlated factors [i.e., intrusion, avoidance, arousal; (1)]; Model 2, two correlated factors (i.e., intrusion, avoidance-arousal); Model 3, unidimensional model; Model 4, numbing model (26); Model 5, dysphoria model (28); Model 6, two target rotated ESEM factors (i.e., intrusion, avoidance-arousal); ^a inadmissible solution due to a non-positive definite PSI matrix. *** $p < 0.001$.

TABLE 3 | Descriptive item statistics, factor loadings and factor correlations for four tested models ($N = 220$).

STSS-F Items	<i>M</i>	<i>SD</i>	Model 1				Model 2			Model 5					Model 6		
			<i>F</i> ₁₋₁	<i>F</i> ₁₋₂	<i>F</i> ₁₋₃	<i>R</i> ²	<i>F</i> ₂₋₁	<i>F</i> ₂₋₂	<i>R</i> ²	<i>F</i> ₅₋₁	<i>F</i> ₅₋₂	<i>F</i> ₅₋₃	<i>F</i> ₅₋₄	<i>R</i> ²	<i>F</i> ₆₋₁	<i>F</i> ₆₋₂	<i>R</i> ²
1. Felt emotionally numb	1.53	0.77		0.56		0.31		0.55	0.30			0.56		0.31	<u>-0.17</u>	<u>0.69</u>	0.38
2. Heart started pounding	1.87	1.04	0.79			0.63	0.79		0.62	0.79				0.62	<u>0.65</u>	<u>0.15</u>	0.56
3. Reliving client's trauma	1.54	0.78	0.74			0.55	0.74		0.55	0.74				0.55	<u>0.67</u>	0.10	0.53
4. Had trouble sleeping	2.57	1.33			0.58	0.33		0.58	0.34			0.59		0.35	<u>0.29</u>	<u>0.37</u>	0.33
5. Discouraged about future	2.19	1.20		0.71		0.51		0.70	0.49			0.72		0.52	<u>0.21</u>	<u>0.55</u>	0.48
6. Upset by reminders	2.04	1.00	0.65			0.42	0.65		0.43	0.65				0.42	<u>0.66</u>	0.03	0.45
7. Little interest	1.49	0.74		0.71		0.50		0.69	0.48			0.71		0.50	<u>-0.22</u>	<u>0.88</u>	0.61
8. Felt jumpy	1.90	1.02			0.70	0.49		0.70	0.49				0.71	0.50	0.07	<u>0.66</u>	0.50
9. Less active than usual	2.04	1.08		0.69		0.48		0.68	0.46			0.70		0.49	-0.07	<u>0.75</u>	0.51
10. Unintended thought	2.16	1.18	0.74			0.55	0.74		0.55	0.74				0.55	<u>0.67</u>	0.09	0.53
11. Trouble concentrating	2.11	1.08			0.78	0.61		0.79	0.62			0.80		0.64	-0.09	<u>0.87</u>	0.68
12. Avoid reminders	1.43	0.85		0.76		0.58		0.75	0.57		0.85			0.73	<u>0.25</u>	<u>0.57</u>	0.55
13. Disturbing dreams	1.55	0.94	0.63			0.40	0.63		0.40	0.63				0.40	<u>0.76</u>	-0.08	0.52
14. Avoid working with clients	1.55	0.81		0.54		0.29		0.53	0.28		0.59			0.35	0.14	<u>0.43</u>	0.27
15. Easily annoyed	2.36	1.04			0.72	0.52		0.73	0.53			0.74		0.55	0.13	<u>0.64</u>	0.52
16. Expected bad to happen	1.74	1.00			0.76	0.58		0.77	0.59				0.78	0.61	<u>0.38</u>	<u>0.49</u>	0.59
17. Memory gaps	1.65	0.87		0.62		0.38		0.61	0.37			0.62		0.39	-0.12	<u>0.71</u>	0.43
Factor correlations			0.66				0.70			0.72					0.56		
			0.75	0.99						0.63	0.84						
										0.80	0.77	0.94					

Model 1, three correlated ICM-CFA factors (1); Model 2, two correlated ICM-CFA factors; Model 5, dysphoria model (28); Model 6, two target rotated ESEM factors; *F*₁₋₁, *F*₂₋₁, *F*₅₋₁, *F*₆₋₁, intrusion; *F*₂₋₂, *F*₆₋₂, avoidance-arousal; *F*₁₋₂, avoidance; *F*₁₋₃, arousal; *F*₅₋₂, narrow avoidance; *F*₅₋₃, dysphoria; *F*₅₋₄, hyperarousal; *R*², squared multiple correlation; ESEM loadings significant at $p < 0.05$ are underlined, secondary loadings $|a| > 0.30$ are printed in italics.

range: 12–57, $\alpha = 0.91$) (for avoidance and arousal see **Table 1**). Using a cut-off score of 38 to determine the presence of STSD (9), $N = 58$ (26.4%) of the midwives were at or above the cut-off score suggesting a moderate prevalence rate of traumatization in the sample. The STSS-F total score was slightly skewed, skew = 0.78, and moderately kurtotic, kurtosis = 1.06 (intrusion: skew = 0.96, kurtosis = 0.72; avoidance-arousal: skew = 0.97, kurtosis = 1.30). At item level, skew ranged from 0.34 to 2.22 ($Mdn = 0.98$) and kurtosis ranged from -1.10 to 4.93 ($Mdn = 0.27$). The rate of endorsement to the response category “1=never” ranged from 22.3% (item 15) to 74.5% (item 12) ($Mdn = 50.5\%$; for 15 items, the mode was ‘1’) which is comparable

to the frequencies reported in Bride (9) for social workers. Item difficulties ranged from 11% (item 12) to 39% (item 4) with a median of 22%. All corrected item-total correlations of the 17 items in the STSS-F total score were satisfactorily ($Mdn = 0.54$, range: 0.40–0.66).

The coefficients omega estimated for the full STSS were $\omega_{\text{hierarchical}} = 0.77$ and $\omega_{\text{total}} = 0.94$. Omega total reflects a high degree of variance due to the major and group factors underlying the STSS-F, whereas $\omega_{\text{hierarchical}}$ indicates that a substantial proportion of item variance was due to a general STS factor. Thus, the STSS-F total score estimates a general STS factor that is common to all 17 STSS-F items at a satisfactory precision which

provides additional support for the usage of the STSS-F total score in further analyses.

Criterion Validity of the Full STSS-F

Pearson correlations and partial correlations including the STSS-F total, intrusion and avoidance-arousal subscales are shown **Table 4**. The STSS-F total score correlated positively with PTSD-7 and HADS total, but according to the z -test for dependent correlations, the correlation with PTSD-7 was significantly stronger, $z = 3.22$, $p = 0.001$. Intrusion was similarly related to general psychological distress and posttraumatic stress, which is likely due to the fact, that the PTSD-7 screener lacks intrusions. Accordingly, PTSD-7 was stronger related to avoidance-arousal than to intrusion, $z = 7.02$, $p < 0.001$. Avoidance-arousal was also positively related to HADS total, but this association was smaller compared to the link to posttraumatic stress, $z = -4.42$, $p < 0.001$. When HADS total was controlled for, the partial correlations between STSS-F total, avoidance-arousal and PTSD-7 remained strong, $pr = 0.62$, and $pr = 0.67$, $p < 0.001$, but the correlation with intrusion declined to $pr = 0.27$, $p < 0.001$. When PTSD-7 was controlled for, the associations between all three STSS-F variables and HADS total dropped but remained significant, implying weak to moderate specific associations between secondary traumatic stress and general psychological distress ($pr = 0.27$ to 0.37 , all $p < 0.001$). In sum, the stronger overlap of STSS-F total with PTSD-7 than with HADS total, which becomes evident in the observed pattern of Pearson correlations and partial correlations, provides support for the criterion validity of the STSS-F.

When STSS-F total was regressed on general psychological distress, PTSD symptoms, perceived stress, occupational efforts, and rewards, a total of 60.6% of variance in STSS-F total was explained, $F_{(5,213)} = 65.54$, $p < 0.001$. The strongest partial effect was found for PTSD-7, $\beta = 0.44$, $p < 0.001$, followed by perceived stress, $\beta = 0.26$, $p < 0.001$, HADS total, $\beta = 0.12$, $p = 0.020$, occupational reward, $\beta = -0.11$, $p = 0.017$, and effort, $\beta = 0.10$, $p = 0.049$. Thus, posttraumatic symptoms, and to a lesser extent perceived stress, general psychological

distress, occupational efforts and rewards were all specifically and independently related to STS.

The results from regressing the core dimensions of burnout on STSS-F total and other mental health and work related variables are shown in **Table 5**. We also initially included the effort-reward imbalance ratio but since no significant partial effects for ERI-ratio were found in the presence of effort and reward, the ERI-ratio was dropped. When STSS-F total entered the model first, STS was related to depersonalization, $\beta = 0.50$, $p < 0.001$, exhaustion, $\beta = 0.68$, $p < 0.001$, and personal accomplishments, $\beta = -0.39$, $p < 0.001$, thereby supporting the criterion validity of the STSS-F. When the remaining variables entered the model in the second step, STSS-F total remained significantly related to depersonalization ($\beta = 0.54$, $p < 0.001$), exhaustion ($\beta = 0.41$, $p < 0.001$), and personal accomplishments ($\beta = -0.18$, $p = 0.043$). Thus, STS accounted for burnout variance beyond posttraumatic stress, general psychological distress, perceived stress, effort, and reward, which supports the incremental validity of the STSS-F. As indicated by the Wald test, STSS-F total was the strongest individual contributor to depersonalization (see **Table 5**). STSS-F total contributed also stronger to exhaustion than posttraumatic stress, perceived stress, and general distress. Thus, STS is highly relevant for both core dimensions of burnout.

DISCUSSION

The current study aimed to validate the French version of Bride et al.'s (1) Secondary Traumatic Stress Scale in a sample of $N = 220$ Swiss midwives by evaluating its factorial and criterion validity. Using the ICM-CFA approach (22), a series of five models was tested, of which the King et al. (26) numbing model, and the Simms et al. (28) dysphoria model were tested for the first time in the context of the STSS. A sixth model including two ESEM factors (31) was also estimated, which is also new in the context of the STSS. The more appropriate utilization of WLSMV estimation represents a methodological advance over recent studies that relied on normal theory estimators [e.g., (1, 19, 21)]. The results supported the factorial and concurrent validity, as well as the reliability of the STSS-F.

When testing the factorial validity, Bride et al.'s (1) three-factor model (Model 1) showed an acceptable model fit, suggesting configurational invariance for the original STSS and the STSS-F. Consistent to prior findings, intrusion and avoidance were poorly differentiated (20, 21). Thus, a more restrictive two-factor model including an intrusion factor and a pooled avoidance-arousal factor (Model 2) fitted acceptably to the data as well and showed no practically relevant loss in model fit (i.e., change in TLI). The single-factor model (Model 3) suggested by Benuto et al. (19) and Ting et al. (21) was not supported by the current data. This is hardly surprising, given that avoidance and arousal are usually differentiable from intrusion [(1, 20), (24) as cited in (21)]. However, Simms et al.'s (28) dysphoria model (Model 5) yielded the best fit of all ICM-CFA models [the test of the numbing model (26) resulted in an inadmissible solution]. Thus, rearranging avoidance and arousal

TABLE 4 | Pearson correlations (below the diagonal) and partial correlations (above the diagonal) between STSS-F variables and mental health variables.

