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Journal articles marked with an asterisk indicate an IWH scientist or adjunct scientist is included in the list of authors.

Burstyn I and Holt K. A cross-sectional survey of the workplace factors contributing to symptoms of anxiety and depression among nurses and physicians during the first wave of COVID-19 pandemic in two US healthcare systems. *Annals of Work Exposures and Health*. 2022; 66(3):312-333.

<https://doi.org/10.1093/annweh/wxab085> [open access]

Abstract: BACKGROUND: Anxiety and depression among physicians and nurses during the COVID-19 pandemic in the USA are not well described and their modifiable causes are poorly understood. METHODS: We conducted a cross-sectional survey of symptoms of anxiety and depression (Hospital Anxiety and Depression Scale) among physicians and nurses in two US healthcare systems in June through September 2020; participation rate was 5-10%. We described features of work as well as their perceptions and associated concerns in relation to the risk of anxiety and depression, while controlling for health history via regression and path analyses. RESULTS: About a third of 684 nurses and 185 physicians surveyed showed symptoms of anxiety or depression, and the excess of symptoms of mood disorders was particularly prominent in nurses. The belief that one was infected was a dominant correlate of both anxiety and depression. This belief was more associated with history of symptoms of pneumonia than the contact with COVID-19 diagnosed patients. Factors found to be associated with reduced anxiety and depression in this working environment were having confidence in the competent use of and access to personal protective equipment, maintaining usual working hours, being surrounded by colleagues who were both sufficient in numbers and not stressed, and the support of immediate family and religious communities.

Involvement in aerosol-generating procedures with infected patients was linked with lower depression in nurses but higher among physicians. Likewise, the setting of recent patient encounters affected risk of anxiety and depression differently for physicians and nurses. CONCLUSIONS: Our findings may help develop mitigation measures and underscore the need to help nurses and physicians bear the psychological burden of the COVID-19 pandemic and similar events in the future

Cioce G, Clark I, and Hunter J. How does informalisation encourage or inhibit collective action by migrant workers? A comparative analysis of logistics warehouses in Italy and hand car washes in Britain. *Industrial Relations Journal*. 2022; 53(2):126-141.

<https://doi.org/10.1111/irj.12359> [open access]

Abstract: Abstract Cross-national research is key to understanding the global presence of informal and non-compliant workplaces. This article comparatively examines how informalisation encourages or inhibits collective action led by migrant workers employed in Italian logistics warehouses (LWs) and the British hand car washes (HCWs). The term collective action derives from mobilisation theory and refers to joint resistance initiatives developed by workers and labour organisations to improve work conditions. The article argues that migrant labour does not necessarily lead to informal practices and claims that labour market regulatory agencies and trade unions play an important but dialectical role in responding to labour market non-compliance and informality. Finally, it notes that sector-based specificities contribute to and potentially inhibit the emergence of collective dynamics in such workplaces

Edgelow M, Scholefield E, McPherson M, Mehta S, and Ortlieb A. A review of workplace mental health interventions and their implementation in public safety organizations. *International Archives of Occupational & Environmental Health*. 2022; 95(3):645-664.

<https://doi.org/10.1007/s00420-021-01772-1>

Abstract: OBJECTIVE: Workplace mental health is relevant to public safety organizations due to the exposure that many public safety personnel (PSP) have to psychological trauma in the course of their daily work. While the importance of attending to PSP mental health has been established, the implementation of workplace mental health interventions is not as well understood. This scoping review describes workplace mental health interventions and their implementation in public safety organizations. METHODS: English published primary studies with any publication date up to July 3, 2020 were considered. JBI methodology and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews was followed. RESULTS: 89 citations met inclusion criteria out of the 62,299 found. Articles and reports found were largely published within the last decade, most frequently from Western nations, and most often applied to police, followed by firefighters. The focus of interventions was commonly stress management and resilience, and a frequent implementation strategy was multi-session group training. Comprehensive quality improvement initiatives, a focus on supervisors and managers, and interventions across

primary, secondary, and tertiary prevention, were infrequent. **CONCLUSION:** Public safety organizations are frequently reporting on stress management and resilience interventions for police and firefighters, implemented through multi-session group training. A focus across a range of PSP, including paramedics, corrections officers, and emergency dispatchers, using implementation strategies beyond group training, is suggested. This area of research is currently expanding, with many studies published within the past decade; ongoing evaluation of the quality of interventions and implementation strategies is recommended

Egozi L, Reiss-Hevlin N, Dallasheh R, and Pardo A. Couriers' safety and health risks before and during the COVID-19 pandemic. *International Archives of Occupational & Environmental Health*. 2022; 95(3):589-598.

