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Psychological adaptation to life-threatening injury in dyads: the role of dysfunctional disclosure of trauma

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Abstract: **BACKGROUND:** Certain modes of trauma disclosure have been found to be associated with more severe symptoms of posttraumatic stress (PTS) in different trauma populations: the reluctance to disclose trauma-related thoughts and feelings, a strong urge to talk about it, and physical as well as emotional reactions during disclosure. Although social-contextual influences gain more and more interest in trauma research, no study has yet investigated these “dysfunctional disclosure tendencies” and their association with PTS from an interpersonal perspective. **OBJECTIVE:** (1) To replicate previous findings on dysfunctional disclosure tendencies in patients with life-threatening injury and their significant others and (2) to study interpersonal associations between dysfunctional disclosure style and PTS at a dyadic level. **METHOD:** PTS symptom severity and self-reports on dysfunctional disclosure tendencies were assessed in N=70 dyads comprising one individual with severe traumatic brain injury and a significant other (“proxy”) 3 months after injury. **RESULTS:** Regression analyses predicting PTS symptom severity revealed dysfunctional disclosure tendencies to have incremental validity above and beyond sex, age, and trauma severity within the individual (both patient and proxy), with moderate effect sizes. The interaction between patient’s and proxy’s disclosure style explained additional portions of the variance in patients’ PTS symptom severity. **CONCLUSIONS:** Findings suggest that dysfunctional disclosure tendencies are related to poorer psychological adaptation to severe traumatic brain injury. This intrapersonal association may be exacerbated by dysfunctional disclosure tendencies on the part of a significant other. Although the results require replication in other trauma samples without brain injury to further generalize the findings beyond the observed population, the study contributes to the expanding literature on the crucial role of interpersonal relationships in trauma recovery.

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Psychological adaptation to life-threatening injury in dyads: the role of dysfunctional disclosure of trauma

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Background: Certain modes of trauma disclosure have been found to be associated with more severe symptoms of posttraumatic stress (PTS) in different trauma populations: the reluctance to disclose trauma-related thoughts and feelings, a strong urge to talk about it, and physical as well as emotional reactions during disclosure. Although social-contextual influences gain more and more interest in trauma research, no study has yet investigated these “dysfunctional disclosure tendencies” and their association with PTS from an interpersonal perspective.

Objective: (1) To replicate previous findings on dysfunctional disclosure tendencies in patients with life-threatening injury and their significant others and (2) to study interpersonal associations between dysfunctional disclosure style and PTS at a dyadic level.

Method: PTS symptom severity and self-reports on dysfunctional disclosure tendencies were assessed in $N = 70$ dyads comprising one individual with severe traumatic brain injury and a significant other (“proxy”) 3 months after injury.

Results: Regression analyses predicting PTS symptom severity revealed dysfunctional disclosure tendencies to have incremental validity above and beyond sex, age, and trauma severity within the individual (both patient and proxy), with moderate effect sizes. The interaction between patient’s and proxy’s disclosure style explained additional portions of the variance in patients’ PTS symptom severity.

Conclusions: Findings suggest that dysfunctional disclosure tendencies are related to poorer psychological adaptation to severe traumatic brain injury. This intrapersonal association may be exacerbated by dysfunctional disclosure tendencies on the part of a significant other. Although the results require replication in other trauma samples without brain injury to further generalize the findings beyond the observed population, the study contributes to the expanding literature on the crucial role of interpersonal relationships in trauma recovery.

Keywords: *disclosure of trauma; communication; dyads; significant other; posttraumatic stress disorder; medical trauma; traumatic brain injury; accident*

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Because traumatic events are never completely detached from the social context, research focusing exclusively on the traumatized individual overly simplifies the complex aftermath of trauma. Not only does the social environment play a key role in the traumatized individual’s recovery, as shown by the results of meta-analyses (Brewin, Andrews & Valentine, 2000;

Ozer, Best, Lipsey & Weiss, 2003) but also does trauma and posttraumatic stress disorder (PTSD) seem to affect close others and interpersonal relationships (e.g., Kaniasty & Norris, 2008; Monson & Taft, 2005). Previous research on social processes after trauma has two shortcomings: First, most studies have simply focused on the broad concept of social support rather

than specifying particular forms of trauma-related social activity. Second, although claiming to investigate interpersonal processes, most studies have not gone beyond the intrapersonal approach.

