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

Ajslev JZN and Nimb IEE. Virtual design and construction for occupational safety and health purposes: a review on current gaps and directions for research and practice. *Safety Science*. 2022; 155:105876.

<https://doi.org/10.1016/j.ssci.2022.105876> [open access]

Abstract: Virtual design and construction (VDC) is an umbrella term for technologies altering communication, visualization and organizational design in construction projects. There are high expectations to the potentials that VDC offer in terms of integrating technological possibilities with occupational safety and health (OSH). Research in this area has however been limited and little is known about use and characteristics of the concept as a potential for improving OSH in construction. The aim of this review is to 1) map out research trends, 2) currently concerned OSH topics addressed by and 3) the status of this research, as well as to 4) identify and discuss particular knowledge gaps in order to provide a point of departure for future research and practice. In the study, we performed a scoping review conducting a search on Pubmed, Web of Science and Google Scholar databases with no time limit. 4282 papers were identified and screened for addressing VDC for OSH purposes. 74 studies was found eligible for full review. The summary of studies display five current research trends displaying vast potentials for integrating VDC technologies and OSH by addressing a number of topics. The status on most research is however at proof-of-concept levels which leaves a number of gaps in research and practice. Of central significance, the review identifies and discuss ten particular gaps to be addressed for improving OSH through VDC technologies.

Thereby the study provides directions for future research and for stakeholders aiming to improve OSH through engagement with VDC technologies in the construction industry.

Bertolazi AN, Mann KC, Lima AVPB, Hidalgo MPL, and John AB. Post-traumatic stress disorder prevalence and sleep quality in fire victims and rescue workers in southern Brazil: a cross-sectional study. Public Health. 2022; 209:4-13.

<https://doi.org/10.1016/j.puhe.2022.05.002> [open access]

Abstract: OBJECTIVES: This survey was conducted to evaluate the prevalence of post-traumatic stress disorder (PTSD) and the sleep quality in victims and rescue team of the third deadliest nightclub fire in the world. STUDY DESIGN: A cross-sectional study. METHODS: Participants were victims and rescue workers exposed to a fire at a nightclub, which occurred in January 2013 in Southern Brazil. The Pittsburgh Sleep Quality Index (PSQI), composed of seven subjective sleep variables (including daytime dysfunction), and PTSD Checklist - Civilian version (PCL-C) were applied to all people who sought medical attention at the local reference center in the first year after the event. Comprehensive information was obtained concerning sociodemographic factors, health status, and sleep complaints. RESULTS: A total of 370 individuals, 190 victims and 180 rescue workers, were included. Participants were 70% male, with an average age of 29 years. The prevalence of PTSD was 31.9%, ranging from 24.4% for rescue workers to 38.9% for victims. The prevalence of poor sleep quality was 65.9%, ranging from 56.1% for rescue workers to 75.3% for victims. Most of the participants with PTSD (91.5%) had PSQI scores >5 (poor sleepers), against 54.0% of the non-PTSD individuals. All seven PSQI subscores showed significant differences between PTSD and non-PTSD individuals, especially daytime dysfunction. Sex, shift work, previous psychiatric disease, and sleep quality remained associated with PTSD in adjusted models, with a prevalence ratio (95% CI) of 1.76 (1.28-2.43) in females, 1.73 (1.17-2.55) in shift workers, 1.36 (1.03-1.80) in individuals with psychiatric disease history, and 5.42 (2.55-11.52) in poor sleepers. CONCLUSIONS: The presence of daytime dysfunction increased by at least tenfold the prevalence of PTSD in this sample. Considering that daytime dysfunction was shown to be strongly associated with PTSD, sleep-related issues should be addressed in the assessment of individuals exposed to traumatic events, both victims and rescuers. Factors like shift work and female sex were also associated with PTSD, especially among victims

Cheng TC, Caponecchia C, and O'Neill S. Workplace safety and future and emerging ways of work: a systematic literature review. Safety Science. 2022; 155:105873.

<https://doi.org/10.1016/j.ssci.2022.105873>

Choper J, Schneider D, and Harknett K. Uncertain time: precarious schedules and job turnover in the US service sector. ILR Review. 2022; 75(5):1099-1132.

