Effort-reward-imbalance, burnout, and physical pain mediate the relationship between overcommitment and depression in German Emergency Medical Technicians

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Abstract

Background Overcommitment (OC) is highly prevalent in health care employees, and may predict depression symptoms. The literature suggests that the relationship between OC and depression is mediated by Effort-Reward-Imbalance (ERI), burnout and physical pain. This study tested a two-step mediation effect between OC and depression by ERI in a first, and burnout and physical pain in a second step using a cohort of German Emergency Medical Technicians (EMTs).

Methods A cross-sectional study was carried out on a volunteer sample of 303 EMTs in Germany. OC and ERI were assessed using the ERI questionnaire, burnout with the Maslach Burnout Inventory, physical pain with the Short Form 36, and depression with the BDI-II. The relationship between these variables was tested using a mediation analysis.

Results We found a partial mediation effect between OC and depression via ERI, burnout (emotional exhaustion, personal accomplishment) and physical pain. The mediation effect of emotional exhaustion is significantly higher than those of depersonalization and physical pain.

Conclusions The partial mediation effect suggests the validity of our model assumptions, but also indicates direct relationships between variables (i.e. OC, ERI and depression). The identification of emotional exhaustion as key mediator implies that prevention and intervention approaches in EMTs should be based on this indicator.

Keywords Burnout, Depression, Effort-reward imbalance, Overcommitment, Paramedic, Physical pain

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Introduction

The rising prevalence of depression in German healthcare employees in recent years, especially in Emergency Medical Technicians (EMT) of between 13.7 and 43.4% [1, 2], and the resulting inability to work, constitutes an important public concern [3]. The increasing number of emergency calls and responses has led to escalating workloads for EMTs [4], and those who are overcommitted to their work may be at particular risk for developing mental health issues. For example, previous studies found a strong link between overcommitted behavior and the occurrence of depression symptoms [5]. Little is known, however, about the interaction and mediating factors between overcommitment (OC) and depression symptoms.

The Effort-Reward Imbalance (ERI) model is a well-established theoretical framework in occupational health. The model was developed and introduced by Siegrist [6], positing that occupational stress arises from an imbalance between efforts at work and rewards received. It comprises the three main components *effort*, *reward* and *OC*. Effort refers to demands or pressure at work, whereas rewards include salary, esteem and career opportunities. OC describes a personality trait, contributing to high work-related commitment [7]. Stress results from an imbalance between perceived efforts and perceived rewards. Overcommitted behavior could, therefore, lead to an imbalance by expanding work-related efforts but not increasing rewards. Previous studies showed that especially occupational groups working in health care are prone to experiencing OC and ERI [8, 9]. In their review, Van Vegchel and colleagues [10] conclude that OC in health care employees occurs due to feelings of responsibility for their patients' care. With increasing numbers of emergency calls and -responses, which is not accompanied by a concomitant rise in the number of employees, overcommitted EMTs may be at increased risk for experiencing ERI, resulting in work-related stress.

Bentley and colleagues [11] found that depression among Emergency medical service (EMS) employees mainly occurs due to work-life characteristics, such as OC and ERI. Recent studies explored the direct link between OC and depression, assuming that OC directly affects the occurrence of depression symptoms [12, 13]. Some findings, however, suggest that the relationship between OC and depression is complex and multifaceted, in that the effect of OC on depression is due to ERI and prolonged experiences of work-related stress [14, 15]. The question arises whether the relationship between OC and depression symptoms is mediated by ERI. Hence, in the current study we aimed at testing for this partial mediation effect (i.e. direct and indirect effect of OC on depression).

Prolonged exposure to job-related stress may result in burnout [16]. Burnout is characterized with a symptom pattern that can is reflected in the dimensions of emotional exhaustion, depersonalization and reduced personal accomplishment [17, 18]. Several studies investigating the link between OC, ERI, and burnout, as well as between burnout and depression symptoms, found that ERI and OC are determinants of burnout [19], which in turn predicts depression [20]. A model explaining the link between OC, ERI, burnout and depression symptoms is the Job Demands-Resources model [21], stating that high job demands but low job resources lead to a state of cynicism and emotional exhaustion. If this state persists, it may result in an inability to effectively cope with job demands, leading to chronic stress and, therefore, increasing depression symptoms [22]. Hering and colleagues [23] pointed out that increasing numbers of emergency calls and responses and decreasing recovery or relaxation periods are amongst the main factors leading to burnout in EMS-employees. Moreover, it was found that high levels in ERI and symptoms of burnout in EMTs lead to lower quality of perceived patient care [24, 25], suggesting a significant negative effect for the patients concerned. Due to their relationship with OC, ERI, and depression, we included burnout dimensions as additional factors in our mediation model.