Dysfunctional disclosure tendencies

One specific social interaction after trauma exposure is the way that trauma survivors talk about their thoughts and feelings concerning their experience with others, and how listeners, in turn, react to these disclosures. Decades of research on Pennebaker's paradigm of written disclosure (Pennebaker & Beall, 1986) revealed that experimentally manipulated disclosure of distressing events enhances well-being (Frattaroli, 2006). Exposure theory (e.g., Bootzin, 1997), cognitive-processing theory (Pennebaker, 1993), and the social integration model (Pennebaker & Graybeal, 2001) have attempted to explain the positive effects by suggesting that disclosure of trauma promotes habituation to trauma-related emotions, enhances structuring and integrating the trauma memory, supports correcting dysfunctional cognitions about oneself and the world, and fosters the mobilization of social support (for an overview, see Frattaroli, 2006). With regard to naturally occurring disclosure of trauma, different facets have been investigated, for example, the perceived reactions to disclosure (Belsher, Ruzek, Bongar & Cordova, 2011; Bolton, Glenn, Orsillo, Roemer & Litz, 2003; Jacques-Tiura, Tkatch, Abbey & Wegner, 2010; Taku, Tedeschi, Cann & Calhoun, 2009; Ullman, 2003), the extent to which individuals disclose to their partners (Davidson & Moss, 2008; Hoyt, Pasupathi, Smith, Yeater, Kay & Tooley, 2010), the type of recipients people choose to disclose to (Leibowitz, Jeffreys, Copeland & Noel, 2008), and attitudes toward self-disclosure (Stephens & Long, 1999). Thereby, empirical findings on the potentially beneficial effects were rather mixed. Although some studies found trauma survivors to profit from disclosure (Bolton et al., 2003; Bowen, Shelley, Helmes & Landman, 2010), other authors emphasized that benefits depended on the listeners' supportive reactions (Taku et al., 2003), and that negative reactions to disclosure were associated with poorer adaptation (Jacques-Tiura et al., 2010; Ullman, 2003).

A series of studies have found certain modes of trauma-related communication to be associated with increased distress in several trauma groups (Maercker, Povilonyte, Lianova & Pohlmann, 2009; Mueller, Beauducel, Raschka & Maercker, 2000; Mueller, Moergeli & Maercker, 2008; Mueller, Orth, Wang & Maercker, 2009). Specifically, trauma survivors who indicated that they did not want to reveal thoughts and feelings about the trauma to others, but also those who perceived a strong desire for talking about it again and again, as well as individuals who experienced intense emotional and physical reactions when they did so, were found to suffer

from more severe symptoms of posttraumatic stress (PTS) than others who did not report such difficulties. Although perceived reluctance to disclose was consistently found to be independent from reported urge to talk about the trauma, substantial intercorrelations were found between experienced emotional and physical reactions during disclosure and the former two disclosure styles (Maercker et al., 2009; Mueller et al., 2000; Mueller et al., 2008). The three modes of disclosure can be interpreted as a reflection of PTS reactions in communication: Avoidance of trauma-related stimuli may manifest itself in communication as a reluctance to talk about thoughts and feelings concerning the traumatic experience. Experiencing a strong desire to talk about the topic again and again may reflect intrusive reliving of the trauma and rumination of trauma-related thoughts. Furthermore, going all over the experience again may cause PTS reactions such as elevated arousal, and feelings of grief, shame, or guilt.

Because confrontation with trauma-associated contents is highly effective in trauma therapy (e.g., Institute of Medicine, 2008; McLean & Foa, 2011), and as avoidance behavior and rumination are known to sustain PTS symptoms (e.g., Ehlers & Clark, 2000; Ehring, Frank & Ehlers, 2008; Zetsche, Ehring & Ehlers, 2009), it can be assumed that the three modes of disclosure interfere with emotional and cognitive processing of the trauma. This may disrupt the natural process of recovery in which initial stress reactions decrease without intervention, and may consequently contribute to the maintenance of PTS symptoms. Primary evidence for this assumption was found in a prospective study with crime victims from Germany (Mueller et al., 2008). In this study such disclosure styles prospectively predicted PTS above and beyond basic etiological factors of PTSD, including initial PTS symptom severity. In the following, we will refer to the described modes of trauma disclosure as "dysfunctional disclosure tendencies."

The interpersonal perspective

One crucial insufficiency of the cited studies is that aspects of trauma disclosure have only been assessed and related to psychopathology within the traumatized individual ignoring potential interactions with the social environment. Because communication involves at least two parties, it seems obvious to include the social context when studying trauma-related communication. From a more general perspective on coping with major life stressors such as cancer, Lepore (2001) proposed the concept of "social constraints" on disclosure, meaning "both objective social conditions and individuals' construal of those conditions that lead individuals to refrain from or modify their disclosure of stress- and trauma-related thoughts, feelings, or concerns" (Lepore & Revenson, 2007, p. 315). Although without social

constraints, the natural desire to disclose emotionally relevant issues to others may enhance the cognitive processing of stressors, suppressing the desire to disclose may be associated with worse adjustment to the trauma (Lepore, Silver, Wortman & Wayment, 1996). In a sample of treatment-seeking trauma survivors, Belsher et al. (2011) found perceived social constraints to be positively related to PTS. This correlation was partially mediated by negative posttraumatic cognitions. The authors conclude that a social context that inhibits and invalidates trauma disclosure causes distress and consolidates negative post-traumatic appraisals that, in turn, foster the maintenance of PTS symptoms. However, the study could lead to premature conclusions because social constraints were only assessed by self-reports of the trauma survivors. Cognitive change due to trauma and PTS may have biased the traumatized individuals' ratings, leading to multicollinearity between the observed concepts. To overcome this limitation, we attempt to adopt an interpersonal perspective by assessing the variables of interest in both parties of a dyad experiencing trauma. Furthermore, because we intend to study naturally occurring disclosure after trauma and do not want to interfere with personal habits of (non-)disclosure, we assess self-reports on dysfunctional disclosure tendencies rather than applying an experimental design in which participants are instructed to talk about the trauma even though they would potentially not do in real life. When assessed in both partners at the same time, self-reports on dysfunctional disclosure tendencies—comprising reluctance to disclose aspects of the trauma and/or urge to talk about the trauma and/or intense reactions during disclosure—can provide interesting indications of the trauma-related communication effectively going on within the dyad. For example, if both partners feel reluctant to disclose their thoughts and feelings about the trauma, subsequently no such conversation is likely to happen. In line with Lepore's theory (2001) and findings on mutual influence within trauma-affected dyads (Monson, Gradus, La Bash, Griffin & Resick, 2009; Renshaw, Rodrigues & Jones, 2008), we expect worse adaptation to trauma in dyads with both partners reporting dysfunctional disclosure styles.