<https://doi.org/10.1177/00197939211048484> [open access]

Abstract: The authors develop a model of cumulative disadvantage relating three axes of disadvantage for hourly workers in the US retail and food service sectors: schedule instability,

turnover, and earnings. In this model, exposure to unstable work schedules disrupts workers' family and economic lives, straining the employment relation and increasing the likelihood of turnover, which can then lead to earnings losses. Drawing on new panel data from 1,827 hourly workers in retail and food service collected as part of the Shift Project, the authors demonstrate that exposure to schedule instability is a strong, robust predictor of turnover for workers with relatively unstable schedules (about one-third of the sample). Slightly less than half of this relationship is mediated by job satisfaction and another quarter by work–family conflict. Job turnover is generally associated with earnings losses due to unemployment, but workers leaving jobs with moderately unstable schedules experience earnings growth upon re-employment.

Ciccia R, French D, Kee F, and O'Doherty M. Deservingness, conditionality and public perceptions of work disability: the influence of economic inequality. *Work, Employment and Society*. 2022; 36(4):610-629.

<https://doi.org/10.1177/0950017020967229> [open access]

Abstract: This article contributes to classical debates about the role of self-interest and social norms in shaping the moral economy of work and welfare by incorporating economic inequalities in the analysis of opinions about welfare deservingness. The relationship between inequality and perceptions of work conditionality has received little attention in previous studies. This article addresses this issue by investigating the association between economic inequalities and perceived work limitations of disabled people experiencing various conditions related to health using vignettes from the English Longitudinal Study of Ageing. The results show that people living in areas with higher levels of wealth inequality, but not income inequality, were more likely to rate the vignettes as limited in the amount of work that individuals can do due to health problems. This finding casts doubts on the crucial role attributed to self-interest as the central mechanism linking economic inequality and solidaristic, pro-welfare attitudes

Friesen KB and Lang AE. Do musculoskeletal disorders affect work tasks in farmers: a study of rural Saskatchewan. *Journal of Occupational & Environmental Medicine*. 2022; 64(9):e591-e596.

<https://doi.org/10.1097/JOM.0000000000002637>

Abstract: OBJECTIVE: Musculoskeletal disorders (MSDs) are common among farmers, yet associated difficulty during work is not well understood. The purpose of this study was to determine the connection between MSDs and work-related task difficulty in rural Saskatchewan. METHODS: Rural Saskatchewan farmers and farm workers with history of MSD in the last 5 years (n = 72) participated via an online survey. RESULTS: Shoulder MSDs were the most common (75%), followed by neck (65%), knees (61%), and lower back (58%). Many participants reported more than one MSD. Presence of MSDs leads to difficulty in work tasks; for example, difficulty when operating power tools with hands was 8.7 times more likely for those with shoulder MSD. CONCLUSIONS: MSDs in rural Saskatchewan farmers are

associated with greater work task difficulty, and future research into risk factors related to those tasks can guide prevention strategies

Gerodimos V, Karatrantou K, Papazeti K, Batatolis C, and Krommidas C. Workplace exercise program in a hospital environment: an effective strategy for the promotion of employees physical and mental health. A randomized controlled study. *International Archives of Occupational & Environmental Health*. 2022; 95(7):1491-1500.

<https://doi.org/10.1007/s00420-022-01856-6>

Abstract: Purpose: The demanding and exhausting working hours, as well as the bad and unsuitable working conditions that prevail in several hospitals, affect employees' physical and mental health. The purpose of this study was to examine the effectiveness of a daily 6-week supervised workplace exercise program on health indices, functional capacity, overall fitness, subjective vitality, and life satisfaction in health professionals. Methods: A randomized controlled study was used. 50 health professionals (40-55 years), working in a hospital environment, were divided into two groups: exercise (EG) and control group (CG). EG performed a 6-week supervised concurrent chair-based exercise program (stretching, strength, balance exercises, aerobic dance; 5 days/week, 30-40 min/day, 2 workouts/day lasted 15-20 min) in the hospital. Health indices (body composition, blood pressure, respiratory function), functional capacity (flexibility, balance), physical fitness (strength, cardiorespiratory fitness), subjective vitality, and life satisfaction were measured before and after the completion of the program. Additionally, after the completion of the program, EG participants' enjoyment was assessed. Results: EG significantly increased ($p < 0.001$) lean body mass and respiratory function (range of mean increase 3.5-4.5%, depending on the variable), functional capacity (range of mean increase 18-40%, depending on the variable), lower and upper limbs maximal strength (range of mean increase 10-25%, depending on the variable), subjective vitality (41.3%) and life satisfaction (21.5%); while significantly decreased ($p < 0.001$) heart rate during submaximal test (- 14%), body fat and blood pressure (range of mean decrease - 3.5% to - 5.5%, depending on the variable). In CG, all the above variables did not change. Furthermore, a great percentage of employees (95%) reported high levels of enjoyment. Conclusion: A workplace exercise program may be safely used for the promotion of employees' physical and mental health.

