



## Health problems among Swedish ambulance personnel: long-term risks compared to other professions in Sweden – a longitudinal register study

Kåre Karlsson, Salmir Nasic, Lars Lundberg, Jan Mårtensson & Anders Jonsson

To cite this article: Kåre Karlsson, Salmir Nasic, Lars Lundberg, Jan Mårtensson & Anders Jonsson (2021): Health problems among Swedish ambulance personnel: long-term risks compared to other professions in Sweden – a longitudinal register study, *International Journal of Occupational Safety and Ergonomics*, DOI: [10.1080/10803548.2020.1867400](https://doi.org/10.1080/10803548.2020.1867400)

To link to this article: <https://doi.org/10.1080/10803548.2020.1867400>



© 2021 Central Institute for Labour Protection – National Research Institute (CIP-PIB). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 02 Mar 2021.



Submit your article to this journal [↗](#)



Article views: 524



View related articles [↗](#)



View Crossmark data [↗](#)

## Health problems among Swedish ambulance personnel: long-term risks compared to other professions in Sweden – a longitudinal register study

Kåre Karlsson <sup>a,b,c\*</sup>, Salmir Nasic <sup>b</sup>, Lars Lundberg <sup>d</sup>, Jan Mårtensson <sup>c</sup> and Anders Jonsson <sup>d,e</sup>

<sup>a</sup>Ambulance Services, Skaraborg Hospital, Sweden; <sup>b</sup>Research and Development Centre, Skaraborg Hospital, Sweden; <sup>c</sup>School of Health and Welfare, Jönköping University, Sweden; <sup>d</sup>School of Health Sciences, Borås University, Sweden; <sup>e</sup>The Swedish Armed Forces, Centre for Defence Medicine, Sweden

**Objectives.** This study aimed to investigate whether Swedish ambulance personnel differ in the extent of suffering from health problems compared to other occupational groups. **Methods.** Two cohorts of ambulance personnel from 2001 and 2008, with 1778 and 2753 individuals, respectively, were followed regarding assignment of diagnostic coding (International Classification of Diseases codes) until 2016. These two cohorts represent all who were employed as ambulance personnel by public employers during these years. Two comparison groups were added: other healthcare workers and other professions. All data were retrieved from national registers. The  $\chi^2$  test was used for statistical calculation. **Results.** Swedish ambulance personnel are at a significantly higher risk of being affected by ‘Paroxysmal tachycardia, atrial fibrillation and flutter, other cardiac arrhythmias’, by ‘Other intervertebral disc disorders’ and by ‘Arthropathies’, when compared to both comparison groups in both cohorts. Almost similar results were seen for ‘Gonarthrosis’ and for ‘Dorsopathies’. **Conclusions.** Swedish ambulance personnel run the risk of being affected by certain diseases and injuries to a greater extent compared to other professions.

**Keywords:** Ambulance personnel; occupational injury; work-related diseases; work-related stress; register study

### 1. Background

Long-term work in ambulance care is shown to be correlated with certain health problems and these problems may vary in different countries. It is generally seen that work in the ambulance environment causes both chronic and acute work-related stress, which is something that in turn may cause, e.g., cardiovascular diseases (CVD). Other diseases related to work-related stress are post-traumatic stress disorder (PTSD), sleeping problems and obesity [1]. Violence and threats of violence are likely to induce stress-related problems for ambulance personnel (AP) worldwide [2]. In a Turkish study, 94.9% of AP were exposed to verbal threats and 39.9% to physical violence [3].

Sleep and sleep quality can be affected by work-related stress [4]. It has been seen among firefighters in North America that night work can lead to sleep disorders and mental health problems that, by extension, can be associated with an increased risk of burnout [5]. Previous studies have also shown that Swedish AP run the risk of developing symptoms of PTSD [6] and that among those who experienced a traumatic event in the profession, up to 15% later showed signs of a severe stress reaction [7].

A high prevalence of work-related stress can be associated with an increased incidence of CVD [8,9]. This

risk was increased among participants who reported both job-related stress and an unhealthy lifestyle [10]. Work-related stress causes an increased risk of stroke, especially for women [11]. In terms of colorectal, lung, breast and prostate cancer, work-related stress does not appear to be a significant risk [12].

