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ORIGINAL ARTICLE

Work stress and reduced health in young physicians: prospective evidence from Swiss residents

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Abstract
Objectives Job stress, investigated by the effort–reward model in various working environments in different countries, has been widely reported, yet studies addressing physicians are lacking. The present study investigated the perceived job stress, its association with the amount of working hours, and its impact on young physicians' self-reported health and their satisfaction with life during residency.
Methods In a prospective study design, a cohort of Swiss medical school graduates was followed up, beginning in 2001. In their second and fourth years of residency, 433 physicians assessed their effort–reward imbalance, overcommitment, physical and mental well-being and satisfaction in life. Taking the longitudinal design into account, four categories of stressed residents were defined: (1) subjects not reporting high work stress at either measurement, (2) subjects reporting high work stress in the second but not in the fourth year of residency, (3) subjects with onset of high work stress in fourth year and (4) residents reporting high work stress at both measurements.
Results All components of the perceived stress at work were significantly correlated with the amount of working hours, effort showing the highest correlation. While two-thirds of the participants do not report high work stress, assessed by the extrinsic part of the effort–reward imbalance model (the ratio between effort and reward) and 12% show a decrease of stress over time, there are 15% with an increase of stress over time, and 10% with persistently high stress experience. In terms of the intrinsic stress component (overcommitment), 71% show low values, 12% show a decrease, 9% an increase and 8% constantly high values. The groups with constant and increasing extrinsic and intrinsic stress experience exhibit significantly worse health and life satisfaction compared to the remaining groups, after controlling for gender and baseline health.
Conclusions Stress at work in young physicians, especially when being experienced over a longer period in postgraduate training, has to be a matter of concern because of its negative impact on health and life satisfaction and the risk of developing symptoms of burnout in the long run.

Keywords Effort–reward imbalance · Overcommitment · Work stress · Reduced health · Residents · Longitudinal study

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Introduction

Several studies report on doctors' postgraduate training being very stressful with a negative impact on physical and mental well-being and life satisfaction (Buddeberg-Fischer et al. 2005a, b, 2006; Cohen and Patten 2005; Collier et al. 2002; Levey 2001; Rockenbauch et al. 2006; Shanafelt et al. 2002; Tyssen et al. 2000). Since Siegrist formulated the model of effort–reward imbalance at work (ERI) in 1986 (Siegrist 1996; Siegrist et al. 1986, 2004), a wide range of studies has indicated that the effort–reward imbalance is a valid instrument for evaluating a stressful working

environment (Tsutsumi and Kawakami 2004; Unterbrink et al. 2007). The central tenet of the ERI model is that an imbalance between (high) efforts and (low) rewards leads to (sustained) strain reactions. The ERI model contains three assumptions: (1) the extrinsic component of the ERI hypothesis: high efforts in combination with low-rewards increase the risk of poor health, (2) the intrinsic component of the overcommitment hypothesis: a high level of overcommitment (i.e. a personality characteristic) may increase the risk of poor health and (3) the interaction hypothesis: employees reporting an extrinsic effort–reward imbalance and a high level of overcommitment have an even higher risk of poor health. Most studies using the ERI model investigate the relationship of effort–reward imbalance and employee health in a cross-sectional design (de Jonge et al. 2000; Godin and Kittel 2004; Kageyama et al. 2001; Kudielka et al. 2005; Larisch et al. 2003; Niedhammer et al. 2004; Pikhart et al. 2004; Preckel et al. 2005; Rockenbauch et al. 2006), some also in a longitudinal design (Godin et al. 2005; Mika Kivimäki et al. 2002; Kuper et al. 2002; Ostry et al. 2004; Stansfeld et al. 1998, 1999). All studies support the hypothesis that adverse working conditions elicit sustained stress reactions with negative long-term consequences for health. However, the interaction of effort–reward imbalance and overcommitment and its influence on employees' health has been scarcely examined.

Most studies investigate the relationship between work stress and cardiovascular disease (Peter and Siegrist 2000; van Vegchel et al. 2005), some between ERI and burnout (Unterbrink et al. 2007); only a few report data on anxiety and depression (Godin and Kittel 2004; Godin et al. 2005; Larisch et al. 2003; Pikhart et al. 2004). As far as we know, only two cross-sectional studies report the perceived effort–reward imbalance in physicians and their self-reported health (Li et al. 2006; Rockenbauch et al. 2006). In the Chinese physicians' study (Li et al. 2006), ERI was found to be strongly associated with impaired health functioning. In the German graduate student study (Rockenbauch et al. 2006), alumni of medical sciences report lower life satisfaction than alumni of other faculties, mainly caused by the low-leisure time and low-financial reward. Longitudinal data in physicians are lacking to date.

