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Occupational burn-out, fatigue and stress in professional rescuers: a cross-sectional study in Kazakhstan

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ABSTRACT

Objectives To find predictors of burn-out in a cohort of rescuers.

Design Cross-sectional study.

Setting Republican Rescue Squad (N=105) and Republican Mudslide Rescue Service under the Ministry of Emergency Situations (N=480) in Almaty, Kazakhstan.

Participants In total, we included 268 (80% men, median age 38 (IQR 22) years) rescuers from both organisations.

Primary and secondary outcome measures We offered a questionnaire to rescuers, which included Maslach Burnout Inventory, quantifying emotional exhaustion (EX), cynicism (CY) and professional efficacy (PE) along with fatigue, stress and health-related quality of life (HRQL) tools.

Results Lower scores of HRQL (Physical Component Score (PCS) beta −0.04 (95% CI −0.06 to −0.02); Mental Component Score beta −0.03 (95% CI −0.05 to −0.01)), higher fatigue (Fatigue Severity Scale (FSS) score beta 0.03 (95% CI 0.03 to 0.04)) and stress (Perceived Stress Score-10 beta 0.04 (95% CI 0.02 to 0.06)) independently predicted greater EX. Lower PCS (beta −0.03 (95% CI −0.06 to −0.01)) and FSS (beta 0.02 (95% CI 0.01 to 0.03)) could predict more CY burn-out. In addition to stress, higher education (beta 0.86 (95% CI 0.40 to 1.32)) was positively associated with lower burn-out severity in PE domain.

Conclusions Fatigue, stress and HRQL were associated with burn-out in rescuers. Addressing these predictors may help guide further interventions to reduce occupational burn-out.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The study of both fatigue, perceived stress and burn-out together along with health-related quality of life, almost never reported before in these groups in one questionnaire is a strength of this study.

⇒ The most pronounced limitation of this analysis is the cross-sectional design, which does not allow to conclude on the direction of associations we have found.

⇒ Another limitation is inability to reach regular rescuers working within the Provincial affiliations of the Ministry of Emergency Situations for comparison.

⇒ Finally, we did not include the tools to verify work–family conflict and other potential sources of stress as confounders of occupational burn-out.

INTRODUCTION

Occupational stress in first responders may be high due to frequent exposure to fatal accidents and emotional suffering of victims and their relatives.[1] In addition, permanent preparedness for immediate response may be associated with accelerated occupational burn-out. However, studies with quantitative description of burn-out in these occupational groups are usually limited to small samples[2] and linked to specific disasters, such as earthquakes,[3] terrorist attacks or mass shootings. Selected reports usually demonstrate low levels of burn-out in both heterogenous groups of responders,[4–6] such as in a recent systematic review[7] and in the study of the earthquake responders,[3] or in more homogeneous groups, such as firefighters.[8]

The systematic review concluded that such low prevalence of secondary traumatisation may be explained by social desirability and job-loss concerns,[7] thus, the overall prevalence of such traumatisation may be underestimated. Burn-out prevention is generally focused on the identification of risk and protective predictors, which include, but not limited to, sex, age, work duration, work–family conflict and even health-related quality of life (HRQL). However, the outcomes in such studies were inconsistent. In Kazakhstan firefighters, who are not in charge of medical evacuation and only deal with fire, age and work duration were not found to have an association with burn-out, whereas the overall scores of all three domains were low.[8] However, other important risk factors should be considered and addressed in secondary burn-out prevention, such as education, uniform discomfort and even intrinsic factors, such as blood testosterone.[9]

The overall levels of fatigue and occupational stress in this specific occupation remain poorly characterised. Furthermore, burn-out domains have not been properly characterised in this occupational group before, whereas rescuers involved in the mitigation of natural and technogenic disasters, including those in the mountainous terrains, have been poorly described in the world literature with regard to burn-out predictors. Because physical strain in mountainous rescue is enormous,[10 11] fatigue and HRQL may be important burn-out predictors, but very little is known about such association. More evidence is needed to understand how stress, HRQL and fatigue in the workplace can affect specific burn-out domains. Therefore, we aimed to find predictors of burn-out in a cohort of rescuers.

