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

Babalola A, Manu P, Cheung C, Yunusa-Kaltungo A, and Bartolo P. A systematic review of the application of immersive technologies for safety and health management in the construction sector. *Journal of Safety Research*. 2023; 85:66-85.

<https://doi.org/10.1016/j.jsr.2023.01.007> [open access]

Abstract: INTRODUCTION: The construction industry employs about 7% of global manpower and contributes about 6% to the global economy. However, statistics have depicted that the construction industry contributes significantly to workplace fatalities and injuries despite multiple interventions (including technological applications) implemented by governments and construction companies. Recently, immersive technologies as part of a suite of industry 4.0 technologies, have also strongly emerged as a viable pathway to help address poor construction occupational safety and health (OSH) performance. **METHOD:** With the aim of gaining a broad view of different construction OSH issues addressed using immersive technologies, a review on the application of immersive technologies for construction OSH management is conducted using the preferred reporting items for systematic reviews and meta-analysis (PRISMA) approach and bibliometric analysis of literature. This resulted in the evaluation of 117 relevant papers collected from three online databases (Scopus, Web of Science, and Engineering Village). **RESULTS:** The review revealed that literature have focused on the application of various immersive technologies for hazard identification and visualization, safety training, design for safety, risk perception, and assessment in various construction works. The review identified several limitations regarding the use of immersive technologies, which include the low level of adoption of the developed immersive

technologies for OSH management by the construction industry, very limited research on the application of immersive technologies for health hazards, and limited focus on the comparison of the effectiveness of various immersive technologies for construction OSH management. CONCLUSIONS AND PRACTICAL APPLICATIONS: For future research, it is recommended to identify possible reasons for the low transition level from research to industry practice and proffer solutions to the identified issues. Another recommendation is the study of the effectiveness of the use of immersive technologies for addressing health hazards in comparison to the conventional methods

Baron S, Cuervo I, Shah D, Gonzalez A, Harari H, and Flores D. COVID-19 infections, pandemic-related social and economic impacts, and changes to mental and self-rated health among Latinx immigrant housecleaners in New York city: the safe and just cleaners study. American Journal of Public Health. 2023; 113(8):893-903.

<https://doi.org/10.2105/AJPH.2023.307324>

Abstract: Objectives. To estimate impacts of COVID-19 infections and social and economic sequelae on mental and self-rated health among Latinx immigrant housecleaners in New York City. Methods. From March to June 2021, we conducted a follow-up study with 74% retention of 402 housecleaners initially surveyed before the pandemic between August 2019 and February 2020. We measured rates of self-reported COVID-19 infections, COVID-19 antibodies, and pandemic-related social and economic sequelae and examined predictors of mental and self-rated health changes using logistic regression models. Results. Fifty-three percent reported COVID-19 infections, consistent with the rate demonstrating COVID-19 antibodies. During shutdown of nonessential services, from March 22 to June 8, 2020, 29% worked as housecleaners, although this was not associated with higher COVID-19 infection rates. COVID-19-related stigma at work, lost earnings owing to COVID-19 infections, housing insecurity, food insecurity, and unsafe homes, including experiencing intimate partner verbal abuse, were statistically associated with changes in mental or self-rated health compared with prepandemic measures. Conclusions. The disproportionate impact and virtually nonexistent safety net housecleaners experienced during the first year of the pandemic highlight the importance of inclusive stopgap measures to mitigate economic insecurity and its sequelae. (Am J Public Health. 2023;113(8):893-903.

<https://doi.org/10.2105/AJPH.2023.307324>)

Conway PM, Rose U, Formazin M, Schollgen I, d'Errico A, Balducci C, et al. Long-term associations of psychosocial working conditions with depressive symptoms and work-related emotional exhaustion: comparing effects in a 5-year prospective study of 1949 workers in Germany. International Archives of Occupational & Environmental Health. 2023; 96(5):661-674.

<https://doi.org/10.1007/s00420-023-01959-8>

Abstract: Objective: To test the hypothesis that psychosocial working conditions are more strongly associated with subsequent work-related emotional exhaustion (core component of

