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Abstract: **OBJECTIVES:** The objectives of the present study are to investigate and compare the relative impact of workplace-related factors and personal characteristics on chronic psychosocial stress experience in young physicians. **METHODS:** In a prospective study, a cohort of Swiss medical school graduates was followed up, beginning in 2001. In their fourth and eighth year after graduation, 443 physicians assessed their workplace conditions, the experienced effort-reward imbalance, the received professional and emotional support as well as their personal characteristics. The chronic stress experience was measured by the Trier Inventory for the Assessment of Chronic Stress-Screening Subscale of Chronic Stress (TICS-SCSS), 7 years after graduation. The model of influencing factors on chronic stress experience was tested with a hierarchical regression analysis. **RESULTS:** The mean in chronic stress (TICS-SCSS) in our study sample is significantly higher ($p < 0.001$) compared to an age-matched population representative sample. In the prediction of chronic stress, the workplace-related factor effort-reward imbalance as well as the personal characteristic overcommitment turned out to be the most important risk factors. Stress protective are high satisfaction with career support, sense of coherence and occupational self-efficacy. The whole set of variables used in the regression model explains 51% of the variance of chronic stress experience. In the prediction of chronic stress, gender has no significant moderator effect. **CONCLUSIONS:** It is a matter of concern that young physicians report to feel chronically stressed early in their professional career. Actions have to be taken to reduce the stress level mainly in regard to re-establish reciprocity between perceived effort invested and rewards received, in the form of esteem, monetary gain and career opportunities including job security.

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Chronic stress experience in young physicians: impact of person- and workplace-related factors

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Results The mean in chronic stress (TICS–SCSS) in our study sample is significantly higher ($p < 0.001$) compared to an age-matched population representative sample. In the prediction of chronic stress, the workplace-related factor effort–reward imbalance as well as the personal characteristic overcommitment turned out to be the most important risk factors. Stress protective are high satisfaction with career support, sense of coherence and occupational self-efficacy. The whole set of variables used in the regression model explains 51% of the variance of chronic stress experience. In the prediction of chronic stress, gender has no significant moderator effect.

Conclusions It is a matter of concern that young physicians report to feel chronically stressed early in their professional career. Actions have to be taken to reduce the stress level mainly in regard to re-establish reciprocity between perceived effort invested and rewards received, in the form of esteem, monetary gain and career opportunities including job security.

Keywords Chronic stress experience · Young physicians · Workplace-related factors · Effort–Reward Imbalance model · Person-related characteristics

Introduction

Stress at work can be conceptualized as an interaction of a person with the demands of his or her personal and work environment (Richter and Hacker 1998). In medicine, various workplace-related stressors are known: the quantity of work, e.g., long working hours and on-call duties; the quality of work, e.g., high standard and complexity of patient care; diversity of the demands, e.g., empathy with patients and high technological skills, time-pressure, coping with life-threatening situations; and compatibility with other demands, e.g., work–home interference (Buddeberg-Fischer et al. 2006; Roevik et al. 2007a). According to Siegrist's Effort-Reward Imbalance model (Siegrist 1996), we hypothesize that jobs characterized by a perceived imbalance between high effort and low rewards elicit stress. The experience of 'high cost/low gain' at work (extrinsic component in stress experience) is frequent in people who exhibit a specific cognitive and motivational pattern of coping with demands characterized by excessive work-related commitment ('overcommitment': intrinsic component in stress experience) (Siegrist and Marmot

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2004). Overcommitted men and women suffer from inappropriate perceptions of demands and of their own coping resources more often than their less involved colleagues, because perceptual distortion prevents them from accurately assessing cost–gain relations (Preckel et al. 2005). As known, physicians show a high professional commitment (Armstrong et al. 2009). As long as they get the expected appreciation for their efforts, they have a high satisfaction in their profession.

Beyond the required balance between effort and reward, mentorship has been identified not only to be a relevant component of career guidance but also to be an important factor for young physicians to feel professionally and emotionally supported, factors which are decisive for not feeling stressed (Blickle et al. 2003).