At least two health problems in the form of sleep problems, headache or stomach symptoms have been reported among 25% of female and 20% of male AP [13]. It has also been shown that work-related stress can lead to numerous gastrointestinal disorders, such as irritable bowel syndrome, peptic ulcer and gastroesophageal reflux disease [14]. However, in a literature study, symptoms of anxiety and depression were lower among ambulance staff compared to the rest of the population [15], and in a Danish study, mental health among AP seems to be equivalent to other workforces [16].

Commonly reported injuries for AP are sprains and strains, often located in the neck and back [17,18]. A consequence of back pain is, in addition to limitations in both daily life and working life, a fear of not being able to continue working in the ambulance profession [19]. In an Australian study, it emerged that AP had up to 13 times the risk of musculoskeletal injuries compared to nurses in general [20].

\*Corresponding author. Email: [kare.karlsson@gmail.com](mailto:kare.karlsson@gmail.com)

© 2021 Central Institute for Labour Protection – National Research Institute (CIOP-PIB). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.

This study highlights the health problems that are more likely to affect Swedish AP, as compared to other health-care professionals and other occupational groups in Sweden, which is a question that previously has drawn limited attention in Sweden.

### 1.1. Aim

The aim of this study was to investigate whether Swedish AP differ in the extent of suffering from health problems compared to other occupational groups.

## 2. Methods

### 2.1. Cohorts

Two cohorts were selected: those who were employed in Sweden as AP in 2001; and those who were employed as AP in 2008. The reason for choosing these particular years is that 2001 is the first year that AP were distinguished as a profession by the employers' organization Swedish Association of Local Authorities and Regions, while 2008 was chosen because paramedics and ambulance nurses were separated as different professional groups from this year. A major organizational change in working conditions for Swedish AP took place in 2005. This year, a demand was introduced which meant that a registered nurse was required to administer drugs. This meant that the level of competence gradually increased until 2005. To these two cohorts were added two comparison groups, one consisting of other healthcare workers (HCW) and the other of occupational groups outside health care. These comparison groups were matched in terms of age, gender, level of education and region in which they lived to make them as comparable as possible. The mean age in the 2001 cohort for AP was 42.4 years, vs 42.4 years for other HCW and 42.4 years for other occupational groups. In terms of gender, 82.4% were male among ambulance staff vs 82.2% for other HCW and 82.4% among other occupational groups. Corresponding data for cohort 2008 were 43.7 years vs 43.7 and 43.7 years, respectively, and regarding gender were 76.1% men vs 75.9% and 76.1% men, respectively. No individuals were found in both cohorts, as those included in the cohort from 2001 are excluded from the 2008 cohort by Statistics Sweden, a government agency that brings official statistics to the public.

### 2.2. Data collection

Each cohort was followed up annually until 2016 for diagnosis in the form of International Classification of Diseases (ICD) codes they had sought in county health care. All data regarding the cohorts were compiled by Statistics Sweden, which also created serial numbers in order to ensure anonymity of the individuals. Serial numbers along with social security numbers were sent to the National Board

of Health and Welfare, which compiled a register for the ICD codes sought for based on the serial numbers. In order to ensure that no individual would appear several times in the material, the disease that they sought medical care for could only appear once as a main diagnosis and once as a secondary diagnosis. The only exclusion criterion for the comparison groups was unemployment since all AP were working.

### 2.3. Data analysis

The ambulance group was compared to each of the two control groups with respect to the presence of different diagnoses. As we dealt with comparisons of counts and proportions, the  $\chi^2$  test was performed to detect statistically significant differences.  $p < 0.05$  was considered statistically significant. For the statistical analysis, SPSS version 25.0 was used.

## 3. Results

As presented in Table 1, both significant higher and lower frequencies of diseases according to ICD-10 could be found when comparing AP with HCW and other professions (OP).

Lower risk is seen in 'Endocrine, nutritional and metabolic diseases' (E00–E90) and 'Mental and behavioural disorders' (F00–F99) when comparing AP and HCW in both cohort 2001 and cohort 2008. For cohort 2001, also 'Congenital malformations, deformations and chromosomal abnormalities' (Q00–Q99) 'Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified' (R00–R99) and 'Injury, poisoning and certain other consequences of external causes' (S00–T98) show a significant difference between AP and HCW. There were no significant differences in which AP had a lower risk compared to OP in any ICD-10 main group (Table 1).