<https://doi.org/10.1007/s00420-021-01795-8> [open access]

Abstract: **OBJECTIVES:** This study aimed to examine the safety and health hazards of motorized couriers and investigate working conditions and driving behavior possibly associated with involvement in road accidents while driving motorcycles or cars. In light of the outbreak of COVID-19, the study was aimed to explore factors that affect the couriers' behaviors related to decreasing the risk of contracting an infectious disease. **METHODS:** A sample of 237 Israeli couriers, about half who drove a two-wheeled vehicles and the others who drove cars, answered an online survey questionnaire. The questionnaire examined organizational, occupational, and personal factors regarding their working conditions, behavior on the road, musculoskeletal disorders, road accidents, and perceptions of and compliance with regulations regarding COVID-19. The data were analyzed by multiple regression in SPSS 25, structural equation modeling and mediation tests in R 3.6.2. **RESULTS:** According to the couriers' self-report, 37% reported musculoskeletal pains at least once a day, 13% of them were involved in work-related road accidents and 10% reported feeling stress at least once a week. More than 60% of the couriers reported increased stress due to the COVID-19 pandemic. Weekly working hours, shift duration and stress were related to involvement in accidents through the mediation of driving while feeling unwell. Reported stress and the weight of parcels were related to musculoskeletal pains. **CONCLUSIONS:** The findings suggest that stress and attributes of work overloads experienced by couriers are associated with reduced safety and impaired health. Organizational, individual, and societal factors were correlated with the degree to which the couriers adhered to COVID-19 regulations. The increased prevalence of new modes of employment relationships in the field highlights the importance of research on employment conditions and safety and health aspects related to this occupation

Fleck ADS, Debia M, Ryan PE, Couture C, Traub A, Evans GJ, et al. Assessment of the oxidative potential and oxidative burden from occupational exposures to particulate matter. *Annals of Work Exposures and Health*. 2022; 66(3):379-391.

<https://doi.org/10.1093/annweh/wxab086>

Abstract: Oxidative potential (OP) is a toxicologically relevant metric that integrates features like mass concentration and chemical composition of particulate matter (PM). Although it has been extensively explored as a metric for the characterization of environmental particles, this is still an underexplored application in the occupational field. This study aimed to estimate the OP of particles in two occupational settings from a construction trades school. This characterization also includes the comparison between activities, sampling strategies, and size fractions. Particulate mass concentrations (PM₄-Personal, PM₄-Area, and PM_{2.5}-Area) and number concentrations were measured during three weeks of welding and construction/bricklaying activities. The OP was assessed by the ascorbate assay (OPAA) using a synthetic respiratory tract lining fluid (RTLFL), while the oxidative burden (OBAA) was determined by multiplying the OPAA values with PM concentrations. Median (25th-75th percentiles) of PM mass and number concentrations were 900 (672-1730) $\mu\text{g m}^{-3}$ and 128 000 (78 000-169 000) particles cm^{-3} for welding, and 432 (345-530) $\mu\text{g m}^{-3}$ and 2800 (1700-4400) particles cm^{-3} for construction. Welding particles, especially from the first week of activities, were also associated with higher redox activity (OPAA: 3.3 (2.3-4.6) $\text{pmol min}^{-1} \mu\text{g}^{-1}$; OBAA: 1750 (893-4560) $\text{pmol min}^{-1} \text{m}^{-3}$) compared to the construction site (OPAA: 1.4 (1.0-1.8) $\text{pmol min}^{-1} \mu\text{g}^{-1}$; OBAA: 486 (341-695) $\text{pmol min}^{-1} \text{m}^{-3}$). The OPAA was independent of the sampling strategy or size fraction. However, driven by the higher PM concentrations, the OBAA from personal samples was higher compared to area samples in the welding shop, suggesting an influence of the sampling strategy on PM concentrations and OBAA. These results demonstrate that important levels of OPAA can be found in occupational settings, especially during welding activities. Furthermore, the OBAA found in both workplaces largely exceeded the levels found in environmental studies. Therefore, measures of OP and OB could be further explored as metrics for exposure assessment to occupational PM, as well as for associations with cardiorespiratory outcomes in future occupational epidemiological studies.

