

# AOEM

## Annals of Occupational and Environmental Medicine

Volume 35 - Supplement - November 2023

**ACOH2023**

23rd Asian Congress on Occupational Health

Nov. 22 – 25, 2023 | Daegu, Korea

Healthy Work, Worthy Worker :  
From Basic Rights to Sustainable Future

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# Preconference ACOH2023

## Interactive Data Visualization for Occupational Health

### Data Exploration using R

(Unleashing Insights with Chat-GPT and R Code Processing)

### Organizer

#### Data Science Committee

Data Science Committee in the Korean Society of Occupational and Environmental Medicine

### The Lecturer

#### Jin-Ha Yoon

Institute for Occupational Health, Yonsei University College of Medicine, Seoul, Korea.

Department of Preventive Medicine, Yonsei University College of Medicine, Seoul, Korea.

### Summary

We cordially invite you to attend the pre-conference workshop on “Interactive Data Visualization for Occupational Health Data Exploration using R.” This workshop delves into the realm of interactive data visualization in R, customized for the unique requirements of occupational health research. Join us in uncovering the potential of R’s data visualization packages and harnessing the capabilities of Chat GPT to process R code, thereby facilitating dynamic exploration and extraction of insights from occupational health datasets.

### Topics (4 hours)

1. Data Exploration and Epidemiological interaction (10 min)
2. Overview of Interactive Data Visualization (10 min)
3. Interactive Data Visualization Principles (10 min)
4. Introduction to R for Data Visualization (20 min)
  - a. R and Rstudio setting
  - b. Environmental Setting
5. Accessing and Preparing Working Condition Survey Data (10 min)
6. Leveraging Chat GPT for R Code Processing (15 min)
7. Building Interactive Visualizations with R (30 min)
8. Advanced Techniques and Customization (optional, chat-gpt API) (30 min)
9. Hands-on Exercises with Chat GPT and R (30 min)
10. Q and A (30 min)

# Keynote Session



## Keynote Session

Ann Occup Environ Med. 2023 Nov;35(Supplement):K-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Translating knowledge into action: technological innovations in occupational safety and health

**David Koh\***

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The work environment has seen rapid changes, necessitated by the need for innovation and productivity. The nature of work is evolving, with many tasks vulnerable to automation. At the same time, technology has become more pervasive, with increasing applications developed in robotics, machine learning, artificial intelligence and wearable technology. Huge amounts of data are routinely collected from many different sources, which can be used for predictive analytics. The generational change in the workforce also has implications on how we work. The above factors, acting in concert, have caused not only disruption, but also technological innovations in occupational safety and health (OSH). We now see the utilization of innovations such as automation, drone technology, artificial intelligence, wearables, predictive analytics, virtual and augmented reality in different OSH scenarios. In order for us to better prepare for and accept such technological innovations, we have to keep abreast of developments, embrace and adapt to change, be aware of hype, and ensure that policy, regulations and ethics keep up with such technological innovations.

**Keywords:** Innovation; Technology; Disruption; Occupational safety and health

## Keynote Session

Ann Occup Environ Med. 2023 Nov;35(Supplement):K-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
 eISSN 2052-4374

## Challenges and achievements of occupational health in Korea

**EunA Kim\***

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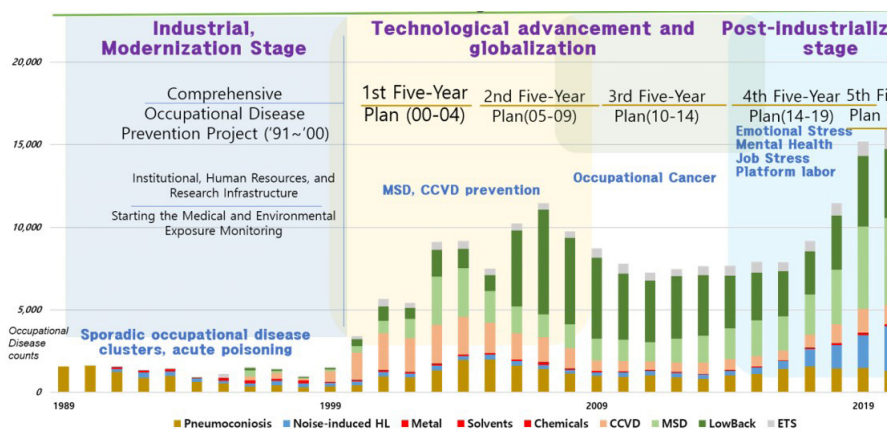
**Background:** Presenting the outcomes, and limitations of the occupational disease prevention policies, for each stage of economic development, using the case of South Korea.

**Methods:** The development of occupational health policies is often dependent on the political and economic context, particularly as key issues change with shifts in the labor market. South Korea's experiences with industrial health policies over the past century hold significant value in sharing with Asian countries.