In addition to mental health impairments, the prolonged exposure to job-related stress has been associated with musculoskeletal pain and other physical health issues. A review by Koch and colleagues [26] found that mainly ERI, but not OC, was directly related to musculoskeletal pain, in that employees who showed high levels of ERI reported musculoskeletal pain more frequently than employees reporting low levels of ERI. Other studies report similar findings, indicating that ERI is associated with neck-shoulder pain [27], and low back and hip pain [28], especially in high-stress professions, such as EMS or police work. Furthermore, previous studies suggest that physical pain has an impact on the occurrence of depression symptoms [29]. A review by IsHak and colleagues [30] not only showed a relationship between pain and depression, but also that the coexistence of depression and pain leads to the prolonged presence of symptoms. Given that physical pain is correlated with ERI, but not with OC [26], it appears plausible that physical pain also mediates the relationship between ERI and depression.

Given the complexity of the associations between OC, ERI, burnout, pain, and depression, particularly in the high-stress context of EMS work, the aim of the current study was to examine a two-step mediation model to explain their inter-relationship. A better understanding of the mechanisms underlying work stress and health in EMTs may contribute to the development of more effective prevention and intervention approaches. We

expected to find a direct effect of OC on depression symptoms. First, we hypothesized that OC increases ERI. Second, we expected the relationship between ERI and depression symptoms to be mediated by burnout and physical pain. To test these assumptions, we collected data using an online questionnaire, addressing German EMTs. To examine the relationship between the variables, a mediation analysis was conducted using Hayes' model 81 in the PROCESS Macro [31]. We hypothesized that OC directly predicts depression symptoms. We also hypothesized that OC has an indirect effect on depression symptoms, first, through ERI, and second, through ERI, as well as burnout and physical pain as chain mediator variables.

Materials and methods
Participants and procedure
In this cross-sectional study 325 volunteers all over Germany participated. The sample size after exclusion of participants, who did not meet the inclusion criteria was $N = 303$ participants. Inclusion criteria were the job qualifications EMT-P and EMT-I, based in Germany as well as employment more than 10%. Two-hundred-twenty participants were EMT-Paramedic (EMT-P) and 93 EMT-Intermediate (EMT-I), based in Germany. The sample consisted of 197 men, 112 women and one non-binary participant. Two-hundred-twenty participants worked twelve-hour shifts, 25 worked eight hours, 47 worked 24-hours shifts, seven worked ten hours, three eleven-hours and one participant worked six-hours shifts. Demographic data is presented in Table 1. Exclusion criteria were part-time employment less than 10% and a job qualification as a Medical Doctor. As there has been only one non-binary participant, this participant had to be excluded as well.

The recruitment took place from 10/11/2023 to 12/15/2023 via social media, EMS-Platforms (e.g. QM-Platform) or invitations via E-Mail, including the link to the online survey. The survey was designed as self-assessment. All questionnaires were approved for self-assessment and online suitable. As there was no compensation offered, it is likely that only EMTs took part in the survey. Participants provided informed consent and were informed of their right to discontinue their participation at any time. Ethics approval was obtained according to the ethics regulations of the psychology study programs of the University of Luxembourg.

Measures
Socio-demographics
Socio-demographic data was collected including age (continuous variable) and gender (1 = male, 2 = female, 3 = non-binary/excluded from analysis). Job-related data was collected including qualification (1 = EMT-P, 2 = EMT-I, 3 = Medical Doctor/excluded from analysis), employment status ('time type'; in percent) as a continuous variable and years employed as EMT, also as a continuous variable. These items were included in the mediation models as confounding variables.

Depression symptoms
Depression symptoms were assessed with the 21-items Beck Depression Inventory-II (BDI-II) [32]. Responses were rated on a four-point scale (0–3). Items are summed up to create a scale score ranging from 0 to 36. Scores ranging from 14 to 19 indicate a mild level of depression, scores ranging from 20 to 28 indicate a moderate level of depression and scores ranging from 29 to 63 indicate a severe level of depression. Cronbach's α coefficient for the BDI-II in this study was 0.93.