Kearney J, Muir C, and Smith K. Occupational injury among paramedics: a systematic review. *Injury Prevention*. 2022; 28(2):175-184.

<https://doi.org/10.1136/injuryprev-2021-044405>

Abstract: INTRODUCTION: Paramedics are frequently exposed to acute and/or chronic environmental, operational and patient-related factors that increase their risk of physical and psychological injury. However, there has been wide variation in reported paramedic injury rates. This systematic review aims to synthesise the evidence to examine the incidence and nature of occupational injury among paramedics. METHODS: This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PROSPERO 2020: CRD42020164556). A systematic search of four

electronic databases was conducted for the years 2004-2019. Peer-reviewed studies examining the incidence and proportions of paramedic occupational injury within civilian emergency medical services (EMS) were included. Injury types, mechanisms, contributing factors and incidence of injury were synthesised narratively. RESULTS: Twelve studies met the inclusion criteria. The incidence of injury ranged from 29.7 to 345.6 injuries per 1000 workers per year. Sprains and strains were the most reported injury types, and the trunk and upper limbs were the main sites. Body motion was the most frequently reported mechanism of injury, accounting for 35%-55% of all injuries. Female paramedics had a proportionally higher rate of injury compared with male paramedics. Paramedics aged 25-34 years accounted for the majority of fatal (mean 34.0%) and non-fatal (mean 51.7%) injuries. CONCLUSION: This review highlights the increased risk of occupational injury among paramedics and provides further insight into their overall injury profile

Khalil H, Ameen D, and Zarnegar A. Tools to support the automation of systematic reviews: a scoping review. Journal of Clinical Epidemiology. 2022; 144:22-42.

<https://doi.org/10.1016/j.jclinepi.2021.12.005>

Abstract: OBJECTIVE: The objectives of this scoping review are to identify the reliability and validity of the available tools, their limitations and any recommendations to further improve the use of these tools. STUDY DESIGN: A scoping review methodology was followed to map the literature published on the challenges and solutions of conducting evidence synthesis using the JBI scoping review methodology. RESULTS: A total of 47 publications were included in the review. The current scoping review identified that LitSuggest, Rayyan, Abstractr, BIBOT, R software, RobotAnalyst, DistillerSR, ExaCT and NetMetaXL have potential to be used for the automation of systematic reviews. However, they are not without limitations. The review also identified other studies that employed algorithms that have not yet been developed into user friendly tools. Some of these algorithms showed high validity and reliability but their use is conditional on user knowledge of computer science and algorithms. CONCLUSION: Abstract screening has reached maturity; data extraction is still an active area. Developing methods to semi-automate different steps of evidence synthesis via machine learning remains an important research direction. Also, it is important to move from the research prototypes currently available to professionally maintained platforms

Killip SC, MacDermid JC, Sinden KE, Gewurtz RE, and Scott L. Identifying predictors of return to work and the duration of time off work in first responders affected with musculoskeletal injuries or mental health issues. International Archives of Occupational and Environmental Health. 2022; 95(3):723-735.

<https://doi.org/10.1007/s00420-021-01800-0>

Abstract: To identify predictors of return to work, duration of time off work, and claim closure for first responders experiencing injuries or illnesses, and summarize the claim data

Leadbeater B, Contreras A, Rajabali F, Zheng A, Beaulieu E, and Pike I. Longitudinal cohort study of injury type, settings, treatment and costs in British Columbia youth, 2003-2013. *Injury Prevention*. 2022; 28(2):110-116.

<https://doi.org/10.1136/injuryprev-2021-044168>

Abstract: BACKGROUND: In 2010 in British Columbia (BC), Canada, total injury costs per capita were higher among youth aged 15-24 years than in any other age group. Injury prevention efforts have targeted injuries with high mortality (transportation injuries) or morbidity (concussions). However, the profile and health costs of common youth injuries (types, locations, treatment choices and prevention strategies) and how these change from adolescence to young adulthood is not known. METHODS: Participants (n=662) were a randomly recruited cohort of BC youth, aged 12-18, in 2003. They were followed biennially across a decade (six assessments). RESULTS: Serious injuries (defined as serious enough to limit normal daily activities) in the last year were reported by 27%-41% of participants at each assessment. Most common injuries were sprains or strains, broken bones, cuts, punctures or animal bites, and severe bruises. Most occurred when playing a sport or from falling. Estimated total direct cost of treatment per injury was approximately \$2500. In addition, 25% experienced serious injuries at three or more assessments, indicating possible differences that warrants further investigation. CONCLUSIONS: The occurrence and health cost of common injuries to youth and young adults are underestimated in this study but are nevertheless substantial. Ongoing surveillance, awareness raising, and prevention efforts may be needed to reduce these costs

Lee BK, Ahn J, Kim NS, Park J, and Kim Y. Cardiovascular age of workers with different employment categories. *Archives of Environmental & Occupational Health*. 2022; 77(3):243-250.