MATERIALS AND METHODS

Two rescue organisations were included in this cross-sectional study of fatigue, stress and occupational burn-out, stationed in Almaty, Kazakhstan, but performing their duty all over the country. The first group (referred to as Group 1) comprised qualified and trained rescuers from the republican rescue squad (RRS), a military organisation, which existed within the Ministry of Emergency Situations of the Republic of Kazakhstan. The overall enlisted staff of the squad is 105 people. These rescuers are trained and usually called for complex emergency situations, such as natural disasters, including earthquakes, floods, large-scale technogenic catastrophes, which cannot be resolved by a local rescue team, affiliated with the Provincial Department of Emergency Situations. Of note, ambulance, fire service and police are separate divisions under different ministries, whereas local emergencies requiring rescue service are usually covered by the local Department of Emergency Situations rescue groups. We could only enrol 90 (86%) subjects from RRS, because the remaining 15 were either on a sick or maternity leave or on a permanent business trip outside Almaty Province.

The second group (referred to as Group 2) in this analysis were trained rescuers from the Republican Mudslide Rescue Service under the Ministry of Emergency Situations. This organisation employs 480 people in six provinces of the country and offers a wide range of service aiming to control and prevent the mudslide consequences. The terms of references include, but not limited to, design and construction of mudslide control engineering means; exploration, research and monitoring of mudslide control structures; immediate response to mudslide events; setting up communication means for the population and response teams and other. Mudslide rescuers are stationed in the mountainous terrains away from the cities and other residence areas.

We offered a self-administered structured questionnaire in either Russian of Kazakh depending on a personal preference to all study participants. The overall number of questions was 68, whereas the questionnaire comprised demographic section, occupational and lifestyle history, general HRQL tool, followed by nine questions on fatigue, sixteen questions on burn-out, a question on subjective discomfort from the uniform and one more question on difficulty in communication because of language. In addition, we offered 10 questions to assess occupational stress. In the demographic part, we collected information on sex, date of birth, marital status and the highest attained education. In an occupational and lifestyle history section, we ascertained the overall years in service and years in current position, shift length in hours, number of shifts per month, the current and the last four positions held. This was followed by cigarette smoking history, stratifying subjects to never, former and current daily smokers; total hours of recreational physical activity per week, and the frequency of alcohol consumption (never, small amounts seldom; large amounts seldom and the use at least once a week).

HRQL was quantified using an 8-item general SF-8 tool, which produced the scores of physical and social functioning, role physical and role emotional, mental health, vitality, bodily pain and general health. In the current analysis, we used two component scores, Physical Component Score (PCS) and Mental Component Score (MCS) as the summary estimates of two HRQL components. Fatigue was measured using nine questions of Fatigue Severity Scale (FSS), with the summary score ranging from 0 to 63, whereas the score above 36 was indicative of high fatigue level. Burn-out was measured with a 16-item Maslach Burnout Inventory (MBI) General tool, producing the mean scores of three dimensions, including emotional exhaustion (EX), cynicism (CY) and professional efficacy (PE). Higher EX and CY scores assumed greater burn-out with the reverse dependence for PE. Stress was measured with a 10-item PSS-10 questionnaire, in which each of 10 included questions ranged from 1 to 5, with inverted scores of four questions of 'stress counteraction' domain. Finally, the overall score ranged from 10 to 50.

When tested for normality, most variables were non-normally distributed; therefore, we used and reported non-parametric tests in this presentation. Means are presented as medians with the corresponding IQR, unless otherwise stated. The medians of two groups were compared using Mann-Whitney U test. Binary variables' frequencies were compared between two or more groups using χ^2 test from contingency tables. We analysed selected variables both as continuous and binary, such as fatigue scores. FSS, PSS-10 and all three scores of burn-out were tested as dependent variables in simple regression models first, which included selected predictors depending on the model. Those found significantly associated with the outcome were then included in adjusted models, in which we first assessed collinearity by means of correlation matrix and inflation factor. Such crude and adjusted models yielded beta coefficients with their 95% CI. In addition to beta coefficients, we also report R^2 for each model of burn-out domain prediction, reflecting the fraction of the overall variability explained by the pool of included predictors. All tests were considered significant