Furthermore, as known from recent stress research (Korotkov 2008; McManus et al. 2004; Roevik et al. 2007a; Semmer 2006; Vollrath 2001; Vollrath and Torgersen 2000), subjects experience stress and deal with it differently, depending on their personal characteristics: they perceive specific aspects of a given situation as more or less stressful; they react differently to situations and show different coping tendencies. Certain personal characteristics like high sense of coherence and self-efficacy proved to be important to cope with chronic stress (Höge and Büssing 2004). These factors focus on an individual's salutogenetic potential and a subject's self-efficacy related to his or her occupation. Other studies investigating the impact of personality traits on chronic stress experience in physicians (Firth-Cozens 1997; Höge and Büssing 2004; McManus et al. 2004; Tyssen et al. 2005) focus on pathogenetic characteristics such as neuroticism, vulnerability and self-criticism. As mentioned, overcommitment is a further personal risk factor to experience the demands at work as stressful (Preckel et al. 2005; Siegrist and Marmot 2004).

There are some studies reporting on young physicians feeling chronically stressed early in their professional career (Buddeberg-Fischer et al. 2005, 2008a, 2008b; Firth-Cozens 2003; Roevik et al. 2007b; Tyssen et al. 2000). These findings are a matter of concern. It is known that chronically stressed physicians are affected in their well-being and life satisfaction with a negative impact on patient care. Additionally, distressed physicians may be distracted from staying in clinical work (Williams et al. 2007a, 2007b).

Most of the studies mentioned investigate either the impact of work-related factors or the impact of personal characteristics on chronic stress experience in physicians. Studies focussing on both these components are lacking. Therefore, the aim of the present study is to investigate and compare the relative impact of these components on chronic stress experience in young physicians 7 years after graduation (Fig. 1).

Methods

Study design, sample development and study sample

The present study is part of an ongoing prospective survey of a cohort of graduates of the three medical schools in German-speaking Switzerland (SwissMedCareer Study), beginning in 2001 (T1). All of the 1,004 registered final-year students were sent a letter explaining the study design, accompanied by a recommendation letter of the deans of the three medical schools and the baseline questionnaire; the students' addresses were provided by the university boards. To ensure participants' anonymity, the returned questionnaires are identified only by a code. The respondents send their addresses to an independent address-administration office, allowing for follow-up. The study protocol was approved by the ethical committee of Zurich University.

In the first assessment (T1, in 2001), 711 graduates participated (Buddeberg-Fischer et al. 2003). Subjects were re-evaluated every 2 years (Buddeberg-Fischer et al. 2009a). The present paper refers to the results of the third (T3) and fifth assessment (T5); the latter was conducted in 2009, 7 years after the participants' graduation.

The *study sample* consists of 443 physicians (233 females, 52.6%; 210 males, 47.4%) participating at T3 and T5 with a full data set; excluded were 31 physicians taking a break from work at T5, mainly because of having children. The mean age of the participants at T5 is 35.2 years (SD 2.2 years, range 31–50 years). Of the residents, 388 (87.8%) have a stable partnership, of whom 227 are married. Eighty-three (35.6%) of the females and 81 (38.8%) of the males have children.

Instruments

In the following, the applied instruments to measure the constructs are described as listed in Fig. 1. All instruments

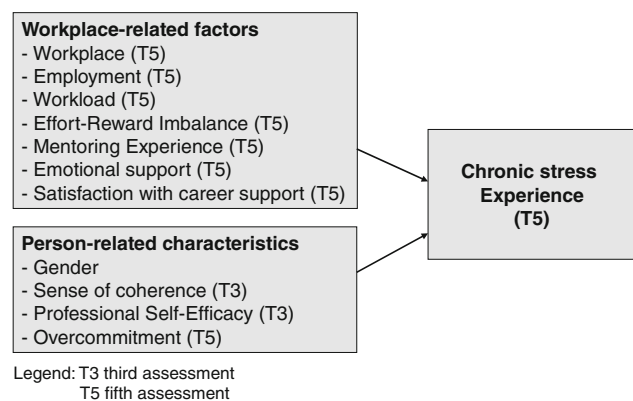


Fig. 1 Model of influencing factors on chronic stress experience in young physicians