**Results:** Occupational disease prevention policies in South Korea have evolved across different stages of industrial development. In the early industrialization(1960s–1970s), The occurrence of occupational disease clusters has created sporadic social issues and there was limited focus on prevention. During the industrialization and modernization stage(1980s–1990s), workplace safety standards improved, and awareness of occupational health risks increased. With technological advancement and globalization (2000s–early 2010s), policies became more advanced, targeting hazardous substances, chronic work-related condition (musculoskeletal disorder, cardiovascular and cerebrovascular diseases) and occupational cancers. In the post-industrialization (late 2010s–), emphasis shifted to work-life balance and mental health support. Challenges remain in implementation and enforcement. In recent years, there has been an increase in labor markets that go beyond traditional labor-management relationships, raising doubts about the effectiveness of existing occupational disease prevention policies. Consequently, there is an effort to shift the paradigm of the policies towards encouraging autonomous prevention activities by workers and employers. Reflection on the effectiveness of occupational health policies has also led to stronger penalties for companies, manifested in the enactment of the Act on the Aggravated Punishment of Specific Economic Crimes, which aims to enhance punishments for major accidents.

**Conclusions:** Experiences in South Korea are a potential source of learning for Asian countries, as they may currently undergo or encounter similar changes in the future. It is hoped that Asian Congress on Occupational Health will serve an opportunity to promote occupational disease prevention for Asian workers.

**Keywords:** Occupational health policy; Korea; Chronological change



**Fig. 1.** Chronological change of the occupational health policy and occupational disease compensation of Korea. MSD: musculoskeletal disorder; CCVD: cardiovascular and cerebrovascular disease; HL: hearing loss.

## Keynote Session

Ann Occup Environ Med. 2023 Nov;35(Supplement):K-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# New challenges in the traditional industry and the need for international cooperation

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**Background:** The traditional industrial sector remains a fundamental pillar of the global economy, primarily due to its substantial contributions to production value and workforce engagement. In 2022, the global workforce numbered approximately 3.32 billion individuals, a notable increase from the 2.28 billion recorded in 1991. Traditional industry encompasses sectors with long-standing historical roots, typically involved in the production of tangible goods or the provision of essential services. These sectors encompass manufacturing, agriculture, mining, oil and gas, and construction. This presentation will explain the current occupational health and safety (OHS) challenges in these industries and highlight the importance of international collaboration.

**Methods:** This presentation was developed based on the analysis of data and information gleaned from searching published documents related to traditional industries, their associated challenges, and the imperative for international cooperation to address these challenges.

**Results:** Workers in traditional industries face many health issues due to the nature of their work. These issues often stem from exposure to hazardous substances, physical exertion, and workplace conditions. Despite numerous efforts to enhance worker safety and well-being, new challenges persistently emerge, and existing ones undergo continual evolution. Even amid a pandemic, a significant portion of this sector remains operational, adapting to ongoing limitations while striving to maintain production.

**Conclusions:** Traditional Industries remain facing the classical OHS challenge and emerging potential health hazards. Digital technology is fundamentally reshaping planning, management, and execution across all industries, including traditional industry. Sharing experiences and advanced technologies through international collaboration is key for clean energy and sustainable production.

**Keywords:** Traditional industry; Occupational health and safety hazards; International cooperation; Clean energy; Advanced technology

## Keynote Session

Ann Occup Environ Med. 2023 Nov;35(Supplement):K-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Occupational cancer epidemiology - why we need more evidence

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Studies of workers have played a crucial role in identifying human carcinogens and have led to national and regional authorities setting occupational exposure limits (OEL) enforced by legislation to protect workers and the environment. The first step towards preventing occupational cancers is to identify carcinogenic agents. Thereafter to assess the relevance of each exposure in the population or industry to identify where prevention measures are best needed. The Global Burden of Disease (GBD) study and other studies provide global estimates of cancers related to different risk factors, including occupational exposure to carcinogens. It is a useful and scientifically rigorous international exercise serving to observe quantifiable progress in global health over time as well as geographic variability. The underlying data is unfortunately often scarce leading to very large uncertainties. The GBD 2016 Occupational Carcinogens Collaborators derived exposure information primarily from CARcinogen Exposure (CAREX) database, which provided the prevalence of exposures to selected agents in industries in Western Europe in the early 1990s. The actual measurements resulting in the development of CAREX originated from series of measurements in Finland and the US mainly in the 1980s, and the GBD study assumed that exposures had not changed when estimating the cancer burden globally in 2016. Scientists usually acknowledge the uncertainties and the lack of data from most countries, but the downstream use of these estimates tend to ignore the many assumptions made and the subsequent uncertainties. Governance is usually reactive to scientific developments. Therefore, occupational cancer epidemiology and exposure surveillance from more countries, notably low- and middle-income countries are needed because exposures may differ considerably within and across countries and over time.