Significantly higher risks were found among AP in the following ICD-10 main groups: 'Diseases of the circulatory system' (I00–I99), AP vs OP in both cohort 2001 and cohort 2008; 'Diseases of the digestive system' (K00–K93), AP vs OP was significant in cohort 2001; and 'Diseases of the musculoskeletal system and connective tissue' (M00–M99), a significant difference in AP vs HCW and OP in both cohort 2001 and cohort 2008 (Table 1).

Table 2 shows in closer detail for 'Diseases of the circulatory system' (I00–I99) that AP has significantly higher risk for 'Hypertensive diseases' (I10–I15) than OP in cohort 2001. In 'Other forms of heart disease' (I30–I52), there is a significant risk in cohort 2008 for AP vs both HCW and OP but not in cohort 2001. In more detail, there is a significant risk for 'Paroxysmal tachycardia, atrial fibrillation and flutter, other cardiac arrhythmias' (I47–I49) for AP vs both HCW and OP in both cohort 2001 and

Table 1. Swedish ambulance personnel compared to healthcare workers and other professions according to ICD-10 main groups.

Main group according to ICD-10	$p^a; p^b$	Cohort 2001			$p^a; p^b$	Cohort 2008		
		Ambulance personnel ( $n = 1778$ ) (%)	Healthcare workers ( $n = 1763$ ) (%)	Other professions ( $n = 1777$ ) (%)		Ambulance personnel ( $n = 2753$ ) (%)	Healthcare workers ( $n = 2725$ ) (%)	Other professions ( $n = 2747$ ) (%)
Certain infectious and parasitic diseases (A00–B99)	0.192; 0.296	7.5	8.7	6.6	0.373; 0.411	4.8	4.3	4.3
Neoplasms (C00–D48)	0.747; 0.447	7.8	8.1	7.1	0.916; 0.221	4.8	4.7	4.1
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50–D89)	0.314; 0.511	2.2	2.8	2.6	0.231; 0.476	1.4	1.0	1.2
Endocrine, nutritional and metabolic diseases (E00–E90)	0.002 <sup>c</sup> ; 0.497	8.2	11.2	7.6	0.019 <sup>c</sup> ; 0.540	4.2	5.5	4.5
Mental and behavioural disorders (F00–F99)	<0.001 <sup>c</sup> ; 0.616	5.9	9.2	5.5	0.003 <sup>c</sup> ; 0.261	3.5	5.2	3.0
Diseases of the nervous system (G00–G99)	0.701; 0.390	4.2	4.5	3.7	0.754; 0.071	2.6	2.8	1.9
Diseases of the eye and adnexa (H00–H59)	0.057; 0.250	0.4	0.9	0.7	0.767; 0.223	0.2	0.3	0.4
Diseases of the ear and mastoid process (H60–H95)	0.581; 0.763	0.3	0.5	0.3	0.727; 0.998	0.1	0.2	0.1
Diseases of the circulatory system (I00–I99)	0.768; 0.009 <sup>d</sup>	20.6	21.0	17.2	0.397; 0.040 <sup>d</sup>	11.7	10.9	9.9
Diseases of the respiratory system (J00–J99)	0.760; 0.447	7.8	7.5	7.1	0.165; 0.987	3.6	4.4	3.6
Diseases of the digestive system (K00–K93)	0.204; 0.007 <sup>d</sup>	13.3	11.9	10.4	0.380; 0.108	7.2	7.8	6.1
Diseases of the skin and subcutaneous tissue (L00–L99)	0.076; 0.732	1.0	1.7	0.9	0.211; 0.700	0.5	0.7	0.5
Diseases of the musculoskeletal system and connective tissue (M00–M99)	0.017 <sup>d</sup> ; <0.001 <sup>d</sup>	13.9	11.2	9.4	0.031 <sup>d</sup> ; 0.002 <sup>d</sup>	7.8	6.3	5.7
Diseases of the genitourinary system (N00–N99)	0.668; 0.760	4.0	4.3	3.8	0.222; 0.762	1.7	2.2	1.6
Congenital malformations, deformations and chromosomal abnormalities (Q00–Q99)	<0.001 <sup>c</sup> ; 0.205	0.2	1.1	0.4	0.310; 0.477	0.1	0.2	0.2
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99)	<0.001 <sup>c</sup> ; 0.111	8.8	12.1	7.4	0.375; 0.056	4.8	5.4	3.4
Injury, poisoning and certain other consequences of external causes (S00–T98)	0.009 <sup>c</sup> ; 0.793	6.0	8.2	5.4	0.616; 0.619	3.6	3.9	3.4
Factors influencing health status and contact with health services (Z00–Z99)	0.164; 0.793	11.1	12.6	10.8	0.707; 0.261	6.5	6.5	5.5

<sup>a</sup> $p$  value when ambulance personnel were compared to healthcare workers.