are *self-assessment scales*. Cronbach's alpha values for the present study are given in Table 1, ranging from 0.63 (Effort-Reward Imbalance) to 0.93 (Mentoring-Experience-Scale). All workplace-related variables are assessed at T5. In residency, the young doctors change their workplace almost every year. Therefore, actual stress experience at work has to be analyzed in respect of the actual workplace. As known from other studies (McManus et al. 2004; Tysen et al. 2005), personal characteristics have a high predictive value on stress experience; therefore, we included data of personal characteristics from T3, testing their impact on chronic stress experience 4 years later.

Outcome

- *The Trier Inventory for the Assessment of Chronic Stress (TICS)* at T5 (Schulz et al. 2004) measures overall chronic stress by means of a five-point Likert scale ranging from 0 to 4 (never–very often). Subjects are asked whether they have had a certain stress experience or have found themselves in a particular stress situation over the past 3 months. The TICS consists of 57 items yielding the following dimensions extracted by factor analysis: *work overload, worries, social stress, lacking social recognition, work discontent and intrusive memories*. Twelve of the 57 items constitute the *Screening Subscale of Chronic Stress (TICS–SCSS)* used in this study. TICS screening items refer to aspects such as being afraid, that something unpleasant may happen, not being able to suppress worrying thoughts or

not being able to cope with all duties. The TICS–SCSS is a sum score of the 12 items and linearly transformed into standard *T*-values (mean = 50, SD = 10). Higher values indicate greater stress.

Workplace-related factors at T5

- *Workplace (hospital vs. other medical workplace)*
- *Employment in percent of full-time (100%)*
- *Workload: Working hours per week*
- *Effort–Reward Imbalance at Work Questionnaire ERI-Q (Fragebogen zu beruflichen Gratifikationskrisen, five-point Likert scales)* (Rödel et al. 2004; Siegrist et al. 2004): the five items of the *effort* scale measure extrinsic components of stressful experience at work such as psychological and physical job demands and/or obligations that are imposed on the employee. The 11 items of the *reward* scale measure extrinsic components of occupational rewards distributed by the employer consisting of money, esteem and job security/career opportunities. The effort/reward ratio is a measure of the imbalance between these two components. A value close to zero indicates a favorable condition (relatively low effort, relatively high reward), whereas values above 1.0 indicate a high amount of expended effort not equalled by the rewards received or expected in return.
- *Mentor-Protégé Relationships Questionnaire* (Blickle et al. 2003) consists of five scales (Likert scale 0–4) measuring different types of career support. We used the *Networking scale* (four items) and the *Support in Career Planning Scale* (three items). These two scales describe crucial aspects of mentoring. Our data analyses show that the two scales are highly correlated ($r = 0.71$). We, therefore, combined them into one scale named '*Mentoring-Experience Scale*', having a high Cronbach's alpha = 0.93. We further used the *Emotional Support Scale* (four items).
- *Question on Satisfaction with Career Support* (Likert scale 1–7, 1 = very unsatisfied to 7 = very satisfied).

Table 1 Descriptive statistics of independent variables and chronic stress experience (TICS–SCSS) ($N = 443$)

Variable	<i>n</i> (%) Mean (SD)	Cronbach's Alpha
Workplace-related factors		
Workplace (hospital)	$n = 399$ (90.1%)	–
Employment in % of full-time (100%)	90.71 (19.03)	–
Workload (in hours per week)	54.49 (9.01)	–
Effort–reward imbalance	0.77 (0.39)	0.63
Mentoring experience	1.79 (1.03)	0.93
Emotional support	2.06 (1.04)	0.91
Satisfaction with career support	4.20 (1.61)	–
Personal characteristics		
Gender (female)	$n = 233$ (52.6%)	–
Sense of coherence	5.22 (0.87)	0.86
Occupational self-efficacy expectation	3.73 (0.67)	0.76
Overcommitment	2.11 (0.54)	0.72
Chronic stress (TICS–SCSS)	63.51 (9.99)	0.91