**Keywords:** Cancer; Occupational exposures; Epidemiology; Population attributable fraction; Cancer prevention

## Keynote Session

Ann Occup Environ Med. 2023 Nov;35(Supplement):K-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Why long workhours harm health and gender equality: insights from Australia and Germany

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In 2021 the World Health Organization ranked long hours as one of the most important work-related global health hazards. Yet, despite decades of evidence on their health harms, workhour limits are routinely violated in many countries and long hours remain a tacit 'rule' for good jobs, good pay and success. Long workhours are incompatible with care and domestic work, and because of this they pose a problem for gender equality and women's earnings and opportunities. In this presentation I explore how expectations to work long hours reward workers not just for their skills and merit, but for 'extra' time. We then model how this creates different health harms for men and women, using representative, longitudinal data from Australia and Germany (103,015–109,886 observations, The Household, Income and Labor Dynamics in Australia and Socio-Economic Panel surveys). We modelled a reciprocal system of wages, hours and health to deal with endogeneity and reverse causality, which very few studies do. We also included estimates of hours in care and domestic work to then estimate health 'ceilings' or points where weekly workhours incur health costs. The 3stage least squares estimates revealed that women's health is compromised considerably more than men's by long hours because of the extra work they do in the home. Our estimates indicate men, on average, can work 10 to 14 hours longer than women without a health cost because of the unequal sharing of care and domestic work. We then layered men's and women's health ceilings by weekly wages and hours to illustrate how, irrespective of experience or education, for women to earn equally and hold high paying jobs, they currently face an unequal health cost. These health costs are an important element to the 'glass ceiling' and I close by discussing recent research on why attempts to change long hours is often resisted by workplaces and policy makers.

**Keywords:** Gender inequality; Psychosocial hazards; Working hours; Work organization

## Keynote Session

Ann Occup Environ Med. 2023 Nov;35(Supplement):K-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Occupational health and safety situation among marginalized workers in Thailand: a case study of immigrant and electronic waste dismantling labors

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**Background:** This research focuses on the well-being of two marginalized workforces: electronic dismantling workers (e-waste workers) and immigrant laborers. These individuals are exposed to various health risks in their daily work, making it crucial to investigate strategies for reducing the incidence of occupational diseases.

**Methods:** We conducted an extensive health survey, employing questionnaires, in-depth interviews, and health check-ups from 2018 to 2020.

**Results:** E-waste workers have a main task to separate valuable components from e-waste. This task was performed close to the living area which increased health hazard exposure to workers and family members. Noise-induced hearing loss was a main health problem, but they could not recognize the link to occupational noise exposure. Additionally, economic concerns took precedence over safety considerations. To address these challenges, we recommend the establishment of official risk perception training programs within the education system and communities. A second survey targeted immigrant laborers working in special economic zones within the Chiang Rai province. These laborers faced health hazards such as noise exposure and heavy lifting. Their limited proficiency in Thai reading and writing relates to low-risk perception, with 40% of them unaware of their healthcare service rights. Barriers to accessing public health services included feelings of alienation, transportation issues, and language barriers. To address these concerns, we propose the implementation of an occupational health volunteer program, comprised of immigrant workers proficient in Thai and possessing a service-oriented mindset. These volunteers undergo a 2-day training program, enabling them to provide valuable information about worker rights and healthcare service accessibility within their communities.

**Conclusions:** This study emphasized the importance of risk assessments for marginalized workers to develop appropriate strategies for reducing occupational health hazards. Any such strategy should be sensitive to language, culture, and social norms to ensure its success in improving the health and safety of these vulnerable worker populations.

**Keywords:** E-waste; Immigrant worker; Inequality; Health care access; Language barrier



Fig. 1. Electronic dismantling place.



Fig. 2. Electronic dismantling place.

## Keynote Session

Ann Occup Environ Med. 2023 Nov;35(Supplement):K-07  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
 eISSN 2052-4374

## Development of a web-based participatory workplace improvement program for the primary prevention of mental health issues in small and medium-sized enterprises

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**Background:** With challenges of the coronavirus disease 2019 pandemic, remote work has become increasingly prevalent, facilitating flexible work methods not bound by time or location. This is in accord with the advances in digitalization of occupational health services. Within this context, the challenge lies in supporting employer and employee health activities, particularly promoting dialogue for work stress management. Participatory workplace improvement programs, crucial for supporting workplace-level dialogue, have spread across various sectors. These programs offer benefits when applied in small-scale business settings. Therefore, our team has undertaken the development of a web-based participatory workplace improvement programs for the primary prevention of mental health stress. We have examined the outcomes and challenges.

**Methods:** The Participatory Workplace Improvement Program (PWIP) is applying participatory approaches tailored to meet the specific needs of each workplace. The program is supported by internal facilitators appointed within each workplace. External coordinators, namely the research team members, train and support these internal facilitators in executing the PWIP.

Step 1 involves a 2-hour training session for internal facilitators. Subsequently, these facilitators evaluate the PWIP readiness applying a checklist (Basic Organizational Development for Your Workplace, BODY checklist), learn facilitation skills through a 5-minute instructional video or receive suggestions for coordinating workplace activities.

Step 2 includes planning and implementing PWIP actions involving co-workers, with the assistance of a web-based procedures. Employees utilize the app to discern positive and improvable workplace conditions, engage in group activities, and contribute to planning workplace improvements. The PWIP comprises the following three sessions:

1. The initial kick-off session involves a brief workplace-level workshop for learning local good practices and how to use the mental health action checklist focusing on low-cost interventions, and job stress prevention measures.
2. Subsequent follow-up and action sessions occur within 1–3 months later through fostering consensus and enabling actions according to the agreed-on plans.
3. Reporting and sharing achievements follow in subsequent months, with a clear focus on local successes in improving workplace conditions and workers' safety and health.