In a cohort of Swiss residents, followed up over a 2-year time period, the following hypotheses are to be tested: (1) There is a positive correlation between working hours and stress experience measured by the extrinsic component of the effort–reward imbalance model (ERI) and the intrinsic component (overcommitment, OVC), respectively; (2) persistently high ERI and OVC values, respectively, have a negative influence on the participants' health and (3) there is an interaction effect between the extrinsic part of the model (ERI) and the intrinsic one (OVC) in terms of negative influence on the participants' health outcome.

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, beginning in 2001 (T_1). 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 were only identified by a code. The respondents sent their addresses to an independent address-administration office, allowing for follow-up. By filling in and returning, the questionnaire to the research group and their address to a separate study administration office, the subjects gave their informed consent to participate in the study and to be followed-up.

The study protocol was approved by the Ethical Committee of Zurich University.

In the first assessment (T_1, in 2001), 715 graduates participated (Buddeberg-Fischer et al. 2003). Subjects were re-evaluated after 2 years in 2003 (T_2) (Buddeberg-Fischer et al. 2005a, 2006). The present paper refers to results of the second (T_2) and third assessment (T_3); the latter was conducted in the participants' fourth year of residency (in 2005).

The study sample consists of 433 residents (233 females, 53.8%; 200 males, 46.2%) participating at T_1, T_2 and T_3. The mean age at T_3 is 31.3 years (SD 2.4 years). Out of the residents, 357 (82.6%) have a stable partnership, of whom, 103 are married (48 females and 55 males). Only 19 (8%) of the females, but 32 (16%) of the males have children (Fisher's exact test, $p = 0.01$). The mean working hours/week are 55.1 h (SD 7.6 h).

There are no significant differences between the dropouts ($T_1 - T_3$) and the 433 subjects participating at all three measurements with regard to socio-demographic data, personality traits and career-related variables at T_1. Whether the dropouts would differ from the study sample at the third assessment (T_3), can neither be answered, nor the reasons why they do no longer participate in the study.

Instruments

In the following, it is described what constructs are measured by the applied instruments. All instruments are self-assessment scales, Cronbach's α values are given for the present study. The scale values were only calculated if <20% of the items were missing. The missing values were substituted by means of the answered items.

- Questions concerning socio-demographic data
- Working hours per week
- Effort–reward imbalance at work questionnaire, *ERI-Q*, *(Fragebogen zu beruflichen Gratifikationskrisen*, five-point Likert scales*)* (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 (Cronbach's α 0.78). 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 (Cronbach's α 0.78). The effort/reward ratio is a measure of the imbalance between these two components. A value close to zero indicates a favourable condition (relatively low effort, relatively high reward), whereas values above 1.0 indicate a high amount of expended effort not equaled by the rewards received or expected in return. In this study, we followed the convention of data analysis concerning the grouping of the effort–reward ratio as reported in several other studies (Dragano et al. 2005; Godin and Kittel 2004; Godin et al. 2005; Kivimäki et al. 2007; Kuper et al. 2002; Niedhammer et al. 2004). According to this convention, subjects in the upper quartile of the ratio were defined as exposed to stressful work in terms of the effort–reward imbalance model (Dragano et al. 2005).
- Overcommitment, OVC, (Siegrist et al. 2004) (six items, four-point Likert scale) is part of the effort–reward imbalance at work questionnaire (Cronbach's α 0.73). It focuses on the intrinsic or personal component of the model, which 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 towards job requirements. Analogously to the methodological procedure in the effort/reward ratio distribution, a group at risk in terms of the intrinsic component of the model was defined by scores in the upper quartile of the respective scale.
- Hospital Anxiety and Depression Scale—German Version HADS-D (Herrmann et al. 1995) contains 14 items on a four-point response scale, summed up to separate scores on anxiety (seven items, Cronbach's α 0.78) and depression (seven items, Cronbach's α 0.81); scale scores < 8 are in the normal range, 8–10 indicates possible psychiatric morbidity and >10 probable mood disorder.
- Life satisfaction questionnaire, *LSQ*, *(Fragebogen zur Lebenszufriedenheit FLZ)* (Henrich and Herschbach 2000) is a measure that assesses aspects of importance of and satisfaction with eight life areas (friends/acquaintances, leisure/hobbies, health, income/financial security, study/work, living situation, family life/children and partnership/sex) (Cronbach's α 0.78). Items are evaluated on a 5-point scale according to (1) degree of importance of these spheres for life satisfaction and (2) satisfaction with these life areas. "General life satisfaction" is calculated from the individual scores for "importance" and "satisfaction".
- Physical and mental well-being are rated on a 7-point Likert scale from very bad (one) to very good (seven). Wording of the question: "How do you assess your physical/mental well-being within the last 4 weeks?"