burnout) than with depressive symptoms at follow-up. Methods: A 5-year cohort study (2011/2012-2017), based on a random sample of persons in employment subject to payment of social contributions aged 31-60 years (Study on Mental Health at Work; S-MGA; N = 1949), included self-reported measures of organisational demands (organisational layoffs and restructuring), task-level demands (work pace and amount of work) and job resources (influence at work, possibilities for development, control over working time, role clarity), all taken from the COPSOQ, except the organisational demands that were single-item measures. Work-related emotional exhaustion and depressive symptoms were measured with the Oldenburg Burnout Inventory and the Patient Health Questionnaire-9, respectively. Results: Cochran Q tests revealed stronger associations between psychosocial working conditions and work-related emotional exhaustion only for the amount of work ($p = 0.013$) and control over working time ($p = 0.027$). No differences were observed for the Demands and Resources Indexes, capturing overall exposure to psychosocial working conditions. The same differences were observed in a subsample including only participants who remained at the same employer from baseline to follow-up, although more psychosocial working conditions were associated with work-related emotional exhaustion than with depressive symptoms. Supplementary analyses employing dichotomous measures of work-related emotional exhaustion and depressive symptoms confirmed these results. Conclusions: Overall, the findings provide limited evidence supporting the hypothesis that psychosocial working conditions are more strongly associated with work-related emotional exhaustion than with depressive symptoms.

Egdell V, Hussein R, Harrison D, Bader AK, and Wilson R. 'I find it daunting . . . that I'm gonna have to deal with this until 60': extended working lives and the sustainable employability of operational firefighters. *Work, Employment and Society*. 2023; 37(3):721-739.

<https://doi.org/10.1177/09500170211041300> [open access]

Abstract: While operational firefighters in the UK fire and rescue service traditionally retired in their 50s, their working lives are now extending. However, external pressures and the emotional and physical demands of firefighting work, lead to questions about whether operational firefighters will be able to extend their working lives. In this article, we engage with Van der Klink et al.'s sustainable employability model, which focuses on situations that allow individuals to make valuable contributions through their work and reveal how working lives can be extended. We consider implications of the characteristics of operational firefighting work, individual circumstances and contextual factors for the extension of working lives. Drawing on interviews conducted with firefighters, crew managers and watch managers working in a UK fire and rescue service, we highlight the unsustainability of many future working lives because of wellbeing and organisational pressures.

Galey L, Audignon S, Brochard P, Debia M, Lacourt A, Lambert P, et al. Strategies to assess occupational exposure to airborne nanoparticles: systematic review and recommendations.

Safety and Health at Work. 2023; 14(2):163-173.

<https://doi.org/10.1016/j.shaw.2023.02.002> [open access]

Abstract: In many industrial sectors, workers are exposed to manufactured or unintentionally emitted airborne nanoparticles (NPs). To develop prevention and enhance knowledge surrounding exposure, it has become crucial to achieve a consensus on how to assess exposure to airborne NPs by inhalation in the workplace. Here, we review the literature presenting recommendations on assessing occupational exposure to NPs. The 23 distinct strategies retained were analyzed in terms of the following points: target NPs, objectives, steps, "measurement strategy" (instruments, physicochemical analysis, and data processing), "contextual information" presented, and "work activity" analysis. The robustness (consistency of information) and practical aspects (detailed methodology) of each strategy were estimated. The objectives and methodological steps varied, as did the measurement techniques. Strategies were essentially based on NPs measurement, but improvements could be made to better account for "contextual information" and "work activity". Based on this review, recommendations for an operational strategy were formulated, integrating the work activity with the measurement to provide a more complete assessment of situations leading to airborne NP exposure. These recommendations can be used with the objective of producing homogeneous exposure data for epidemiological purposes and to help improve prevention strategies

Guth M, Coste A, Lefevre M, Deygas F, Danjou A, Ahmadi S, et al. Testicular germ cell tumour risk by occupation and industry: a French case-control study: TESTIS. Occupational and Environmental Medicine. 2023; 80(7):407-417.

<https://doi.org/10.1136/oemed-2022-108601> [open access]

Abstract: Objective: Testicular germ cell tumours (TGCT) are the most common cancer in men of working age and its incidence has increased notably over the past 40 years. Several occupations have been identified as potentially associated with TGCT risk. The aim of this study was to further explore the relationship between occupations, industries and TGCT risk in men aged 18-45 years. Methods: The TESTIS study is a multicenter case-control study conducted between January 2015 and April 2018 in 20 of 23 university hospital centers in metropolitan France. A total of 454 TGCT cases and 670 controls were included. Full job histories were collected. Occupations were coded according to the International Standard Classification of Occupation 1968 version (ISCO-1968) and industry according to the 1999 version of Nomenclature d'Activités Française (NAF-1999). For each job held, ORs and 95% CIs were estimated using conditional logistic regression. Results: A positive association was observed between TGCT and occupation as agricultural, animal husbandry worker (ISCO: 6-2; OR 1.71; 95% CI (1.02 to 2.82)), as well as salesman (ISCO: 4-51; OR 1.84; 95% CI (1.20 to 2.82)). An increased risk was further observed among electrical fitters and related, electrical and electronics workers employed for 2 years or more (ISCO: 8-5; OR=2 years 1.83; 95% CI (1.01 to 3.32)). Analyses by industry supported these findings. Conclusions: Our findings suggest that agricultural, electrical and electronics workers, and salesmen workers

experience an increased risk of TGCT. Further research is needed to identify the agents or chemicals in these high-risk occupations which are relevant in the TGCT development. Trial registration number: NCT02109926.