	STSS-F total ^a	Intrusion ^a	Avoidance-arousal ^a	PTSD-7	HADS total
STSS-F total ^a	–	–	–	0.62***	0.37***
Intrusion ^a	0.77*** ^b	–	–	0.27***	0.27***
Avoidance-arousal ^a	0.95*** ^b	0.54***	–	0.67***	0.34***
PTSD-7	0.68*** ^c	0.37*** ^d	0.72*** ^{d,e}	–	0.03
HADS total	0.50*** ^{c,f}	0.37***	0.48*** ^e	0.36*** ^f	–

Partial correlations were either controlled for the respective STSS-F variable, PTSD-7, or HADS total; ^aPrior to the analyses one score was altered to reduce the impact of an univariate outlier. ^{b,c,d,e,f}Correlations with the same superscript differ in Steiger's (54) z -test for dependent correlations at $p < 0.01$; *** $p < 0.001$ (2-tailed); $N = 219$.

TABLE 5 | Hierarchical regression analyses with secondary traumatic stress entered at step 1, and posttraumatic stress, general distress, perceived stress, occupational effort, and rewards entered at step 2.

	Depersonalization (MBI) ^a			Exhaustion (MBI)			Accomplishments (MBI)		
	β	SE	z	β	SE	z	β	SE	z
1. Secondary traumatic stress (STSS-F) ^a	0.50	0.06	8.47***	0.68	0.05	13.61***	-0.39	0.06	-6.24***
2. Secondary traumatic stress (STSS-F) ^a	0.54	0.09	6.01***	0.41	0.07	5.95***	-0.18	0.09	-2.02*
Posttraumatic stress (PTSD-7)	-0.11 ^c	0.08	-1.34	0.03 ^c	0.06	0.45	-0.01	0.08	-0.12
General distress (HADS)	-0.01 ^c	0.07	-0.16	-0.06 ^c	0.05	-1.14	0.02	0.07	0.27
Perceived stress (PSS)	-0.07 ^c	0.08	-0.86	0.14 ^b	0.06	2.25*	-0.25	0.08	-3.11**
Effort (ERI)	0.23 ^b	0.07	3.55***	0.25	0.05	5.00***	0.24 ^c	0.07	3.73***
Reward (ERI)	0.04 ^c	0.07	0.60	-0.24 ^c	0.05	-4.84***	0.37 ^c	0.06	5.72***
Step 1	$R^2 = 0.25$, $SE = 0.05$, $z = 4.88***$			$R^2 = 0.46$, $SE = 0.05$, $z = 9.25***$			$R^2 = 0.15$, $SE = 0.05$, $z = 3.39***$		
Step 2	$R^2 = 0.30$, $SE = 0.05$, $z = 5.72***$			$R^2 = 0.59$, $SE = 0.04$, $z = 14.03***$			$R^2 = 0.31$, $SE = 0.05$, $z = 5.89***$		

Regression analyses were carried out in Mplus using maximum likelihood estimation; β = standardized regression coefficient; SE, standard error; z, z-test (β/SE); ^aPrior to the analyses one score (STSS-F total) and three scores (depersonalization) scores were altered; ^bCoefficient differs at $p < 0.01$ from the respective STSS-F coefficient (Wald-test); ^cCoefficient differs at $p < 0.001$ from the respective STSS-F coefficient (Wald-test); tolerance values for all predictor variables in the second step were $\geq .49$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; $N = 219$.

symptoms into a dysphoria factor and two narrower avoidance and hyperarousal factors improved the model fit. This finding is in line with evidence on the factor structure of inventories assessing PTSD in accordance with DSM-IV's (3) PTSD criteria (23, 25).

Concluding that the factor structure of the STSS-F and of established PTSD inventories converge at the dysphoria model is premature in the light of the results obtained for Model 6. The ESEM analysis supported a two-factor model and both factors were readily interpretable as intrusion and avoidance-arousal [cf., (15)]. Model 6 is similar to the ICM-CFA Model 2, but it fitted significantly better than Model 2 and we found indications that it fitted also better to the data than Model 5. Consistent with the literature (22, 31), both ESEM factors were better differentiated than both factors in Model 2. The deflated factor correlation and the superior model fit of Model 6 were mainly due to seven small, yet statistically significant cross-loadings. These cross-loadings are consistent with the insight that in applied settings, psychometric indicators are seldom perfectly pure indicators of a given construct (31). However, only one cross-loading (item 16) can be considered to be of practical importance (i.e., $a > 0.30$) and this cross-loading is likely due to substantive theory: The expectation of "something bad to happen" mainly reflects arousal, but it also comprises the occurrence of future intrusions as "bad events." This cross-loading thus reflects the influence of the intrusion factor on the construct-relevant part of item 16 and it allows intrusion to be estimated more precisely. In sum, the superior model fit and the better divergent validity of both ESEM factors imply that Model 6 provided the best representation of the factor structure underlying the STSS-F. It suggests that perfect simple structure does not adequately represent STSD phenomena. The marked preference of STSD-researchers for models that conform to perfect simple structure and their reliance on ICM-CFA models may have led to a biased understanding of the nature of STSD [for an exception see (15)]. However, covariation among STSD symptoms may also be under the influence of methodological

factors (30). Thus, we need to emphasize that the two-factor structure may hold only for the STSS-F rather than for the STSD structure in general.

Interestingly, the two-factor model is inconsistent to prior research on the factor structure of PTSD instruments. As Elhai and Palmieri (25) note, little data support two-factor PTSD models that also diverge structurally from the current two-factor STSS model [e.g., intrusion/avoidance and numbing/hyperarousal factors; (56)]. However, the two-factor STSS model is consistent with prior findings of poorly differentiated arousal and avoidance ICM-CFA-factors [e.g., (19–21), see also (15)]. It thus cannot be dismissed as an artifact of item translation, sampling bias or a cultural idiosyncrasy. Instead, the present findings might indicate that the factor structures of the STSS and established PTSD instruments do not fully converge. If this holds true, this divergence might extend prior findings that the structure of PTSD symptom measures might be impacted by differences in trauma exposure [i.e., trauma-exposed vs. non-trauma exposed respondents; (25)]. However, recent attempts to bring a modified STSS into alignment with the DSM-5 (5) definition of PTSD supported a hybrid model, which connects fairly well to the DSM-5 based PTSD literature (6) and casts doubts on the potential divergence of the factorial structure of both STSD and PTSD symptoms. However, Mordeno et al. (6) did not test for an alternative ESEM model and their reliance on overly restrictive ICM-CFA models might have led to biased results.

Which conclusions regarding the factorial structure of the original STSS can be drawn from the current study? Consistent with the research on DSM-IV-based PTSD models (23), a single factor unlikely represents the factorial structure of the STSS. The three-factor model suggested by Bride et al. (1) regularly evidenced an acceptable model fit in prior research. The current results also suggest that the dysphoria model (28) is superior to the three-factor model and that both models are inferior to the two-factor ESEM model. The former suggestion is consistent with previous research on PTSD models (23). However, the

two-factor ESEM model is parametrically more complex than both alternative models, which might impair its generalization. Given that tests of the factorial invariance of the STSS across different cultures and populations of helping professionals are lacking, it might be premature to discard the three-factor model and the dysphoria model in favor of the promising two-factor ESEM model. Thus, more research is needed to draw reliable conclusions on the factorial structure of the STSS in general and the two-factor ESEM model in particular. In order to investigate the structure of the STSS further, future research should consider Bayesian Structural Equation Modeling [BSEM; (57)]. Within BSEM, unimportant cross-loadings are specified to have a mean of zero and a small variance. As a consequence, BSEM with informative small-variance priors shrinks the cross-loadings toward their zero prior mean likely yielding smaller cross-loadings than ESEM with target rotation (57). This feature is appealing for a re-evaluation of the cross-loading obtained for item 16. Finally, once the factorial structure of the STSS has been sufficiently established, future research may improve the original STSS (1) and the DSM-5 adapted STSS (6) by applying item response theory [IRT; (58)]. IRT provides detailed information on individual item characteristics, which may help to improve the psychometric quality of the STSS by excluding poorly performing items.

In applied research settings, the STSS-F total score is usually taken as overall index of secondary traumatic stress. The present results also supported the criterion validity and reliability of the STSS-F total score: The correlated ESEM factors, which imply a substantial second-order STS factor, and the acceptable to good reliability of the STSS-F total score in terms of coefficient alpha, $\alpha_{\text{hierarchical}}$, and α_{total} support the usage of the STSS-F total score. The STSS-F total score was positively related to general psychological distress and PTSD symptoms, but the association with the latter was stronger, thus supporting the validity of the STSS-F. When PTSD symptoms were controlled for, the STSS-F total score remained positively related to general psychological distress. The specific associations of the full STSS-F with PTSD symptoms and general psychological distress suggest that the STSD symptoms have different etiologies in PTSD, depression, and anxiety. However, it has been recognized that PTSD and STSD include non-specific negative affect (28). Thus, these results are in line with the literature on PTSD and STSD and provide no threat to the validity of the STSS-F.

Finally, the core dimensions of burnout (35) were regressed on STSS-F total (step 1), mental health and occupation-related variables (step 2). In step 1, the full STSS-F was positively linked to emotional exhaustion and depersonalization and negatively linked to personal accomplishments. Given that STS is a reliable correlate of burnout (38), these findings bolster the criterion validity of the STSS-F. Perceived stress, general psychological distress, PTSD symptoms, occupational reward, and occupational effort accounted for 60.6% of variance in the STSS-F total score. And even when this substantial overlap was controlled for, the full STSS-F remained significantly related to all three core dimensions of burnout, thereby demonstrating incremental validity. We also compared the partial effects of the full STSS-F with the effects of the remaining exogenous variables in the regression model. For depersonalization, the

strongest partial effect in the model was found for the full STSS-F. Moreover, the partial effect of the full STSS-F on exhaustion was stronger than the respective effects of posttraumatic stress, perceived stress, and general psychological distress. For personal accomplishments, the effect of the full STSS-F was less pronounced. These results provide further support for the notion that STS is of utmost importance for the understanding of burnout in helping professionals (38).

LIMITATIONS

Several limitations of the current study need to be mentioned: First, the current sample size might be considered as rather small for factor analysis. However, WLSMV yields reliable test statistics, parameter estimates, and standard errors for medium sized CFA models and sample sizes as small as $N = 200$ (50). The ratio of cases per indicator in each model (1:13) and the sample size of $N = 220$ is sufficient for models with $df \geq 100$ to achieve power of 0.80 for RMSEA-based tests of close fit (59). Thus, sample size unlikely represents a serious limitation to the current study. Second, no tests of factorial invariance of the STSS-F and the original STSS were conducted. As long as such tests are missing, the results obtained by both STSS versions need to be compared cautiously. Third, a homogeneous sample of midwives was used in the current study. Given that various variables may impact the factor structure of the STSS-F [see (25)] more research is needed to test the factorial invariance across various samples of helping professionals. Fourth, recent attempts have been made to bring the STSS in alignment with the DSM-5 definition of PTSD (6). However, this study was unavailable when the current study was conducted. Given that the original STSS is still in extensive use, we continued with the original STSS. Despite this, the modification of the STSS-F to assess STSD in line with DSM-5 is a necessary step in future research. A related limitation is the omission of symptoms of intrusion in the PTSD screening scale, which likely resulted in a downwardly biased association between PTSD symptoms and STSS-F intrusion. Fifth, the current data are cross-sectional, which prevents causal interpretations of the obtained effects. Sixth, the results are exclusively based on self-report data, which might be biased by several methodological factors (30). Finally, the present study was conducted as a web-based survey, which might cast doubt on the quality of the data. However, prior evidence suggests that traditional paper-and-pencil and web-based data collection methods yield basically equivalent data [e.g., (60, 61)].