Person-related characteristics

- *Questions concerning socio-demographic data* at T5
- *Sense of Coherence Scale (SOC-13)* at T3 (Antonovsky 1987) (seven-point Likert scale), a measure of a person's resistance to stress and his or her ability to manage stress.
- *Occupational Self-Efficacy Expectation Questionnaire* at T3 (Fragebogen zu beruflichen Selbstwirksamkeitserwartungen (BSW) (Abele et al. 2000) (six items, five-point Likert scale): the BSW questionnaire is a

measure of a person's general occupational self-efficacy expectations.

- *Overcommitment* at T5 (Siegrist et al. 2004) (six items, four-point Likert scale) is part of the Effort–Reward Imbalance at Work Questionnaire. It focuses on the intrinsic or personal component of the model that stands for a specific, individual pattern of coping with the various job demands and eliciting rewards. It reflects a respondent's (in)ability to withdraw from work obligations and develop a more distant attitude toward job requirements.

Statistical analyses

All analyses were carried out with SPSS for Windows, release 15 (SPSS Inc., Chicago, Ill.). Descriptive statistics are given in terms of counts and percentages, means and standard deviations, respectively. Cronbach's alpha was used to estimate the reliability of the scales. The difference between the mean in TICS–SCSS in our study and a representative population sample was investigated with *z*-test. Bivariate correlations between independent variables and outcome were computed using Pearson correlations. A hierarchical regression analysis was conducted to investigate the associations between workplace-related factors, personal characteristics and chronic stress experience: in a first step we included the workplace-related factors—'Workplace' (hospital vs. other medical workplace), 'Employment' in percentage of full-time (100%)', 'workload' (in hours per week), 'Effort–Reward Imbalance', 'Mentoring experience', 'Emotional support' and 'Satisfaction with Career Support'. In a second step, we additionally included the personal characteristics 'Gender', 'Sense of Coherence', 'Occupational Self-efficacy Expectation' and 'Overcommitment' controlled for workplace-related factors. Beta-weights and 95% confidence intervals ($\beta \pm SE(\beta) \times 1.96$) are reported as well as adjusted R^2 , *F*-statistics and change in R^2 and *F*. Furthermore, we additionally included all interaction terms between gender and the workplace-related factors, and personal characteristics, respectively, in the regression model to investigate the moderator effect of gender.

Results

Descriptive statistics of the used scales are given in Table 1. The mean in chronic stress (TICS–SCSS) in our study sample of young physicians is significantly higher ($p < 0.001$) compared to the age-matched representative population sample (63.51 vs. 50) (Schulz et al. 2004). Seven years after graduation, the majority of young physicians

work in hospital (90.1%), only few work in private practice or in other medical fields. Most of the cohort doctors *work full-time* ($n = 343$, 77.4%); of the female physicians with children ($n = 83$), 60 (72.3%) work part-time. The Swiss federal contract on working hours for residents and senior physicians, in place since 2005, limits the workload to 50 h/week. Nevertheless, the mean *workload* of study participants is 54.5 ± 9.0 h per week. A lack of *reciprocity of effort expended and reward received* (ERI-Quotient > 1) shows 87 (18.5%) participants. The *gender* distribution in the study sample is comparable to the overall gender distribution in the age-matched group of working doctors (Foederatio Medicorum Helveticorum 2009). The mean of the *Sense of Coherence Scale* is comparable with the age-matched representative population sample (mean 5.22 vs. 5.08) (Singer and Brähler 2007).