Hartikainen E, Solovieva S, Viikari-Juntura E, and Leinonen T. Working life expectancy and working years lost among users of part- and full-time sickness absence in Finland. *Scandinavian Journal of Work, Environment & Health*. 2022; [epub ahead of print].

<https://doi.org/10.5271/sjweh.4054> [open access]

Abstract: OBJECTIVES: The use of part-time sickness absence (pSA) instead of full-time sickness absence (fSA) is known to increase work participation. Yet, its effect on the total length of working lives remains unclear. We carried out a quasi-experiment to assess the impact of using pSA versus fSA on the length of working lives. METHODS: We used a register-based 70% random sample of the working-age population living in Finland on 31 December

2007 to (i) form propensity-score-matched groups of users of pSA and fSA and (ii) calculate their working life expectancy (WLE) and working years lost (WYL). We applied the Sullivan method based on daily measured time spent at work and other labor market statuses, followed up over a four-year period until the end of year 2017. The study population consisted of private and public sector employees with SA due to mental and musculoskeletal disorders, ie, the diagnostic groups where pSA has been primarily used. RESULTS: Among both genders, the pSA group had a significantly higher WLE at age 30 than the fSA group, with larger differences seen in mental disorders compared to musculoskeletal diseases and in the private versus public sector. Overall, the pSA group had fewer WYL due to unemployment and disability retirement but more expected years working with partial disability benefits than the fSA group. CONCLUSIONS: Based on beneficial working career effects, the use of pSA instead of fSA should always be recommended for persons with mental or musculoskeletal disorders where feasible

Humphries N, Byrne JP, Creese J, and McKee L. 'Today was probably one of the most challenging workdays I've ever had': doing remote qualitative research with hospital doctors during the COVID-19 pandemic. Qualitative Health Research. 2022; 32(10):1557-1573.

<https://doi.org/10.1177/10497323221106294> [open access]

Abstract: In this article we outline how a team of qualitative researchers responded to the challenging circumstances of the COVID-19 pandemic, describing how we successfully and speedily adopted remote/digital methods to research the experiences of hospital doctors. In 2020, we used Zoom to conduct qualitative interviews with 48 hospital doctors; in 2021, we used Zoom and WhatsApp to conduct a Mobile Instant Messaging Ethnography with 28 hospital doctors. We explain how we adapted to a virtual setting and provide clear insights (case study vignettes) into the additional demands on researchers and respondents, in particular, the impact on the research team. Finally, we analyse the positive and negatives of using remote qualitative methods and highlight the potential of hybrid data collection models that combine remote and face-to-face methods. We also highlight our success in communicating findings to a policy audience, important in time-critical situations, such as the COVID-19 pandemic

Jacob L, Koyanagi A, Smith L, Shin JI, Haro JM, Garthe T, et al. Prevalence of and factors associated with long-term sick leave in working-age adults with chronic low back pain in Germany. International Archives of Occupational & Environmental Health. 2022; 95(7):1549-1556.

<https://doi.org/10.1007/s00420-022-01841-z>

Abstract: Objective: There are little data on the impact of chronic low back pain (CLBP) on long-term sick leave. Thus, the aim was to investigate the prevalence of and the factors associated with long-term sick leave in working-age adults with CLBP in Germany. Methods: This retrospective study included adults aged 18-65 years diagnosed for the first time with

CLBP in one of 1193 general practices in Germany between 2000 and 2019. CLBP was defined as the presence of two diagnoses of low back pain with > 90 days between them. Long-term sick leave was assessed in the year following the first diagnosis of low back pain, and was defined as > 42 days of absence from work for health-related reasons. In Germany, employees on sick leave lasting > 42 days are not paid by the employer anymore but by the health insurance fund. Finally, an adjusted logistic regression model was used to assess the association between predefined variables (e.g., age, sex, and comorbidities) and long-term sick leave. Results: A total of 59,269 working-age adults were included in this study [mean (SD) age 32.8 (11.5) years; 41.4% women]. The prevalence of long-term sick leave in the sample was 49.1%. Long-term sick leave was significantly associated with young age, male sex, and several physical and psychiatric comorbidities (e.g., reaction to severe stress and adjustment disorder, gastritis and duodenitis, and depression). Conclusions: Based on these results, public health measures are urgently needed to mitigate the deleterious effects of CLBP on work participation in Germany.