Despite these limitations, the present study provides evidence for the validity and reliability of the STSS-F and thus makes the STSS accessible to French speaking research and clinical contexts. Future research might aim to compare different professional groups using the STSS-F.

AUTHOR CONTRIBUTIONS

IJ and AH conceived of and designed the study, jointly drafted the manuscript and approved the final version. IJ carried out the data analysis. IJ and AH contributed to the interpretation of data. MC and CM contributed to the design of the study, the

data collection, and interpretation of the data. They also critically reviewed and approved the final draft of the manuscript. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Parental Recognition of Bullying and Associated Factors Among Children After the Fukushima Nuclear Disaster: A 3-Year Follow-Up Study From the Fukushima Health Management Survey

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This study examined parental recognition of bullying victimization and associated factors among evacuated children after the 2011 Fukushima Daiichi Nuclear Power Plant accident, using a 3-year follow-up data (wave 1: January 2012; wave 2: January 2013; wave 3: February 2014). The sample included the caregivers of 2,616 children in the first–sixth grades of elementary school, who lived in one of the 13 municipalities that were the target areas of the Mental Health and Lifestyle Survey, conducted as part of the Fukushima Mental Health Management Survey. Across 3 years, around 80% of caregivers responded “not true,” 15% responded “somewhat true,” and 5% responded “certainly true” in response to a question about bullying victimization of their children. Being male was significantly associated with the parental recognition of bullying victimization at wave 1 and wave 3. At wave 1, experiencing the nuclear plant explosion was significantly associated with parental recognition of bullying victimization. Moreover, age at wave 3 was negatively associated with parental recognition of bullying victimization. Our findings will be helpful for establishing community- and school-based mental health care for children, parents, and teachers.

Keywords: bullying victimization, nuclear disaster, child and adolescent psychiatry, relocation, disaster mental health

INTRODUCTION

The Fukushima Daiichi Nuclear Power Plant (FDNPP) disaster occurred on March, 11, 2011, after the Great East Japan Earthquake. An earthquake of magnitude 9.0 in the Tohoku area of Japan triggered a huge tsunami that reached heights of up to 40 m. In the Soma area near the FDNPP, the tsunami had a height of 9.3 m, and 1,817 people were presumed dead (1). The tsunami caused a total loss of

electricity, several explosions at FDNPP buildings, and widespread diffusion of radioactive materials. A nuclear emergency was declared for the first time in Japan, and residents within 20 km of the FDNPP were evacuated. Among the approximately 2 million people living in Fukushima Prefecture at the time of the disaster, more than 160,000 people were evacuated as of May 2012. As of 5 years after the Fukushima disaster, approximately 11,000 school-aged children were relocated along with their family members (2). The Fukushima disaster was regarded as a complex of different types of disasters: earthquake, tsunami, and nuclear disaster (3, 4).

The local government of Fukushima Prefecture and Fukushima Medical University started a large cohort study called the Fukushima Health Management Survey to investigate the effects of long-term low-dose radiation exposure caused by the accident (5). The study consists of several surveys, including thyroid ultrasound examinations for all children in Fukushima aged 18 years or younger at the time of the disaster, a comprehensive health check for all residents from the evacuation zones, an assessment of the mental health and lifestyle factors of all residents from the evacuation zones, and records of all pregnancies and births among all women in the prefecture who were pregnant on March 11, 2011. A survey of mental health and lifestyle factors has been conducted annually.

Nuclear disasters are typically regarded as an “invisible” disaster. Because it is difficult to estimate the health impacts and risk associated with a nuclear disaster, the relevance of psychological consequences after a disaster may increase in the long term. Importantly, researchers have reported that the biggest impact of the Chernobyl disaster throughout the years has been on mental health (6). Thus, the concerns of parents regarding the health status of their children represent one of the most important issues involved in the aftermath of nuclear accidents. Previous studies of the Fukushima disaster reported that the mental health impacts continued for years after the disaster (7), with a difference in the impacts for evacuees and nonevacuees. Thus, the situations of the evacuees after a nuclear disaster in the long term could be considered as the “daily living in the post-disaster context.”

In the current study, we focused on bullying among children after the Fukushima disaster. A survey by the Ministry of Education, Culture, Sports, Science, and Technology of Japan found 204 cases of bullying victimization involving children who evacuated Fukushima after the nuclear disaster (2, 8). Examples of disaster-related bullying included being nicknamed “radiation,” being told to go back to Fukushima, or being accused of causing the plant explosion. One previous study reported that the prevalence of bullying victimization among children evacuated from the Fukushima Prefecture was 1.09% in 2016 (2). However, the Ministry of Education, Culture, Sports, Science, and Technology of Japan reported that the number of school bullying cases in the country under a nondisaster setting was 323,808 in 2016, with a prevalence of 2.39% in 2015 (2). According to an international survey, the proportion of students bullied under a nondisaster setting varies from 6.3% to 41.4% (9). In a study of 2,630 Japanese junior high school children, the prevalence of being bullied under a nondisaster setting was 18.6% in boys and 19.9% in girls (10). Thus, these results indicate a higher prevalence of bullying than reports by the Japanese government.

A small number of previous studies have examined bullying and bullying victimization among children after large-scale disasters. Terranova et al. (11) reported that youth from an area affected by Hurricane Katrina showed significant increases in relational and overt bullying after the hurricane (11). Although the results did not reveal a significant increase in relational peer victimization, there was a significant decrease in the comparison group over a similar period (11). In addition, the study revealed that being male and being the target of relational victimization before the hurricane predicted higher posthurricane relational victimization (11). Another study of a representative sample of 2,030 children in the United States aged 2–17 years revealed that disaster exposure was associated with some forms of victimization including peer victimization (12).

In the current study, using data from the Fukushima Health Management Survey (5), we examined the prevalence of bullying victimization and associated factors among children who experienced the Fukushima disaster, to elucidate the difference between the prevalence reported in previous study results and the reports by the Ministry of Education, Culture, Sports, Science, and Technology of Japan. Because the data regarding children were obtained from their caregivers (e.g., parents, grandparents), we examined parental recognition of bullying victimization. In addition, using a 3-year follow-up dataset, we investigated changes in the prevalence of bullying victimization over time.

We hypothesized that the proportion of bullying victimization might be associated with sociodemographic factors, including sex and age, and with disaster-related factors, such as the number of disaster types experienced, namely, earthquake, tsunami, and nuclear plant explosion, and the place of residence. With respect to sex, an international comparative study under nondisaster settings showed a higher proportion of boys being bullied than girls in most of the 28 countries studied (9). However, in a Japanese study, the prevalence of being bullied under a nondisaster setting was higher among girls than boys (10). We hypothesized that children whose current place of living was outside of the Fukushima Prefecture would have a higher proportion of bullying victimization, based on a previous study showing that out-of-prefecture evacuee children were at a greater risk of more severe emotional symptoms compared with children who remained living in the affected area (13).

MATERIALS AND METHODS

Study Design

This study was designed as a cohort study at three time points, using the 3-year follow-up dataset from the Mental Health and Lifestyle Survey (14). This survey is one of the detailed surveys of the Fukushima Health Management Survey (5). The target areas of the Mental Health and Lifestyle Survey included 13 municipalities: Hirono, Naraha, Tomioka, Kawauchi, Okuma, Futaba, Namie, Katsurao, Iitate, Minamisoma, Tamura, Kawamata, and highly affected areas in Date. These municipalities were the nationally designated evacuation zones (as of April 2011) inside Fukushima Prefecture, because of their proximity to the FDNPP. The wave 1 and wave 2 assessments were each performed in January of 2012

and 2013. The wave 3 assessment was performed in February 2014. These assessments were conducted through postal mail 10, 22, and 35 months after the disaster. The research group did not conduct the first assessment 12 months after the disaster to avoid transient psychological effects related to anniversary reactions. The comprehensive protocol of this survey has been published elsewhere (5).

Study Population

Study respondents were the caregivers of children born between April 2, 1998 and April 1, 2004, who were in the first to sixth grade of elementary school on March 11, 2011, and living in one of the 13 municipalities that were the target areas of the Mental Health and Lifestyle Survey.

We used data for respondents who answered all three assessments sent directly by post to individual residents. The total number of children in the target area was 8,282 and the response rate of the assessments was 90.1% ($n = 7,463$) at wave 1, 55.2% ($n = 4,574$) at wave 2, and 45.9% ($n = 3,799$) at wave 3. Therefore, the number of study participants of this study was 2,626, constituting 31.7% of the target respondents. Familial relationships of the respondents were 1) mother, 90.1% ($n = 2,357$); 2) father, 7.7% ($n = 201$); 3) grandparents, 1.2% ($n = 31$); and 4) others, 0.8% ($n = 22$). The family member who responded to the questionnaires was decided by the family on a voluntary basis.

Sociodemographic Information

Sociodemographic information such as sex, age at the disaster, disaster types experienced, the number of experiences at the disaster, and place of residence at wave 1 were examined. The experience of the earthquake and tsunami was asked using the following questions: “Did you experience the earthquake?” and “Did you experience tsunami?” Regarding the experience of the nuclear plant accident, we used the question, “Did you hear the sound of the nuclear plant explosion?” because many survivors had experienced intense fear after hearing the hydrogen explosions, which occurred three times during the first day and the fourth day after the earthquake. We assumed that this experience had caused direct, sharply defined horror for the residents, in addition to the vague fear of invisible radiation. We added data regarding the cumulative number of experiences at the disaster, in accordance with the assumption that the psychological burdens depend on the cumulative number of experiences at the disaster. The number of experiences at the disaster was calculated as the total of three kinds (earthquake, tsunami, explosion of the nuclear plant) of experiences at the disaster, ranging from 0 to 3. For place of residence, it was previously reported that many residents in the target area experienced frequent relocations after the disaster (7). To avoid exploring the complex nature of changes in place of residence over time, we only used the data regarding whether the respondent lived within or outside Fukushima Prefecture at the time of the survey at wave 1. Place of residence was categorized into within Fukushima Prefecture or outside Fukushima Prefecture.

Assessments

Children’s victimization was assessed using the criterion “Picked on or bullied by other children over the last six months,” extracted from the peer relationship subscale of the Strengths and Difficulties Questionnaire (SDQ)–Parents’ Version (15–17). The SDQ is a 25-item questionnaire used for identifying psychopathological problems in children. The Japanese version has been reported to exhibit adequate internal consistency (18, 19) and convergent validity (19). In the question regarding children’s victimization, we did not ask the respondent whether the victimization was disaster-related or not. However, because this question was a part of the dataset of the Mental Health and Lifestyle Survey, it is possible that some caregivers thought this question referred to nondisaster settings in the postdisaster context.

Statistical Analysis

We conducted chi-square tests to compare the prevalence of children at risk of being bullied on the basis of sociodemographic characteristics and disaster-related variables. Residual analyses were conducted to identify the contribution of variables. Cramer’s *V* was used for calculating effect sizes (0.1 as small, 0.3 as medium, and 0.5 as large). Ordered logistic regression analysis was conducted for multivariate analysis. We conducted the analyses with three assessments (wave 1, wave 2, and wave 3) independently. The existence of parental recognition of bullying (0 = Not true, 1 = Somewhat true, 2 = Certainly true) was the dependent variable. The independent variables of this analysis were sex (1 = female, 0 = male), age at the disaster, experience of earthquake (1 = yes, 0 = no), experience of tsunami (1 = yes, 0 = no), experience of nuclear plant explosion (1 = yes, 0 = no), and place of residence (1 = Outside Fukushima Prefecture, 0 = within Fukushima Prefecture). A significance level of 0.05 was used in the two-sided tests. All statistical analyses were conducted using IBM SPSS Statistics for Windows, Version 21.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Sociodemographic Characteristics and Disaster-Related Variables

Sociodemographic characteristics and disaster-related variables are shown in **Table 1**. The mean age and the standard deviation of children at the disaster was 9.33 ± 1.7 years. While almost all children experienced an earthquake, only 12.3% had experienced a tsunami. Approximately 40% of children heard the nuclear plant explosion.