<https://doi.org/10.1080/19338244.2021.1873094>

Abstract: INTRODUCTION: We compared the cardiovascular age (an indicator of cardiovascular disease risk) in workers with different employment status after adjustment for demographic and socioeconomic factors. METHODS: This cross-sectional study used data collected from 2007 to 2017 for the Korea National Health and Nutrition Examination Survey (KNHANES). Study participants were placed into different employment categories based on employment status and work schedule: regular full-time, regular part-time, temporary full-time, temporary part-time, daily full-time, and daily part-time. RESULTS: Analysis of women indicated that regular part-time, temporary full-time, temporary part-time, daily full-time, and daily part-time workers were more likely to have an older cardiovascular age (OR = 1.180, 1.238, 1.297, 1.493, and 1.408, respectively) after adjustment for age, marriage, education, income, residence, region, and drinking status. Analysis of men indicated employment status was unrelated to cardiovascular age. CONCLUSION: Female nonstandard Korean workers were more likely to have an increased cardiovascular age. However, most of these workers, especially daily workers, are not currently protected by the Occupational Safety and Health

Act (OSHA) of Korea. Collaboration or networking with community-based health care services in Korea is essential to better manage the health of these vulnerable female workers

Mattila TEA, Perkiö-Makela M, Hirvonen M, Kinnunen B, Vare M, and Rautiainen RH. Work exposures and mental and musculoskeletal symptoms in organic farming. *Ergonomics*. 2022; 65(2):242-252.

<https://doi.org/10.1080/00140139.2021.1974102>

Abstract: This study focussed on harmful exposures and mental and musculoskeletal symptoms in organic and conventional farming using interview data of Finnish farmers over the winter of 2014-2015. The data consisted of 2,169 full-time farmers, out of whom 231 (11%) practiced organic farming and 1,938 (89%) conventional farming. Exposure to poisonous and irritating substances was less frequent while exposures to vibration and mould ('smell of root cellar') were more frequent on organic farms. Mental and musculoskeletal symptoms were slightly more common among organic farmers, but the associations were not statistically significant in regression modelling. Risk factors for mental symptoms included animal production, hired labour, female gender, constant hurry, working alone, economic uncertainty, and inadequate recovery from workdays. Risk factors for musculoskeletal symptoms included older age, female gender, constant hurry, economic uncertainty, difficult working postures, heavy lifting and carrying, and inadequate recovery. Workload and recovery, managing the transition period and better follow-up of the occupational well-being were identified as concerns among organic farmers. **Practitioner summary:** Converting from conventional to organic farming has become increasingly common. Farmer interviews indicated that exposure to poisonous and irritating substances was less frequent while exposures to vibration and mould were more frequent on organic farms. Mental and musculoskeletal symptoms and risk factors were similar in both types of farming

Ofori SK, Hung YW, Schwind JS, Diallo K, Babatunde D, Nwaobi SO, et al. Economic evaluations of interventions against influenza at workplaces: systematic review. *Occupational Medicine*. 2022; 72(2):70-80.

<https://doi.org/10.1093/occmed/kqab163>

Abstract: **BACKGROUND:** The burden of influenza is mostly felt by employees and employers because of increased absenteeism rates, loss of productivity and associated direct costs. Even though interventions against influenza among working adults are effective, patronage and compliance to these measures especially vaccination are low compared to other risk groups. **AIMS:** This study was aimed to assess evidence of economic evaluations of interventions against influenza virus infection among workers or in the workplace setting. **METHODS:** The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) reporting guideline for systematic reviews was followed. Three databases, PubMed, Web of Science and EconLit, were searched using keywords to identify relevant articles from inception till 25 October 2020. Original peer-reviewed papers that conducted economic evaluations of influenza interventions using cost-benefit, cost-effectiveness or cost-utility analysis methods

focused on working-age adults or work settings were eligible for inclusion. Two independent teams of co-authors extracted and synthesized data from identified studies. RESULTS: Twenty-four articles were included: 21 were cost-benefit analyses and 3 examined cost-effectiveness analyses. Two papers also presented additional cost-utility analysis. Most of the studies were pharmaceutical interventions (n = 23) primarily focused on vaccination programs while one study was a non-pharmaceutical intervention examining the benefit of paid sick leave. All but two studies reported that interventions against influenza virus infection at the workplace were cost-saving and cost-effective regardless of the analytic approach. CONCLUSIONS: Further cost-effectiveness research in non-pharmaceutical interventions against influenza in workplace settings is warranted. There is a need to develop standardized methods for reporting economic evaluation methods to ensure comparability and applicability of future research findings