Table 1 Demographic and questionnaire data

Variable	unit	M	(SD)
Age	years	33.1	(10.3)
Gender	m/f	197/112	
Years employed	years	10.7	(9.0)
Weekly working hours relative to full time	%	93.9	(17.1)
Effort-/Reward-Imbalance/Overcommitment			
Effort-/Reward-Imbalance		1.4	(0.5)
Overcommitment		15.1	(2.6)
Maslach Burnout Inventory			
Emotional Exhaustion		29.8	(11.1)
Depersonalization		15.4	(6.3)
Personal Accomplishment		34.9	(7.9)
Short Form-36			
Physical Pain		4.4	(2.3)
Beck's Depression Inventory II			
Depression		15.4	(10.5)

OC and ERI

OC and ERI were measured with the 22-items version of the ERI Questionnaire [7, 33], consisting of the three scales Effort, Reward and OC. Responses are provided on a four-point Likert scale assessing the level of agreement ranging from *Strongly disagree* (1) to *Strongly agree* (4). Scale scores are summed up. OC was measured by six items, with scores ranging from 6 to 24. Effort was measured by six items with scores ranging from 6 to 24, and Reward was measured by ten items with scores ranging from 10 to 40. Higher scores indicate higher levels for the respective scale. The recommended analysis procedure for the ERI involves computing the ER-Ratio, with a cut-off point of one. Scores above one indicate a high ERI. In this study, Cronbach's α coefficients in this study were 0.68 for OC, 0.67 for Effort and 0.82 for Reward.

Burnout

We assessed burnout with the 22-items version of Maslach Burnout Inventory-Human Services Survey (MBI-HSS) [16]. The MBI-HSS measures burnout in three dimensions: Emotional Exhaustion (MBI EE) with nine items, Depersonalization (MBI DP) with five items, and Personal Accomplishment (MBI PA) with eight items. Previous studies confirmed the three-factor structure of the MBI [34, 35]. Responses are given on a seven-point Likert scale ranging from *never* (1) to *every day* (7). Item scores of the respective scales are summed up to create scale scores. For MBI EE, a score less than 17 indicates a low level of MBI EE, a score ranging from 18 to 29 indicates a moderate level and a score above 30 a high level. For MBI DP a score less than 5 indicates a low level, a score ranging from six to eleven indicates a moderate level and a score above twelve a high level. For MBI PA, a score less than 33 indicates a low level, a score ranging from 34 to 39 indicates a moderate level and a score above 40 a high level. High levels for MBI EE and MBI DP, as well as a low level for MBI PA indicate a severe burnout level. In this study, Cronbach's α coefficients were 0.91 for Emotional Exhaustion, 0.73 for Depersonalization and 0.74 for Personal Accomplishment.

Physical pain

Physical pain (SF-36 BP) was assessed with the subscale bodily pain of the SF-36 health survey questionnaire [36]. The subscale consists of two items. The first item "How much bodily pain have you had over the past 4 weeks?" is measured with a six-point scale from *None* (1) to *Very severe* (6). The second item, "During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?" is assessed with a five-point scale from *Not at all* (1) to *Extremely* (5). Item scales are summed up to a total score ranging from two to eleven. The higher the score

the higher the level of pain indicated for the past four weeks. In this study, Cronbach's α coefficient for Physical Pain was 0.85.

Statistical analysis

First, all variables were z-scored to mitigate the impact of multicollinearity. Second, Pearson zero-order correlations were calculated to examine if there were principle relationships between the dependent, independent and mediator variables, which justify a follow-up mediation analysis.

The mediation analysis was computed using IBM SPSS Statistics 29.0 and Hayes' model 81 in the PROCESS Macro [31]. For the mediation analysis, the dependent (depression symptoms), independent (OC) and mediator variables (ERI, burnout and physical pain), as well as confounds (age, qualification, long-term medication intake, years employed as EMT and time type) were added. The mediation model is shown in Fig. 1. Assumptions for mediation analysis were tested. To control for heteroscedasticity, the HC3 method was used for adjustment of the standard error and to achieve more reliable significance tests. The number of bootstrap samples was 5000. The estimation of confidence intervals (CI) was 95%. If zero was included in CI, no mediating effect can be assumed.

Results

Descriptives and correlations

Mean scores of ERI/OC, burnout, physical pain and depression are presented in Table 1. The dependent (depression/BDI-II), independent (OC) and mediator variables (ERI, emotional exhaustion, depersonalization, personal accomplishment) are all positively inter-correlated (see Table 2), except for personal accomplishment, which showed a negative correlation with all other variables.

Mediation analysis

The results for each path of the mediation analysis are displayed in Table 3 and Fig. 2, whereas results for indirect effects are displayed in Table 4. The analysis showed a significant positive direct effect for OC on BDI-II, and a positive significant indirect effect on BDI-II, indicating a partial mediation effect. OC predicted ERI, and ERI positively predicted BDI-II scores. In addition, ERI positively predicted the burnout dimensions MBI EE and MBI DP, as well as SF-36 BP. There was a significant negative association between ERI and the burnout dimension MBI PA. MBI EE and SF-36 BP positively predicted BDI-II scores, whereas MBI PA negatively predicted BDI-II scores. MBI DP and BDI-II scores were unrelated.