**Results:** We gained trial experiences in several workplaces. The program followed the stress prevention guidelines in learning from local practices, tackling multifaceted stress-related risks, and taking group-work steps at the workplace level. Emphasis was placed on low-cost strategies for improving internal communication, work schedules, and team-work arrangements. The majority of improvements were attributed to these areas, often implemented in a combined manner, with communication enhancements frequently integrated with better work methods or less stressful schedules. Improvements in the physical environment were also usually paired with better communication or team dynamics. These multifaceted improvements were facilitated by the use of action checklists reflecting local good practices.

**Conclusions:** The web-based participatory program facilitated: 1) joint workplace assessments leading to locally adjusted actions, 2) documentation and sharing of primary preventive measures for job stress at the workplace, and 3) provision of local resources for promoting employee dialogue. It is poised to support workplace environment improvements through stress-check programs, particularly expanding its reach in small and medium-sized enterprises with limited resources. These experiences confirm that there is a need to: 1) develop training for internal/external facilitators for program utilization, 2) devise usage strategies for workplaces



unfamiliar with IT tools, and 3) innovate approaches to addressing workplaces with clear issues, such as high-stress workplace environments. The accumulation of good practices by utilizing both on-site and web-based approaches, and the development of new off-line occupational health services, is anticipated.

**Keywords:** Workplace improvements; Participatory approach; Web-based program; Stress prevention; Small-medium sized enterprises

# Symposium

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-01-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Occupational stress assessment: are we doing it right?

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The ever fast evolving information technology and globalisation have added to the boiling cauldron of stress at work. The most important issue to be addressed while measuring occupation stress is the validity of the questionnaire, (other being sampling bias) without which, the generalisability of the findings will be affected. This talk will deliberate on the flaws encountered in assessing occupational stress. One of the major limitations reported is questionnaires measuring general stressors across most organisations, while failing to incorporate stressors unique to specific, higher-stress occupations. This is further questioned as to whether general occupational stress measures have the same, or even similar, psychometric properties across different occupational groups. Studies revealed workers using their own experiences or observations on their colleagues, in developing stressors which lead to a diverse variety of stress studies devoid of pertinent issues relevant to that organisation. Another limitation identified is conducting a qualitative questionnaire through focus groups or one to one interview, which though may provide a snapshot of the information, did not allow quantification of stress which is important for mitigation measures. Studies had 60 item or 86 stressor questionnaire which contributed too much to the survey burden faced by the already burdened workers, especially in highly stressed occupations. Another limitation is overemphasis on the job itself without heed to the work-family boundaries which overlap causing a two-way effect where one effects the other and vice-versa. Reports revealed stress questionnaires not measuring the appropriate stressors relevant to one's job. Studies reported measuring perceived stress instead of the actual stress experienced. Questionnaire used were not exhaustive in content to address all ranks or positions in an organisation thus limiting generalisability of the findings to the whole organisation. The speaker will deliberate on the above flaws and address the progress made in overcoming these limitations.

**Keywords:** Occupational stress; Stress questionnaire; Assessment of stress; Validity; Limitations

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-01-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Psychological safety, a core element in workplace culture

**Edwin Ho\***

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Psychological safety is the shared belief that the team is safe for interpersonal risk-taking. This means that team members feel comfortable being themselves, sharing their ideas, and admitting mistakes without fear of being judged or punished. Psychological safety is essential for high-performing teams because it allows team members to be more creative, innovative, and productive. There are many benefits to having a psychologically safe workplace. For example, employees in psychologically safe workplaces are more likely to be engaged and motivated, take risks and try new things, speak up and share their ideas, be more creative and innovative, have better relationships with their colleagues, be less stressed and burned out. There are a number of things that organizations can do to create a psychologically safe workplace and embed it into their culture. These include setting clear expectations and norms for behavior, modeling respectful and inclusive behavior, providing opportunities for feedback and learning, creating a culture of trust and openness, addressing concerns and problems promptly. Measuring psychological safety is important for organizations to track their progress and make sure that they are creating a safe and supportive environment for their employees. There are a number of different ways to measure psychological safety, but some of the most common methods include surveys, observation and interviews. Surveys are a popular way to measure psychological safety because they can be easily administered and analyzed. However, it can be biased and affected by many factors, so it is important to design the right survey tools. By measuring psychological safety, organizations can identify areas where they need to improve and make sure that they are creating a workplace where employees feel comfortable taking risks and being themselves, thus completing the cycle of continuous improvement along the way.

**Keywords:** Psychological safety; Workplace culture; Health and wellbeing; Mental health; Measuring

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-01-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Mental well-being in the workplace for a sustainable future

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**Background:** Mental well-being in the workplace has become a priority for many organisations around the world as the coronavirus disease 2019 pandemic brought the mental health challenges faced by employees to the forefront. Employee burnout and decreased work-life balance satisfaction that came together with many dynamic and rapid changes taking place in recent times became a concern. Employers are seen to increasingly address the psychosocial risk factors faced by employees while overcoming stigma and discrimination, which is still very much prevalent.