Statistical analyses

Formation of groups depending on the ratio between effort and reward, and overcommitment values

In order to evaluate the dynamics of stressful experiences at work over-time, the sample is divided into four groups based on the ratio between effort and reward scores, ERI, according to the above described convention of data analysis (Dragano et al. 2005; Godin and Kittel 2004; Godin et al. 2005; Kivimäki et al. 2007; Kuper et al. 2002; Niedhammer et al. 2004).

– Group A is composed of residents who do not report high work stress at both measurements (scores on the ERI ratio were lower than those in the upper quartile).
– In group B, there are subjects with high work stress present at second but not at fourth year of residency.
– Conversely, in group C, there are subjects with experience of high work stress in fourth year but not in second.
– Finally, group D is composed of residents reporting high work stress at both measurements.

The same procedure of grouping is conducted with the OVC scores: *group A* not high-OVC scores at *T*2 and *T*3; *group B* not high OVC scores at *T*2, but high-OVC scores at *T*3; conversely, *group C* high-OVC scores at *T*2, not high-OVC scores at *T*3; and finally *group D* high levels of OVC at both measurements.

Thus we have two between-subject factors (ERI and OVC stress groups) in each with four categories (groups A, B, C and D).

Data analysis

A power analysis, considering a medium effect size of $f = 0.25$, revealed that the number of subjects in the described groups should reach at least $n = 45$. Thus a two-tailed significance testing will reach a test power of 0.80 (gold standard). The size of the groups, established by the described forming of the groups, achieved this condition.

All analyses are carried out with SPSS for windows, release 12.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics are given in terms of counts and percentages, and means and standard deviations, respectively. Objective 1 is analyzed by computing Pearson correlations; objectives 2 and 3 are analyzed by multivariate and univariate analyses of covariance with ERI and OVC stress groups as independent variables, physical and mental health as dependent variables, and gender and measurements at baseline as covariates. Bonferroni was used to adjust for multiple comparisons.

Results

Stress groups based on the effort–reward imbalance/OVC model

As described in the "Methods" section, the sample is divided into four groups based on the ratio between effort and reward scores (ERI), and also into four groups based on the OVC mean score. Subjects scoring in the upper quartile either of the ratio between effort and reward or the OVC scale are considered to experience high-stress at work. Subjects in group A do not report high-stress at either measurement, whereas residents in group B show high-stress in their second year of residency and not in their fourth year. Group C subjects suffer from incident stress in their fourth year of residency. Residents assigned to group D feel continuously stressed at work.

In Table 1, the means and standard deviations of the ERI and the OVC values at *T*2 and *T*3 are listed for the four stress groups. By definition, participants assigned to group A show the lowest values, and those of group D the highest ones.

Stress experience and working hours

The association between stress experience measured by the effort–reward imbalance model and the amount of working hours is investigated. All stress components show significant correlations with the amount of working hours: the effort scale, $r = 0.34$ ($p < 0.001$); the reward scale, $r = -0.11$ ($p = 0.032$); the ERI quotient, $r = 0.29$ ($p < 0.001$) and the OVC scale, $r = 0.23$ ($p < 0.001$). Albeit all correlations are significant, the residents' expended effort shows the highest correlation with the working hours.

Effects of perceived stress on physical and mental health, and life satisfaction

In a further step, the impact of experienced effort–reward imbalance on the subjects' physical and mental health is examined. As listed in Table 2, residents experiencing incident (group C) or continuous (group D) stress at work show a significantly less favourable health outcome compared to groups A and B. In groups C and D, 23% show sub-clinical anxiety and 14–16% clinically relevant anxiety disorder, 14% reveal symptoms of sub-clinical depression, and 8% (group C) and 20% (group D) have clinically relevant depression. The residents in groups C and D also assess their satisfaction with life and their physical and mental well-being significantly lower than those in the A and B groups. The multivariate analysis of covariance indicates a significant influence of the ratio between effort and reward on health outcome, even after controlling for gender and measurements at baseline.