For the parallel mediators, a contrast in indirect effects was observed for MBI EE and SF-36 BP, $b = 0.313$, BCa
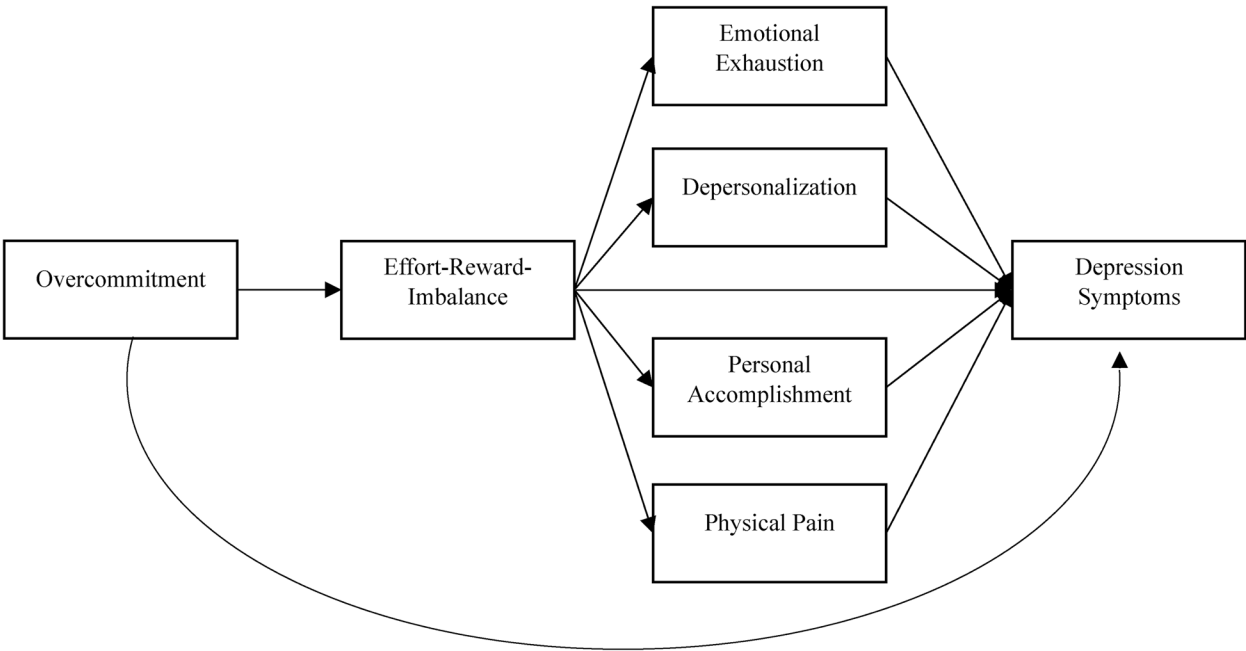
Fig. 1 Mediation hypothesis based on Hayes' model 81. It is hypothesized that OC will lead to depression symptoms, mediated by ERI in a first step, as well as burnout symptoms and physical pain in a second step

Table 2 Pearson correlations of dependent (DV), independent (IV) and mediator variables (MV)

	1.	2.	3.	4.	5.	6.	7.
1. OC (IV)	1						
2. ERI (MV)	0.461**	1					
3. MBI EE (MV)	0.485**	0.662**	1				
4. MBI DP (MV)	0.347**	0.471**	0.692**	1			
5. MBI PA (MV)	− 0.341**	− 0.379**	− 0.253**	− 0.253**	1		
6. SF-36 BP (MV)	0.247**	0.382**	0.369**	0.282**	− 0.346**	1	
7. BDI II (DV)	0.474**	0.581**	0.697**	0.496**	− 0.472**	0.471**	1

$N = 303$

**p<.01

95% CI [0.135, 0.514], indicating a larger effect for MBI EE.

Discussion

To the best of our knowledge, this is the first study to investigate the relationship between OC and depression, and the mediating role of ERI, burnout and physical pain in German EMTs. We hypothesized that OC directly and indirectly predicts depression. Furthermore, it was hypothesized that the relationship is mediated by ERI in a first step, and by burnout and physical pain in a second step. Our findings support both hypotheses, as a partial mediation effect was observed, although limited to the burnout facets of emotional exhaustion and personal accomplishment, as well as to physical pain.

In this study we found that OC has both a direct and an indirect effect on depression in EMTs. This finding demonstrates that EMTs who are overcommitted to their work, such as to be expected increasing emergency calls and responses, are more at risk to experience higher levels of depression. Gillet and colleagues [37] reported that individuals who are overcommitted might struggle to detach from their work, leading to difficulties in relaxation. An inadequate detachment from work can result in insufficient recovery periods, thereby leading to elevated levels of stress and facilitating depression symptoms. Our results are also in line with previous studies examining the relation between OC and reduced overall mental health [38, 39]. For example, OC has been directly linked to increased anxiety [12], higher job stress levels [40], sleep disturbances, and cardiovascular disorders that are linked to stress [41]. Our findings support the key role of OC for mental health in EMTs, suggesting that prevention and intervention programs should target EMTs with high OC.

