# Fire fighters' psychosocial risks and physical fitness: Evidence-based study from Estonia

*Karin* Reinhold[1,*], *Marina* Järvis[1], and *Jelena* Hartšenko[1]

[1]Institue of Business Administration, Tallinn University of Technology, Tallinn, Estonia

**Abstract.** Current study explores important aspects of mental and physical health of fire fighters in Estonia. It is well known that high work performance requires good physical and mental health among fire fighters. However, there is a steady increase of the Body Mass Index (BMI) of rescue workers, which may be a result of little physical activity, poor or irregular diet, exhaustive shift work and sleep disturbances, emotionally difficult work or other psychosocial factors. These aspects were studied by a quantitative and qualitative research. As a result, a model for developing a culture that promotes workers' physical and mental health was developed. The findings have implications for health and safety management and health promotion in order to find more solutions for future activities to support and ensure the high work performance of fire fighters.

## 1 Introduction

Fire fighting and rescue work involve high physical and mental demands under unpredictable and dangerous conditions. During the emergence situations, the fire fighters need to take quick and multiple decisions and act according to those. The actions are often critical in space and time, duration as well as biomechanical movements (such as climbing stairs, running, jumping etc). Psychological pressure, together with other occupational hazards (such as physical, thermal, ergonomic and chemical risk), can lead to fatigue, burnout, and a variety of chronic diseases [1, 2]. Several studies have proved that fire fighters are more susceptible to heart and respiratory diseases as well as to several types of cancers [3-5]. In order to cope with their demanding work tasks without overstrain and health risks, fire fighters need to have a good health and their physical and mental capacity have to be above average. Fire fighters perform multiple fire ground tasks: fire attack, search and rescue, exterior ventilation and fire prevention activities [6]. Numerous studies have demonstrated a direct association between better fire fighting job performance with higher levels of physical fitness [7]. Additionally, cardio-respiratory fitness has been proved as essential contributing factor to higher work performance enabling fire fighters to carry out on-duty tasks more efficiently [8].

The overall aim of the study was to evaluate the physical activity of fire fighters and their psychosocial hazards at work. We explored how the healthy life-style is appreciated,

*Corresponding author: karin.reinhold@taltech.ee

valued and practically realised among fire fighters and if and how the life-style correlates to other factors. Additionally, we tried to find out the enabling and inhibiting factors that affect fire fighters' mental wellbeing. Finally, we studied how organization can support fire fighters' mental and physical health.

## 2 Material and methods

The study was conducted during 2 years, in 2018-2020. It had a mixed-method approach: quantitative study (COPSOQII questionnaire about psychosocial hazards and tailored questionnaire about physical activities and health behaviour) and qualitative study (focus-group semi-structured interviews with fire fighters).

COPSOQII is an instrument developed and validated by the Danish Institute of Occupational Health to assess psychosocial risk factors in the work environment. The questionnaire is freely available [9]. The questionnaire can be used to assess work demands, work organisation and content, interpersonal and managerial relationships, conflicts and unpleasant behaviours, work culture and values, job satisfaction and mental health problems that may be caused or increased by psychosocial hazards in the work environment. The second part of the questionnaire consisted of a set of questions developed by university researchers to assess fire fighters' physical activity, dietary habits, attitudes and habits towards their own health, the main disturbing health problems, the presence of sleep disturbances and the relationship between these factors and the specific nature of their work. The number of completed questionnaires was 400. The sample covered 4 regions in Estonia - North, South, East and West and fire fighters with similar main duties were the subjects (there are no different tasks assigned by age or sex for firefighters in Estonia, except the lead of the event during firefighting or other emergency situation; but some may have had more training for the special events, such as chemical spillages). The survey was conducted in the Lime Survey online environment and was anonymous. Each fire fighter had his own code to access the platform, created automatically. The results were statistically analysed using the SPSS program - data files were sorted, standard tables with key results were created, and statistical data were presented (for correlations, Spearman's coefficient ρ was used). The gender breakdown of respondents was as follows: 18% of participants were women and 82% were men. This represents the overall sample size as majority of Estonian fire fighters are men, however the female occupancy is slowly increasing. Employees from all age groups responded to the survey: employees under 30 years of age accounted for 13.3% of the respondents, employees aged 30-39 for 31.3%, employees aged 40-49 for 30.8%, employees aged 50-59 for 20% and employees aged 60+ for 4.8% of the respondents.