<sup>b</sup> $p$  value when ambulance personnel were compared to other professions.

<sup>c</sup>When ambulance personnel had lower risk compared to one or both control groups.

<sup>d</sup>When ambulance personnel had higher risk compared to one or both control groups.

Note: Statistical significance was considered to exist if  $p < 0.05$ ,  $\chi^2$  test. ICD = International Classification of Diseases.

cohort 2008. In ‘Hernia, noninfective enteritis and colitis, other diseases of intestines, diseases of peritoneum’ (K40–K67) we found a significant risk for AP vs OP in cohort 2001. In ‘Diseases of the musculoskeletal system and connective tissue’ (M00–M99), there was a significant risk for ‘Arthropathies’ (M00–M25) for AP vs OP in cohort 2001 and AP vs HCW and OP in cohort 2008. For ‘Gonarthrosis [arthrosis of knee]’ (M17), this was true for AP vs HCW and OP in cohort 2001 and AP vs OP in cohort 2008. For ‘Dorsopathies’ (M40–M54), risk was significant for AP vs HCW and OP in cohort 2001 and AP vs OP in cohort 2008. ‘Other intervertebral disc disorders’ (M51) was significant for AP vs HCW and OP in both cohort 2001 and cohort

2008. ‘Soft tissue disorders’ (M60–M79) was significant for AP vs OP in cohort 2008 (Table 2).

#### 4. Discussion

Our results show that AP had an increased risk of suffering from various CVD and especially of different types of atrial fibrillation. Why cardiac arrhythmias affect AP to a greater extent compared to OP has not been investigated, but one cause for atrial fibrillation is work-related stress [21–23] as well as long working hours [24], which is included as part of the practice of ambulance care. Despite some support from one cohort that AP suffer from high blood pressure

Table 2. ICD-10 subgroups where Swedish ambulance personnel have a higher risk compared to the control groups.

Subgroup according to ICD-10	$p^a; p^b$	Cohort 2001			$p^a; p^b$	Cohort 2008		
		Ambulance personnel ( $n = 1778$ ) (%)	Healthcare workers ( $n = 1763$ ) (%)	Other professions ( $n = 1777$ ) (%)		Ambulance personnel ( $n = 2753$ ) (%)	Healthcare workers ( $n = 2725$ ) (%)	Other professions ( $n = 2747$ ) (%)
Hypertensive diseases (I10–I15)	0.253; 0.017 <sup>c</sup>	12.5	13.8	10.0	1.000; 0.203	7.1	7.1	6.3
Other forms of heart disease (I30–I52)	0.087; 0.055	7.7	6.5	6.1	0.001 <sup>c</sup> ; 0.001 <sup>c</sup>	4.1	2.5	2.5
Paroxysmal tachycardia, atrial fibrillation and flutter, other cardiac arrhythmias (I47–I49)	0.012 <sup>c</sup> ; 0.005 <sup>c</sup>	6.1	4.3	4.1	<0.001 <sup>c</sup> ; <0.001 <sup>c</sup>	3.3	1.7	1.6
Hernia, noninfective enteritis and colitis, other diseases of intestines, diseases of peritoneum (K40–K67)	0.287; 0.010 <sup>c</sup>	6.5	5.6	4.5	0.758; 0.501	3.4	3.2	3.1
Arthropathies (M00–M25)	0.258; 0.016 <sup>c</sup>	7.3	6.4	5.3	0.007 <sup>c</sup> ; 0.019 <sup>c</sup>	4.5	3.1	3.3
Gonarthrosis [arthrosis of knee] (M17)	0.034 <sup>c</sup> ; 0.001 <sup>c</sup>	3.0	1.9	1.4	0.246; 0.001 <sup>c</sup>	1.5	1.1	0.5
Dorsopathies (M40–M54)	0.003 <sup>c</sup> ; <0.001 <sup>c</sup>	5.6	3.5	2.8	0.244; 0.018 <sup>c</sup>	2.7	2.2	1.7
Other intervertebral disc disorders (M51)	<0.001 <sup>c</sup> ; <0.001 <sup>c</sup>	2.2	0.7	0.6	0.037 <sup>c</sup> ; 0.013 <sup>c</sup>	1.1	0.6	0.5
Soft tissue disorders (M60–M79)	0.858; 0.307	2.5	2.4	2.0	0.644; 0.017 <sup>c</sup>	1.2	1.1	0.6

<sup>a</sup> $p$  value when ambulance personnel were compared to healthcare workers.