Table 3 Results of the serial and parallel mediation analysis for each mediation model

	Model 1		ERI			Model 2		MBI EE		
	$R^2 = .504$		$F = 13.825$***			$R^2 = .695$		$F = 36.748$***		
Predictor	B	SE	t	LCI	UCI	B	SE	t	LCI	UCI
Age	.001	.005	.168	−.009	.011	.015	.114	.13	−.211	.24
Gender[1]	.044	.052	.851	−.058	.147	−.901	1.013	−.89	-2.894	1.092
Qualification[2]	.149*	.059	2.516	.032	.265	.808	1.112	.727	-1.38	2.995
Time-type	.001	.001	1.042	−.001	.004	.019	.241	.813	−.028	.067
Years employed	.007	.006	1.154	−.005	.019	.016	.136	.121	−.252	.285
OC	.081***	.011	7.059	.058	.103	.952***	.214	4.45	.531	1.373
ERI						12.308***	1.204	10.223	9.939	14.677
	Model 3		MBI DP			Model 4		MBI PA		
	$R^2 = .268$		$F = 15.243$***			$R^2 = .695$		$F = 36.748$***		
Predictor	B	SE	t	LCI	UCI	B	SE	t	LCI	UCI
Age	.081	.071	.122	−.061	.221	−.005	.12	−.043	−.241	.231
Gender[1]	-1.743	.685	-2.542	-3.091	−.393	−.244**	.884	-2.77	-4.184	−.705
Qualification[2]	.074*	.734	.1	-1.372	1.519	.059	1.068	−.056	-2.161	2.042
Time-type	.022	.018	1.224	−.013	.057	.011	.027	.432	−.041	.064
Years employed	.062	.084	.737	−.104	.228	−.069	.142	−.488	−.349	.21
OC	.38**	.138	2.76	.109	.651	−.647***	.183	-3.53	-1.008	−.256
ERI	4.935***	.769	6.416	3.421	6.449	-4.356***	1.049	-4.15	-6.422	-2.291
	Model 5		SF-36 BP			Model 6		BDI-II		
	$R^2 = .216$		$F = 9.877$***			$R^2 = .618$		$F = 34.708$***		
Predictor	B	SE	t	LCI	UCI	B	SE	t	LCI	UCI
Age	−.751	.425	-1.768	-1.587	.085	.039	.079	.488	−.117	.195
Gender[1]	5.204	2.881	1.806	−.466	10.876	2.084	.993	2.098	.129	4.039
Qualification[2]	-6.192*	2.621	-2.362	-11.351	-1.032	-2.881**	.935	-3.082	-4.722	-1.041
Time-type	−.021	.071	−.287	−.161	.12	.023	.022	−.987	−.068	.022
Years employed	−.468	.468	−.999	-1.39	.454	−.009	.094	−.102	−.194	.175
OC	.797	.478	1.668	−.143	1.738	.494**	.177	2.799	.147	.843
ERI	16.755***	2.746	6.101	11.35	22.16	3.107*	1.227	2.531	.691	5.523
MBI EE						.414***	.066	6.231	.284	.544
MBI DP						.093	.085	.861	−.094	.248
MBI PA						−.174**	.063	-2.748	−.297	−.049
SF-36 BP						.072*	.023	3.126	.026	.117

$n = 303$, *B* regression coefficient, *SE* standard error, *t* t-test value, *LCI* lower limit of the 95 % confidence interval, *UCI* upper limit of the 95 % confidence interval