Similar results emerge for the stress groups based on OVC values (Table 3). Residents in groups C and D show a significantly worse health outcome in all variables than those in the groups A and B. The percentage of (sub)clinical mood disorders is even higher than in the effort–reward based stress groups C and D. The multivariate analysis of covariance indicates a significant influence of the OVC on health outcome, even after controlling for gender and measurements at baseline.

Overlap and interaction between effort–reward stress groups and OVC stress groups

At first, the cross-tabulation between ERI and OVC stress groups is shown in Table 4. There is a significant overlap between the two groups. Furthermore, we conducted a

Table 1 Means and standard deviations of ERI and OVC values for ERI and OVC stress groups at *T*2 and *T*3

Scale	Effort–reward imbalance (ERI) stress groups				
	A ($n = 272$)	B ($n = 52$)	C ($n = 65$)	D ($n = 44$)	Total ($n = 433$)
ERI *T*2	0.65 (0.15)	1.16 (0.22)	0.72 (0.16)	1.27 (0.27)	0.78 (0.29)
ERI *T*3	0.63 (0.16)	0.67 (0.17)	1.21 (0.34)	1.28 (0.34)	0.79 (0.34)
Scale	Overcommitment (OVC) stress groups				
	A ($n = 308$)	B ($n = 49$)	C ($n = 40$)	D ($n = 36$)	Total ($n = 433$)
OVC *T*2	2.00 (0.43	3.00 (0.18)	2.27 (0.39)	3.18 (0.30)	2.23 (0.58)
OVC *T*3	1.94 (0.42)	2.29 (0.35)	3.01 (0.22)	3.17 (0.27)	2.18 (0.58)

All values are in mean and standard deviations within paranthesis

Table 2 Means and standard deviations in HADS-D anxiety and depression scale, satisfaction with life, physical and mental well-being scales depending on stress groups ($n = 433$), results of analyses of variance and covariance (covariates: gender and measurements at baseline)

	Effort–reward imbalance Stress groups					
Scale (at *T*3)	A ($n = 272$)	B ($n = 52$)	C ($n = 65$)	D ($n = 44$)	*p*	Bonferroni multiple comparisons
Anxiety	4.74 (3.22)	4.29 (2.64)	6.32 (3.60)	6.82 (3.74)	<0.001	C, D > A, B
Value 8–10						
n (%)	35 (13)	4 (8)	15 (23)	10 (23)		
Value ≥ 11						
n (%)	14 (5)	2 (4)	9 (14)	7 (16)		
Depression	3.07 (2.64)	2.75 (2.21)	4.69 (3.29)	6.23 (4.00)	<0.001	D > C > A, B
Value 8–10						
n (%)	12 (4)	1 (2)	9 (14)	6 (14)		
Value ≥ 11						
n (%)	5 (3)	0	5 (8)	9 (20)		
Satisfaction in life	63.8 (29.3)	58.6 (26.9)	49.9 (29.0)	38.6 (34.2)	<0.001	D < C < A, B
Physical well-being	5.67 (1.26)	5.65 (1.06)	5.00 (1.41)	4.86 (1.52)	<0.001	C, D < A, B
Mental well-being	5.49 (1.34)	5.69 (0.96)	4.48 (1.58)	4.52 (1.66)	<0.001	C, D < A, B

Multivarate analysis of covariance

Wilk's λ	$F(15, 1143)$	*P*	Partial eta squared
0.86	4.19	<0.001	0.05

A *T*2 not high values/*T*3 not high values, *B* *T*2 high values/*T*3 not high values, *C* *T*2 not high values/*T*3 high values, *D* *T*2 high values/*T*3 high values

Table 3 Means and standard deviations in HADS-D anxiety and depression scale, satisfaction with life, physical and mental well-being scales depending on stress groups ($n = 433$), results of analyses of variance and covariance (covariates: gender and measurements at baseline)