**Methods:** PETRONAS has taken proactive actions in supporting and enhancing mental well-being of its workforce by developing various interventions at leadership, organisational and individual levels through its umbrella programme; MESTIfit4Health. Among the intervention programmes are Leaders Reach Out, Intentional Wellness Engagement, MIND-A-CARE, and Individualized Coaching for Resilience Enhancement (i-C4RE). Employees can also access round-the-clock wellness support through the Employee Assistance Programme (myFriends) that includes counselling, careline calls and digital wellness coaching provided through a holistic approach. Specific interventions are also targeted to enhance psychosocial safety climate in the organisation.

**Results:** PETRONAS now has 217 MIND-A-CARE ambassadors among its employees empowered to support mental health first aid. Eighty-nine percent of employees who attended Intentional Wellness Engagement with their leaders responded that the sessions were helpful in improving psychological safety at their workplace. Sixty-four percent resilience score improvement was recorded among those who completed all the i-C4RE modules. Seventy percent of employees who sat for counselling sessions through myFriends found the therapy effective in improving their daily life functions.

**Conclusions:** Mental well-being interventions in PETRONAS were found to be effective in supporting its workforce, including those at remote and offshore facilities. These intervention programmes are periodically reviewed to remain impactful and beneficial, in line with PETRONAS' purpose of being a progressive energy and solutions partner enriching lives for a sustainable future.

**Keywords:** PETRONAS; Mental health; Wellness; Workplace; Occupational health

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-01-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### My organization's mental health journey

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This presentation provides an overview of my organization's journey in implementing mental health programs within the organization. The organization's purpose is to unite science, technology, and talent to get ahead of disease together. With a focus on biopharma, the organization strives to develop transformative vaccines and medicines, intending to positively impact the health of 2.5 billion individuals over the next decade. Recognizing that the well-being of its employees is crucial, we believe that nurturing mental health is as vital as maintaining physical health. By prioritizing mental health and fostering resilience, employees can better navigate daily challenges. The presentation delves into the organization's comprehensive approach to integrating mental health support across all employees. This begins by establishing a supportive environment, which serves as the foundation for mental health initiatives. The organization also emphasizes the importance of equipping employees and people managers with the necessary skills and knowledge to address mental health concerns effectively. One notable initiative is the global mental health training program, accessible to all employees. This training equips individuals with the confidence to engage in mental health conversations and appropriately guide their colleagues towards our available resources. Additionally, the presentation highlights our "Performance with Choice" policy, a global hybrid working approach. This policy empowers office-based workers to tailor their work arrangements to support both their performance and personal wellbeing. Through its commitment to mental health, our organization demonstrates its dedication to creating a workplace where individuals can thrive. By fostering a supportive environment, providing mental health training, and implementing flexible work policies, we prioritize the wellbeing of our employees, recognizing the significant impact it has on their overall health and productivity. In summary, this presentation showcases our organization's journey in integrating mental health programs, emphasizing the importance of mental wellbeing, and outlining the initiatives undertaken to support employees in achieving optimal work-life balance.

**Keywords:** Health and wellbeing; Mental health; Thriving employees; Resilience

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-01-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Mental health: taking care of the caring profession

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The coronavirus disease 2019 pandemic, which emerged in early 2020, had far-reaching consequences on global society. Among the most impacted were frontline healthcare workers (HCWs), especially those working in hospital environments. The management of a teaching hospital in Kuala Lumpur recognized early on the significance of safeguarding the well-being of HCWs and addressing their mental health during this crisis. Throughout different stages of the pandemic, HCWs encountered various mental health challenges. Initially, they faced anxiety and fear due to limited knowledge and the proliferation of misinformation. This was followed by social isolation, burnout, depression, emotional distress, post-traumatic stress disorder (PTSD), and moral distress. The experience at this teaching hospital provided valuable insights for the management of similar situations in the future. Measures were devised and implemented in a timely manner, responding to emerging needs. Key factors that facilitated the response included 1) a strong, dedicated and responsive management team, 2) an established occupational and public health service, and 3) resource people with a good foundation in occupational and public health. Implemented measures encompassed the establishment of a risk assessment team, a psychosocial telephone helpline, childcare facilities for HCWs, designated accommodations for quarantined or apprehensive HCWs, effective communication channels through emails and townhall sessions involving experts and top management, development of HCW-friendly work schedules, among others. This presentation aims to outline strategies and a framework for managing mental health issues in a hospital setting during future pandemics.

**Keywords:** Occupational safety and health services; Public health services; Risk assessment; Holistic measures

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-02-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Advantages and limitations of applying causal inference to observational studies for workers

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**Background:** Causal inference is increasingly popular in applied health research for estimating causal effects.

**Methods:** We would like to introduce the advantages and limitations of the following causal inference methods: directed acyclic graphs (DAGs), inverse probability weighting (IPW), standardization, g-methods, and causal mediation analysis.