Model 1: OC → ERI

Model 2: OC → ERI → MBI EE

Model 3: OC → ERI → MBI DP

Model 4: OC → ERI → MBI PA

Model 5: OC → ERI → SF-36 BP

Model 6: OC → ERI → MBI EE, MBI DP, MBI PA, SF-36 BP → BDI-II

*** $p<.001$; ** $p<.01$; * $p<.05$

[1]male=1; female=2

[2]EMT-P=1, EMT-I=2

The results further support our hypothesis that ERI mediates the association of OC and depression. EMTs who are overcommitted might experience higher levels of ERI, which might contribute to increased depression symptoms. The ERI-Model Siegrist [6] suggests that stress at work can be caused by the mismatch in perceived effort compared to perceived reward. Employees who show overcommitted behavior tend to work beyond their capacities, thus exerting excessive effort [42], which contributes to the mismatch in perceived effort compared to perceived reward. Other studies [43, 44] also found evidence that OC as a personality trait is a risk factor for experiencing ERI and work-related stress. Further contributing to our findings, Rugulies and colleagues [45] reported in their meta-analysis ERI to be a significant risk factor for depression symptoms. There is no consistent evidence, however, for ERI mediating between OC and depression. Lehr and colleagues [46] found that OC
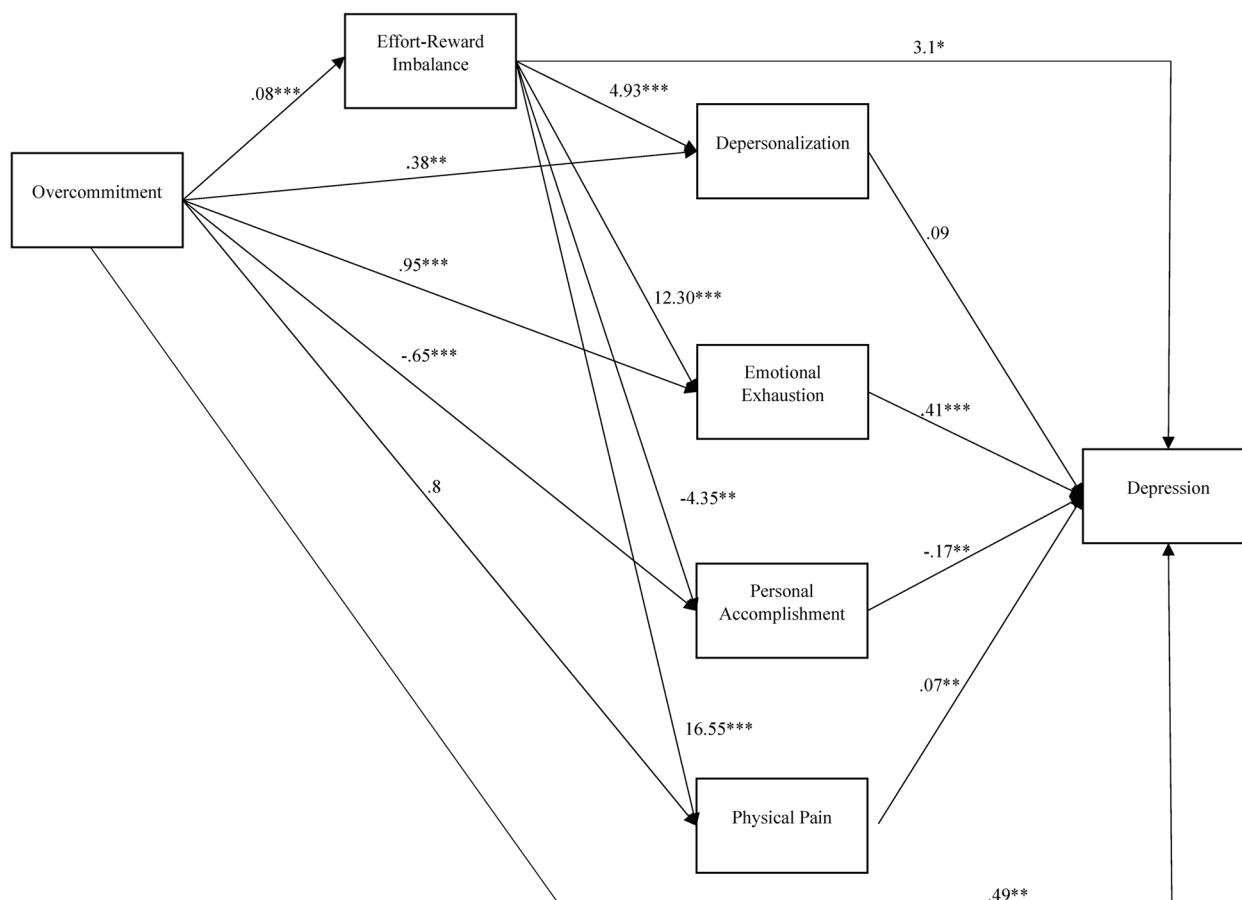
Fig. 2 Results of the serial and parallel mediation with regression coefficients and significance levels. *** $p < .001$; ** $p < .01$; * $p < .05$

Table 4 Effects and indirect effects of the mediation analysis of OC on depression via ERI, burnout and physical pain, shown for the different paths

	B	SE	Bootstrap LCI	Bootstrap UCI	t
Total effect OC on BDI-II	1.935***	0.221	1.499	2.369	8.753
Direct effect OC on BDI-II	0.494**	0.177	0.147	0.843	2.799
Total indirect effect OC on BDI-II	1.439	0.192	1.084	1.832	
Indirect effect via ERI	0.25	0.106	0.055	0.473	
Indirect effect via ERI and MBI EE	0.41	0.094	0.243	0.612	
Indirect effect via ERI and MBI DP	0.029	0.035	− 0.036	0.101	
Indirect effect via ERI and MBI PA	0.061	0.027	0.015	0.121	
Indirect effect via ERI and SF-36 BP	0.097	0.038	0.038	0.183	

n 303, *B* regression coefficient, *SE* standard error, *t* t-test value, *LCI* lower limit of the 95 % confidence interval, *UCI* upper limit of the 95 % confidence interval