	Overcommitment stress groups					
Scale (at *T*3)	A ($n = 308$)	B ($n = 49$)	C ($n = 40$)	D ($n = 36$)	*p*	Bonferroni multiple comparisons
Anxiety	4.15 (2.74)	5.53 (2.82)	8.57 (3.37)	9.00 (3.55)	<0.001	C, D > B > A
Value 8–10						
n (%)	29 (11)	6 (12)	18 (45)	11 (31)		
Value ≥ 11						
n (%)	8 (3)	3 (6)	8 (20)	13 (37)		
Depression	2.84 (2.62)	4.06 (2.65)	6.13 (3.00)	6.56 (3.67)	<0.001	C, D > B > A
Value 8–10						
n (%)	12 (4)	3 (6)	6 (15)	7 (19)		
Value ≥ 11						
n (%)	6 (2)	2 (4)	6 (15)	5 (15)		
Satisfaction with life	63.1 (29.6)	61.4 (25.9)	37.8 (25.4)	37.1 (33.8)	<0.001	C, D < A, B
Physical well-being	5.68 (1.23)	5.65 (1.18)	4.83 (1.26)	4.39 (1.63)	<0.001	C, D < A, B
Mental-well being	5.57 (1.28)	5.37 (1.29)	3.85 (1.39)	4.03 (1.52)	<0.001	C, D < A, B

Multivarate analysis of covariance

Wilk's λ	$F(15,1151)$	*p*	Partial eta squared
0.80	6.42	<0.001	0.07

A *T*2 not high values/*T*3 not high values, *B* *T*2 high values/*T*3 not high values, *C* *T*2 not high values/*T*3 high values, *D* *T*2 high values/*T*3 high values

Table 4 Counts and percentages within ERI and OVC stress groups

Stress groups	OVC A	OVC B	OVC C	OVC D	Total
ERI A					
n	217	22	19	14	272
Within ERI (%)	79.8	8.1	7.0	5.1	100.0
Within OVC (%)	70.5	44.9	47.5	38.9	62.8
ERI B					
n	32	14	4	2	52
Within ERI (%)	61.5	26.9	7.7	3.8	100.0
Within OVC (%)	10.4	28.6	10.0	5.6	12
ERI C					
n	39	8	11	7	65
Within ERI (%)	60.0	12.3	16.9	10.8	100.0
Within OVC (%)	12.7	16.3	27.5	19.4	15.0
ERI D					
n	20	5	6	13	44
Within ERI (%)	45.5	11.4	13.6	29.5	100.0
Within OVC (%)	6.5	10.2	15	36.1	10.2
Total					
n	308	49	40	36	433
Within ERI (%)	71.1	11.3	9.2	8.3	100.0
Within OVC (%)	100.0	100.0	100.0	100.0	100.0

$\chi^2 = 58.06$, $df = 9$, $p < 0.001$

two-factorial analysis of covariance with the independent variables effort–reward stress groups and OVC stress groups, the dependent variables self-reported health and the covariates gender and self-reported health at baseline. All interactions between the two independent variables are not significant in regard to health outcome (all *p*-values > 0.30). This means that ERI and OVC only have an additive effect on the residents' health outcome ($p < 0.001$), and not an additional effect by combination of the extrinsic (ERI) and the intrinsic (OVC) stress factors.

Discussion

The present study is part of an ongoing prospective survey of a cohort of graduates of the three medical schools in German-speaking Switzerland, beginning in 2001 (*T*1) (Buddeberg-Fischer et al. 2003). To our knowledge, this is the first prospective study investigating the influence of work stress caused by effort–reward imbalance and overcommitment on young physicians' health and satisfaction with life. The paper reports data of the second (*T*2) and third (*T*3) assessments conducted in the participants' second (*T*2 in 2003) and fourth (*T*3 in 2005) years of residency. (At *T*1, the ERI model was not applied because the items are not suitable for students) Young physicians of about 433 participated in all three assessments. That is 60.6% of the initial study sample at $T1(n = 715)$. Compared to other longitudinal studies in medicine (Abele 2005; Stiller and Busse 2006), the participation rate has to be considered fairly high. A comparison between study participants and dropouts was only possible for baseline data, revealing no significant differences.

Perceived stress in residency

Residency is known to be a stressful time, especially during the first year (Levey 2001; Rockenbauch et al. 2006). Junior physicians lack clinical experience, have difficulty also in establishing the doctor–patient-relationship and often struggle with the administrative demands of their work (Jungbauer et al. 2003, 2004; Levey 2001). In our study sample, 10% of the alumni perceive an imbalance between the expended effort and the received reward at work, scoring in the upper quartile at both assessments. Medical students and residents tend to be very dedicated to the demands of their profession and caring for patients (Rockenbauch et al. 2006). However, some of them seem to be overcommitted in a way that they have difficulties to get away from patient issues and job demands, suffering from sleeping problems and neglecting social contacts. In our study, 7% of the participants scored in the upper quartile of the overcommitment scale at both measurements. In the cross-sectional German study (Rockenbauch et al. 2006), 50% of the medical alumni report suffering from time pressure, 40% cannot get away from thinking of the performance of their duties and 30% have sleeping problems.