Life-threatening injuries from accidents

Severe traumatic injuries involving life-threatening medical conditions offer a useful context for studying dyadic interactions posttrauma. For both the injured individual and the significant other, this may involve fear of death, disability, or loss. The traumatic event happens suddenly and unexpectedly and seems to be uncontrollable. Accordingly, both survivors and significant others have been found to experience increased distress in terms of PTS as a consequence of medical trauma (Davydow, Gifford, Desai, Needham & Bienvenu, 2008; McAdam & Puntillo,

2009; Mundy & Baum, 2004; Pielmaier, Walder, Rebetez, & Maercker, 2011).

Objective

The first aim of this study was to replicate the findings of previous research showing that a dysfunctional disclosure style is related to higher PTS symptom severity within the individual in both patients with severe traumatic injury and their significant others. Second, we expected to find additional interpersonal associations among disclosure and psychopathology. In particular, we hypothesized that—at a dyadic level—a dysfunctional disclosure style of one individual would be associated with higher symptom levels of PTS in the other, over and above the intrapersonal effect of self-reported dysfunctional disclosure.

Method

The data stem from the research network on Patient-relevant Endpoints after Brain Injury from Traumatic Accidents (PEBITA¹) that aims to evaluate the incidence and 1-year health outcomes of severe traumatic brain injury (TBI) in Switzerland. In this article, we present cross-sectional data from a nested study of PEBITA on the psychological consequences of TBI on patients and their significant others conducted in the German speaking part of Switzerland only.

Participants

Patients were eligible for the study if they had experienced severe TBI defined as an Abbreviated Injury Scale score for the head region of 4 = "severe" or 5 = "critical" based on in-hospital diagnoses and had been admitted to one of the participating hospitals with neurosurgical facilities in the German speaking part of Switzerland. Further inclusion criteria were a minimum age of 16 years, place of residence in Switzerland, fluency in written and spoken German, absence of severe cognitive deficits that would impair verbal communication, and the availability of a significant other also willing to participate in the study. Patients' significant others ("proxies") were eligible to participate if they were a parent, romantic partner, close friend, child, or other relative. Proxies were either the person to whom medical staff referred to in the first days after injury when the patients were not able to make decisions themselves, or the person indicated by the patient as being most closely related to them. Again, minimum age was 16 years, and fluency in German was required.

During the recruitment period from December 2009 to April 2010, a total of 284 patients were included in PEBITA's follow-up study, and 190 of those were willing to additionally participate in the nested study on

¹For more information, see <http://www.pebita.ch/>.

psychological consequences of TBI. Forty-nine patients were excluded because of severe cognitive impairment ($n=34$), insufficient German ($n=2$), or because they did not complete all questionnaires ($n=13$). In another 31 cases, no proxy data were available because of refusal ($n=22$) or because the patient did not indicate any significant other ($n=9$). The final sample comprises a total of 70 patient-proxy dyads. Demographic and trauma data are presented in Table 1. Patients were between 16 and 82 years old ($M=45$, $SD=21$) and most of them were male (77%). Proxies' mean age was slightly higher ($M=50$, $SD=16$) and the majority was female (79%). In half of the cases, the proxy was the romantic partner of the patient (51%). Most participants had sustained severe TBI in a road traffic accident (44%) or fall (37%). At 3 months after injury, 14% of patients still had severe and 23% had moderate disability. More than half of the sample (63%) had recovered well in terms of functionality as assessed by the Glasgow Outcome Scale Extended (GOSE).

Procedure

Case identification and data collection began within the first day of the patient's accident. Informed consent, medical, and trauma data as well as demographic information were obtained by PEBITA's local collaborators in the participating hospitals within the first 14 days. Three months after the accident (median = 95 days; range = 66 – 133), we invited patients and proxies to take part in a research session. The sessions took place either at the patient's home or at the institution where he or she was located at that point (acute care hospital, rehabilitation center, and nursing home) and were conducted by three trained clinical psychologists. On the basis of a clinical interview assessing the neuropsychological status, the interviewers decided on the exclusion of dyads in which the patient was affected by pronounced communication problems.