Ho DC, Tolgyesi D, Beech C, and Fischer SL. Identifying the critical physically demanding tasks performed by personal support workers in Canada. *Applied Ergonomics*. 2023; 112:104069.

<https://doi.org/10.1016/j.apergo.2023.104069>

Abstract: Due to increased work demands, personal support workers (PSWs) are experiencing more work-related injuries. However, little is known about PSW work tasks and their corresponding physical demand. The purpose of this study was to identify critical tasks that are physically demanding and completed frequently as identified by PSWs. Additionally, we identified contextual factors (i.e., environmental-, situational-, patient-related) that influenced physical demands. We surveyed 443 community-based PSWs working in Canada who rated the physical demand associated with client care tasks and identified contextual factors that can increase task specific physical demands. Transferring/repositioning patients, dressing, and bathing were perceived as most demanding. Patient weight and mobility influenced the level of physical demand required for most tasks. These data provide a foundation to develop physical employment standards and task specific education and training to prevent PSW injuries

Jalil Al-Bayati A, Renner AT, Listello MP, and Mohamed M. PPE non-compliance among construction workers: an assessment of contributing factors utilizing fuzzy theory. *Journal of Safety Research*. 2023; 85:242-253.

<https://doi.org/10.1016/j.jsr.2023.02.008> [open access]

Abstract: INTRODUCTION: Construction practitioners are at a disproportionately higher risk of fatal and nonfatal injuries compared to practitioners from other industries. The absence of and inappropriate use of personal protective equipment (PPE), hereinafter referred to as PPE non-compliance, are major causes of fatal and nonfatal injuries at construction workplaces. METHOD: Accordingly, a robust 4-step research methodology was employed to investigate and assess factors that contribute to PPE non-compliance. As a result, 16 factors were identified utilizing literature review and ranked utilizing fuzzy set theory and K-means clustering. Top among them: inadequate safety supervision, poor risk perception, lack of climate adaptation, lack of safety training, and lack of management support. RESULTS: Managing construction safety in a proactive manner is vital to eliminate or minimize construction hazards and improve overall site safety. Thus, proactive measures to address these 16 factors were identified utilizing a focus group methodology. The validation of the statistical findings with that of the focus groups of industry professionals provides validation of the findings as both practical and actionable. PRACTICAL APPLICATIONS: This study significantly contributes to construction safety knowledge and practice which, in turn, aids

academic researchers and construction practitioners in their continuous efforts to reduce fatal and nonfatal injuries among construction workers

Jamjoom LA and Mills AJ. Narratives of workplace resistance: reframing Saudi women in leadership. *Human Relations*. 2023; 76(7):955-989.

<https://doi.org/10.1177/00187267221087593>

Kangas A, Kukko K, Kanerva T, Saamanen A, Akmal JS, Partanen J, et al. Workplace exposure measurements of emission from industrial 3D printing. *Annals of Work Exposures and Health*. 2023; 67(5):596-608.

<https://doi.org/10.1093/annweh/wxad006> [open access]

Abstract: Particle and gaseous contaminants from industrial scale additive manufacturing (AM) machines were studied in three different work environments. Workplaces utilized powder bed fusion, material extrusion, and binder jetting techniques with metal and polymer powders, polymer filaments, and gypsum powder, respectively. The AM processes were studied from operator's point of view to identify exposure events and possible safety risks. Total number of particle concentrations were measured in the range of 10 nm to 300 nm from operator's breathing zone using portable devices and in the range of 2.5 nm to 10 µm from close vicinity of the AM machines using stationary measurement devices. Gas-phase compounds were measured with photoionization, electrochemical sensors, and an active air sampling method which were eventually followed by laboratory analyses. The duration of the measurements varied from 3 to 5 days during which the manufacturing processes were practically continuous. We identified several work phases in which an operator can potentially be exposed by inhalation (pulmonary exposure) to airborne emissions. A skin exposure was also identified as a potential risk factor based on the observations made on work tasks related to the AM process. The results confirmed that nanosized particles were present in the breathing air of the workspace when the ventilation of the AM machine was inadequate. Metal powders were not measured from the workstation air thanks to the closed system and suitable risk control procedures. Still, handling of metal powders and AM materials that can act as skin irritants such as epoxy resins were found to pose a potential risk for workers. This emphasizes the importance of appropriate control measures for ventilation and material handling that should be addressed in AM operations and environment

Mwanga HH, Baatjies R, and Jeebhay MF. Occupational risk factors and exposure-response relationships for airway disease among health workers exposed to cleaning agents in tertiary hospitals. *Occupational and Environmental Medicine*. 2023; 80(7):361-371.