Table 1 Demographic and lifestyle profile of the sample

	Overall	RRS rescuers	Mudslide rescuers	P value
N (%)	268 (100)	90 (34)	178 (66)	–
Age, years	38 (22)	33 (10.3)	45 (21)	<0.001
Men, N (%)	214 (80)	78 (87)	136 (76)	0.048
Shifts, N (%)				
8 hours	140 (52)	16 (18)	124 (70)	<0.001
12 hours	20 (8)	0 (0)	20 (11)	
24 hours	108 (40)	74 (82)	34 (19)	
Years of work in the rescue	5 (9.8)	5 (8)	5 (10)	0.82
Marital status				
Single	39 (15)	7 (8)	32 (18)	0.07
Married	208 (78)	76 (84)	132 (74)	
Divorced	21 (7)	7 (8)	14 (8)	
Education				
Secondary school	7 (3)	2 (2)	5 (3)	0.34
High school	68 (25)	17 (19)	51 (29)	
College	65 (24)	25 (28)	40 (22)	
University	128 (48)	46 (51)	82 (46)	
Cigarette smoking				
Never	127 (48)	29 (32)	98 (55)	<0.001
Former	52 (19)	34 (38)	19 (11)	
Current daily	89 (33)	27 (30)	61 (34)	
Exercising regularly, N (%)	145 (54)	58 (64)	87 (49)	0.02
Hours per week exercised	4 (4)	5 (3.4)	3 (4.8)	<0.001
Never-alcohol users, N (%)	157 (59)	48 (53)	109 (61)	0.21

Data are presented either as medians (IQR), assuming non-normal distribution for continuous variables or as N (%) for binary variables. P values were calculated using Mann-Whitney U test or, alternatively, χ^2 test from contingency tables.
RRS, Republican Rescue Squad.

when p was below 0.05, where NCSS 2020 (Utah, USA) was the statistical package to run all tests.

RESULTS

One-third of the sample were rescuers from RRS. Age ranged from 21 to 73 years, and the median age of included subjects was 38 (IQR 22) years, whereas the majority were men (table 1). Study participants worked in rescue system for 5 years on average (from 0.2 to 41 years), 40% worked 24-hour shifts, and the majority (78%) were married. Almost half of the sample had a university degree and never smoked cigarettes. Fifty-four per cent exercised off work regularly, with the median of four times a week. Two study groups were different with regard to age, shifts worked, cigarette smoking and exercising profile. Group 1 was significantly younger and the majority worked 24-hour shifts. Furthermore, there were significantly more former cigarette smokers and daily off-work exercisers in rescuers compared with mudslide prevention personnel.

There were 12 (13.3%) subjects with fatigue (FSS more than 36) among RRS rescuers and 13 (7.3%) among mudslide rescuers, with non-significant difference between these groups. Despite being significantly younger, rescuers in group 1 showed higher scores of fatigue (table 2). Working 24-hours shifts, age, sex, years in rescue, being married, higher education, current cigarette smoking were not associated with FSS, in contrast with regular exercise, which was negatively associated with FSS. In addition, both physical (beta −0.41 (95% CI −0.69 to −0.12)) and mental (beta −0.50 (95% CI −0.74 to −0.27)) component scores of HRQL showed negative and PSS-10 positive (beta 0.48 (95% CI 0.18 to 0.82)) association with FSS, independent of each other in an adjusted model. These three predictors explained 22% of the overall FSS variability. Obviously, greater FSS score in younger rescuers from group 1 may be explained by specific job tasks.