***$p < .001$; **$p < .01$

alone was not directly predictive for affective disorders in schoolteachers. Moreover, they found a strong link between ERI and depression symptoms, which was even stronger when introducing OC as a moderating variable. Another study examining the relationship between OC, ERI and mental health [42] found that ERI had no direct effect on mental health, unless OC was introduced as a mediator variable, stating OC to be a mediator between ERI and mental health. These findings are in contrast to

our finding that ERI mediates the association between OC and depression. An explanation for these inconsistencies might be that previous studies conceptualized OC as a coping mechanism rather than a personality trait as in the present study. If OC is conceived as a personality trait leading to an increase in job effort without concomitant increases in reward, this might result in ERI.

In partial disagreement with our hypothesis for burnout as a chain mediator between OC, ERI and depression,

not all burnout dimensions turned out to be significant mediators, in thatdepersonalization did not show a significant mediating effect in our model. This suggests that overcommitted EMTs are more likely to experience higher levels in ERI, leading to higher levels in emotional exhaustion and lower levels in personal accomplishment, in turn leading to elevated levels in depression. The opposite effects of emotional exhaustion and personal accomplishment on health are in line with validation studies on the MBI [47, 48]. The non-significant relationship between depersonalization and depression, however, differs from previous studies [13, 49], who found burnout to mediate between work-related stress and depression symptoms. In a study by Violanti and colleagues [50], people with higher scores in ERI and OC showed higher scores in depersonalization and emotional exhaustion, whereas in a study by Martin and colleagues [51], higher scores in depersonalization and emotional exhaustion strongly predicted the severity of depression symptoms. Our findings of emotional exhaustion as the strongest chain mediator between ERI and depression imply that future prevention and intervention programs in EMTs should particularly focus on the reduction of emotional exhaustion.

An explanation for this contradicting finding might be that due to high correlations between emotional exhaustion and depersonalization, it is possible that both dimensions affect depression levels, resulting in a non-mediating effect of depersonalization [52]. This assumption is supported by our finding that, concerning the parallel mediators, the burnout dimension of emotional exhaustion seems to have the strongest mediating effect. An alternative explanation is that the role of emotional exhaustion as a chain mediator of OC, ERI and depression may be a specific characteristic of EMTs. Future studies should compare EMTs with comparable social services with regard to OC, ERI, burnout and depression to test the specificity of this pattern.

Our findings further demonstrate a mediating effect through physical pain as a chain mediator between OC, ERI and depression. There is evidence suggesting that work-related stress enhances the probability of musculoskeletal pain [53]. Due to higher work-related stress experiences, muscle tensions can be enhanced, hence causing physical pain, which may contribute to depression symptoms [54, 55]. Our findings not only suggest that burnout, but also physical symptoms may be affected by OC/ERI, finally contributing to mental health in EMTs. Hence, the modification of the antecedents of OC and ERI, such as a reduction of workload, an increase of monetary compensation or an extension of relaxation periods, have the potential to positively affect both physical and mental health in EMTs.

Our findings have theoretical implications for the mechanisms linking occupational stress and mental health, by contributing to a better understanding of the interaction between OC and depression in EMTs. The complexity of the mediation model suggests that simple linear models might not be sufficient to understand the relationship between occupational stress and mental health outcomes. Moreover, our findings emphasize the importance of integrating indicators of physical and mental health. Furthermore, the differences between the burnout dimensions in mediating effects demonstrate the necessity to integrate emotional exhaustion, depersonalization and personal accomplishment as separate variables to predict mental health in EMTs.

These results have important practical implications in the field of EMS, in that they demonstrate the need to support mental health and decrease the number of EMTs experiencing depression symptoms by managing OC effectively. Especially EMTs who are highly overcommitted and those with high levels of emotional exhaustion are at risk of experiencing physical and mental health impairments. Therefore, EMS organizations should consider implementing stress management programs and trainings on effective coping strategies to handle work related stress and OC. EMS organizations should also consider organizational changes, reducing excessive job demands and improving rewards, thereby reducing perceived ERI. Considering the increase in emergency calls and responses over the last years, and the associated strain (= *effort*), our findings highlight the importance to increase *rewards*, thereby protecting EMTs from occupational stress.