<https://doi.org/10.1136/oemed-2022-108763>

Abstract: Objectives: This study investigated occupational risk factors and exposure-response relationships for airway disease among health workers (HWs) exposed to cleaning agents in two tertiary hospitals in South Africa and Tanzania. Methods: In this cross-sectional study, 697 participants completed questionnaire interviews while 654 underwent fractional exhaled

nitric oxide (FeNO) testing. Asthma Symptom Score (ASS) was computed based on the sum of answers to five questions on asthma-related symptoms in the past 12 months. For exposure-response analyses, cleaning agent-related self-reported exposure variables were categorised into three levels (cleaning product not used; use of a cleaning product for up to 99 min per week and use of a cleaning product for =100 min per week). Results: Asthma-related outcomes (ASS and FeNO) demonstrated positive associations with medical instrument cleaning agents (orthophthalaldehyde and enzymatic cleaners) and tasks (instruments precleaning and changing sterilisation solutions) as well as patient care activities (disinfection prior to procedures and disinfecting wounds). A particularly pronounced dose-response relationship was observed between work-related ocular-nasal symptoms and medical instrument cleaning agents (orthophthalaldehyde, glutaraldehyde, enzymatic cleaners, alcohols and bleach) (OR range: 2.37-4.56) and tasks (OR range: 2.92-4.44). A strong association was also observed between ASS and use of sprays for fixed surface cleaning (mean ratio 2.81; 95% CI 1.41 to 5.59). Conclusions: Specific agents for medical instrument disinfection for example, orthophthalaldehyde and enzymatic cleaners, patient care activities and use of sprays are important occupational risk factors for airway disease among HWs.

Porta M, Porceddu S, Leban B, Casu G, Mura GM, Campagna M, et al. Characterization of upper limb use in health care workers during regular shifts: a quantitative approach based on wrist-worn accelerometers. *Applied Ergonomics*. 2023; 112:104046.

<https://doi.org/10.1016/j.apergo.2023.104046>

Abstract: Despite the high prevalence of upper limb (UL) work-related musculoskeletal disorders (WRMSD) among health care workers (HCWs), little is known about their relationship with exposure to biomechanical risk factors. This study aimed to assess UL activity features under actual working conditions using two wrist-worn accelerometers. Accelerometric data were processed to obtain duration, intensity, and asymmetry of UL use in 32 HCWs during the execution of commonly performed tasks (e.g., patient hygiene, transfer, and meal distribution) within a regular shift. The results show that such tasks are characterized by significantly different patterns of UL use, in particular, higher intensities and larger asymmetries were observed respectively for patient hygiene and meal distribution. The proposed approach appears, thus, suitable to discriminate tasks characterized by different UL motion patterns. Future studies could benefit from the integration of such measures with self-reported workers' perception to elucidate the relationship between dynamic UL movements and WRMSD

Rysstad T, Grotle M, Aasdahl L, Dunn KM, and Tvetter AT. Identification and characterisation of trajectories of sickness absence due to musculoskeletal pain: a 1-year population-based study. *Journal of Occupational Rehabilitation*. 2023; 33(2):277-287.

<https://doi.org/10.1007/s10926-022-10070-7> [open access]

Abstract: Purpose This study aimed to identify trajectories of sickness absence in workers on sick leave due to musculoskeletal disorders and explore the association between these

trajectories and established prognostic factors for sickness absence. **Methods** We conducted a prospective cohort study of 549 workers (56% women, aged 18-67 years) on sick leave due to musculoskeletal disorders in Norway in 2018-2019. Sickness absence data were collected from the Norwegian sick leave registry and prognostic factors via self-reported baseline questionnaires. We used group-based trajectory modelling to define the different trajectories of sickness absence spanning a 1-year period. Multivariable multinomial logistic regression was used to estimate odds ratios and 95% confidence intervals for prognostic factors associated with the identified trajectory groups. **Results** We identified six distinct trajectories of sickness absence over 1 year: 'fast decrease' (27% of the cohort); 'moderate decrease' (22%); 'slow decrease' (12%); 'u-shape' (7%); 'persistent moderate' (13%); and 'persistent high' (18%). Prognostic factors, such as previous sickness absence days, return-to-work expectancy, workability, multisite pain, and health scores, differentiated between the sickness absence trajectories (all $P < 0.05$). Negative return-to-work expectancy was associated with the three trajectory groups with the highest number of sickness absence days ('slow decrease', 'persistent moderate', and 'persistent high'). **Conclusions** This is the first study to explore the association of return-to-work expectancy with trajectories of sickness absence. Our findings highlight different patterns of sickness absence and the complex range of prognostic factors. These findings have implications for secondary and tertiary prevention strategies for work absence in workers with musculoskeletal disorders.