Focus group interviews took place in different commands, looking in depth at the reasons behind the health behaviours revealed in the survey and asking fire fighters to identify and describe successes and bottlenecks in healthy life-style, challenges in nutrition, motivation to be physically active and other similar issues. In addition, different options and ideas for employers to improve the health behaviour of their employees were discussed. The underlying causes of the main work stressors were also explored in depth - with the aim of finding out whether work stressors and their root causes tend to be similar in different regions and linked to the general working atmosphere, organisation, and management style, or whether work stressors are a function of regional characteristics, organisation, and management quality. The focus group interviews took place in nine commands/units. The number of participants was between 4 and 11, with a total of 77 professional fire fighters, 2 command chiefs, and 2 volunteers. The same participants were free to fill also the anonymous quantitative questionnaire. The interviews lasted between 70

and 120 minutes. The collected results were analysed qualitatively with NVivo program. Anonymity was guaranteed and results were discussed at the group level.

## 3 Results

The main results of the study are discussed below. First, health behaviour and life style among fire fighters are explored, followed by description of psychosocial hazards and finally, a model of culture of workers' physical and mental health is presented.

### 3.1 Health behaviour and life style among fire fighters

More than half (57.3%) of respondents have a BMI below 25 and less than half (42.8%) have a BMI above 25 (Table 1). When asked if anyone had advised the fire fighters to lose weight in the last 12 months, 34 workers (8.5% of respondents) said that a doctor had advised them to lose weight; and 45 workers (11.3% of respondents) had had a similar discussion with a family member.

**Table 1.** Body Mass Index (BMI) among fire fighters.

| BMI | No. of respondents | % of respondents |
|---|---|---|
| BMI under 25 | 229 | 57.3 |
| BMI over 25 | 171 | 42.8 |
| Total | 400 | 100 |

Indeed, the high body mass index among rescue staff is a cause for concern, and was pointed out by the institution's occupational health doctors. They stated that a steady increase of the BMI index of rescue workers can be observed yearly. This can be due to several reasons such as an unhealthy or irregular diet, lack of physical activity, insufficient sleep or irregular rest, as well as an inability to cope effectively with occupational or other life stressors. All of those factors will be discussed in following sub-chapters.

#### *3.1.1 Commuting behaviour*

Conscious choice of commuting behaviour may increase physical health and reduce the risk of obesity and cardiovascular diseases. The results showed that fire fighters travel to and from work using a variety of transport modes. Table 2 shows that the main means of transport used is the car: 77.5% of the respondents to the survey stated that they mainly travel to work by car. However, car commuting was followed by walking to work, with almost a quarter (24.8%) of respondents stating that they come to work on foot. Bicycles are also actively used (21%), followed by public transport (15.8%). It should be noted that one respondent could also choose more than one answer - for example, an employee cycles to work in summer time, but uses a car or public transport in winter. Certainly, the way of getting to work also depends on the distance: 39.8% of the respondents stated that it takes them less than 15 minutes to get to work and 32% of the respondents stated that it takes them 15-30 minutes to get to work.

Comparing men and women, men are significantly more likely to use a bicycle to get to work (24.1% vs. 6.9%), but also significantly more likely to use a car (82% vs. 56.9%).

Women are more likely to use public transport (34.7% vs. 11.6%) and to walk (36.1% vs. 22.3%). Bus, tram and train were the modes of public transport mentioned by the participants.

**Table 2.** Modes of commuting from home to work.

| Means of transport | No. of respondents | % of respondents |
|---|---|---|
| On foot | 99 | 24.8 |
| By bicycle | 84 | 21 |
| By car | 310 | 77.5 |
| By public transport | 63 | 15.8 |
| By taxi | 2 | 0.5 |
| Other means | 8 | 2 |

Interviews with rescue workers confirmed that the preferred mode of transport between work and home is the car. This is due to remoteness, convenience or the need to rush to another job as illustrated here*:* '*I go by car. After my shift I have to rush to another job, that's why I have to come by car to be on time*' (Int 33). Some interviewees indicated that the employer has invested to healthier and more environmentally friendly options, but this is not enough to change the commuting behaviours. For example, one fire fighter stated: '*At work, there's a bike park, there's a shower. The conditions are there, but only a few people cycle*' (Int 2). Another fire fighter added the reason why he is not using other options than the car: '*Although I live 1 km from here, I still use the car as I take the kids to the school before my workday and I don't know, what the weather will be like when I get home. It's more convenient*.' (Int 21).