Kim J and Choi S. The effect of job demands, job resources, and musculoskeletal complaints on presenteeism among the dependent self-employment workers in Korea: testing of a mediation and moderation model. *Journal of Occupational & Environmental Medicine*. 2022; 64(9):719-725.

<https://doi.org/10.1097/JOM.0000000000002613>

Abstract: OBJECTIVES: We tested the effects of job demands on presenteeism to investigate the mediation of musculoskeletal complaints (MSCs) and the moderating effects of job resources among dependent self-employment (DSE) workers in Korea. METHODS: Using data from the fifth Korean Working Conditions Survey, we analyzed 2252 workers, and a two-step regression analysis was used to test the mediated effect of MSCs and moderated the effect of job resources on the relationship between job demand and presenteeism. RESULTS: Musculoskeletal complaints mediate the relationship between job demands and presenteeism. Job control moderated the relationship between MSCs and presenteeism among the job resources. However, the conditional indirect effect of job demands on presenteeism through MSCs was independent of job resource levels among DSE workers. CONCLUSIONS: Various strategies are needed to address MSCs and enhance job resources for DSE workers, which might diminish the negative effect of job demands on presenteeism

Morton Ninomiya ME, Tanner B, Peach LJ, George N, Plain S, George T, et al. Anishinabek sources of strength: learning from First Nations people who have experienced mental health and substance use challenges. *Social Science & Medicine*. 2022; 309:115197.

<https://doi.org/10.1016/j.socscimed.2022.115197> [open access]

Abstract: We report on the system of care and sources of strength and resilience for mental health among First Nations People experiencing the impacts of historical and contemporary colonization. Aamjiwnaang First Nation, a vibrant community of approximately 2400 members in southwestern Ontario, Canada, partnered in research to reveal sources of

strength and resilience among community members with lived experiences (PWLE) with mental health and/or substance use challenges. A thematic content analysis was done using qualitative data collected as part of two complementary studies. In the first study called the "Five Views on a Journey" study, interviews with PWLE and family members of PWLE were conducted to better understand strengths and deficits in the system of care for mental health and substance use. In the second study entitled "A Strengths-Based Approach to Understanding How First Nations People Cope with Stress and Trauma," Photovoice was used to examine sources of strength and resilience among PWLE. Combined, these studies revealed that mental health supports and services that are trustworthy, open, and confidential are foundational to healing, helping PWLE find pathways to wellness by engendering feelings of hope, self-worth and pride. The integral roles of Anishinaabe culture and cultural identity as well as strong connections with family and community were key sources of strength and resilience. Our findings are discussed in the context of Aamjiwnaang's informal and formal systems of care, culture as wellness, inner strength, and the Truth and Reconciliation Commission of Canada's Calls to Action

Patel MR, Jacob KC, Amin KS, Ribot MA, Pawlowski H, Prabhu MC, et al. Does baseline mental health influence outcomes among workers' compensation claimants undergoing minimally invasive transforaminal lumbar interbody fusion? *Asian Spine Journal*. 2022; [epub ahead of print].

<https://doi.org/10.31616/asj.2021.0388> [open access]