We found an excellent internal consistency for depression scores (BDI-II), a good consistency for physical pain (SF-36), and acceptable to excellent consistency for burnout scales (BMI), which is well in line with the literature [56–58]. The scale 'Reward' exhibited a good consistency. Only the scales 'OC' and 'Effort' (ERI) showed consistencies slightly lower than 0.70, which may be due to a higher heterogeneity of items or of participants in the current EMT sample. Nevertheless, the consistencies of ERI/OC in the current sample is comparable or only slightly lower than reported in the literature [7, 59, 60].

Limitations

First, the current study used a cross-sectional design. As the mediation model was based on theoretical assumptions, it might well be that statistical effects show equal significance levels when re-arranging them, although with a lower conceptual validity of the model. To draw conclusions on causalities between these variables a longitudinal design is needed. Furthermore, a longitudinal design would provide insights into the evolvement of the relationship between OC and depression, as well as

their mediation over time. Notwithstanding, the current results suggest a complex relationship between OC and depression, as well as their mediation by ERI, burnout and physical pain. Second, the sample in this study was relatively young with a mean age of 33.1 years (SD = 10.27 years) and this may, therefore, limit the generalizability of our findings to EMTs in general. Notwithstanding, the age of the current study is almost identical to that in previous studies [1, 61], thereby ensuring comparability between studies. As age was unrelated to all other variables in our mediation models, however, this assumption seems not to be supported by our data. Third, this study included only EMS employees in Germany, limiting the applicability of our results to EMTs in general. Future studies should examine the mediation model in other professions, as well. The data in this study relies on self-reported data, introducing biases such as social desirability. However, the data was anonymously collected via online platforms, keeping biases like social desirability at a minimum. Fourth, EMTs might be at increased risk of exposure to traumatic events [62] and high emotional demands [63] at workplace. For example, EMTs are exposed to situations involving suffering and pain or even events that lead to an emotional connections to their patients and families [64]. Those factors are associated with the risk for developing mental disorders, such as PTSD [65]. Furthermore, excessive OC may contribute to an increased vulnerability for mental disorders [66, 67]. This is of particular importance as EMTs are exposed to high emotional demands when serving patients with severe and life-threatening health conditions [68], whereas OC (i.e. excessive work-related commitment and striving, a strong need to be approved [7]) may serve as a coping mechanism to handle these demands [12, 15, 69]. However, the purpose of this study was to investigate ERI and OC in relation to depression, with a particular focus on employer-provided rewards and the value of appreciation. Hence, we did not assess emotional demands and trauma. Future studies should also control for emotional demands in case they aim at replicating the model assumptions of the current study. Future studies testing for alternative models with a more broader focus on mental health in EMTs (including PTSD) may include both trauma exposure and occupational stressors, and their interactions, as ERI and depression could be identified as risk factors for PTSD.

Conclusions

This study demonstrates that the relationship between OC and depression is partially mediated by ERI (first step), as well as burnout (emotional exhaustion, personal accomplishment) and physical pain (second step) in German EMTs. Emotional exhaustion was identified as strongest chain mediator of the second step. Furthermore, OC still has a direct positive effect on depression symptoms. Our findings demonstrate the need for prevention and intervention programs to target OC/ERI and burnout (e.g., effective stress management strategies and organizational changes in EMS) to reduce risk factors for mental- and physical health impairments.

Abbreviations

BDI-II	Beck Depression Inventory-II
CI	Confidence interval
DV	Dependent variable
ERI	Effort-Reward Imbalance
EMS	Emergency medical service
EMT	Emergency medical technicians
EMT-P	EMT-Paramedic
EMT-S	EMT-Intermediate
OC	Overcommitment
IV	Independent variable
LCI	Lower limit of the 95 % confidence interval
MBI DP	Maslach Burnout Inventory, scale 'Depersonalization'
MBI EE	Maslach Burnout Inventory, scale 'Emotional Exhaustion'
MBI HSS	Maslach Burnout Inventory-Human Services Survey
MBI PA	Maslach Burnout Inventory, scale 'Personal Accomplishment'
MV	Mediator variable
SD	Standard deviation
SE	Standard error
SF-36 PP	Short Form 36, scale 'Phyiscal Pain'
UCI	Upper limit of the 95 % confidence interval

Data availability
The data reported in this article are available on reasonable request. The data are not publicly available because the informed consent did not cover publication of raw data.

Declarations

Ethics approval and consent to participate
The present study adhered to the guidelines of the Helsinki Declaration for the experimental investigation with human participants required by the University of Luxembourg. Ethics approval was obtained according to the ethics regulations of the psychology study programs of the University of Luxembourg. All participants provided informed consent before data collection.

Consent for publication
All authors consent that the current manuscript will be published under the relevant Creative Commons license.

Competing interests
The authors declare no competing interests.

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