Schmalz T, Colienne A, Bywater E, Fritzsche L, Gartner C, Bellmann M, et al. A passive back-support exoskeleton for manual materials handling: reduction of low back loading and metabolic effort during repetitive lifting. IJSE Transactions on Occupational Ergonomics and Human Factors. 2022; 10(1):7-20.

<https://doi.org/10.1080/24725838.2021.2005720>

Abstract: OCCUPATIONAL APPLICATIONS Globalization and eCommerce continue to fuel unprecedented growth in the logistics and warehousing markets. Simultaneously, the biggest bottleneck for these industries is their human capital. Where automation and robotic solutions fail to deliver a return on investment, humans frequently take over handling tasks that place harmful loads and strains on the body. Occupational exoskeletons can reduce fatigue and strain by supporting the lower spine and are designed to prevent work-related musculoskeletal disorders and other injuries. They are a mid- to long-term investment for industries to improve ergonomic conditions in workplaces, with the potential for reducing absences from work, sick days logged, and workers compensation claims. To examine the effectiveness of the newly introduced Paexo Back exoskeleton, a study was completed with 10 participants who completed manual load handling tasks with and without the exoskeleton. Key findings include significant reductions in metabolic effort and low back loading when the exoskeleton is worn

Xu Q, Wu Y, Wang M, Liu B, Jiang J, You X, et al. The relationship between sense of calling and safety behavior among airline pilots: the role of harmonious safety passion and safety climate. Safety Science. 2022; 150:105718.

<https://doi.org/10.1016/j.ssci.2022.105718>

Yedulla NR, Battista EB, Koolmees DS, Montgomery ZA, and Day CS. Workplace-related musculoskeletal injury trends in the United States from 1992 to 2018. *Injury*. 2022; [epub ahead of print].

<https://doi.org/10.1016/j.injury.2022.03.007>

Abstract: INTRODUCTION: The purpose of our study is to assess workplace-related musculoskeletal (wrMSK) injury trends by utilizing Bureau of Labor Statistics (BLS) data. We hypothesize that trunk injuries are the most commonly reported, injuries occur most frequently in the manufacturing sector, and that injury type occurrence differs according to body region affected. METHODS: This study assessed wrMSK injury data provided by the BLS from 1992 to 2018. The three main body regions analyzed were lower extremity (LE), upper extremity (UE), and trunk. Injury data was also assessed by industrial sector (Agriculture, Manufacturing, Healthcare, and Construction) and injury type (fractures, multiple injuries, sprains/strains/tears, tendonitis, cuts/lacerations, pain/soreness, and bruises). Negative binomial regression and pairwise comparisons with a Benjamini-Hochberg adjustment were utilized to compare calculated incidence rate ratios for wrMSK injuries. Exponentiated beta estimates were used to calculate the estimated annual percent changes of wrMSK injuries within each industrial sector. RESULTS: Occurrence of wrMSK injuries from 1992 to 2018 was significantly lower for LE when compared to both upper extremity and trunk ($p < 0.001$). Manufacturing is shown to be the industry with the most wrMSK injuries in each of UE, LE, and trunk. wrMSK injuries were shown to decrease in each industrial sector over the timespan assessed, with the greatest percent change occurring in the manufacturing sector. Lacerations and tendonitis were the most common diagnosis types in UE, while pain/soreness and strains/sprains/tears were most common in trunk and bruises were most common in LE. DISCUSSION: From 1992 to 2018, trunk injuries were the most frequently occurring wrMSK injury, but not to a significantly higher degree than upper extremity injuries. wrMSK injury types that may require orthopedic surgical care affect specific body regions to different degrees, with cuts/lacerations and tendonitis most commonly affecting the upper extremity. Thus, it appears that wrMSK injuries in the upper extremity are of particular importance from an orthopedic care perspective

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