Abstract: Study design: This was a retrospective cohort study. Purpose: This study investigated the influence of preoperative mental health on patient-reported outcome measures (PROMs) and minimal clinically important difference (MCID) among workers' compensation (WC) recipients undergoing minimally invasive transforaminal lumbar interbody fusion (MIS TLIF). Overview of literature: No studies have evaluated the impact of preoperative mental functioning on outcomes following MIS TLIF among WC claimants. Methods: WC recipients undergoing single-level MIS TLIF were identified. PROMs of Visual Analog Scale (VAS) for back and leg pain, Oswestry Disability Index (ODI), 12-item Short Form Physical and Mental Composite Scale (SF-12 PCS/MCS), and Patient-Reported Outcomes Measurement Information System Physical Function evaluated subjects preoperatively/postoperatively. Subjects were grouped according to preoperative SF-12 MCS: <41 vs. \geq 41. Demographic/perioperative variables, PROMs, and MCID were compared using inferential statistics. Multiple regression was used to account for differences in spinal pathology. Results: The SF-12 MCS <41 and SF-12 MCS \geq 41 groups included 48 and 45 patients, respectively. Significant differences in Δ PROMs were observed at SF-12 MCS at all timepoints, except at 6 months ($p=0.041$, all). The SF-12 MCS <41 group had worse preoperative to 6-months SF-12 MCS, 12-weeks/6-months VAS back, 12-week VAS leg, and preoperative to 6-months ODI ($p=0.029$, all). The SF-12 MCS <41 group had greater MCID achievement for overall ODI and 6-weeks/1-year/overall SF-12 MCS ($p=0.043$, all); the SF-12 MCS \geq 41 group had greater attainment for 6-month VAS back ($p=0.004$). Conclusions:

Poorer mental functioning adversely affected the baseline and intermediate postoperative quality-of-life outcomes pertaining to mental health, back pain, and disability among WC recipients undergoing lumbar fusion. However, outcomes did not differ 1-2 years after surgery. While MCID achievement for pain and physical function was largely unaffected by preoperative mental health score, WC recipients with poorer baseline mental health demonstrated higher rates of overall clinically meaningful improvements for disability and mental health.

Ruco A, Pinto AD, Nisenbaum R, Ho JW, Bellicoso E, Hassen N, et al. Collecting occupation and hazards information in primary care using O*NET. American Journal of Industrial Medicine. 2022; 65(10):783-789.

<https://doi.org/10.1002/ajim.23420>

Abstract: OBJECTIVE: The objective of this study was to determine the feasibility of collecting occupation and occupational hazard data in a primary care setting, using the Occupational Information Network (O*NET) database to assist with classification. METHODS: We collected data from 204 employed adult primary care patients in Toronto, Canada, on their occupation and exposure to occupational hazards, and mapped their job titles to the O*NET database. We compared their self-reported occupational hazard exposures with the likelihood of exposure on O*NET. RESULTS: Exposure to repetitive arm movement was reported by 78%, to vapors/gas/dust/fumes by 30%, to noise by 30%, and to heavy loads by 31%. Significant differences in exposure to vapors/gas/dust/fumes were associated with work precarity. We matched the majority of job titles (89%) to O*NET categories. CONCLUSIONS: Collecting employment information in primary care setting was feasible, with the majority of job titles mapping onto O*NET classifications

Tiesman H, Marsh S, Konda S, Tomasi S, Wiegand D, Hales T, et al. Workplace violence during the COVID-19 pandemic: March-October, 2020, United States. Journal of Safety Research. 2022; 82:376-384.

<https://doi.org/10.1016/j.jsr.2022.07.004> [open access]

Abstract: Problem: COVID-19 has impacted United States workers and workplaces in multiple ways including workplace violence events (WVEs). This analysis scanned online media sources to identify and describe the characteristics of WVEs related to COVID-19 occurring in the United States during the early phases of the pandemic. Method: Publicly available online media reports were searched for COVID-19-related WVEs during March 1-October 31, 2020. A list of 41 keywords was used to scan four search engines using Natural Language Processing (NLP). Authors manually reviewed media reports for inclusion using the study definition and to code variables of interest. Descriptive statistics were calculated across three types of violence: non-physical, physical, and events with both physical and non-physical violence. Results: The search of media reports found 400 WVEs related to COVID-19 during March 1-October 31, 2020. Of the WVEs, 27% (n = 108) involved non-physical violence, 27% (n = 109) physical violence, and 41% (n = 164) both physical and non-physical violence. Nineteen WVEs

could not be assigned to a specific type of violence (5%). Most occurred in retail and dining establishments (n = 192, 48%; n = 74, 19%, respectively). Most WVEs related to COVID-19 were perpetrated by a customer or client (n = 298, 75%), but some were perpetrated by a worker (n = 61, 15%). Most perpetrators were males (n = 234, 59%) and acted alone (n = 313, 79%). The majority of WVEs were related to mask disputes (n = 286, 72%). In 22% of the WVEs, the perpetrator coughed or spit on a worker while threatening infection from SARS-CoV-2, the virus that causes COVID-19. Discussion: This analysis demonstrated that media scraping may be useful for workplace violence surveillance. The pandemic resulted in unique violent events, including those perpetrated by workers. Typical workplace violence prevention strategies may not be effective in reducing COVID-19-related violence. More research on workplace training for workers during public health crises is needed.