### *3.1.2 Physical training behaviour at work or during free time*

Majority of employees regularly do sports or physical activities during and after working time. When asked if fire fighters have time to exercise regularly, more than half (52.8%) of respondents said they always or often have time. More than quarter (31.3%) of respondents claimed that they find time to exercise from time to time and 14% of employees stated that they find time to exercise rarely. Only 8 workers (2%) admitted that they never find time to exercise.

The usual regularity of physical training is 2-3 times a week (44.5%) or once a week (16.8%). There are also employees (11.5%) who exercise 4 times a week and employees (8.5%) who exercise 5 or more times a week (see Table 3). However, 10.2% of employees confessed that they train only a few times a year or are not physically active at all.

Each command has conditions for doing sports during at work. Mostly it means a gym in the premises, but sometimes also good opportunities outside in the means of jogging, walking or cycling paths. Rescue workers actively walk or cycle: 35.5% of respondents said they walk or cycle for 30-60 minutes a day and 31.3% said that they walk or cycle for more than an hour. Only 8.5% of respondents admitted that they do not walk or cycle for more than 15 minutes a day (see Table 4).

**Table 3.** Frequency of physical training.

| Frequency | No. of respondents | % of respondents |
|---|---|---|
| Once a week | 67 | 16.8 |
| 2-3 times in a week | 178 | 44.5 |
| 4 times in a week | 46 | 11.5 |
| 5 or more times in a week | 34 | 8.5 |
| 2…3 times in a month | 32 | 8 |
| Very few times in a year or never | 42 | 10.5 |
| Unable to do physical training due to injury or health condition | 1 | 0.3 |
| Total | 400 | 100 |

**Table 4.** Frequency of cycling or walking.

| Frequency | No. of respondents | % of respondents |
|---|---|---|
| Less than 15 minutes per day | 34 | 8.5 |
| 15-30 minutes per day | 99 | 24.8 |
| 30-60 minutes per day | 142 | 35.5 |
| More than 60 minutes per day | 125 | 31.3 |
| Total | 400 | 100 |

The interviews confirmed the general high level of physical activity and sportsmanship of the fire fighters with examples such as: *'I am dealing with different kind of sports, like cycling, skiing, volleyball'* (Int 12) or: '*I like travelling a lot. I'm not a serious sportsman, but I still do downhill skiing*' (Int 14). Others admitted they do not train regularly but have an active life in general. An example can be given such as: '*What keeps me in shape? It is a hard physical work. I am a farmer'* (Int 2).

Correlation calculations between BMI and physical fitness showed weak negative associations (see Table 5). Workers with a high BMI rate their health as poorer, and they do not find enough time to exercise.

### *3.1.3 Sleeping quality*

Fire fighters are aware of the importance of recovering time and sleep during the night. Although the majority of fire fighters sleep 6-9 hours before the shift, only 9% of respondents admitted that they are always refreshed and 52% of respondents reported that they are often refreshed. Others prefer longer sleeping time in order to rest from work, but it's often impossible due to family responsibilities, disturbances or a second job.

**Table 5.** Relationships between BMI and physical fitness.

| | BMI | How do you rate your physical health? | Do you have time to work out? |
|---|---|---|---|
| BMI | 1 | | |
| How do you rate your physical health? | -,163** | 1 | |
| Do you have time to work out? | -,183** | ,186** | 1 |

**Correlation is statistically significant at p=0.01 (2-tailed), Spearman's coefficient ρ.

The correlation calculation showed (Table 6) that there is a very weak relationship between physical training and sleep quality: if an employee sleeps poorly, he does not find time to exercise (ρ = -0.118), and an employee who sleeps poorly/restlessly evaluates his physical fitness generally worse (ρ = -0.183) than employees with a good sleep quality. In addition, there is a weak relationship between finding time for training and being in good physical shape (ρ = 0.399).

**Table 6.** Relationships between sleep and physical activity.

| | How often have you slept poorly or restlessly? | How often have you woken up several times during the night and found it difficult to fall back asleep? | How would you rate your current physical fitness? | Do you have time to work out? |
|---|---|---|---|---|
| How often have you slept poorly or restlessly? | 1 | | | |
| How often have you woken up several times during the night and found it difficult to fall back asleep? | ,535** | 1 | | |
| How would you rate your current physical fitness? | -,183** | -,107* | 1 | |
| Do you have time to work out? | -,118* | -,067 | ,399** | 1 |

**Correlation is statistically significant at $p = 0.01$ (2-tailed), Spearman's coefficient ρ.
*Correlation is statistically significant at $p = 0.05$ (2-tailed), Spearman's coefficient ρ.