Measures

Injury severity and functional recovery

The 1998 update of the Abbreviated Injury Scale (AIS, American Association for the Advancement of Automotive Medicine, 2001) was used to assess TBI severity. The AIS classifies all types of injuries to six body regions on an ordinal scale according to their degree of threat to life from 0 = "no injury" to 6 = "lethal." AIS ratings for the head region were based on cerebral CT scans taken within 24 hours after admission.

A second measure of brain injury severity was provided by the Glasgow Coma Scale (GCS, Teasdale & Jennett, 1974), which is a clinical assessment of the level of consciousness. Ratings reflect patients' reactions to verbal and pain stimuli with a final score between 3 = "deep

Table 1. Sample characteristics ($n=70$)

	Patients	Proxies
Demographics		
Type of relationship ($n\%$)		
Partner		36 (51.4)
Parent		20 (28.6)
Close friend		6 (8.6)
Child		5 (7.1)
Sibling/cousin		3 (4.3)
Education ($n\%$)		
Higher level	10 (14.3)	15 (21.4)
Lower level	34 (48.6)	55 (78.6)
Unknown	26 (37.1)	–
Accident		
Proxy's presence at accident ($n\%$)		
Not present		62 (88.6)
Present, but not injured		7 (10.0)
Present, and injured		1 (1.4)
Trauma mechanism ($n\%$)		
Fall	26 (37.1)	
Motor vehicle accident	14 (20.0)	
Bike accident	11 (15.7)	
Pedestrian	6 (8.6)	
Sport accident	6 (8.6)	
Object	5 (7.1)	
Other	2 (2.8)	
Intention ($n\%$)		
Unintentional, one party involved	43 (62.3)	
Unintentional, two parties or more	23 (33.3)	
Violence	3 (4.3)	
Health		
Initial GCS (Md ; $min-max$)		
13–15 ($n\%$)	13 (3–15)	30 (42.9)
9–12 ($n\%$)		12 (17.1)
3–8 ($n\%$)		14 (20.0)
Not assessed ($n\%$)		14 (20.0)
Days in hospital (Md ; $min-max$)	33 (1–125)	
Location at 3 months ($n\%$)		
At home	61 (88.4)	
Rehabilitation/nursing home	8 (11.6)	
GOSE at 3 months (Md ; $min-max$)	7 (3–8)	

Note: GCS, Glasgow Coma Scale; GOSE, Glasgow Outcome Scale Extended.

coma or death" and 15 = "fully awake person." In this study, the GCS was assessed by the emergency services on arrival at the accident scene.

The GOSE (Wilson, Pettigrew & Teasdale, 1998) was administered to assess the functional status of the patient 3 months after injury. This scale compares pre and postinjury functional abilities and impairments in various domains of life (e.g., work, leisure time activities, interpersonal relationships, and independence). Functional

status is represented on an 8-point ordinal scale: 1 = “dead”; 2 = “vegetative state”; “3/4 = lower/upper severe disability”; 5/6 = “lower/upper moderate disability”; 7/8 = “lower/upper good recovery.” The QOLIBRI group (Von Steinbuechel et al., 2010) translated and linguistically validated the scale into German. Psychometric data on the original version showed high interrater reliability, convergent validity with functional as well as neuropsychological outcome measures, and sensitivity to changes (GOSE, Wilson et al., 1998).

Symptoms of PTS

For several reasons, we used different approaches to assess PTS symptom severity in patients and in proxies. We decided to use a clinical assessment instrument in patients to better control for potential overlaps between symptoms of PTS and complaints due to brain injury (see the recommendations of Bryant, 2001). However, because many patients were still rapidly exhausted due to the effects of their brain injury, we tried to limit mental load on participating patients by choosing a comparatively short yet reliable screening tool to assess PTS: the Short Screening Scale for DSM-IV PTSD (SSS-PTSD; Breslau, Peterson, Kessler & Schultz, 1999). The SSS-PTSD comprehends five avoidance and numbing symptoms (C2, C4, C5, C6, and C7) and two hyperarousal symptoms (D1 and D5). This selection of symptoms was identified as being the most predictive for PTSD diagnosis status in a large population-based sample. Furthermore, the scale showed high sensitivity and specificity, and correctly classified 96% of participants in an independent sample (Bohnert & Breslau, 2011). We administered the SSS-PTSD in the form of an interview asking patients how frequently and severely they had experienced each symptom in the previous 4 weeks. Patients were instructed to focus on symptoms relating to their accident and its sequelae (e.g., emergency treatment). Patients' answers were rated on a 4-point scale (0 = “never/only once” to 3 = “five times a week/almost always”), a total mean score was calculated representing PTS symptom severity. Good internal consistency and preliminary evidence for construct validity have been reported for the German version of the scale (Siegrist & Maercker, 2010). In this study, internal consistency of the total score proved to be acceptable (Cronbach's $\alpha = 0.73$).

The proxies' level of trauma-related stress was assessed by the Impact of Event Scale-Revised (IES-R; Weiss & Marmar, 1996), a widely used and recommended assessment tool in trauma research (Brewin, 2005). Respondents were asked to indicate how distressed they felt by each of the 22 PTS symptoms over the past 7 days on a 5-point scale (0 = “not at all” to 4 = “extremely”). Like the patients, we instructed the proxies to relate their assessments to the patient's accident and its sequelae.