Parental Recognition of Bullying Victimization

Table 2 shows the percentages of parental recognition of bullying victimization. Across the 3 years, around 80% responded “not true,” 15% responded “somewhat true,” and 5% responded “certainly true.”

TABLE 1 | Sociodemographic characteristics and disaster-related variables of the study children ($n = 2,616$).

	<i>n</i>	%
Sex		
Male	1,326	50.7
Female	1,290	49.3
Age at time of disaster (years)		
6	28	1.1
7	463	17.7
8	465	17.8
9	463	17.7
10	424	16.2
11	406	15.5
12	367	14.0
Disaster types experienced		
Earthquake	2,590	99.0
Tsunami	321	12.3
Nuclear plant explosion	1,059	40.5
Number of experiences at the disaster		
0	11	0.4
1	1,426	54.5
2	981	37.5
3	194	7.4
Data missing	4	0.2
Place of residence (current address) at wave 1		
Within Fukushima Prefecture	2,087	79.8
Outside Fukushima Prefecture	518	19.8

TABLE 2 | Percentages of parental recognition of bullying victimization, by waves.

	Wave 1 (2012)	Wave 2 (2013)	Wave 3 (2014)
Not true, <i>n</i> (%)	2,043 (78.1)	2,090 (79.9)	2,130 (81.4)
Somewhat true, <i>n</i> (%)	412 (15.7)	394 (15.1)	369 (14.1)
Certainly true, <i>n</i> (%)	154 (5.9)	124 (4.7)	103 (3.9)
Data missing, <i>n</i> (%)	7 (0.3)	8 (0.3)	14 (0.5)
Total, <i>n</i>	2,616	2,616	2,616

Comparison by Sociodemographic Characteristics and Disaster-Related Variables

Comparisons of parental recognition of bullying victimization by sociodemographic characteristics and disaster-related variables are shown in **Table 3**. Chi-square tests revealed significant differences in parental recognition of bullying victimization for all independent variables, except age at the time of the disaster. Cramer's *V* for all chi-square analyses were categorized into "small" effect sizes (0.11 or smaller).

Across the three assessments, there were significant differences between boys and girls. Residual analysis revealed that the percentage of "somewhat true" and "certainly true" responses for boys were significantly higher than that for girls ($|r| = 3.8$ and 4.0 , $p < 0.01$). There were no significant differences on age at the disaster.

With respect to disaster-related variables, there were significant differences in experiences for all types of disaster (earthquake, tsunami, nuclear plant explosion) at wave 1. However, only the experience of tsunami showed significant differences at wave 2, and none of the types showed significant

differences at wave 3. Residual analysis revealed that the percentage of "certainly true" responses for children who had experienced tsunami at wave 1 was significantly higher than that for children who had not experienced tsunami ($|r| = 2.3$, $p < 0.05$). The percentages of "somewhat true" and "certainly true" responses for children who had experienced the nuclear plant explosion were significantly higher than those for children who had not experienced the nuclear plant explosion at wave 1 ($|r| = 2.8$ and 2.0 , $p < 0.01$ and $p < 0.05$). The cumulative number of experiences showed significant differences at waves 1 and 2. At wave 1, the percentage of "somewhat true" responses for two experiences was significantly higher than that for other numbers of experiences ($|r| = 3.6$, $p < 0.01$), and the percentage of "certainly true" responses for three experiences was significantly higher than that for other numbers of experiences ($|r| = 2.8$, $p < 0.01$). At wave 2, a similar trend was observed, with the results revealing that the percentage of "somewhat true" responses for two experiences was significantly higher than other numbers of experiences ($|r| = 2.0$, $p < 0.05$), and the percentage of "certainly true" responses for three experiences was significantly higher than other numbers of experiences ($|r| = 2.7$, $p < 0.01$). Although there was no difference in the percentages according to the place of residence at waves 1 and 3, a significant difference was observed at wave 2. The Cramer's *V* for the analyses were 0.03 at wave 1, 0.06 at wave 2, and 0.05 at wave 3. Residual analyses revealed that the percentage of "somewhat true" responses for children who lived outside the Fukushima Prefecture was significantly higher than that for children who lived within the Fukushima Prefecture ($|r| = 3.2$, $p < 0.01$).

Multivariate Ordered Logistic Regression Analysis for Parental Recognition of Bullying Victimization

The results of the ordered logistic regression analysis for parental recognition of bullying victimization, by sociodemographic characteristics and disaster-related variables, by year, are shown in **Table 4**. Being male was significantly associated with the parental recognition of bullying victimization at wave 1 and wave 3. At wave 1, experiencing the nuclear plant explosion was significantly associated with parental recognition of bullying victimization. Moreover, age at wave 3 was negatively associated with parental recognition of bullying victimization.

DISCUSSION

In this study, we found that sex, age at the disaster, and experience of nuclear plant explosion significantly influenced the prevalence of parental recognition in bullying victimization at some point during the study period. Regarding time course, the impact of sex was observed at wave 1 and wave 3; the impact of age was observed at wave 3, whereas the impact of experience of nuclear plant explosion was observed at wave 1. Together with the results of the univariate analysis that the cumulative number of experiences at the disaster was significantly associated until the 2-year follow-up, the disaster-related

TABLE 3 | Comparison of parental recognition of bullying victimization, by sociodemographic characteristics and disaster-related variables, by waves.

	Wave 1 (2012), <i>n</i> (%)				
	Not true	Somewhat true	Certainly true	Chi-square	Cramer's V
Sex					
Male	978 (73.9)	244 (18.4)	102 (7.7)	33.4**	0.11
Female	1,065 (82.9)	168 (13.1)	52 (4.0)		
Age at the disaster					
6	18 (64.3)	9 (32.1)	1 (3.6)	11.0	0.05
7	358 (77.3)	75 (16.2)	30 (6.5)		
8	360 (77.4)	80 (17.2)	25 (5.4)		
9	355 (76.8)	76 (16.5)	31 (6.7)		
10	332 (78.5)	64 (15.1)	27 (6.4)		
11	325 (80.4)	56 (13.9)	23 (5.7)		
12	295 (81.0)	52 (14.3)	17 (4.7)		
Experience of earthquake					
Yes	2,025 (78.4)	409 (15.8)	149 (5.8)	6.1*	0.05
No	15 (68.2)	3 (13.6)	4 (18.2)		
Experience of tsunami					
Yes	238 (74.4)	54 (16.9)	28 (8.8)	6.1*	0.05
No	1,802 (78.9)	358 (15.7)	125 (5.5)		
Experience of nuclear plant explosion					
Yes	789 (74.8)	192 (18.2)	74 (7.0)	13.1**	0.07
No	1,251 (80.7)	220 (14.2)	79 (5.1)		
Number of experiences at the disaster					
0	8 (72.7)	2 (18.2)	1 (9.1)	22.8**	0.09
1	1,156 (81.2)	194 (13.6)	73 (5.1)		
2	732 (74.8)	187 (19.1)	59 (6.0)		
3	144 (74.6)	29 (15.0)	20 (10.4)		
Place of residence (current address) at survey at wave 1					
Within Fukushima Prefecture	1,647 (79.1)	316 (15.2)	118 (5.7)	3.1	0.03
Outside Fukushima Prefecture	391 (75.6)	93 (18.0)	33 (6.4)		
Wave 2 (2013), <i>n</i> (%)					
	Not true	Somewhat true	Certainly true	Chi-square	Cramer's V
Sex					
Male	1,011 (76.4)	236 (17.8)	76 (5.7)	23.4**	0.10
Female	1,079 (84.0)	158 (12.3)	48 (3.7)		
Age at the disaster					
6	24 (85.7)	3 (10.7)	1 (3.6)	8.7	0.04
7	364 (78.8)	78 (16.9)	20 (4.3)		
8	374 (80.6)	64 (13.8)	26 (5.6)		
9	358 (77.7)	83 (18.0)	20 (4.3)		
10	342 (80.7)	64 (15.1)	18 (4.2)		
11	330 (81.9)	54 (13.4)	19 (4.7)		
12	298 (81.4)	48 (13.1)	20 (5.5)		
Experience of earthquake					
Yes	2,075 (80.3)	387 (15.0)	121 (4.7)	6.0	0.05
No	13 (61.9)	5 (23.8)	3 (14.3)		
Experience of tsunami					
Yes	251 (78.2)	44 (13.7)	26 (8.1)	9.2*	0.06
No	1,837 (80.5)	348 (15.2)	98 (4.3)		
Experience of nuclear plant explosion					
Yes	828 (78.3)	174 (16.5)	55 (5.2)	3.8	0.04
No	1,260 (81.4)	218 (14.1)	69 (4.5)		
Number of experiences at the disaster					
0	5 (50.0)	4 (40.0)	1 (10.0)	17.8**	0.08
1	1,163 (81.8)	197 (13.9)	61 (4.3)		

(Continued)

TABLE 3 | Continued

	Wave 2 (2013), <i>n</i> (%)				
	Not true	Somewhat true	Certainly true	Chi-square	Cramer's V
2	769 (78.5)	165 (16.9)	45 (4.6)		
3	151 (77.8)	26 (13.4)	17 (8.8)		
Place of residence (current address) at wave 1					
Within Fukushima Prefecture	1,691 (81.3)	290 (13.9)	100 (4.8)	10.3**	0.06
Outside Fukushima Prefecture	391 (75.8)	101 (19.6)	24 (4.7)		
	Wave 3 (2014), <i>n</i> (%)				
	Not true	Somewhat true	Certainly true	Chi-square	Cramer's V
Sex					
Male	1,027 (77.9)	230 (17.5)	61 (4.6)	28.2**	0.10
Female	1,103 (85.9)	139 (10.8)	42 (3.3)		
Age at the disaster					
6	24 (85.7)	2 (7.1)	2 (7.1)	19.0	0.06
7	366 (79.0)	79 (17.1)	18 (3.9)		
8	376 (81.2)	63 (13.6)	24 (5.2)		
9	375 (81.2)	74 (16.0)	13 (2.8)		
10	337 (80.2)	67 (16.0)	16 (3.8)		
11	335 (83.3)	49 (12.2)	18 (4.5)		
12	317 (87.1)	35 (9.6)	12 (3.3)		
Experience of earthquake					
Yes	2,110 (81.9)	365 (14.2)	101 (3.9)	0.03	<0.01
No	18 (81.8)	3 (13.6)	1 (4.5)		
Experience of tsunami					
Yes	252 (78.5)	49 (15.3)	20 (6.2)	5.8	0.05
No	1,876 (82.4)	319 (14.0)	82 (3.6)		
Experience of nuclear plant explosion					
Yes	856 (81.2)	154 (14.6)	44 (4.2)	0.6	0.02
No	1,272 (82.4)	214 (13.9)	58 (3.8)		
Number of experiences at the disaster					
0	9 (81.8)	2 (18.2)	0 (0.0)	5.0	0.04
1	1,177 (83.1)	190 (13.4)	50 (3.5)		
2	785 (80.4)	150 (15.4)	41 (4.2)		
3	157 (80.9)	26 (13.4)	11 (5.7)		
Place of residence (current address) at wave 1					
Within Fukushima Prefecture	1,717 (82.7)	285 (13.7)	74 (3.6)	5.1	0.05
Outside Fukushima Prefecture	406 (78.8)	82 (15.9)	27 (5.2)		

p* < 0.05, *p* < 0.01.

variables were considered larger effect at the earliest stage. Because our study did not include a control group that was not affected by the disaster, our method using the cumulative number of experiences could be helpful for estimating the quantitative mental health effects of the Fukushima disaster, which is considered a complex disaster (3, 4).