Truchon M, Gilbert-Ouimet M, Zahiriharsini A, Beaulieu M, Daigle G, and Langlois L. Occupational Health and Well-being Questionnaire (OHWQ): an instrument to assess psychosocial risk and protective factors in the workplace. Public Health. 2022; 210:48-57. <https://doi.org/10.1016/j.puhe.2022.06.008>

Abstract: Objectives: Psychosocial stressors at work have been identified as significant risk factors for several mental and physical health problems. These stressors must be compensated by psychosocial resources to prevent or reduce adverse effects on health. Questionnaires measuring these stressors and resources already exist, but none integrate digital stress, ethical culture, and psychosocial safety climate; factors that are increasingly linked to workers' health. This study aims to develop and establish the psychometric properties of one of the most comprehensive instruments measuring the psychosocial work environment to date: the Occupational Health and Well-being Questionnaire (OHWQ). Study design: A cross-sectional validation study is proposed to develop the OHWQ and document its psychometric properties. Methods: The OHWQ was developed from validated instruments to which new items were added. The questionnaire includes psychosocial dimensions, along with indicators of psychological distress, musculoskeletal disorders, and well-being. It was administered to a sample of 2770 participants from a population working in the academic field. Exploratory and confirmatory factor analyses and the calculation of Cronbach's a coefficient were used to identify the variables, items, and dimensions of the OHWQ and to document its main psychometric properties. Results: The acceptability of the measurement model was evaluated by the reliability of the items, internal consistency between the items, and the convergent and discriminant validity. Construct validity was assessed using exploratory and confirmatory factor analyses. Using factor analyses and cut-off rules, the new instrument has 124 items grouped into 22 dimensions. The OHWQ demonstrated satisfactory reliability and validity, as well as reasonable fit indices. The internal consistency of the scales was also good (Cronbach's a = 0.68-0.96, median = 0.85). Conclusion: The OHWQ demonstrated good psychometric properties. It could be useful for both research purposes

and for workplaces interested in developing concrete action plans aimed at improving the balance between psychosocial work stressors and resources.

Wijnands APG, de Vries I, Verbruggen T, Carlier MP, de Lange DW, and Rietjens SJ. Acute occupational exposures reported to the Dutch Poisons Information Center: a prospective study on the root causes of incidents at the workplace. *Journal of Occupational Medicine and Toxicology*. 2022; 17(1):19.

<https://doi.org/10.1186/s12995-022-00360-4> [open access]

Abstract: BACKGROUND: Hazardous substances at the workplace can cause a wide variety of occupational incidents. This study aimed to investigate the nature and circumstances of acute occupational intoxications reported to the Dutch Poisons Information Center. METHODS: During a one-year prospective study, data on the circumstances and causes of the incident, the exposure(s) and clinical course, were collected by a telephone survey with victims of an acute occupational intoxication. RESULTS: We interviewed 310 patients. Most incidents occurred in industry (25%), building and installation industry (14%) and agriculture (10%). Patients were often exposed via multiple routes. Inhalation was the most common route of exposure (62%), followed by ocular (40%) and dermal contact (33%). Acids and alkalis were often involved. Exposure often occurred during cleaning activities (33%). The main root causes of these accidents were: technical factors such as damaged packaging (24%) and defective apparatus (10%), organizational factors such as lack of work instructions (44%) and poor communication or planning (31%), and personal factors such as disregarding work instructions (13%), not (adequately) using personal protective equipment (12%) and personal circumstances (50%) such as inaccuracy, time pressure or fatigue. The majority of the patients only reported mild health effects and recovered quickly (77% within 1 week). CONCLUSIONS: Poison Center data on occupational exposures provide an additional source of knowledge and an important basis for poisoning prevention strategies related to hazardous substances at the workplace. These data are useful in deciding which risk mitigation measures are most needed in preventing future workplace injuries

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