Stress experience and working hours

All components of the ERI model showed significant correlations with the amount of working hours, the expended effort having the strongest contribution, i.e. residents perceive work stress not only dependent on the amount of working hours, but also on high job demands to be carried out in a short time. In some hospitals, residents are not well supervised and have to carry a high-responsibility for patient care. According to a general contract of residents' employment, implemented in Switzerland in 2000, full-time employed residents should not work more than 50 h/week. Regardless, many residents are obliged to work overtime, in some specialties up to 80 h/week. All these efforts spent at work are often not compensated by adequate rewards, i.e. professional acknowledgement, career support and promotion. Same findings are reported in the German medical alumni study (Rockenbauch et al. 2006): 70% have a high-amount of monthly overtime, and 50% are on weekend and night duty 4–8 times per month. The working conditions in Switzerland are not much different.

Work stress and self-reported health

According to other studies from different cultural backgrounds and professions (Godin and Kittel 2004; Godin et al. 2005; Kageyama et al. 2001; Larisch et al. 2003; Li et al. 2006; Niedhammer et al. 2004; Pikhart et al. 2004; Preckel et al. 2005; Rockenbauch et al. 2006), we also found a strong relationship between stress at work measured by the ERI model and self-reported health. It is a matter of concern that ongoing stress at work leads to serious physical and mental problems, especially symptoms of anxiety disorder and depression, and low-satisfaction in life in young physicians. These symptoms can be interpreted as first signs of burnout (Tyssen and Vaglum 2002; Tyssen et al. 2000). In the cross-sectional Chinese study (Li et al. 2006), also strong and consistent effects with regard to ERI for the physical and mental health indicators were found; these effects were even stronger than in the demand–control–support model (Karasek et al. 1998).

The same negative effect on health is seen in highly overcommitted residents. Other authors also report that employees characterized by high-overcommitment have a multiple elevated risk of suffering from various (psycho)somatic symptoms than their less overcommitted colleagues (Head et al. 2007; Joksimovic et al. 2002; Kuper et al. 2002; Larisch et al. 2003; Li et al. 2006). Highly stressed and/or overcommitted residents are more likely to experience vital exhaustion and dissatisfaction, which might lead to difficulties in pursuing their chosen professional career (Preckel et al. 2005; Unterbrink et al. 2007). Overcommitted and stressed residents might have more difficulties establishing a good doctor–patient relationship, a factor, which again contributes to feeling stressed (Jungbauer et al. 2003, 2004; Langewitz et al. 2002). Furthermore, stressed doctors have a negative influence on the atmosphere at their workplace; an unfavourable working atmosphere is again a factor for feeling stressed at work (Karasek and Theorell 1990). The German medical alumni study (Rockenbauch et al. 2006) reports that overcommitment in residents explains the greatest percentage of life satisfaction (in a negative sense), even more than effort–reward imbalance, instrumentality and occupational self-efficacy expectation.

Interaction of ERI and OVC stress groups

The hypothesis of an interaction between effort–reward imbalance and overcommitment could not be confirmed in our study: the effects of effort–reward imbalance and overcommitment are only additive, overcommitment having the greater influence on health and satisfaction with life. De Jonge et al. (2000) found that risks of an effort–reward imbalance were aggravated for highly overcommitted employees, whereas Kuper et al. (2002) and Van Vegchel et al. (2001) found no evidence for a moderating effect of overcommitment on the relation between effort–reward and (psycho)somatic symptoms. As there are no other prospective studies of perceived work stress assessed by the effort–reward and overcommitment scales in medicine, the data in our study cannot easily be compared with studies conducted among people in other professions.

Conclusions

The results of our prospective study confirm the hypothesis that the number of working hours is related to the perceived work stress caused by an imbalance between effort and reward. Effort–reward imbalance and overcommitment are strong predictors for physical and mental health as well as for satisfaction in life in young physicians. These findings should be a matter of concern as they might be first signs of burnout. The interaction effect between effort–reward imbalance and overcommitment could not be confirmed in the present study.

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