The German version of the IES-R used in this study has shown good psychometric properties (Maercker & Schützwohl, 1998). In our sample, internal consistency was high with Cronbach's α of the intrusions, avoidance, and hyperarousal subscales at 0.87, 0.87, and 0.89, respectively.

Dysfunctional disclosure tendencies

We used a short version of the Disclosure of Trauma Questionnaire (DTQ; Mueller et al., 2000) to assess dysfunctional trauma disclosure style in patients and proxies. In the instruction, we informed participants that we were interested in learning about how they have talked about the accident and its sequelae with the other person in the dyad in the period since injury. Participants were instructed to indicate their agreement with statements drafted by other people who had experienced similar conditions after an accident. Where possible, the wording of the original DTQ items was slightly changed to relate statements on disclosure tendencies to the partner in the observed dyad. An English translation of the version for dyads (DTQ-dyads) is provided as supplemental material of this article. The scale has three subscales comprising (1) six items tapping reluctance to talk about the traumatic experience; (2) four items tapping urge to talk; and (3) four items tapping strong emotional and physical reactions while talking about the traumatic experience. Respondents indicated their agreement on a 6-point Likert scale (0 = “not at all” to 5 = “absolutely”). Mean scores were calculated for each subscale. Additionally, a total mean score was calculated across all items to represent the overall dysfunctionality of disclosure style. The original version of the DTQ showed satisfactory psychometric properties (Mueller et al., 2000). With regard to the DTQ-dyads used in this study, internal consistencies were acceptable with the exception of one subscale: in the sample of patients, Cronbach's α was 0.62, 0.79, 0.81, for the three subscales and 0.75 for the total score; in the subsample of proxies, the figures were 0.70, 0.75, 0.80, and 0.79, respectively.

Statistical analyses

Because most scales were not normally distributed, non-parametric correlation analyses were conducted reporting Spearman's correlation coefficients and medians as well as minimum to maximum ranges as descriptive data. The primary method of analysis was multiple hierarchical regression analyses predicting patients' and proxies' PTS symptom severity. The total mean score of symptom severity assessed with the SSS-PTSD served as a dependent variable in the subsample of patients. Because the calculation of a total score is not recommended for the IES-R (Maercker & Schützwohl, 1998), we choose to conduct separate regression analyses for the three subscales in the sample of proxies. For each analysis, the

same regression modeling strategy was applied: In a first step, we entered all basic predictors of PTSD selected for this study on the basis of meta-analytic findings (Brewin et al., 2000; Ozer et al., 2003). These were sex, age, and the functional status of the patient (GOSE) as an indicator of trauma severity. Because previous studies have found higher distress in TBI patient's spouses than in other significant others (Kreutzer, Gervasio & Campbell, 1994), we also tested this association, having dichotomized the relationship categories into "intimate partner" versus "other relationship." In step 2, we included the DTQ-dyads total scores of the proxy and the patient. In step 3, we tested the interaction between patient's and proxy's dysfunctional disclosure style following Aiken and West (1991) with predictor variables centered to the sample mean. To probe and plot significant interactions, we followed the suggestions of Hayes and Matthes (2009) and used the Johnson-Newman technique to identify regions of significance in the range of the moderator variable. All statistical analyses were performed using the SPSS software package for Windows (SPSS version 19) applying the macro "MODPROBE" by Hayes and Matthes (2009).

Results

Descriptive data and correlations are displayed in Table 2. For both the patients and the proxies, the median PTS symptom severity scores indicated fairly low levels of distress, and the ranges did not include the maximum scores.

For the patients, none of the indicators of injury severity at the time of the accident were significantly related to PTS symptom severity at 3 months after injury (initial GCS: $r_s = 0.18$, ns ; length of stay in hospital: $r_s = 0.07$; ns). However, ongoing functional problems assessed at 3 months postinjury were associated with higher PTS symptom severity ($r_s = -0.27$, $p < 0.05$). The functional status of the patient was also negatively correlated with the proxy's intrusions and hyperarousal symptoms, whereas the patient's level of PTS symptom severity was independent of the proxy's IES-R scores.

For both patients and proxies, all within-person correlations between dysfunctional disclosure style and PTS symptom severity were significant and most were moderate sized according to Cohen's effect size classification (Cohen, 1988). Substantial within-person correlations with proxy's symptom severity were also found for proxy's age ($r_s = 0.26$ to $r_s = 0.29$, all $ps < 0.05$), and being an intimate partner to the patient ($r_s = 0.28$ to $r_s = 0.31$, all $ps < 0.05$). Patient's symptom severity was only significantly associated with female sex ($r_s = 0.25$, $p < 0.05$). Table 3 presents the results of regression analyses.