The *bivariate correlation analyses* (Table 2) show significant correlations between all independent variables and the outcome variable for chronic stress, except the workplace and the employment in percentage of full-time. The *hierarchical regression analysis* (Table 2) indicates that in regard to workplace-related factors, the Effort–Reward Imbalance is a significant risk factor for stress, while Satisfaction with Career Support reveals to be stress protective. Controlled for workplace factors, the personal characteristics Sense of Coherence and Occupational Self-Efficacy Expectation have a significant protective impact on chronic stress experience, while Overcommitment proves to be a high risk factor. No interaction term between gender and workplace-related factors, and personal characteristics, respectively, is significant (all p -values > 0.05, change in $R^2 = 0.01$, $p = 0.281$), i.e., gender does not play a significant role as a moderator variable. The value of the adjusted R^2 (0.51) illustrates that the independent variables explain a significant percentage of variance in chronic stress experience.

Discussion

The present study is a part of an ongoing prospective survey of a cohort of graduates of the three medical schools in German-speaking Switzerland, beginning in 2001 (T1) (Buddeberg-Fischer et al. 2009a, b). The paper reports data of the third (T3) and fifth (T5) assessment, conducted in the participants' fourth (T3 in 2005) and eighth year (T5 in 2009) after graduation. Four hundred and forty-three young physicians participated in both assessments providing a complete data set.

Chronic stress experience

Most studies on stress experience in physicians focus either on general workplace conditions (Höge and Büssing 2004;

Table 2 Results of bivariate correlations and hierarchical regression analysis between independent variables and chronic stress experience (TICS–SCSS) ($N = 443$)

Dependent variable	Bivariate correlation with TICS–SCSS	Beta-weight in multiple regression for TICS–SCSS (step one)	Beta-weight in multiple regression for TICS–SCSS (step two)	95% CI for beta (in step two)
<i>Step one</i>				
Workplace-related factors				
Workplace (hospital)	0.06	0.06	0.06	−0.01;0.13
Employment in % of full-time (100%)	0.01	−0.01	−0.03	−0.10;0.05
Workload (in hours per week)	0.16**	0.02	−0.03	−0.10;0.04
Effort–reward imbalance	0.43***	0.39***	0.24***	0.17;0.32
Mentoring experience	−0.23***	−0.08	0.00	−0.09;0.09
Emotional support	−0.20***	−0.01	−0.01	−0.09;0.07
Satisfaction with career support	−0.35***	−0.23***	−0.18***	−0.27; − 0.09
Adjusted $R^2 = 0.27$; $F(7,435) = 23.92$; $p < 0.001$				
<i>Step two</i>				
Personal characteristics				
Gender (female)	0.19***		0.07	−0.01;0.14
Sense of coherence	−0.48***		−0.19***	−0.27; − 0.10
Occupational self-efficacy expectation	−0.39***		−0.09*	−0.18; − 0.01
Overcommitment	0.58***		0.38***	0.30;0.45
R^2 change = 0.24; F change = 55.85; $p < 0.001$				
Adjusted $R^2 = 0.51$; $F(11,431) = 42.76$; $p < 0.001$				

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Roevik et al. 2007b; Tyssen et al. 2000), on Siegrist's Effort–Reward Imbalance model (Buddeberg-Fischer et al. 2008a; Li et al. 2006; Rockenbauch et al. 2006), or on personality traits (Firth-Cozens 1997; Tyssen et al. 2005). The present study investigates the combination of these dimensions in their impact on chronic stress experience.

As reported by our research group and other authors (Buddeberg-Fischer et al. 2005; Buddeberg-Fischer et al. 2008a; Firth-Cozens 1997; Linzer et al. 2002; Tyssen et al. 2000), young physicians experience a high level of chronic stress at work. The proportion of chronically stressed physicians is remarkably consistent over time and amounts up to about 30% of doctors (Buddeberg-Fischer et al. 2008a, b; Firth-Cozens 2001). Accordingly, the mean level of the physicians' chronic stress experience in the present study is more than one standard deviation above the mean level of stress in a population representative sample.