In the current study, the percentage of “somewhat true” responses for children was approximately 15%, and the percentage of “certainly true” responses was approximately 4%–6%. This is in line with previous large-scale studies in nondisaster conditions (9, 10). The percentage of “certainly true” responses was higher than the prevalence among evacuated children from the Fukushima Prefecture, reported by the Ministry of Education, Culture, Sports, Science, and Technology of Japan (2).

Although we did not find significant differences across 3 years in the multivariate analysis, our finding of an increase in the

impact of place of residence at wave 2 in the univariate analysis suggested the existence of a qualitative change according to a mid- or long-term relocation of families who were evacuated from Fukushima Prefecture to other prefectures. A 3-year follow-up study of people who were evacuated from Fukushima Prefecture reported that the causes of stressors changed from the damage of the earthquake itself to the circumstances of living in shelters over time (20). A small-scale study showed that 28 children who were evacuated from the affected area of the FDNPP accident and lived in temporary housing in the nonaffected area of the Fukushima Prefecture experienced more frequent bullying than 106 children living in their own houses in Fukushima Prefecture and 321 children living in a nonaffected area in the Saitama Prefecture (21). The authors suggested that changes in friendship and the limitation of playground space may have influenced the results. According to the relationship between bullying and

TABLE 4 | Ordered logistic regression analysis for parental recognition of bullying victimization.

Independent variables	Wave 1 (2012)				Wave 2 (2013)				Wave 3 (2014)			
	B	Wald	p	95% CI	B	Wald	p	95% CI	B	Wald	p	95% CI
Sex (1 = Female, 0 = Male)	-0.55	32.22	<0.01	[-0.75, -0.36]	-0.36	3.68	0.06	[-0.73, 0.01]	-0.38	5.73	0.02	[-0.69, -0.07]
Age at the disaster	-0.05	3.11	0.08	[-0.11, 0.01]	0.10	0.32	0.57	[-0.24, 0.44]	-0.18	3.84	0.05	[-0.36, 0.00]
Experience of earthquake (1 = Yes, 0 = No)	-0.74	2.77	0.10	[-1.62, 0.13]	0.06	0.01	0.92	[-1.11, 1.23]	-0.64	3.59	0.06	[-1.30, 0.02]
Experience of tsunami (1 = Yes, 0 = No)	0.18	1.56	0.21	[-0.10, 0.45]	0.27	1.12	0.29	[-0.23, 0.77]	-0.15	0.39	0.53	[-0.63, 0.33]
Experience of nuclear plant explosion (1 = Yes, 0 = No)	0.34	11.89	<0.01	[0.15, 0.53]	-0.38	0.93	0.33	[-1.15, 0.39]	0.35	1.33	0.25	[-0.24, 0.94]
Place of residence (1 = Outside Fukushima Prefecture, 0 = Within Fukushima Prefecture)	0.14	1.42	0.23	[-0.09, 0.37]	0.18	0.57	0.45	[-0.29, 0.65]	0.04	0.04	0.85	[-0.35, 0.43]

relocations at the disaster, a previous study of the impact of Hurricane Katrina demonstrated that an influx of new students in schools around a disaster area likely increases overall rates of bullying and victimization, as young people struggle to establish or maintain dominance in changing peer groups (11), in accord with social dominance theory (22).

Because nuclear disasters have unique characteristics, such as being invisible and odorless, it is important to compare the impacts with those of other invisible disasters, such as infectious disease outbreak or toxic chemical exposure. For example, after a railroad chemical spill of the toxic pesticide metam sodium in the United States, the spill-affected residents had greater environmental concerns about chemicals in the environment (23). Although we did not examine the existence of social stigma directly, stigmatization may be associated with an increase in the impact of bullying victimization according to the place of residence. A study of adult evacuees living outside Fukushima Prefecture revealed that 44% of males and 54% of females avoided telling others that they were evacuees from Fukushima, and 50% of males and 55% of females had bad experiences in regard to being evacuees (20). It is likely that relocated children also have had bad experiences with respect to being evacuees. Social stigma was also reported after other environmental disasters. Following a radiological accident in Goiania, Brazil, hotels in other parts of Brazil refused to allow residents of Goiania to register and some airplane pilots refused to fly airplanes that residents of Goiania aboard (24). In another case, a recent cohort study assessing Ebola-related stigma in Liberia demonstrated the existence of stigmatization against survivors 1 year after recovery from Ebola virus disease (25).

The current finding of a higher prevalence of bullying among boys was in accord with previous studies (9, 26). However, some previous studies have reported that girls are more susceptible to bullying under nondisaster settings (10, 27, 28). A recent study in Korea, which showed a higher prevalence of the experience of being bullied in girls, speculated that boys report being victimized less frequently than girls in Korea when self-reporting rather than peer-reporting methods are used (28). In addition, a previous study reported that the types of bullying differed between girls and boys (29). Because the respondents in the current study were

caregivers, they may have been more likely to notice physical victimization more than nonphysical victimization. Regarding the effect of age group, the current study did not reveal significant differences, in contrast to previous studies reporting that bullying victimization decreased by age under a nondisaster setting (30).

The present study had several limitations that should be taken into account. First, we were not able to demonstrate causal associations between sociodemographic characteristics/disaster-related variables and parental recognition of bullying victimization. Second, parent-completed questionnaires may be less accurate than clinician-administered diagnostic tools. Third, we did not include a comparison group recruited from areas not affected by the disaster. Fourth, the response rates at wave 2 and wave 3 were relatively low. Fifth, social stigmatization was not examined in the questionnaire. Finally, we included only one question for detecting children at risk of bullying victimization.

Despite these limitations, the current study demonstrated that being male, the cumulative number of experiences at the disaster, and the place of residence were factors that significantly influenced the parental recognition of bullying victimization among children after the Fukushima disaster. Our findings may be helpful for informing the development of community- and school-based mental health care for children, parents, and teachers. For example, trauma-informed care may be a promising intervention (31). Trauma-informed care includes the perspective of children's psychological trauma, and is beginning to be implemented in Japan (31, 32). Future research, including more detailed questionnaires on bullying victimization, is needed to examine risk and resilience factors against bullying victimization in relation to nuclear disasters.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of STROBE Statement with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Ethics Review Committee of

Fukushima Medical University (number 1316) and the Ethical Committee of Kurume University (number 15188).

AUTHOR CONTRIBUTIONS

MM and MO conceived the original idea for the study. MO performed the analyses of the data and drafted the manuscript. TO, SI, MH, YS, HY, SY, KK, and HO contributed critical comments. All authors approved the final version.

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Effects of Institutionalization and Parental Living Status on Children's Self-Esteem, and Externalizing and Internalizing Problems in Rwanda

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The negative effects of institutionalization on children's wellbeing and psychological adjustment have been extensively documented. Throughout the world, particularly in developing countries, many children in residential child care institutions known as orphanages have parents, and it is not clear how this situation affects the psychological adjustment of institutionalized children. This study aimed at investigating specifically whether institutionalization impacts negatively children's psychological adjustment defined in terms of externalizing and internalizing behavior problems and self-esteem and whether having living parents or not has an additional influence. Children were recruited in Rwanda from seven registered institutions and six primary schools. Ninety-six institutionalized children (48 orphans, who lost at least one parent, and 46 non-orphans, who had both parents living) and 84 non-institutionalized children, who lived in a family (28 orphans and 56 non-orphans) aged 9 to 16 participated. The caregivers or parents assessed externalizing and internalizing behavior problems using the Child Behavior Checklist. Children completed the Coopersmith Self-Esteem Inventory. Controlling for gender, age, and residential area, analyses of covariance revealed that institutionalized children had significantly more externalizing behavior problems than had non-institutionalized children. In addition, non-orphans had more externalizing behavior problems than had orphans, regardless of whether they lived in an institution or not. There were no group differences in internalizing behavior problems, but there was a significant main effect of the parental living status (orphans vs. non-orphans) and a significant interaction effect between parental living status and institutionalization on self-esteem. Self-esteem of non-orphans in families was significantly higher than self-esteem of the other groups. This should be considered when making the decision to place a child in an institution, especially when her or his parents are still living, and when developing supportive programs for children without adequate parental care.

Keywords: orphan, residential child care institution, psychological adjustment, self-esteem, externalizing behavior, internalizing behavior, family, institutionalization

INTRODUCTION

Residential child care institutions, known as orphanages in Rwanda, rarely meet the average acceptable environmental conditions for children's normal development (1). They often lack stable caregiving as well as open opportunities for exploration and mastery of the world (2, 3). Moreover, the removal from family and subsequent transition to an institution embodies a wide range of stress factors for the child and poses enormous challenges for the child's psychological adjustment (4). Subsequently, compared with children raised in families, numerous studies showed that children in institutions, referred herein as institutionalized children, demonstrate poorer physical and psychosocial development outcomes such as stunting (5, 6), insecure attachment (7–9), lower intelligence quotient (IQ) (10–12), and attention and social problems (13, 14). In addition, a large body of evidence suggests that institutionalized children are consistently more vulnerable to develop behavior problems (15), psychopathological symptoms (16), and a low self-esteem (16, 17).

According to the Unicef, an "orphan" is a child below 18 years who has lost either one (single orphan) or both parents (double orphan) by any cause of death (18). In the year 2015, globally, approximately 125 million children have lost a mother or a father, and 15.1 million children have lost both parents. More than a third of all orphans live in Africa (52 million) (18). Most of these children live with the surviving parent, the grandparent(s), or other relatives (19). For example, approximately 95% of children whose parents suffer from immunodeficiency virus infection and acquired immunodeficiency syndrome (HIV/AIDS) or died of HIV/AIDS continue to live with their extended family (20). While most orphans in Africa live with their extended families (21), a number of orphans and other vulnerable children slip through the traditional family support system and end up living in residential child care institutions.

In general, residential child care system is understood as the institutional care system for orphans (22). Children who live in such an institution are usually called orphans, despite the fact that many of them still have living parents (19). A study in Central and Eastern European and former Soviet Union countries showed that only 2% of the institutionalized children were single or double orphans (23). Globally, at least four out of five, among up to 8 million children placed in institutions, have one or both parents alive (24). In Rwanda, more than 80% of children living in institutions called orphanages are not orphans (25).

Parental loss is one of the most extreme social deprivations that a child can experience. However, the vast majority of studies on the impact of parental death have been conducted with children who currently reside with their surviving parent or another family member (26). Psychological outcomes in children who have experienced the death of a parent are heterogeneous (27). On the one hand, studies show that bereaved children more likely develop psychiatric disorders (27, 28), experience more internalizing and externalizing distress, and have a lower self-esteem than do their non-bereaved counterparts (29–31). On the other hand, studies found that death of a family member was not related to higher levels of mental health problems nor to a

lower self-esteem (28–30). Thus, the impact of the loss of a parent on children's psychosocial functioning remains unclear (32). In addition, little is known about the role of being an orphan or not in an institution.

Moreover, most of the research on the effects of institutionalization and parental loss on children was conducted in developed countries. However, results cannot easily be generalized to children in other countries, with a different economic and cultural background (32). Even within the same country, generalization of results to particular communities or cultural groups is problematic. For instance, in a study conducted in the United States of America, the effect of parental death on psychological adjustment was moderated by race. Externalizing behavior problems were significantly higher for bereaved than for non-bereaved youth in a nonminority group, but there was no difference between bereaved and non-bereaved nonminority youth (31). Similarly, other researchers have argued that institutionalization would have less or even no negative effect on children coming from disadvantaged societies, communities, or families (33–37).