In total, the predictors explained 56% of variance in the patient's and 35%–45% of variance in the proxy's symptom severity. All regression analyses revealed self-reported

dysfunctional disclosure tendencies to have incremental validity above and beyond the established predictors of PTSD (35% for patient's SSS-PTSD scores, 18% for proxy's intrusions, 28% for proxy's avoidance, and 21% for proxy's hyperarousal symptoms; all $ps < 0.01$). In addition, a significant interaction effect between patient's and proxy's DTQ-dyads scores was found predicting patient's PTS symptom severity ($\Delta R^2 = 0.07$; $b = 0.29$, 95% CI [0.10, 0.48], $SE[b] = 0.09$; $t = 3.10$, $p < 0.01$). Step 3 was not significant for any of the proxy's symptom measures. Fig. 1 illustrates the conditional effects of patients' DTQ-dyads scores on their PTS symptom severity when proxies' DTQ-dyads scores were set to one standard deviation below and one standard deviation above the sample mean ("low level" vs. "high level"). The Johnson-Newman technique to identify regions of significance of the moderator revealed that the association between patients' DTQ-dyads and SSS-PTSD scores was statistically significant only if proxies had a DTQ-dyads total mean score of 0.53 or higher. This was the case for 81% of the sample. At the transition point of proxies' DTQ-dyads = 0.53, the conditional effect of patients' DTQ-dyads scores on PTS was $b = 0.19$ ($SE[b] = 0.09$; $t = 2.13$, $p < 0.05$; see Table 4 for more conditional effects). Because all conditional effects of patients' DTQ-dyads scores on PTS within the region of significance were positive, the interaction effect can be interpreted as follows: Patients who reported more dysfunctional disclosure experienced even more intense PTS symptoms if their significant other also had more dysfunctional disclosure tendencies.

Discussion

In this study, previous findings on dysfunctional disclosure tendencies were replicated in dyads of an individual who had sustained severe TBI and a significant other (Mueller et al., 2000; Mueller et al., 2008; Mueller et al., 2009). Results revealed substantial within-person associations of PTS symptom severity with self-reported reluctance to talk about the accident and its consequences, with a strong desire to talk about it, and with intense physical and emotional reactions while disclosing after controlling for established predictors of PTSD. The reported moderate effect sizes are comparable with findings in a sample of crime victims (Mueller & Maercker, 2006).

This study was the first to investigate self-reported dysfunctional disclosure at a dyadic level. A substantial interaction effect between patient's and proxy's disclosure style was found with regard to the patient's PTS symptom severity. Accordingly, the proxy's disclosure style modified the association between the patient's dysfunctional disclosure and PTS in terms of an enhancing interaction, with both predictors affecting the dependent variable in the same direction. This finding indicates that disclosure dysfunction in a significant other intensifies the

Table 2. Descriptive statistics (median, range) and correlations (Spearman's r_s) among study variables for patients and proxies ($n = 70$)

Patients	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Mdn																	
(min-max)																	
Demographics																	
1 Age		41 (16-82)															
2 Sex ^a		-0.03															
Health																	
3 SSS-PTSD	0.14 (0-1.86)	0.04	0.25*														
4 GOSE	7 (3-8)	-0.16	-0.03	-0.27*													
DTQ-dyads																	
5 Reluctance	0.83 (0-3)	0.14	0.21*	0.33**	-0.07												
6 Urge to talk	1.50 (0-5)	0.06	-0.29**	0.23*	-0.07	-0.11											
7 Reaction	0.38 (0-4.3)	-0.09	0.18	0.57**	-0.31**	0.39**	0.40**										
8 Total	0.89 (0.2-2.9)	0.09	0.01	0.48**	-0.22*	0.60**	0.63**	0.79**									
Proxies																	
Demographics																	
9 Age	52 (19-79)	0.58**	-0.12	0.04	-0.08	0.06	0.18	0.01	0.14								
10 Sex ^a		0.06	-0.38**	-0.07	0.06	-0.27*	0.17	-0.21*	-0.14	0.08							
11 Relationship ^b		0.58**	-0.29**	-0.12	-0.11	-0.10	0.26*	-0.15	0.01	0.28**	0.26*						
IES-R																	
12 Intrusions	6.5 (0-27)	0.20*	-0.33**	0.08	-0.22*	-0.20*	0.14	0.07	-0.02	0.29**	0.19	0.28*					
13 Avoidance	5.5 (0-29)	0.31**	-0.19	0.12	-0.13	-0.03	0.34**	0.12	0.21*	0.26*	0.07	0.31**	0.61**				
14 Hyperarousal	6.0 (0-24)	0.22*	-0.29**	0.10	-0.36**	-0.08	0.21*	0.14	0.14	0.27*	0.10	0.30**	0.81**	0.64**			
DTQ-dyads																	
15 Reluctance	0.83 (0-3.3)	0.26*	-0.07	0.22*	-0.08	0.30**	0.15	0.20*	0.33**	0.31**	-0.09	0.13	0.32**	0.55**	0.42**		
16 Urge to talk	1.25 (0-4.3)	0.11	-0.36**	0.02	-0.17	-0.04	0.21*	-0.05	0.07	0.24**	0.17	0.22*	0.24*	0.30**	0.26*	0.10	
17 Reaction	0.75 (0-4.5)	0.11	-0.37**	0.21*	-0.31**	0.04	0.33**	0.31**	0.34**	0.24*	0.25*	0.21*	0.51**	0.58**	0.56**	0.45**	0.48**
18 Total	0.96 (0-2.6)	0.25*	-0.34**	0.25*	-0.25*	0.14	0.30**	0.20*	0.34**	0.37**	0.14	0.27*	0.47**	0.64**	0.56**	0.71**	0.66**