### *3.1.4 Diet and eating behaviour*

Fire fighters are aware that regular and healthy eating is necessary, especially working in shifts. The results of the study showed that breakfast is important and almost all fire fighters eat breakfast either at home or at work. Only 5% of respondents stated that they never have breakfast. For breakfast, fire fighters eat porridge, sandwiches, boiled or fried eggs and often drink coffee with milk. The results of the study showed that coffee is often preferred among other drinks at work.

The results of the study also showed that majority of employees eat hot meal either always or often. This is either prepared at home before the shift, or cooked at work or ordered from a fast food restaurant. Table 7 shows that the majority of employees either never buy fast food (275), rarely (39%) or sometimes (21.8%) in order to take it to work.

Over half of the respondents claimed that they eat snacks between the meals. Among fire fighters, the favourite snacks are fruits (53.5%), sweets and chocolate (36%); muesli, nuts and raisins (33.3%); savoury snacks (22.3%) and pastries (21.3%). Comparing men and women, both men and women show a preference for fruits (51.8% and 61.1% respectively). Men also prefer sweets and chocolate (32.6%), followed by muesli, nuts and raisins (30.8%). Women prefer muesli, nuts and raisins (44.4%). Interviews with rescue workers also confirmed that fruit and other healthy products are the favourite snacks: '*Here we eat whatever is brought in, but fruits are the best. I remember once the management sent us a basket of vitamins. There were... there were lemons, ginger, garlic. It was a good surprise and we enjoyed it*.' (Int 6)

**Table 7.** Frequency of buying fast food as a work meal.

| Frequency | No. of respondents | % of respondents |
|---|---|---|
| Always | 8 | 2 |
| Often | 41 | 10.3 |
| Sometimes | 87 | 21.8 |
| Rarely | 156 | 39 |
| Never | 108 | 27 |
| Total | 400 | 100 |

Several interviewees mentioned that they pay attention to what and when they eat, but sometimes fire fighters eat more in the evenings because *'...we have to charge the batteries all the time, otherwise there is no performer of the fire event at night…'* (Int. 4). The interviewees revealed that the employer is expected to provide healthy snacks and sample menus with healthy recipes, as well as better facilities for preparing and consuming food in the workplace. Team spirit, i.e. joint cooking competitions, personalised meal plans and lectures on healthy eating would also contribute to healthier eating.

### 3.2 Psychosocial hazards at work for fire fighters

Majority of psychosocial hazards are under control and the top management is dealing with this topic systematically. However, some issues have to be emphasized such as emotionally hard work, low influence of work, work-life conflict, leadership quality issues and justice and respect in the organization.

A large number (42.3%) of respondents find the job emotionally difficult to a large or medium extent. However, employees are less likely to feel that work often puts them in emotional situations - only 9.3% of employees felt that this happens always or often and 36% of employees claimed this occurs from time to time. Psychological counselling is available for everyone among fire fighters. There is also guidance material for staff on how to deal with psychologically difficult situations. The counselling service is divided into individual counselling and team counselling. However, interviews revealed that fire fighters are aware of the counselling service offered by psychologists, but do not actively use it, as they are more accustomed to discuss difficult situations in a team right after the fire/rescue event has occurred. In addition, long experience helps to cope with mental stress on its own. Still, there is a concern about less experienced or new employees who may face

difficulties to deal with such emotional situations, which may eventually lead to burnout and other mental health issues. Interviewees shared the opinion that the counselling service is a passive measure which is not effective in reality and needs to be improved. Earlier research has proved that high emotional and quantitative demands are influential and strongly associated with stress, sleep disturbance, burnout, as well as poor health outcomes [10].

### *3.2.1 Leadership quality, justice, and respect*

The quality of management is measured by employees' assessment of the management skills and competences of their line manager. Fire fighters rate the quality of management as average. There can be a variety of reasons for some dissatisfaction such as inappropriate management style, rotation of commanders, lack of flexibility, etc. The conflict resolution skills of line managers received rather high praise: *'Our leader is human. He is a former rescuer, that's why he understands. If there is a problem to solve, he solves it quickly'* (Int 26). However, some critique was also communicated such as *'Our manager is more of an administrator, ... passing on information, doing what he's told. He tells little positive words to us.'*(Int 24). Similar issues were observed from the results of quantitative study. Especially, the respondents felt that the feedback from managers is poor: only 29.3% of respondents said that their manager always or often tells them how they are doing at work. A similar proportion (27.5%) of respondents were not satisfied with the feedback they receive from their manager: they felt that their manager very rarely tells them how they are doing at work; and 40% of employees felt that their manager gives only occasional feedback.