Almost no scientific information about the effects of being an orphan and being institutionalized is available from Sub-Saharan Africa [for exceptions, see Refs. (38–40)]. This lack of knowledge is especially important if we take into account that the risk to become an orphan is among the highest there. Therefore, studies are necessary to fill this gap. With regard to this gap in the existing literature, we aimed to investigate the psychological adjustment of orphans and non-orphans who live either in an institution or in a family environment in a sub-Saharan country, namely, in Rwanda.

Conceptualized as an individual's ability to effectively cope with environmental demands and associated stressors, psychological adjustment (41) has been associated with externalizing behavior problems, internalizing behavior problems, and self-esteem (32, 42). Internalizing behavior problems comprise behavioral tendencies of withdrawal, avoidance, anxiety, depression, and somatization. They refer to the tendency to express distress towards the inside (43). Externalizing behavior problems comprise aggressive and rule-breaking behavior and reflect children's propensity to express distress outwards (44). According to Coopersmith, self-esteem is a set of basic beliefs and attitudes about the own person that is essentially shaped by the way significant people (caregivers/parents, teachers, and peers) treat a person (45).

From the literature outlined above, we derived three hypotheses: The first hypothesis (H-1) states that institutionalized children have a) more externalizing behavior problems, b) more internalizing behavior problems, and c) a lower self-esteem than have non-institutionalized children. The second hypothesis (H-2) states that children who lost at least one parent (orphans) have a) more externalizing behavior problems, b) more internalizing behavior problems, and c) a lower self-esteem than children who have both parents (non-orphans). Finally, the third hypothesis (H-3) postulates that whether children are orphans or not moderates the effect of institutionalization. The negative effect of institutionalization should be stronger for orphans than for non-orphans. Thus, in contrast to orphans and non-orphans

who live in a family environment, children in institutions who are orphans have a) more externalizing behavior problems, b) more internalizing behavior problems, and c) a lower self-esteem than have children in institutions who are non-orphans. In addition, we explored whether children who lost one parent had a better psychological adjustment than had those who lost both.

To test these hypotheses, we conducted a cross-sectional study in Rwanda on children with and without parents and who lived either in institutions or in families. Rwanda is an important example for compounded adversity. The genocide against the Tutsi, severe poverty, and HIV/AIDS have had devastating consequences for the functioning of families and the larger community. They have damaged the social networks that once facilitated healthy child rearing (46, 47). Given this background, the current study sheds light on the effects of institutionalization and losing parents on the psychological adjustment of children in a poor and traumatized social environment.

MATERIALS AND METHODS

Participants

Institutionalized children were recruited from seven institutions registered at the National Commission for Children, which were located in different geographical areas of Rwanda [urban area of Rwanda's capital Kigali (Kicukiro and Nyarugenge districts) and rural areas of Rwanda (Kamonyi, Rubavu [rural], and Karongi [rural] districts)]. Children who lived in families were recruited in six primary schools. Schools were chosen based on their proximity to the selected institutions. The nearest school wherein the majority of the local institutionalized children were enrolled was identified as a "matching" school to that institution.

Institution managers and school directors contributed to the identification of potential children to participate in the study. Children were eligible for study recruitment if they were between 9 and 16 years old and able to communicate in Kinyarwanda. The lower age level was set to 9 years, as children at that age are able to adequately read and write. The upper level of 16 years was chosen because this is the maximum age that primary school children might have. In Rwanda, primary education and lower secondary education are known as "nine years' basic education." This consists of 6 years of primary education and 3 years of lower secondary education. Primary education starts at age 7 and concludes with a national examination. Delays to start school, repetition of classes following poor school results, or school dropouts are very common in Rwanda and make it likely to find 16-year-old children in primary schools.

Children suspected by their caregivers or director to have learning, mental, or physical disabilities, as well as children who did not wish to participate, were not included in the research sample. Selected children gave their informed consent to participate in the study after an information session. In addition, institution managers provided informed consent as legal guardians for institutionalized children, while parents or

guardians did so for never-institutionalized children recruited from schools. Monetary transport compensation was offered to adults who had to travel in order to take part in the study.

Ethical approval for this study was obtained from the Rwanda National Ethics Committee. One hundred ninety-five children between 9 and 16 years participated in this study. However, in one institution, transfer of children into families had begun, and the institution was supposed to be closed. Therefore, this institution could not be considered to be typical, and 17 children who provided data had to be excluded from the analysis. Thus, only 178 children were eligible for data analysis: 94 of them lived in institutions, and 84 lived in families.

Of those children who lived in an institution, 34 were double orphans, who lost both parents; 14 were single orphans, who lost one parent; and 46 were non-orphans. Reasons for non-orphans to be in an institution were mostly abandonment and poverty. Roughly half of the children came to an institution when they were 3 years or younger (22 orphans and 23 non-orphans), and only a few children spent less than 4 years there (six orphans and five non-orphans). According to Rwanda's participative community categorization of household economy, known locally as *ubudehe* categories, institutions were considered to belong to the second and third economic category (very poor and poor), which enable the satisfaction of very basic needs like food and health care (48).

Of those children who lived in a family, 16 were double orphans, nine were single orphans, and three were orphans, but the information whether one or both parents died was missing, and 56 were non-orphans. Fifty-four non-orphans lived in the family they were born in. Thirty-six lived with both parents, 15 with their mothers, three with their fathers, and two with other caregivers. According to the *ubudehe* categories, 32 of the households were very poor, 16 were poor, and eight were resource poor. Regarding orphans, four were raised by a parent, 19 by the extended family, four by an unrelated family, and one by a former institution staff. Nineteen orphans lived with two caregivers, seven with a female caregiver, and two in child-headed households. Thirteen of the households were very poor, 10 were poor, and four were resource poor (for one household, this information was missing).

The composition of gender was not significantly different between groups (Fisher's exact test = 2.23, $p = .514$, $w = 0.12$), but the composition of residential areas was (Fisher's exact test = 21.81, $p < .001$, $w = 0.35$). As shown in **Table 1**, more institutionalized orphans lived in urban areas, while more non-institutionalized orphans lived in rural areas. In addition, there were significant group differences in children's age [one-way analysis of variance: $F(3, 174) = 5.21$, $p = .002$, $\eta^2 = .082$]. Non-orphans, especially those who lived in families, were younger than orphans (see **Table 1**). Regarding time spent in the institution/family and age of placement, there was no significant difference between institutionalized non-orphans, institutionalized orphans, and non-institutionalized orphans [$F(1, 120) \leq 2.95$, $ps \geq .056$, partial $\eta^2s \leq .048$]. However, in both variables, non-orphans in families obviously differed from those of the other groups, because 54 out of 56 children were living since their birth in their family).

TABLE 1 | Sample characteristics.

	Institutionalized children				Non-institutionalized children				Total	
	Non-orphans (<i>n</i> = 46)		Orphans (<i>n</i> = 48)		Non-orphans (<i>n</i> = 56)		Orphans (<i>n</i> = 28)		(N = 178)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>N</i>	%	<i>N</i>	%
Girls	20	43.5	19	39.6	26	46.4	16	57.1	81	45.5
Rural residential area	19	41.3	16	33.3	28	50.0	24	85.7	87	48.9
Double orphans			34	70.8			16	64.0 ^a	50	68.5 ^{ab}
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age (years)	12.70	2.11	13.10	1.97	11.82	1.82	13.29	1.90	12.62	2.02
Years spent in institution/family	9.09	4.38	8.04	4.37	11.62	2.09	7.81	4.57	9.40	4.12
Age (years) at placement	3.61	3.67	5.06	4.22	0.20	1.35	5.78	3.96	3.27	3.99

^aFor three children, information was missing on whether they were single or double orphans.

^bPercentage was calculated for orphans.

Measures

The first and second authors conducted interviews with the directors of the institutions, the caregivers, and parents in the families to get background information about each child, including her or his age, whether one or both parents died, age when the child started living in the current place, the reason why the child was placed into an institution or family, and the economic background of the family.

To measure externalizing and internalizing behavior problems, we used the *Child Behavior Checklist (CBCL/6–18)* (49). The *Child Behavior Checklist (CBCL)* is a widely used caregiver's report of children's behavioral and emotional problems. The CBCL consists of 113 items (e.g., “cries a lot” and “cruelty, bullying, or meanness to others”) that capture a broad range of behavioral, physical, and emotional problems “now or within the past six months.” Parents or caregivers rate each item on a 3-point scale, ranging from 0 = “not true,” 1 = “somehow or sometimes true,” to 2 = “very true or often true.” Items are summarized to eight subscales, and several of these subscales are then combined to capture two broad-band syndrome scales. One assesses internalizing behavior problems and corresponds to the sum of the three subscales Withdrawn, Somatic Complaints, and Anxious/Depressed. The other assesses externalizing behavior problems and corresponds to the sum of the subscales Rule-Breaking Behavior and Aggressive Behavior (49).

In institutions, the director designated three caregivers closest to the child, for each participating child. The first and second authors (EN and ER) gave the designated caregivers a copy of the CBCL for each child. Then, EN and ER explained the instructions to them. Each CBCL item was read loudly by one of the three caregivers. They had to reach a consensus on their response, and the agreed response was recorded. The same procedure was applied when mothers and fathers or female and male caregivers and single parents in mono-parental families were rating the behavior of the children who were not institutionalized.

The CBCL is highly reliable and has demonstrated its validity in many studies including studies in which caregivers rated children's behavior in residential settings (50). In our study, the Cronbach alphas for the externalizing and internalizing

behavior problems scales were high ($\alpha = .87$ and $\alpha = .84$, respectively).

To measure self-esteem, children completed the Coopersmith Self-Esteem Inventory, school form (CSEI) (45). This self-report questionnaire is a broadly used instrument to measure global self-esteem in children and adolescents between 8 and 18 years with high reliability and proven validity (51, 52). It consists of 58 items (e.g., “I'm easy to like”) with two response options, “like me” or “not like me,” which are summarized to four self-esteem subscales and a “lie-scale” that assesses defensiveness and does not count for self-esteem. Eight items that refer to the subscale “Home-Parents” assess the quality of the relationship with parents (e.g., “My parents and I have a lot of fun together”) and children's perception of being at home (e.g., “No one pays much attention to me at home”). These items do not fit for children in institutions and children who lost their parents and would thus produce lower scores for those children. Therefore, we replaced “parents” by “caregivers” and “home” by “in your usual environment.” Because subscales are highly correlated, we used the total self-esteem score (sum across 50 self-esteem items multiplied by 2) that ranges from 0 to 100. In our study, Cronbach's alpha of the total score was satisfactory ($\alpha = .82$). EN and ER individually gave a paper copy of the CSEI to every child participating in the study and instructed her or him how to complete the questionnaire.

When responses for single items were missing, we estimated the total self-esteem and externalizing and internalizing behavior problem scores by computing for each child the mean across the items with valid responses and multiplied it by the number of items that belong to that scale. However, five children did not complete the CSEI at all, and for one child, data on externalizing and internalizing behavior problems were missing.