<sup>b</sup> $p$  value when ambulance personnel were compared to other professions.

<sup>c</sup>When ambulance personnel had higher risk compared to one or both control groups.

Note: Statistical significance was considered to exist if  $p < 0.05$ ,  $\chi^2$  test. ICD = International Classification of Diseases.

to a greater extent, we cannot say, as in previous studies [25], that this is true in Sweden. One contributing factor may be that we did not have access to data from primary health care, where many seek treatment and are treated for this particular disease.

Other studies have shown that AP suffer from neck and back problems [17, 18, 20], which is also proven true among Swedish AP in this study. We found that especially arthrosis of knee, dorsopathies and intervertebral disc disorders affected AP. This may not be surprising since the professional work involves heavy lifting, and moving patients in spaces that are not adapted to this type of work and can also be narrow, e.g., in patients' homes. In addition, it is common to work outdoors in the cold and dark, which increases the risk of sprains and strains. Working in the ambulance profession also means being a professional driver. Therefore, it is not surprising that arthrosis of the knee is one of the diseases affecting this profession. It was seen that pain from knees increased in taxi drivers with the time they sat behind the wheel [26, 27]. Both arthrosis of the knee and neck and back pain can be linked to professions such as bus driver, truck driver and taxi driver [28, 29]. One possible explanation could be the long periods of prolonged sitting behind the steering wheel and low-frequency vibrations from the vehicle.

We also found ICD-10 groups where there were benefits for AP. This was true for 'Endocrine, nutritional and metabolic diseases' (E00–E90) where, e.g., diabetes is found. This was true for both cohorts when AP were compared to other HCW. One contributing reason for this may

be that in many regions in Sweden, ambulance organizations do not employ people with type 1 diabetes. However, we do not have access to data from the primary health care, and diabetes is a disease that is largely handled within this level of care, so the numbers might have been a little different if data from the primary health care had been available.

We also found that there was a positive outcome in 'Mental and behavioural disorders' (F00–F99) for AP in both cohorts compared to HCW. The reason for this, however, is difficult to state. With regard to the 'Congenital malformations, deformations and chromosomal abnormalities' (Q00–Q99) group, the numbers are so small that it does not take as many individuals to make an impact. The significance seen in cohort 2001 for AP compared to HCW may be due to the fact that, before and shortly after the turn of the millennium, some of the individuals with so-called congenital malformations were employed in the healthcare system on special employments in order to give these individuals jobs. Similarly, in 'Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified' (R00–R99) and 'Injury, poisoning and certain other consequences of external causes' (S00–T98) we see a better outcome for AP compared to healthcare personnel in cohort 2001. We cannot find an explanation in our material for why that is.

An important measure to prevent and avoid health problems from occurring is that the employer provides regular occupational health care for early detection. For cardiac arrhythmias, known risk factors that could be detected

early and treated can be high blood pressure and obesity [30]. When it comes to arthrosis of the knee and back problems, it is desirable to offer and develop personal training programmes when personnel are hired and to dedicate paid working hours to the same training to prevent injuries. The introduction, training with and use of various lifting aids when applicable would probably also reduce the incidence of sprains and strains in ambulance care [31].

## 5. Limitations

### 5.1. Strengths and weaknesses

The strength of this study is that the data requested each year are reported from both hospitals and employers to Statistics Sweden and the National Board of Health and Welfare, respectively, where they can then be used, e.g., for research. This means that the data can be followed up annually and are both valid and reliable. There are no dropouts in the cohorts, except for deaths, so all individuals are followed throughout the study period.

The main weakness is that we did not have access to data from primary care, which could have led to some ICD groups looking different. Another weakness is that none of the private ambulance companies wanted to participate, nor state how many employees they had in the two years in question, 2001 and 2008. The number of employees in these companies is not so great, as most ambulances are operated by the public health service in Sweden, but this still leads to some uncertainty.