**Results:** DAGs offer a diagrammatic representation of causal paths between variables, ensuring clarity in visualizing complex relationships based on prior knowledge. However, DAGs have the disadvantage that there is uncertainty about whether the DAG is correct due to limitations in prior knowledge, and they cannot express the magnitude of the effect or existence of interaction. Based on the DAG and potential outcomes framework, IPW and standardization provide causal effect of exposure on outcome by fitting parametric models with multiple confounders. They intuitively express the effect using risk difference, risk ratio, and odds ratio scales. However, it is well known that the traditional methods produce biased effects when analyzing complex longitudinal data with exposure-confounder feedback. Therefore, g-methods were developed to control the bias. Among g-methods, the parametric g-formula can evaluate the joint effects of multiple exposures but is known to be vulnerable to model misspecification. G-estimation is usually more efficient than marginal structural model with IPW, and requires fewer parametric assumptions than the g-formula. However, g-estimation has conceptual difficulties compared to other methods. Causal mediation analysis clarifies the assumptions necessary to establish the causal role of mediating factors based on the potential outcomes framework, which may not be present in traditional analyses. When there are multiple mediators, estimating the indirect effect of each mediator can be challenging.

**Conclusions:** Causal inference methods are very attractive in that, despite some limitations that need to be resolved in the future, they can infer causal relationships when several assumptions are satisfied and clarify non-causal paths where bias may occur.

**Keywords:** Causal inference; DAGs; G-methods; Causal mediation analysis



## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-02-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Effects of long-term combined exposure to blood lead and blood cadmium on anemia: application of the g-formula

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**Background:** The health effects of combined exposure to heavy metals, especially long-term exposure, have rarely been studied in occupational epidemiological studies. G-formula, which is one of the g-methods, was developed to remove the bias caused by the exposure-confounder feedback when estimating the long-term effect in complex longitudinal data. We aimed to evaluate the combined effect and the interaction of long-term exposure to lead and cadmium on the development of anemia in Korean workers using the g-formula.

**Methods:** The special health examination data for Korean workers, which are collected in Occupational Safety and Health Research Institute, from 2013 to 2019 were used in this study. We used the g-formula to investigate the effect of combined exposure to lead and cadmium on anemia on a risk ratio scale, assuming different hypothetical intervention levels of blood lead and blood cadmium. As a reference group, we defined a hypothetical intervention in which all workers were fixed at blood lead 1.6 µg/dL and blood cadmium 0.9 µg/L at all time points.

**Results:** Compared to the reference group, the risk ratios for anemia were significantly increased when all workers were exposed to at least blood lead 15 µg/dL or blood cadmium 3 µg/L, respectively. Additionally, when the blood concentration of one heavy metal was fixed at a certain level, the risk ratio increased with increasing the blood concentration of the other heavy metal.

**Conclusions:** This study showed the risk of anemia according to the long-term exposure to blood lead and blood cadmium at various concentrations. Through this, the dose-response relationship between blood lead and anemia, the dose-response relationship between blood cadmium and anemia, the dose-response relationship when exposed to two heavy metals simultaneously, and the interaction between blood lead and blood cadmium can all be observed.

**Keywords:** Complex longitudinal data; Long-term effect; Combined exposure; Exposure-confounder feedback; G-formula

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-02-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# The application of causal inference to observational studies for workers in the Republic of Korea

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**Background:** Epidemiological studies of the association between parental occupation and the risk of adverse pregnancy outcomes are controversial, especially in studies concerning the father's occupation. Therefore, we examined the risk of miscarriage, preterm birth, low birth weight, and congenital anomalies among male workers in the 'human health activities (86)' and 'manufacture of basic metal product (24)' industries.

**Methods:** We used data from the 2010–2019 Korean National Health Information database and the family tree database for this study. Workers in 'public administration and defense; compulsory social security (84)' and 'education (85)' were used as reference groups for comparison. The standardization and inverse probability weighting method were used to estimate the causal effect of these occupations on the risk of adverse reproductive outcomes. Additionally, we conducted a causal mediation analysis to estimate the direct effects, excluding potential indirect effects such as those from family income, alcohol drinking, and smoking status.

**Results:** Male workers in the 'manufacture of basic metal product (24)' and the 'human health activities (86)' had an increased risk of miscarriage, preterm birth, and low birth weight. The increased risk of congenital anomalies was specifically observed in male workers from the 'manufacture of basic metal product (24)'. In addition, these results were consistently observed to be significant in direct effects.

**Conclusions:** The results of this study not only shed light on the reproductive health challenges faced by male workers in specific industries in Korea, but also provide scientific evidence to inform policies aimed at protecting the reproductive health of Korean male workers.

**Keywords:** Causal inference; Pregnancy

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-02-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Healthy worker survivor bias in a cohort of medical radiation worker

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**Background:** Occupational cohort studies face challenges in studying causal inference from the healthy worker survivor effect. We investigated the effect of cumulative radiation exposure on mortality and cancer incidence among medical radiation workers (MRWs) adjusting for time-varying confounders affected by prior exposure.

**Methods:** We used the dataset of South Korean diagnostic MRWs registered on the National Dose Registry from 1996 to 2011. This dataset was merged with cancer incidence data and death data. Occupational exposure was dichotomized based on cumulative badge dose with a 10-year lag (1 mSv vs.  $\geq 1$  mSv). We applied g-estimation of structural nested accelerated failure-time models to adjust for time-varying confounding and compared the results with those obtained from the Weibull regression. Both models included sex, year of birth, duration of employment, attained age, and employment status as covariates.