Translation Procedure

Both *Child Behavior Checklist (CBCL/6–18)* and Coopersmith Self-Esteem Inventory, school form (CSEI), were forward- and back-translated to get equivalent Kinyarwanda versions of the original English version. The first author, EN, whose mother tongue is Kinyarwanda, speaks English and is familiar with

psychology terms in English, translated the instruments from English to Kinyarwanda, emphasizing conceptual rather than literal translation. A bilingual (Kinyarwanda–English) expert panel including the original translator (EN), a psychologist and an expert with experience in instrument development and translation, identified and resolved the inadequate expressions/concepts of the translation. The complete Kinyarwanda version of the questionnaires were then translated back to English by an independent translator whose mother tongue is English and who has no knowledge of the questionnaires. Discrepancies were discussed by the bilingual expert panel to get the final Kinyarwanda version.

Data Analysis

Statistical analyses were performed with IBM SPSS Statistics 25. Because there were significant differences in age and residential area between groups (see description of the sample), we treated age and residential area as control variables. In addition, we controlled for gender, because robust gender differences in externalizing and internalizing behavior problems and self-esteem have been reported (15, 51). Externalizing and internalizing behavior problems scores were skewed to the right. To normalize the distribution, we applied a square root transformation, which also made variation within groups more homogeneous.

With the first set of analyses, we explored whether single orphans differed from double orphans by calculating a two-way (2×2) analysis of covariance (ANCOVA) for each dependent variable. Between-subjects factors were institutionalization (living in an institution vs. living in a family) and number of parents lost (one parent dead = single orphans vs. both parents dead = double orphans). Covariates were age, gender, and residential area, while dependent variables were self-esteem (total CSEI) and externalizing or internalizing behavior problems.

If these analyses did not show significant differences between single and double orphans, we did not distinguish these two groups anymore and computed 2×2 ANCOVAs to test our hypotheses. Between-subjects factors were parents' living status (both parents alive = non-orphans vs. at least one parent dead = orphans) and institutionalization, with age, gender, and residential area as control variables.

A sensitivity analysis with the program G*Power revealed that power was sufficient ($.80$, $\alpha = .05$) to detect moderate-to-large effects for the first set of ANCOVAs ($f = .34$; $\eta^2 = .103$), and moderate effects for the second set of ANCOVAs ($f = .21$; $\eta^2 = .044$) with our sample size.

RESULTS

Externalizing Behavior Problems

With the first ANCOVA, single orphans were compared with double orphans. After age, gender, and residential area were controlled for [none was significant, $F(1, 65) \leq 2.50$, $ps \geq .122$, partial $\eta^2 \leq .036$], there was no difference in square-root-transformed externalizing behavior between single and double orphans [main effect number of parents lost, $F(1, 65) = 0.61$, $p = .806$, partial $\eta^2 = .001$], nor was there an interaction of number of parents lost with institutionalization [$F(1, 65) = 0.18$, $p = .893$, partial $\eta^2 < .001$]. However, the main effect of institutionalization was significant and of moderate size [$F(1, 65) = 4.59$, $p = .036$, partial $\eta^2 = .066$]. Children in institutions had more externalizing behavior problems than had children in families, which was in line with H-1a.

As single orphans were not different from double orphans, they were put into one group, and both were compared with non-orphans in the second ANCOVA. After age, gender, and residential area were controlled for [none was significant, $F(1, 170) \leq 0.87$, $ps \geq .354$, partial $\eta^2 \leq .005$], there was no interaction effect [$F(1, 170) = 0.16$, $p = .900$, partial $\eta^2 < .001$; rejection of H-3a], but the main effect of institutionalization was of moderate size and significant [$F(1, 170) = 10.44$, $p = .001$, partial $\eta^2 = .058$]. As predicted, by H-1a, institutionalized children had more behavior problems than had non-institutionalized children (see **Table 2** and **Figure 1A**). There was also a moderate and significant main effect of parents' living status [$F(1, 170) = 9.50$, $p = .002$, partial $\eta^2 = .053$], which was, however, contrary to the prediction of H-2a. **Table 2** and **Figure 1A** show that non-orphans had even more externalizing behavior problems than had orphans.

Internalizing Behavior Problems

Regarding square-root-transformed internalizing behavior problems, the first ANCOVA that compared single orphans with

TABLE 2 | Means and standard deviations of psychological adjustment.

	Institutionalized children				Non-institutionalized children				Total	
	Non-orphans (<i>n</i> = 46)		Orphans (<i>n</i> = 47) ^a		Non-orphans (<i>n</i> = 56)		Orphans (<i>n</i> = 28)		(N = 177) ^a	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Externalizing behavior problems	13.81	10.36	10.00	9.20	8.58	5.75	6.68	6.43	10.02	8.51
Internalizing behavior problems	9.68	7.26	9.87	8.01	11.19	6.47	12.20	9.84	10.61	7.69
	(n = 43) ^b		(n = 47) ^a		(n = 55) ^a		(n = 28)		(N = 173) ^c	
Total self-esteem	58.64	12.44	60.16	13.48	67.99	14.61	55.73	15.67	61.56	14.61

^aOne case was missing. ^bThree cases were missing. ^cFive cases were missing.

FIGURE 1 | Estimated means of (A) square-root-transformed externalizing behavior problems, (B) square-root-transformed internalizing behavior problems, and (C) self-esteem total score for institutionalized and non-institutionalized children whose parents were alive or dead. Estimates were based on two-way analysis of covariance (ANCOVAs) with gender, age, and residential area as control variables. Error bars display 95% confidence intervals.

double orphans did not reveal any significant main or interaction effect [$F(1, 65) \leq 0.79$, $p \geq .376$, partial $\eta^2 \leq .012$], nor were the control variables age and gender significant [$F(1, 65) \leq 0.64$, $p \geq .802$, partial $\eta^2 \leq .001$]. Only residential area had a significant effect [$F(1, 65) = 6.22$, $p = .015$, partial $\eta^2 = .087$]. Parameter estimates revealed that children who lived in rural areas had more internalizing behavior problems than had children who lived in urban areas.

As single orphans were not different from double orphans, we compared orphans with non-orphans in the second ANCOVA. All covariates were significant [age: $F(1, 170) = 4.44$, $p = .037$, partial $\eta^2 = .025$; gender: $F(1, 170) = 5.93$, $p = .016$, partial $\eta^2 = .034$; residential area: $F(1, 170) = 4.76$, $p = .030$, partial $\eta^2 = .027$]. Parameter estimates showed that older children, girls, and children who lived in rural areas had more internalizing behavior problems than had younger children, boys, and children who lived in urban areas. However, as can be seen on **Figure 1B** there was neither a significant main effect of institutionalization, nor of parents' living status, nor a significant interaction [$F(1, 170) \leq 1.40$, $p \geq .238$, partial $\eta^2 \leq .008$]. These results suggest a rejection of the hypotheses for internalizing behavior problems (H-1b, H-2b, and H-3b).

Self-Esteem

Regarding self-esteem (CSEI total score), the first ANCOVA in which single orphans were compared with double orphans did not reveal any significant main or interaction effect [$F(1, 65) \leq 0.73$, $p \geq .396$, partial $\eta^2 \leq .011$], nor were the control variables significant [$F(1, 65) \leq 1.08$, $p \geq .302$, partial $\eta^2 \leq .016$].

As single and double orphans were not different, we compared orphans with non-orphans in the second ANCOVA. None of the covariates was significant [$F(1, 166) \leq 2.59$, $p \geq .109$, partial $\eta^2 \leq .015$]. Although there was no significant main effect of institutionalization on total self-esteem [$F(1, 166) = 2.06$, $p = .153$, partial $\eta^2 = .012$], the main effect of parents' living status [$F(1, 166) = 4.10$, $p = .045$, partial $\eta^2 = .024$] and the interaction of parents' living status with institutionalization were of small to medium size and became significant [$F(1, 166) = 7.31$, $p = .008$, partial $\eta^2 = .042$]. **Table 2** and **Figure 1C** show that the difference was due to non-orphans who lived in their family. A multiple regression analysis with the three covariates and a dummy variable for each group, except for non-orphans who lived in their family (reference group), revealed that the latter group had a significantly higher total self-esteem than had children in the three other groups. After age, gender, and residential area were controlled for, self-esteem of non-orphans who lived their family was estimated to be 66.95 ($SE = 2.44$). Self-esteem of orphans in families compared with non-orphans was 10.59 ($SE = 3.37$; $t = -3.32$, $p = .002$) units lower, self-esteem of orphans in institutions was 7.88 ($SE = 2.93$; $t = -2.70$, $p = .008$) units lower, and self-esteem of non-orphans in institutions was 9.39 ($SE = 2.88$; $t = -3.26$, $p = .001$) units lower. This pattern of results rejects H-3c and suggests a modification of H-3a and H-3b.

DISCUSSION

The goal of the present study was to investigate psychological adjustment in orphans and non-orphans who live either in an institution or in a family environment in Rwanda. Only one result was in line with our hypotheses. We expected that psychological adjustment is worse for children who live in an institution than for those who live in a family, and we found the predicted difference for externalizing behavior problems. However, there was no such difference for internalizing behavior problems or self-esteem. Moreover, we expected that the effect of institutionalization is worse for orphans than for non-orphans, but we did not get the predicted interaction effect in the behavior problem variables. Only for self-esteem was the effect of institutionalization moderated by parents' living status. However, the pattern of results did not confirm our prediction. Although self-esteem was low for children who lived in an institution (orphans and non-orphans), it was comparably low for orphans who lived in a family. Only non-orphans who lived in a family had a higher self-esteem.

The lower self-esteem observed in institutionalized children was in line with previous studies. Parental and subsequent social deprivation associated with institutionalization and the necessity to redefine themselves and to adapt their identity make many institutionalized children and adolescents feel insecure, lonely, and worthless, which in turn impairs their self-acceptance, self-confidence, and self-esteem (15, 53–56). However, also, non-institutionalized children who lost one or both parents need to overcome the loss and have to go through a long process of adaptation and redefinition of their self-concept, which likely decreases their self-esteem and other facets of their psychological adjustment (30, 31, 54). This reasoning might explain the lower self-esteem of never-institutionalized orphans in our study, who mostly lived with their relatives (68%) or unrelated caregivers (18%).

The finding that institutionalized children had more externalizing behavior problems than non-institutionalized children is in line with studies that reported increased externalizing behavior problems (15) and deviant behaviors for institutionalized children (57). Higher rates of externalizing behavior problems among institutionalized children might be the result of the quality of caregiver–child attachment and relations and the intensity of parenting stress within institutions which have been proven to be important factors that affect the development of children's externalizing behaviors (58). The lack of individualized support and regimented routines, low children-to-caregiver ratio, and shift mode are frequent characteristics of institutions. Such conditions impair the bonding between children and caregivers and make it more likely that children are treated inconsistently and harshly, with little warmth and limited emotional responsiveness for their individual needs (56, 59). Moreover, children have to find their place among their peers, which is often associated with rivalry, aggression, and violence (57). In addition, institutionalized children are more likely to feel frustrated and react inadequately with deviant behavior, because they are often unable to achieve valued goals (60). Institutionalized children have been found to have elevated daily cortisol levels, which indicate ongoing stress due to a persistently activated “fight or flight” mode (61). In sum, in an institutional environment, children have difficulties in developing psychological and social skills that allow them to

adequately regulate their emotions and behaviors, which in turn increases the risk to develop externalizing behavior problems (59).

In contrast to our results regarding externalizing behavior problems and our expectation (H-1b), institutionalized children did not have more internalizing behavior problems than never-institutionalized children. An explanation for this unexpected finding might be that internalizing behavior problems are more difficult to observe than externalizing behavior problems (62). In contrast to externalizing behavior problems, which are disruptive or harmful for others, internalizing behavior problems are intro-punitive (63). Symptoms may fluctuate in intensity (64) and are thus more difficult to detect. In addition, internalizing behavior problems tend to be viewed as less problematic (65). A child with internalizing behavior problems is more likely to be seen as a “good” and “easy to rear” child than as a child with reportable difficulties. Consequently, the prevalence of internalizing behavior problems is lower than the prevalence of externalizing behavior problems in both orphanage and community samples when parents, caregivers, or teachers provide the information (15, 66, 67). However, contrary to the judgments of their parents, caregivers, or teachers, children report similar or even higher levels of internal compared with external behavior problems (15, 67). Thus, adults likely underestimate children's internalizing behavior problems.