## 6. Conclusion

The findings in this study show that Swedish AP run the risk of being affected by atrial fibrillation, knee arthritis and back problems, including intervertebral disc disorders, to a higher extent than other occupational groups. Better utilization of occupational health care and use of various lifting aids could probably prevent some of these health problems.

### Disclosure statement

No potential conflict of interest was reported by the authors.

### Ethics approval

Ethical permission for the study was obtained from the Regional Ethical Review Board in Gothenburg, dated 22 February 2017, with Dno: 024-17.

### Availability of data and materials

The data that support the findings of this study are available from Research and Development Centre, Skaraborg Hospital, Skövde, Sweden but restrictions apply to the availability of these data, which were used under license for the current study, and so are

not publicly available. Data are, however, available from the corresponding author upon reasonable request and with permission of the Regional Ethical Review Board in Gothenburg.

### Funding

Research Fund at Skaraborg Hospital, Skövde, Sweden provided the means required to access data [Grant FoU VGSKAS-931695].

### ORCID

Salmir Nasic  <http://orcid.org/0000-0003-0437-3958>

Lars Lundberg  <http://orcid.org/0000-0003-0453-6913>

Anders Jonsson  <http://orcid.org/0000-0001-7928-7021>

Jan Mårtensson  <http://orcid.org/0000-0002-7406-8732>

Kåre Karlsson  <http://orcid.org/0000-0003-4626-5824>

### References

- [1] Hegg-Deloye S, Brassard P, Jauvin N, et al. Current state of knowledge of post-traumatic stress, sleeping problems, obesity and cardiovascular disease in paramedics. *Emerg Med J.* 2013;emermed-2012;31(3):201672.
- [2] Maguire BJ, O'Meara P, O'Neill BJ, et al. Violence against emergency medical services personnel: a systematic review of the literature. *Am J Ind Med.* 2018;61(2):167–180. doi:10.1002/ajim.22797
- [3] Gülen B, Serinken M, Hatipoğlu C, et al. Work-related injuries sustained by emergency medical technicians and paramedics in Turkey. *Ulus Travma Acil Cerrahi Derg.* 2016;22(2):145–149.
- [4] Åkerstedt T. Psychosocial stress and impaired sleep. *Scand J Work Environ Health.* 2006;32(6):493–501. doi:10.5271/sjweh.1054
- [5] Wolkow AP, Barger LK, O'Brien CS, et al. Associations between sleep disturbances, mental health outcomes and burnout in firefighters, and the mediating role of sleep during overnight work: a cross-sectional study. *J Sleep Res.* 2019;28:e12869.
- [6] Jonsson A, Segesten K. Daily stress and concept of self in Swedish ambulance personnel. *Prehospital Dis Med.* 2004;19(3):226–234. doi:10.1017/S1049023X00001825
- [7] Jonsson A, Segesten K, Mattsson B. Post-traumatic stress among Swedish ambulance personnel. *Emerg Med J.* 2003;20(1):79–84. doi:10.1136/emj.20.1.79
- [8] Chandola T, Britton A, Brunner E, et al. Work stress and coronary heart disease: what are the mechanisms? *Eur Heart J.* 2008;29(5):640–648. doi:10.1093/eurheartj/ehm584
- [9] Thayer JF, Yamamoto SS, Brosschot JF. The relationship of autonomic imbalance, heart rate variability and cardiovascular disease risk factors. *Int J Cardiol.* 2010;141(2):122–131. doi:10.1016/j.ijcard.2009.09.543
- [10] Kivimäki M, Nyberg ST, Fransson EI, et al. Associations of job strain and lifestyle risk factors with risk of coronary artery disease: a meta-analysis of individual participant data. *Can Med Assoc J.* 2013;185(9):763–769. doi:10.1503/cmaj.121735
- [11] Huang Y, Xu S, Hua J, et al. Association between job strain and risk of incident stroke: a meta-analysis. *Neurology.* 2015;85(19):1648–1654. doi:10.1212/WNL.0000000000002098
- [12] Heikkilä K, Nyberg ST, Theorell T, et al. Work stress and risk of cancer: meta-analysis of 5700 incident cancer events