Thomas A, Roberge-Dao J, Iqbal MZ, Salbach NM, Letts LJ, Polatajko HJ, et al. Developing multisectoral strategies to promote evidence-based practice in rehabilitation: findings from an end-of-grant knowledge translation symposium. *Disability & Rehabilitation*. 2023; [epub ahead of print].

<https://doi.org/10.1080/09638288.2023.2227565>

Abstract: **PURPOSE:** Following a longitudinal study to understand how evidence-based practice evolves during the initial years of occupational therapy (OT) and physiotherapy (PT) practice, we held an end-of-grant symposium with representatives from education, practice, research, and policy. The objectives were to: (1) elicit feedback on the implications of the study results; and (2) co-develop a list of actionable recommendations for each sector. **METHODS:** Qualitative participatory approach. The symposium was held over two half days and consisted of a presentation of study findings, a discussion on the implications of the research for each sector and future recommendations. Discussions were audio recorded, transcribed verbatim and analyzed using qualitative thematic analysis. **RESULTS:** The themes related to implications of the longitudinal study included: (1) A need to rethink what evidence-based practice (EBP) really is; (2) How to practice EBP; and (3) The continuing challenge of measuring EBP. The co-development of actionable recommendations resulted in nine strategies. **CONCLUSIONS:** This study highlighted how we may collectively promote EBP competencies in future OTs and PTs. We generated sector-specific avenues that may be pursued to promote EBP and argued for the importance of pooling efforts from the four sectors so that we may achieve the intended ethos of EBP. **IMPLICATIONS FOR**

REHABILITATION There is a need to revisit the definition of evidence-based practice (EBP) and the traditional 3-circle model in rehabilitation to include a broader conceptualization of what constitutes evidence. We recommend using EBP measures as tools for self-reflection and professional development that can support practitioners to be reflective and accountable evidence-based practitioners. Optimal promotion of EBP competencies in occupational therapists and physiotherapists should rest upon collaborative efforts from the education, practice, research, and policy sectors

Ukkola-Vuoti L, Karlsson A, Tuominen S, Lassenius MI, Aaltonen J, Ranta M, et al. Burden of idiopathic inflammatory rheumatic diseases in occupational healthcare: increased absenteeism and healthcare resource utilization. *Scandinavian Journal of Work, Environment & Health*. 2023; 49(5):341-349.

<https://doi.org/10.5271/sjweh.4095> [open access]

Abstract: Objectives: Patients with idiopathic inflammatory rheumatic diseases (IIRD) often have decreased working capacity resulting in indirect costs. However, data on patients' short-term sick leave has been limited. This retrospective cohort study evaluated the number and length of sick leave, including short-term leave, and occupational healthcare resource utilization (HCRU) of the working-aged patients with IIRD compared to controls. Methods: The data on sick leave and occupational HCRU were gathered from the electronic medical records of the largest occupational healthcare provider in Finland from January 2012 to December 2019. Employed patients with an IIRD (including rheumatoid arthritis, spondyloarthritis, psoriatic and enteropathic arthritis, juvenile arthritis, and reactive arthritis) with at least a 12-months follow-up were identified and compared to age-, sex-, and follow-up matched controls without IIRD. Results: Altogether 5405 patients with IIRD were identified and compared with an equal number of controls. The patients incurred approximately 2.5 times more sick leave than controls: 21.7 versus 8.5 days per patient year, respectively. Short-term sick leave was common: 83% of sickness absence periods of the patients lasted 1-9 days and represented 30% of the total absenteeism. Loss of productivity due to lost workdays was on average €4572 (95% confidence interval €4352-4804) per patient year. Occupational HCRU was approximately 1.8 times higher among IIRD patients than controls. Conclusions: Workers with an IIRD incur considerably more sick leave and use more occupational healthcare services than controls. Short sick leave not registered in national insurance registers constitute a significant portion of days off work among patients with IIRD.

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