Moreover, it has been shown that caregivers' reports are biased. Mothers report more externalizing and internalizing behavior problems than do fathers (49), and parents report more behavior problems than do teachers (65). A similar bias is likely for caregivers in institutions. Like teachers, caregivers in institutions see several children at the same time, including other children with problems. This likely increases their threshold to judge a behavior as problematic. Moreover, it is probably more difficult for caregivers in institutions to detect internalizing behavior problems than for parents or foster parents, because they work in shifts and are responsible for several children at the same time (68). In sum, we cannot exclude that such a bias might have obscured a truly existing difference in internalizing behavior problems between institutionalized and non-institutionalized children, which has been reported in other studies (15, 16).

Our second hypothesis predicted a lower psychological adjustment for orphans compared with non-orphans. It was formally confirmed by a significant main effect for self-esteem (H-2c). However, the main effect was further qualified by a stronger interaction effect, and the only children who were different and had a higher self-esteem were those who lived with their own parents. A potential explanation for these unexpected results was discussed above.

In contrast to our prediction and results reported in other studies (15, 28, 30, 31, 69), orphans did not have more internalizing behavior problems than have non-orphans (H-2b). As the demographic data show, orphans in our study have lived for many years in a new family or institution and have had time to overcome the loss of their parent(s) and adapt to the new environment. This might be a reason why withdrawal, somatic symptoms, and symptoms of depression and anxiety that are typically elevated during bereavement were not elevated in the orphans in our study. It might also explain why we did not find any difference between single and double orphans. In several of the studies that found more internalizing behavior problems for orphans compared with non-orphans, less time since

the death of the parent(s) had passed (30, 31, 40) than in our study, which might explain the diverging findings.

Moreover, orphans had significantly less externalizing behavior problems, regardless of whether they lived in an institution or not. This finding was opposite to our hypothesis (H-2a). Even in institutions, orphans had less externalizing behavior problems than had non-orphans and did not exceed the level of externalizing behavior problems of non-orphans raised by their parents. Because effects were additive, children with the highest level of aggression and rule-breaking behavior were non-orphans in institutions. These findings contradict the stereotype that orphans are badly behaved and more likely to engage in defiant or socially unacceptable behaviors. Yet this is a common belief in Rwanda, which limits the willingness of the community to support orphans (70). In addition, this result is particularly concerning since children in institution who have higher rates of externalizing behavior are, once deinstitutionalized, more likely to experience family placement disruptions, which further increases their risk of externalizing behavior.

Our study has several limitations. The first limitation is its rather weak internal validity. Ideally, the answer about the effects of institutionalization would come from a randomized controlled trial. In such a trial, random assignment sends some orphans and non-orphans into institutions while others remain in a family setting (71), or orphans and non-orphans who have already been institutionalized are randomly placed into families while others remain in an institution. The Bucharest Early Intervention Project is a unique example for such a randomized controlled trial that has been underway for many years (16, 72). Such a randomized controlled trial is logistically and ethically very challenging (73).

We therefore used a better realizable naturalistic approach and conducted a quasi-experimental study. As a control group, we recruited a sample of never-institutionalized children in elementary schools, located in the direct environment of the respective institutions, who most likely share the same socioeconomic living conditions as the institutionalized children. Because we also wanted to investigate the effect of parents' living status on institutionalization, we further distinguished orphans and non-orphans and thus had a two-factorial design with four groups.

As the description of our sample showed, the four groups were not substantially different in crucial variables, such as economic condition (poverty classification), gender composition, or single- vs. double-orphan status. Moreover, the three groups of children who did not grow up with their own parent(s) were also largely comparable regarding age of placement and time spent in the institution or family.

Nevertheless, there were some group differences. More children in institutions lived in urban areas and more children in families lived in rural areas, and children who lived with parents were younger than were children in the other groups. We therefore controlled both variables statistically by including them as covariates into the analysis. In addition, we included gender as a control variable because robust gender differences have been observed in all our indicators of psychological adjustment. Control variables were only significantly associated with internalizing behavior problems but not with externalizing behavior problems or self-esteem.

Although we did our best to exclude or control confounding variables, we cannot definitely rule out that our findings are caused

by other factors than institutionalization or parents' living status. It might be the case that children were already different before they entered an institution or family. A review of empirical studies on institutionalization revealed a number of variables that may explain the poorer adjustment among institutionalized children (46), such as impaired physical health or developmental delay that might be caused or augmented by the pre-institutionalization rearing situation. Severe social and mental health problems or alcohol and drug abuse of parent(s) more likely leads to child abandonment or neglect and finally to a separation of the child from his or her parents. This probably happens more frequently in non-orphans who are institutionalized than in orphans who are institutionalized and may lead to a greater vulnerability of the former children. This might be an alternative explanation for our finding that institutionalized non-orphans have the most externalizing behavior problems.

Moreover, research in epigenetics shows that early life stress, caused by child abuse and neglect, which might be more likely in institutionalized children, can change histone modification or DNA methylation, which then alters the way genes are expressed. This likely increases the vulnerability and risk for psychopathology later (47) and could be an additional explanation for the higher externalizing problem score of institutionalized children or the lower self-esteem scores we found. However, we cannot tell whether this was indeed the case for the institutionalized children in our study. The same is true for information about circumstances of parental death that might have had an effect on the further development of children, like deceased parent's gender, time since death, death circumstances (74), or life events that followed parental death (27). The paucity of records, information sharing, and management in institutions in Rwanda (75) made it difficult or impossible to get reliable data about children's background information and lived experiences before institutionalization.

A consequence of the difficulty to disentangle the various causes of problems in psychological adjustment among institutionalized children is that we do not know whether the institutional experience actually causes deficits, augments pre-existing deficits, or just maintains them (76).

The second concern refers to construct validity. We collected data with self-report and other-report instruments that were validated in Western countries. The translation-back-translation procedure to obtain a Kinyarwanda version of the CBCL and the Coopersmith Self-Esteem Inventory focused on cross-cultural and conceptual, rather than on linguistic/literal equivalence. According to our experience, externalizing and internalizing behavior problems and self-esteem are constructs that in an African cultural context may differ in nuances but will not be fundamentally different there. Therefore, we believe that the Kinyarwanda version that we have used would assess the constructs adequately, although we could not perform a validation study.

To ensure a high validity of the behavioral problem ratings, parents and caregivers who were in charge or spent the most time with the child had to find a consensus for every item. A potential problem that we cannot exclude is that caregivers and parents have a different calibration for the judgment of the severity of behavior problems. While parents seem to be more sensitive to detect and report behavior problems (77), there are several reasons (outlined above) to assume that caregivers in institutions are less sensitive to report

behavior problems. Such a judgment bias would lead caregivers in institutions to underestimate the true amount of behavior problems and parents to overestimate the true amount of behavior problems. For externalizing behavior problems, the true difference between institutionalized and non-institutionalized children would then be even larger. However, such a bias might have covered a true difference between institutionalized and non-institutionalized children regarding internalizing behavior problems. We might have been able to detect such a bias if we had asked children's teachers to complete the teachers' form of the CBCL and had asked children to complete youth self-report form (49), in addition.

In general, our sample was rather small, especially for never-institutionalized orphans. Nevertheless, the whole sample was large enough to detect medium effects with an adequate power, when all children were included into the analyses. Therefore, it is unlikely that the nonsignificant results for internalizing behavior problems (H-1b, H-2b, and H-3b) or the missing interaction effect for externalizing behavior problems (H-1c) were due to a lack of power. Indeed, nonsignificant results were associated with effects close to zero. If we leave aside the calibration problems related to the CBCL assessment, discussed before, this would support the conclusion that these effects do not exist or are of negligible size in our population.

We collected 2014 data, at a time when a national campaign of deinstitutionalization was being conducted in Rwanda. In order to balance potential effects on our study, we targeted institutions in which deinstitutionalization programs had not yet begun and others that had formally begun. In addition, we selected institutions that were located in urban and rural areas. Non-institutionalized children should be comparable with those who were institutionalized and were therefore recruited in primary schools close to the selected institutions. Although we tried to capture the available variability between children, we only could realize convenience samples, which might have unknown biases. Therefore, we do not know how well our samples represent the population of institutionalized and non-institutionalized orphans and non-orphans in Rwanda. Nevertheless, we believe that our results reflect their situation in Rwanda and probably the situation of many children in Sub-Saharan Africa.

CONCLUSION

This is the first study conducted in Rwanda that aimed to systematically investigate the effects of institutionalization and parents' living status. Despite the above-mentioned limitations, our study provides new insights regarding the psychological adjustment of Rwandan children who live in an institution compared with those who live in families. By taking into account whether children were orphans or not, we discovered that being in an institution and not being an orphan were independently associated with higher levels of externalizing behavior problems. Thus, children who were institutionalized, although their mothers and fathers were alive, had the most externalizing behavior problems. This suggests that non-orphans are more vulnerable to the adverse effects of institutionalization than are orphans. On the other hand, orphans who lived with a family environment

had the least externalizing behavior problems. Although the quasi-experimental design of our study cannot definitely rule out other interpretations, these results are in line with findings of other studies, which suggest that a family environment provides better conditions for a positive development of orphans than an institutional environment (15, 16, 78).

However, these findings were specific for externalizing behavior problems and did not generalize across the other indicators of psychological adjustment. We did not find any differences between groups regarding internalizing behavior problems. This might have been due to the fact that internalizing behavior problems are more difficult to detect than externalizing behavior problems, and that parents and caregivers may have particular biases (49, 67). Therefore, children's and teachers' perspective should also be taken into account when behavioral problems are assessed.

Finally, results regarding self-esteem revealed that non-orphans who lived with their parents had substantially higher values than had orphans living in families and orphans as well as non-orphans living in institutions. This suggests that not being able to live with the own parents, regardless of whether they are dead or alive, seems to impair children's self-esteem more than living in an institution or not.

This should be considered when making the decision to place a child out of his or her family of origin. In line with the literature, our results suggest that an adequate foster family should be preferred before an institution (15, 16, 78, 79). In addition, supporting children to develop a positive self-concept and a robust self-esteem, despite difficult or adverse experiences, should be a special focus in the training of professional caregivers and in support programs for foster parents.

ETHICS STATEMENT

All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by Rwanda National Ethics Committee and the Internal Review Board of the Department of Psychology of the University of Fribourg/Switzerland.

AUTHOR CONTRIBUTIONS

EN and CM-S contributed to the conception and design of the study. ER contributed in ensuring that the protocol is in accordance to Rwanda National Ethics Committee requirements and the acquisition of data from the field. PW and EN organized the database and performed the statistical analysis. EN wrote the first draft of the manuscript. All authors contributed to the manuscript revision and have read and approved the submitted version.

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Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. The first author EN is director of the Learning and Research Unit of Hope and Homes for Children, Kigali, Rwanda. The aim of this organization is to find families for children who still live in institutions. However, when this study was planned and conducted, EN was a doctoral student at the University of Fribourg, with a grant from the Swiss Federal Department of Foreign Affairs that guaranteed the independence of this research.

Although EN identifies with the goals of Hope and Homes for Children, the other authors hold a neutral position. Results were intensively discussed in order to eliminate or minimize any bias in the interpretation of the findings.

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