Associations between workplace-related factors, personal characteristics and chronic stress experience

In our hierarchical regression model, as far as the workplace-related factors are concerned, the *Effort–Reward Imbalance* reveals to be a significant risk factor for stress experience, as described in Siegrist's model (Siegrist 1996). As long as physicians receive adequate reward, they

might cope with high efforts in their work. The *Satisfaction with Career Support* has also a significant association with stress experience. Linzer et al. (2002) reported similar findings in their physician work-life study. In our study, full-time or part-time *employment* and *workload* are not associated with chronic stress. Similarly, in a 10-year follow-up study of general practitioners in Great Britain, Firth-Cozens did not find current stress levels to be correlated with hours worked in the past week (Firth-Cozens 1997). While *Mentoring Experience* and *Emotional Support* are significantly associated with chronic stress in the bivariate analyses, these factors do not reach the level of significance in the multivariate model. Satisfaction with career support seems to have a higher impact suppressing the effect of the other two work-related factors.

The personal characteristics increase the explanatory power of the regression model. *Overcommitment* reveals to be the most relevant risk factor for chronic stress experience in physicians. This finding supports results from our and other studies (Buddeberg-Fischer et al. 2008a; Head et al. 2007; Joksimovic et al. 2002; Li et al. 2006; Preckel et al. 2005) that highly overcommitted subjects report high levels of stress and are more likely to experience vital exhaustion. Furthermore, the *Sense of Coherence* proves to be strongly stress-protective. In a cross-sectional study, Höge and Büsing (2004) also reported the sense of

coherence having a protective impact on the work stressor–strain relationship. In previous studies within the prospective SwissMedCareer Study (Buddeberg-Fischer et al. 2009a, b), the sense of coherence proved to be a protective factor also for health and life satisfaction (Buddeberg-Fischer et al. 2008b, 2009b). Our results are consistent with Antonovsky's salutogenetic concept (Antonovsky 1987). Admittedly, there is some discussion about the sense of coherence scale being inadvertently measuring negative affectivity, especially because some of the SOC items are negatively formulated (Höge and Büssing 2004). It has to be considered, however, that the sense of coherence is a complex construct that is above the trait level described by Struempfer et al. (1998a, b). As further personal characteristic *Occupational Self-efficacy Expectation* turns out to be stress protective, but with lower beta weights than the sense of coherence; the sense of coherence plays a more important role in coping with stress. This might be explained by the sense of coherence being a broader construct, while occupational self-efficacy expectation mainly refers to the occupational context (Abele et al. 2000).

Gender is neither a significant predictor for chronic stress nor a significant moderator variable; it does not influence stress experience. That means that the association between work-related factors, personal characteristics and chronic stress are not gender specific. This result can be explained by comparable objective workplace conditions in residency for both genders.

Summarizing, both workplace-related factors and personal characteristics have an equally substantial influence on chronic stress experience in residency. This influence is not gender specific.

Limitations of the study: It has to be considered that there is a potential conceptual overlap between Chronic Stress, Effort–Reward Imbalance and Sense of Coherence, as well as in the operationalization of the constructs (Höge and Büssing 2004). Furthermore, the responses of the study participants could be partly explained by individual factors influencing the response pattern in general, i.e., negative affectivity or neuroticism (Watson et al. 1987). As a consequence, this could lead to an overestimation of the common variance between chronic stress and the predictors. However, Spector et al. (2000) argued that partialling out negative affectivity could lead to an underestimation of a person's stress experience. Participants' reports of stressors and strain have to be understood as valid data of their perception and experiences.

Conclusion

Considering the findings of the present study, it is a matter of concern that young physicians report to feel chronically

stressed early in their professional career. Therefore, interventions of stress prevention addressing the principal work-related stressors should be implemented. Primary preventive interventions should focus on giving junior doctors satisfactory professional support and adequate reward. Part of this reward consists in appreciation for the young physicians' professional commitment, so that they feel personally estimated. This kind of appreciation may also have a positive impact on a person's occupational self-efficacy and contribute to reduce his or her tendency to be overcommitted at work.

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Conflict of interest The authors declare that they have no conflict of interest.

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