Note: One-tailed tests with $p < 0.05$, ** $p < 0.01$; SSS-PTSD, Short Screening Scale for PTSD; GOSE, Glasgow Outcome Scale Extended; DTQ-dyads, Disclosure of Trauma Questionnaire-Version for Dyads (subscales: reluctance to talk, urge to talk, emotional and physical reactions while disclosing, total score); IES-R, Impact of Event Scale-Revised; ^amale = -1/female = 1; ^bother relationship = -1/intimate partner = 1.

Table 3. Hierarchical regression analyses predicting PTSD symptom severity in patients and proxies (N = 70): results of step 3

	Patients' SSS-PTSD						Proxies' IES-R											
	Intrusions			Avoidance			Hyperarousal			Hyperarousal								
	B	SE	β	B	SE	β	B	SE	β	B	SE	β						
Step 1	$R = 0.38, R^2 = 0.14^*$						$R = 0.31, R^2 = 0.10$						$R = 0.50, R^2 = 0.25^{**}$					
GOSE	-0.03	0.03	-0.11	-0.36	0.43	-0.09	0.12	0.45	0.03	-0.88	0.41	-0.22*						
Age ^a	0.00	0.00	-0.08	0.03	0.04	0.09	0.04	-0.02	-0.15	0.03	0.04	0.06						
Sex ^a	0.18	0.05	0.31**	0.61	0.84	0.08	0.13	0.88	0.02	0.40	0.80	0.05						
Proxy type	-	-	-	0.76	0.68	0.12	0.78	0.72	0.12	0.82	0.65	0.13						
Step 2	$R = 0.71, R^2 = 0.50^{**}$						$R = 0.61, R^2 = 0.38^{**}$						$R = 0.67, R^2 = 0.45^{**}$					
Disc _{patient}	0.34	0.07	0.45**	-1.23	1.07	-0.12	1.54	1.12	0.15	0.07	1.02	0.01						
Disc _{proxy}	0.20	0.07	0.27**	4.58	1.10	0.49**	5.26	1.15	0.52**	4.93	1.05	0.50**						
Step 3	$R = 0.75, R^2 = 0.56^{**}$						$R = 0.75, R^2 = 0.56^{**}$						$R = 0.75, R^2 = 0.56^{**}$					
Disc _{patient} *Disc _{proxy}	0.29	0.09	0.22**	-	-	-	-	-	-	-	-	-						

Note: Two-tailed tests with $p < 0.05$; ^a $p < 0.01$; ^bno value because step 3 non-significant; SSS-PTSD, PTSD symptom severity; GOSE, Glasgow Outcome Scale Extended (functional status of patient); proxy type, type of relationship between patient and proxy dichotomized (other vs. intimate partner); Disc_i, DTQ-dyads total mean score; Disc_{patient}*Disc_{proxy}: patient's and proxy's interacting disclosure tendencies; IES-R, Impact of Event Scale-Revised.

association between the patient's own dysfunctional disclosure tendencies and mental health. Surprisingly, there was no effect of the patient's disclosure style on the proxy's PTS symptoms, either when tested as an independent predictor or in terms of an interaction with the proxy's disclosure tendencies.

Although social constraints were not directly measured in this study, results can be interpreted against the background of Lepore's social-cognitive processing model (Lepore, 2001) suggesting inhibiting and invalidating reactions from interactants to impede cognitive processing of the trauma and thus lead to poorer trauma adjustment. In this study, proxies who themselves had dysfunctional disclosure tendencies may have constrained patients' attempts to disclose their concerns and feelings about the accident and its consequences. In consequence, these patients' processing and integration of the incident may have been impaired. It is possible that the effect of such social constraints on disclosure was more pronounced for the patient than for the proxy. Although the patients may have experienced a period of decreased social contacts due to physical impairment and therefore have been more dependent on his or her significant other, the latter was free to choose other interaction partners with whom to discuss their worries if the patient was not willing to talk about what happened. Therefore, the association between the proxy's disclosure style and the proxy's mental health may have been more independent of the patient's disclosure style than vice versa. Because social constraints were measured indirectly, the proposed interpretation requires further empirical support.