The organisational factor of justice and respect looks at conflict management in the organisation as well as management's recognition of the employee (whether the employee feels that employee suggestions are taken seriously and employees are involved, whether work and responsibilities are distributed fairly). This factor is also related to other factors, such as how the employee feels valued, recognised, and supported by management. For all questions about justice and respect, there were respondents who did not know how to assess fairness and respect in an organisation. For example, 20.8% of respondents could not answer whether conflicts are resolved fairly in the organisation. A large proportion (41.5%) of respondents considered that conflicts are partially resolved fairly.

Additionally, 21.8% of respondents presumed that good work is adequately rewarded. On the other hand, 27.5% of employees were not satisfied with recognition and 44% of respondents thought that there is some recognition for good work. Only 10.8% of respondents thought that management takes employee suggestions seriously; a further 32.5% thought that employee suggestions are considered to some extent. Of the respondents, 36% found that management does not take employee suggestions seriously. Again, a large number (20.8%) did not know how to assess this issue. During interviews, lack of employee involvement in decision-making processes, such as the selection of work-wear and personal protective equipment, was highlighted. For example: *'There is a feeling that we are asked for our opinion, but we are not listened to and nothing changes... I don't think anything will change and there is no motivation to contribute anymore.*' (Int 57)

### *3.2.2 Work-life conflict*

The factor with the highest variance is the work-life conflict factor, which suggests that, depending on fire fighters' marital status and/or the presence of children, they perceive work-life conflict differently - those with a family at home generally rated work-life conflict higher than those without a partner or without minor children in the household.

This is expectable, given the specific nature of work, which is based on shifts that requires time away from home, including at night.

The results of the study showed that working at the rescue services is, on the whole, quite compatible with family life: 42.8% of respondents consider that there are no problems in reconciling family and work life, and only 0.8% of respondents say that there are challenges all the time. However, more than half (51%) of respondents confessed that they have either occasionally or seldom problems with work-life balance. Correlation analysis showed whether and how work and family life are related to physical and emotional exhaustion and whether there is time to be physically active (exercise). Physical exhaustion is strongly associated with emotional exhaustion ($\rho = 0.492$) and work-life conflict ($\rho = 0.318$). There is also a strong association with work-family conflict and emotional exhaustion ($\rho = 0.399$). From the results, it can be concluded that the more a worker feels that his/her work-life balance is not achieved, the more likely he/she is to experience physical and emotional exhaustion (manifestations of physical and emotional exhaustion). These results are similar to those of Abendroth and den Dulk [11].

### 3.3 Culture of workers' physical and mental health

As a recommendation, a model for developing a culture that promotes workers' physical and mental health and was given addressing the issues discussed above. The model is based on Gunther et al [12] with objectives of 4 blocks: Why? Who? What? and How? (Fig. 1).