**Results:** A total of 3,759 first primary cancer cases and 1,831 deaths were included among 93,918 MRWs. The hazard ratios (HRs) obtained using g-estimation were significantly higher than Weibull regression estimates for all causes of death (1.38 vs. 2.34) and for all cancer incidence (1.30 vs. 1.62). Male workers showed increased HRs for all causes of death (1.26 vs. 2.55) and all cancer incidence (1.34 vs. 1.96), while HRs of female workers decreased (2.12 vs. 0.72 for all causes of death, 1.27 vs. 0.83 for all cancer incidence). The results were consistent in sensitivity analyses restricted to workers who were employed in or after 1996.

**Conclusions:** Our results suggested the presence of healthy worker survival bias in MRWs, which led to an underestimation of the effect of occupational radiation exposure. The healthy worker survival effect appeared larger in mortality than incidence index and had different patterns by sex. Careful consideration should be considered in occupational epidemiological studies, particularly for male mortality studies.

**Keywords:** Bias; Causal inference; Cohort; Health professionals; Ionizing radiation

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-03-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Education, training and practice of occupational medicine/health in China

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The terms occupational medicine and occupational health are often used interchangeably in China, and there is no real difference between them in certain scenarios. Mostly, in the area of preventive medicine, like in the School of Public Health within university or in the Centers for Disease Control and Prevention (CDC) system under Health Ministry, the term occupational health is used, but occupational medicine if it emphasized on clinic activity. Under the clinical medicine, mostly the term occupational disease or poisoning treatment are used. In China, a total of 170 colleges and/or universities have set up public health education teaching. Undergraduate students take a compulsory course called occupational health and medicine, including theory and practice and mainly focusing on prevention of occupational diseases and/or related diseases. If they work in CDC system, they can get qualifications with Public Health Physician after passing national examination. Within school of medicine, the course Internal Medicine includes contents of occupational diseases. During the standardized training stage for residents, they study the knowledge related occupational medicine and make practice in the department (division) of occupational disease for 1–2 weeks in comprehensive hospitals (if having). In China, there is national center for occupational safety and health of National Health Commission, except for national institute of occupational health and poisoning control under national CDC. Occupational health departments are set up in provincial, municipal, and county-level CDC, but the professionals number varies. In Shanghai, Guangdong and some other provinces and even in some counties, except for CDC, independent institutes for occupational health (prevention of occupational disease) are set.

**Keywords:** Occupational health; Public health; Education; Practice; China

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-03-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Profile of occupational medicine training/education in India and beyond

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It is estimated that loss of gross domestic product (GDP) attributable to Occupational Safety Health ranges from 4% of GDP across the globe and goes up to 10% in developing economies. India aspires to be a 5 trillion-dollar economy in next few years. This would certainly require a healthy and productive workforce in both formal and informal sectors. Workplace Occupational Health services with trained health manpower is the ideal way to enable achieve positive health and productivity and attain the goal. In India, Occupational Health is a chapter in the community medicine subject of undergraduate medical education. Apart from this, a 3-month course of Associate Fellow in Industrial Health is offered by Ministry of Labour through Labour Institutes and other academic institutes. This course was designed to meet the requirements of the Factories Act. Interestingly only 8% of the workforce are in the organised sector who benefit from this formal course. The remaining 92% of the workforce are served by medical professionals who do not have any formal qualification in Occupational Health. The biggest challenge for Occupational Medicine is the affiliation of the ministry. The Medical education is governed by the Ministry of Health. However, Occupational Medicine is primarily governed by the Ministry of Labour. There is a National Institute of Occupational Health under Ministry of Health, but its role is more in research and has consultative status rather than defining the Occupational Health education. In the past there were courses like Diploma in Industrial Health and Diplomate in National Board in occupational health which are no longer available. Efforts are being made by the Indian Association of Occupational Health (IAOH) to foster partnership with Community Medicine Department of Medical Colleges and the University to start a diploma/degree course in Occupational Health. IAOH would act as a platform to link the educational institute with industry to enable students to carry out residency programmes and complete their research work. The situation is similar in other South Asian countries. There is an urgent need for collaboration not just nationally but also internationally in designing and offering quality and training in Occupational Health.

**Keywords:** Occupational health education; Indian Association of Occupational Health; South Asian scenario; National & international collaboration; Training in occupational health

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-03-03

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Occupational medicine education in Indonesia

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**Background:** Indonesia has a long history of Occupational Health Training; however, structured Occupational Medicine education has been conducted just in a decade. The undergraduate curriculum does not give enough attention to occupational medicine as a specialty, and few medical trainees choose it as a career. According to the World Health Organization Committee, occupational health aims to ensure the highest level of well-being for workers in all occupations. Therefore, competent physician in occupational medicine is necessary through standardized education.

**Methods:** The data and information were collected by searching the national and university documents concerning occupational health services and occupational medicine practices in Indonesia.