In both RRS rescuers and mudslide rescuers, as well as in the whole cohort, all three studied burn-out domain

Table 2 Median and interquartile scores of fatigue, burn-out and stress in two studied groups

	RRS rescuers	Mudslide rescuers	P value
FSS (0–63)	16 (21)	12 (19)	0.02
Burn-out			
EX (0–6)	0.6 (1.7)	0.8 (1.2)	0.18
CY (0–6)	1.5 (2.1)	1.6 (1.4)	0.15
PE (0–5)	4.9 (2.4)	4.7 (3)	0.24
PSS-10 (10-50)	22.5±6.2	23 (7)	0.90

All p values from Mann-Whitney U test.
CY, cynicism; EX, emotional exhaustion; FSS, Fatigue Severity Scale; PE, professional efficacy; PSS, Perceived Stress Scale; RRS, Republican Rescue Squad.

levels were either low or very low. The overall EX score was 0.8 (IQR 0.2–1.6), CY 1.6 (IQR 0.8–2.4), PE 4.7 (IQR 3–5.8), with no differences between RRS rescuers and mudslide rescuers. We found moderate correlation between EX and FSS (r=0.61) and CY (r=0.54). No differences were found between groups with regard to stress level. The overall PSS-10 score was 23 (IQR 8), which corresponded to its low level. In the univariate analyses, age, sex, working 24-hour shifts, marital status, cigarette smoking, were not associated with higher PSS-10. However, FSS, exercising regularly, higher education and HRQL could predict stress score. When adjusted for each other, both HRQL components (PCS beta −0.27, p<0.001; MCS beta −0.25, p<0.001), fatigue (FSS beta 0.07, p<0.01) and higher education (beta 1.44, p<0.05) still remained significantly associated with PSS-10 score.

In testing candidate variables to predict burn-out domains in simple univariate regression models, age, sex, working 24-hour shifts, years in rescue, marital status or cigarette smoking were not associated with any burn-out domain. In a multivariate regression model of predicting EX, regular exercise, PCS, MCS, FSS and PSS-10 were included, and this model yielded the highest power among three domains, in which these five variables explained 52% of EX variability. As table 3 shows, lower scores of both domains of HRQL, higher fatigue and stress scores independently predicted greater EX. The model of predicting CY only included four variables, of

which two (MCS and PSS-10) did not show an association in an adjusted model, and R^2 for the model was 0.13. With regard to CY, only lower PCS and FSS scores, independent of each other, could predict more burn-out. Finally, adjusted model for PE had even smaller R^2 (0.10) with four variables included, of which both domains of HRQL did not yield an association with PE. In addition to FSS-10, higher education was positively associated with higher PE burn-out score (beta 0.86 (95% CI 0.40 to 1.32)), thus, lower burn-out severity.

DISCUSSION

In this first presentation of the occupational burn-out, stress and fatigue in rescuers from Kazakhstan, we found that the overall prevalence of high burn-out scores in any three studied dimensions, including EX, CY and PE, was low. Using multivariate modelling, we showed that higher EX burn-out in this group was associated with lower HRQL, greater fatigue and stress, whereas CY burn-out could be predicted by more fatigue and poorer physical component of HRQL. Finally, PE burn-out was associated with stress and education. We consider these findings important to plan early prevention of burn-out in rescuers; thus, potentially affecting survival rates in natural disaster victims through high PE.

Occupational burn-out is widely reported in different occupational groups, mostly medical professionals, such as nurses, but studies in rescuers do not often take occupational burn-out into account. In Kazakhstan, medical ambulance, fire departments and rescuers do not function together and are attributed to separate organisations. We earlier reported that occupational burn-out in firefighters was generally low and its predictors in multivariate models included HRQL, uniform discomfort, language barrier, sex and education, depending on a specific domain.[8] The terms of reference of firefighters and rescuers in Kazakhstan were different, and we therefore aimed to now detect burn-out predictors in the latter. We found common burn-out predictors with firefighters, such as HRQL and education (with regard to PE), indicative of potentially similar mechanisms of burn-out development and progression in these groups.