- in 116 000 European men and women. *BMJ*. 2013;346:f165. doi:10.1136/bmj.f165
- [13] Aasa U, Brulin C, Angquist KA, et al. Work-related psychosocial factors, worry about work conditions and health complaints among female and male ambulance personnel. *Scand J Caring Sci*. 2005;19(3):251–258. doi:10.1111/j.1471-6712.2005.00333.x
- [14] Konturek PC, Brzozowski T, Konturek S. Stress and the gut: pathophysiology, clinical consequences, diagnostic approach and treatment options. *J Physiol Pharmacol*. 2011;62(6):591–599.
- [15] Sterud T, Hem E, Ekeberg Ø, et al. Health problems and help-seeking in a nationwide sample of operational Norwegian ambulance personnel. *BMC Public Health*. 2008;8(1):3. doi:10.1186/1471-2458-8-3
- [16] Hansen CD, Rasmussen K, Kyed M, et al. Physical and psychosocial work environment factors and their association with health outcomes in Danish ambulance personnel – a cross-sectional study. *BMC Public Health*. 2012;12(1):534. doi:10.1186/1471-2458-12-534
- [17] Reichard AA, Jackson LL. Occupational injuries among emergency responders. *Am J Ind Med*. 2010;53(1):1–11.
- [18] Sterud T, Ekeberg Ø, Hem E. Health status in the ambulance services: a systematic review. *BMC Health Serv Res*. 2006;6(1):82. doi:10.1186/1472-6963-6-82
- [19] Randhawa SM, Hay-Smith J, Grainger R. The experience of lower back pain and its treatment among ambulance officers in New Zealand: a qualitative study. *Aust J Paramed*. 2019;16. doi:10.33151/ajp.16.617
- [20] Roberts MH, Sim MR, Black O, et al. Occupational injury risk among ambulance officers and paramedics compared with other healthcare workers in Victoria, Australia: analysis of workers' compensation claims from 2003 to 2012. *Occup Environ Med*. 2015;72(7):489–495. doi:10.1136/oemed-2014-102574
- [21] Graff S, Prior A, Fenger-Grøn M, et al. Does perceived stress increase the risk of atrial fibrillation? A population-based cohort study in Denmark. *Am Heart J*. 2017;188:26–34. doi:10.1016/j.ahj.2017.03.002
- [22] Fransson EI, Nordin M, Magnusson Hanson LL, et al. Job strain and atrial fibrillation – results from the Swedish Longitudinal Occupational Survey of Health and meta-analysis of three studies. *Eur J Prev Cardiol*. 2018;25(11):1142–1149. doi:10.1177/2047487318777387
- [23] Fransson EI, Stadin M, Nordin M, et al. The association between job strain and atrial fibrillation: results from the Swedish WOLF study. *BioMed Res Int*. 2015;2015:1–7. doi:10.1155/2015/371905
- [24] Kivimäki M, Nyberg ST, Batty GD, et al. Long working hours as a risk factor for atrial fibrillation: a multi-cohort study. *Eur Heart J*. 2017;38(34):2621–2628. doi:10.1093/eurheartj/ehx324
- [25] Kales SN, Tsismenakis AJ, Zhang C, et al. Blood pressure in firefighters, police officers, and other emergency responders. *Am J Hypertens*. 2009;22(1):11–20. doi:10.1038/ajh.2008.296
- [26] Chen J-C, Dennerlein JT, Shih TS, et al. Knee pain and driving duration: a secondary analysis of the Taxi Drivers' Health Study. *Am J Public Health*. 2004;94(4):575–581. doi:10.2105/AJPH.94.4.575
- [27] Murray KE, Buul A, Aden R, et al. Occupational health risks and intervention strategies for US taxi drivers. *Health Promot Int*. 2019;34(2):323–332. doi:10.1093/heapro/dax082
- [28] Rossignol M. Primary osteoarthritis and occupations: a national cross sectional survey of 10 412 symptomatic patients. *Occup Environ Med*. 2003;60(11):882–886. doi:10.1136/oem.60.11.882
- [29] Szeto GP, Lam P. Work-related musculoskeletal disorders in urban bus drivers of Hong Kong. *J Occup Rehabil*. 2007;17(2):181–198. doi:10.1007/s10926-007-9070-7
- [30] Grundvold I, Skretteberg PT, Liestøl K, et al. Upper normal blood pressures predict incident atrial fibrillation in healthy middle-aged men. *Hypertension*. 2012;59(2):198–204. doi:10.1161/HYPERTENSIONAHA.111.179713
- [31] Harrison J, Dawson L. Occupational health: meeting the challenges of the next 20 years. *Saf Health Work*. 2016;7(2):143–149. doi:10.1016/j.shaw.2015.12.004