The results are in line with the findings of the few studies that have investigated mutual influences after trauma by simultaneously measuring social interaction characteristics in both the trauma victim and a significant other (Monson et al., 2009, Renshaw et al., 2008). Some studies drawing on dyadic data have identified certain cognitions (shared or unshared) to play a key role in both communication about the traumatic event and the adaptation process in general. For example, Monson et al. (2009) found that in couples exposed to a severe flood, wives' world assumptions were associated with PTS symptom severity only if their husbands held less benevolent world assumptions. Thus, the cognitions of one partner moderated the association between negative trauma-related beliefs and pathology in the other. In a study by Renshaw et al. (2008), spouses of war veterans reported more symptoms of PTS if they perceived high levels of PTS in their husbands, but the veterans themselves reported low levels. One might hypothesize that this mismatch between veterans' self-reports of symptoms and spouse perceptions was caused by a lack of communication within the couple. These studies along with our finding demonstrate that social interaction processes after trauma exposure, such as the

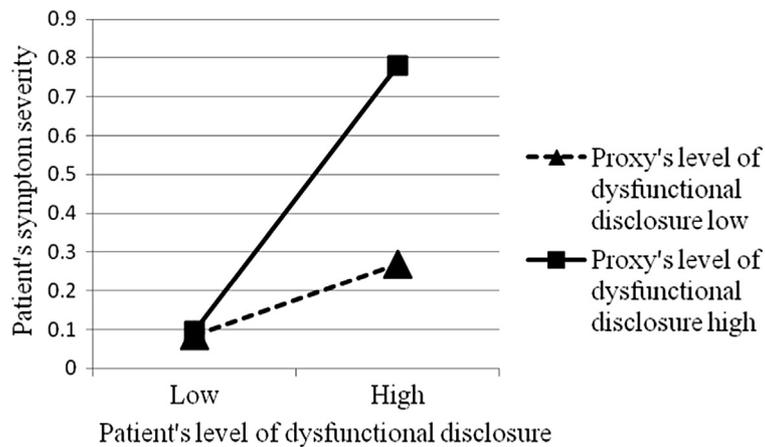


Fig. 1. Illustration of the moderating effect of proxy’s dysfunctional disclosure on the association between patient’s level of dysfunctional disclosure and patient’s PTSD symptom severity when covariates are set to their sample means.

communication about trauma-related experiences, may interfere with individual recovery. Several authors have, therefore, emphasized the need to include mutual influences between the trauma survivor and his or her social environment in models of PTSD to fully understand its genesis and to use this knowledge to further develop treatment approaches (Goff & Smith, 2005; Maercker & Horn, 2011; Monson, Fredman & Dekel, 2010).

Limitations

First, one major limitation stems from the choice of trauma population. In this study, dyads comprising a patient with severe TBI and a significant other served as a case example for investigating naturally occurring trauma-related communication. Because TBI can affect communication abilities (Togher, 2011), it was necessary to exclude those patients with severe cognitive impair-

ment. Subsequently, the sample consisted of patients with better functional status 3 months after severe TBI. This may be one reason why PTS symptom levels in patients and proxies were fairly low. For the same reason, it is possible that the sample is not representative of individuals with poorer health outcomes after severe TBI, and results cannot be generalized beyond patients with relatively good recovery. Furthermore, it has been well documented that TBI specifically impacts social life (e.g., Verhaeghe, Defloor & Grypdonck, 2005). Therefore, a potential interference between interpersonal problems specific to the consequences of TBI and PTS-related communication problems cannot be ruled out. Although in the main analyses we controlled for the functional status of the patient including changes in social abilities, findings need to be replicated with a non-TBI trauma sample to be extrapolated beyond individuals with elevated PTS symptom severity after TBI.

Second, the study’s sample size is rather small. Data were collected within a large research network investigating the consequences of severe TBI in Switzerland. Lack of reimbursement for the additional time expenditure required in the nested study may be a reason why a large group of eligible patients refused to participate.

Another important limitation to the study concerns the applied methodology. Because of time constraints, we used a very short screening tool to assess symptom severity in patients. This measure may have led to underestimations of distress levels. Furthermore, the use of different measures to assess PTS symptoms in patients than in proxies could be one reason why different regression models emerged for patients than for proxies. Therefore, the findings in the subsample of patients should not be directly compared to the results for proxies. However, one strength of the study is the application of a clinical assessment instrument to control for potential

Table 4. Conditional effects of patients’ dysfunctional disclosure scores on PTS symptom severity revealing the region of significance of the moderator variable (proxies’ disclosure scores)

Proxy’s DTQ-dyads total score	B	SE B	t	p
0.00 ^a	0.02	0.13	0.19	0.850
0.53	0.19	0.09	2.12	0.039
1.06	0.35	0.07	4.88	0.000
1.59	0.51	0.09	5.54	0.000
2.11	0.68	0.13	5.01	0.000
2.64 ^b	0.84	0.18	5.54	0.000

Note: DTQ-dyads, Disclosure of Trauma Questionnaire—Version for Dyads; ^aminimal score of the sample, ^bmaximal score of the sample.

overlap between PTS symptoms and neuro-psychological problems due to brain injury. Furthermore, despite the use of identical measurements for both partners of the dyad, future investigations on dyadic interactions in relation to PTS should capture more aspects of trauma-related communication such as perceived constraints and social reactions to disclosure.

Conclusions

To our knowledge, this study was the first to examine the association between dysfunctional disclosure tendencies and PTS at a dyadic level. Disclosure tendencies of a significant other were found to intensify the within-person association between dysfunctional disclosure tendencies and PTS symptom severity of patients who sustained severe TBI. To cast further light on the pathways between naturally occurring disclosure and PTS, future studies need to examine the course of disclosure styles and PTSD from a longitudinal and social-contextual perspective.

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