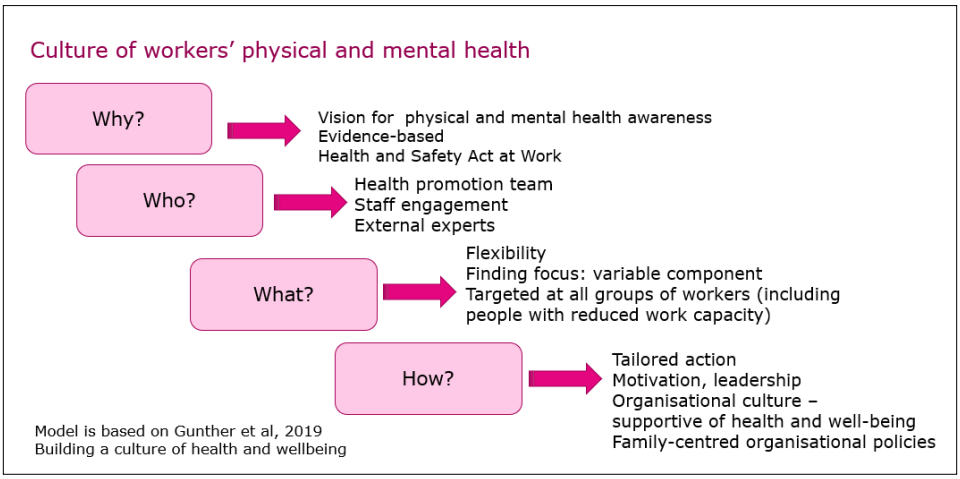


**Figure 1.** Model for developing a culture that promotes workers' physical and mental health.

The employer should have a clear vision for physical and mental health awareness, which is reflected in their health and safety politics. The vision should be based on scientifically proven data. A health promotion team should also actively engage staff for developing the new framework for promoting physical and mental health among fire fighters, but keeping in mind that external experts should contribute with high-level knowledge and comprehensive programmes. In order to build up the culture of workers' mental and physical health, flexibility is needed to accommodate different age groups, genders, locations, preferred activities, as well as working capacity. Finally, leadership support is an integral part of success in order to create an organizational culture, which supports workers' health and well-being.

## 4 Conclusions

The present study identified the health behavioural habits, attitudes, and awareness of fire fighters and assessed their psychosocial hazards at work. In summary, it can be said that there is a high level of health awareness, good physical activity, healthy diet, and awareness of the need for adequate sleep among fire fighters. Most of the psychosocial hazards are under control and are systematically addressed at management level. However, some issues need to be addressed such as exhaustive shift work, emotionally difficult work, little recognition for good work, challenges in work-life balance. It was also learned that mental fitness and psychosocial well-being of fire fighters receive less attention and support due to several contextual factors. A model for developing a culture that promotes workers' physical and mental health was developed.

The findings have implications for health and safety management and health promotion in order to find more solutions for future activities to support and ensure the high work performance of fire fighters.

## References

1. S. Igboanugo, P.L. Bigelow, J.G. Mielke, Health outcomes of psychosocial stress within firefighters: A systematic review of the research landscape. J Occup Health **63**(1), e12219 (2021)
2. J. Melius, Occupational health for firefighters, Occup Med. **16**(1), 101-8 (2001)
3. J. Brown, J. Stickford, Physiological stress associated with structural firefighting observed in professional firefighters, (Indiana University Firefighters Health and Safety Research, Bloomington, 2009)
4. D. Kang, L.K. Davis, P. Hunt, D. Kriebel, Cancer incidence among male Massachusetts firefighters, 1987–2003, Americal J Ind Med. **51**(5), 329-335 (2008)
5. G.K. LeMasters, A.M. Genaidy, P. Succop, J. Deddens, T. Sobeih, H. Barriera-Viruet, K. Dunning, J. Lockey, Cancer risk among firefighters: a review and meta-analysis of 32 studies, J Occup Environ Med **48**(11), 1189-1202 (2006)
6. B. Cook, W. Mitchell, Occupational health effects for firefighters: The extent and implications of physical and psychological injuries. *The high rates of mental health conditions experienced by first responders, emergency service workers and volunteers* **70**(6) (Centre of Full Employment and Equity, 2013)
7. M.A. Michaelides, K.M. Parpa, L.J. Henry, G.B. Thompson, B.S. Brown, Assessment of physical fitness aspects and their relationship to firefighters' job abilities, J Strength Cond Res. **25**(4), 956-65 (2011)
8. F. Perroni, L. Guidetti, L. Cignitti, C. Baldari, Psychophysiological Responses of Firefighters to Emergencies: A Review, The Open Sports Sciences Journal **7**(1), 8-15 (2014)
9. T. Kristensen, H. Hannerz, A. Hogh, V. Borg, The Copenhagen Psychosocial Questionnaire-a tool for the assessment and improvement of the psychosocial work environment. Scandinavian Journal of Work Environment and Health **31**(6), 438-449 (2005)
10. J.Y. Wong, J.-H. Lin, S.H. Liu, T.-H. Wan, Fireman's job stress: Integrating work/non-work conflict with job demand-control-support model, Revue européenne de psychologie appliquée **64**(2), 83-91 (2014)

11. A.-K. Abendroth, L. den Dulk, Support for the work-life balance in Europe: the impact of state, workplace and family support on work-life balance satisfaction, Work, employment and society **25**(2), 234-256 (2011)
12. C.E. Gunther, V. Peddicord, J. Koslowski, D. Menture, R. Fabius, S.G. Frazee, P.J. Nigro, Building a Culture of Health and Wellbeing at Merck, Population Health Management **22**(5), 449-456 (2019)