Burn-out in rescuers most likely develops as a result of secondary traumatisation,[12 13] that is a stress that develops

Table 3 Beta coefficients with the corresponding 95% CIs of selected predictors of emotional exhaustion, cynicism and professional efficacy in fully adjusted regression models

Predictor	EX	CY	PE
PCS	−0.04 (−0.06 to −0.02)	−0.03 (−0.06 to −0.01)	NS
MCS	−0.03 (−0.05 to −0.01)	NS	NS
FSS	0.03 (0.03 to 0.04)	0.02 (0.01 to 0.03)	–
PSS-10	0.04 (0.02 to 0.06)	NS	−0.06 (−0.10 to −0.02)

CY, cynicism; EX, emotional exhaustion; FSS, Fatigue Severity Scale; MCS, Mental Component Score; NS, non-significant; PCS, Physical Component Score; PE, professional efficacy; PSS, Perceived Stress Scale.

in those who contacted and assisted others experiencing direct stress. As opposed to burn-out, such secondary traumatisation has been widely reported in responders, including police officers, firefighters and paramedics.[12–14] In group comparisons, the findings of studies have not been consistent. Thus, more compassion fatigue in firefighters in one report[15] contradicted less traumatisation in firefighters compared with rescue personnel in another presentation.[14] In addition, risk factors for occupational burn-out in rescuers have been very poorly described and included the experience of feeling threatened, the experience of being jailed or insulted and the number of years of service in one study in paramedics[16]; self-efficacy, collective efficacy and sense of community in another study in first responders.[17] Furthermore, a 4-year follow-up study of medical rescue workers during the Great East Japan Earthquake showed that stress before deployment was a significant predictor of burn-out.[18] None of these and other published studies examined HRQL, and the association of HRQL with burn-out we detected was a novel finding in the field.

The overall low prevalence of high burn-out in rescuers in Kazakhstan may result from a well-set system of psychological aid and consultations with regularly trained psychologists in the staff. These psychologists operate 8-hour daily shifts and are in charge of daily monitoring of the so-called psychological climate. They disseminate and analyse the questionnaires to the duty personnel on a monthly basis and complete regular training on the ways to consult rescuers how to mitigate occupational stress. The efficacy of these interventions is also assessed regularly, but we have found no reports showing the effect of such interventions in the published literature.

The analysis of both fatigue, perceived stress, burn-out and HRQL is a strength of this study, because the association of these in such occupational groups has never been reported before. The most pronounced limitation of this analysis is the cross-sectional design, which does not allow to conclude on the direction of associations we have found. Another limitation is inability to reach regular rescuers working within the Provincial affiliations of the Ministry of Emergency Situations for comparison. Furthermore, we did not include the tools to verify work-family conflict and other potential sources of stress as confounders of occupational burn-out, which we also consider a limitation of our study.

This study has broad and clear implications for the management of rescue service in the country and elsewhere. The association of HRQL, mostly physical component, with two out of three burn-out domains confirms earlier findings in firefighters and necessitates setting up a more comprehensive medical surveillance system with a focus on annual medical screening and fitness to work. Such annual screening, as mandated by the local legislation covers a broad range of medical conditions and diagnoses, but has never addressed stress, fatigue or burn-out as a routine procedure. The panel of screening doctors includes a psychiatrist, but not a medical psychologist,

leaving the problems of stress, burn-out and fatigue unaddressed during screening. Burn-out itself and its predictors, such as stress and fatigue, should be better and timely recognised at any contact of rescue personnel with medical doctors and psychologists, whereas primary burn-out prevention programmes should be initiated and integrated at the annual medical screening.

The associations we identified in our study raise questions for future research. HRQL usually reflects individual satisfaction with one's health, including already existing chronic and acute diseases and conditions. Because HRQL was found to be consistently associated with most domains of burn-out, individual health can also predict burn-out and, hence, interventions tailored at improving individual health can theoretically ameliorate burn-out. However, we could not find studies confirming this hypothesis in rescuers with specific terms of reference, such as in Kazakhstan groups. More studies are needed uncovering the overall and specific health status of such occupational groups, as any associations will help guide primary and secondary burn-out prevention.

CONCLUSIONS
To conclude, this is the first presentation of the occupational burn-out, fatigue and stress in a large sample of professional rescuers of Kazakhstan, which showed that fatigue was an independent predictor of burn-out in this group. Because HRQL was also an important predictor of EX and even CY, primary burn-out prevention should consider general health status and HRQL and aim to support better physical health though efficient health interventions, exercise and health surveillance as mandated by the local regulations. Burn-out prevention in rescuers should focus on fatigue reduction through better worktime and shift planning.

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