**Results:** Indonesia has the University-based Occupational Medicine Specialist Study Program at the Universitas Indonesia. The study program helps occupational medicine residents understand and develop skills in preventing and diagnosing occupational diseases, assessing work capacity, and assisting patients returning to work after illness. They also support doctors in understanding how to handle workers' health and adhere to employment and occupational medicine regulations and ethics. The physicians should pass the thesis exams of the research in the field of Occupational Medicine. Once the physician obtains the University Certificate of Occupational Medicine, they must take the national board examination conducted by The Indonesian College of Occupational Medicine. They must have taken and passed the college board exams for occupational health services to demonstrate their knowledge and abilities. Then, they get a national occupational medicine competence certificate. By having this national certificate, they may be registered by the Indonesian Medical Council and obtain a license from the local health district office where they do their occupational medicine practice. There are currently 195 Indonesian Occupational Medicine Association members who have Indonesian Occupational Medicine College Certification.

**Conclusions:** There is a challenge to expand the number of Occupational Medicine Study Centers in Indonesia due to limited physicians joining the university. The high demand for occupational medicine jobs in private industries and hospitals makes it more challenging. Nevertheless, harmonizing occupational medicine education in Asian countries and beyond will improve professional quality and international collaboration.

**Keywords:** Education; Occupational medicine; Indonesia; University based

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-03-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Training system for Occupational and Environmental Medicine physicians in the Republic of Korea

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**Background:** In the symposium on occupational medicine education, training systems from different countries will be presented and discussed.

**Methods:** The framework for occupational medicine education in Korea is introduced, including its system and structure.

**Results:** Korea recognizes 25 board certifications for medical specialties, all of which are endorsed by the Ministry of Health and Welfare. The occupational and environmental medicine (OEM) board-certified residency training program began in 1996. The Korean Society of Occupational and Environmental Medicine (KSOEM) oversees the training and certification process. Currently, 34 hospitals and research agencies operate as training institutions. Trainees are required to hold a medical doctor's license upon graduation from medical college or a graduate medical school and must have completed a one-year internship. The training comprises a four-year course covering a diverse range of OEM skills and subjects, including basic principles, epidemiologic research, clinical medicine (with a mandatory one-year training in other medical departments), toxicology, occupational health management, specialized medical examinations, and more.

**Conclusions:** Since the inception of the training course in 1996, KSOEM has certified approximately one thousand specialists in OEM. These specialists significantly contribute to public health in Korea by preventing, managing, and surveilling workplace hazards and diseases.

**Keywords:** Education; Training; Board-certified

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-03-05

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Occupational medicine education/training in Japan

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Japan's training system for occupational physicians is characterized by 2 types of training: one for physicians who have undergone minimum training to meet the qualifications stipulated by law, and the other for physicians who are building their careers as occupational physicians, occupational medicine specialists. The requires employers to appoint occupational physicians in workplaces that employ 50 or more workers. The requirement is that they have the knowledge necessary to manage workers' health, and specific conditions are enumerated in the ministerial ordinance. The main condition is the completion of minimum training, which is 50 hours of training conducted by the Japan Medical Association or the University of Occupational and Environmental Health, Japan, which is the training organization designated by the Minister of Health, Labor, and Welfare. More than 100,000 physicians have already completed the training. On the other hand, the training of occupational medicine specialists is conducted by the Japan Society for Occupational Health, which has established a certification program for the specialists. Under the program, approximately 180 training facilities, including both service provider type and educational/informational type facilities, are currently registered, and the cumulative number of trained specialists is 650 since the system was launched in 1993. The requirements for starting training as an occupational medicine specialist are completion of basic clinical residency training and obtaining a medical specialty in social medicine or one of the clinical medicine fields. The duration of training ranges from one to 3 years, depending on the status of specialty training at the start point. The program designates 27 training topics. Currently, Japan's occupational health system is undergoing a major shift from regulation-based to autonomous occupational health, and the need for occupational medicine specialists with advanced knowledge is increasing. The current number of trained occupational medicine specialists is far inadequate to meet the needs.

**Keywords:** Occupational medicine; Specialist; Training; Japan



## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-03-06

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Harmonizing Asian occupational medicine education/training

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There are 2 kind of physician who involved in occupational medicine practice in Thailand. First the occupational medicine specialist which finished the 3-year training in Occupational Medicine Course and get the “Diploma of the Thai Board of Preventive Medicine (Occupational Medicine).” This course is endorsed by Thai Medical Council. The physician who finished MD for 3 years can join this course. The first year is the rotation in Medicine, Ear, Nose and Throat (ENT), Orthopedic Department, the second year is the master’s degree study, and the third year is rotating factory and hospital-based service training. There are 8 institutes responsible for training and 26 finished specialist each year. Now there are only 178 occupational physicians in Thailand. The second kind of physicians are those who finished short-course 2 months training course on basic occupational medicine for physicians. These is endorsed by the Association of Occupational and Environmental Disease of Thailand and Department of Medical Services, Ministry of Public Health. Now there are 1,980 physicians who finished short courses. The main problem of occupational medicine physicians in Thailand is that there is no law mandate the factory to have occupational medicine physician as a consultant. Most of the physicians who involve in occupational medicine do the Health Risk Physical Examination for the workers according to the law by Ministry of Labor. Now there the law from Ministry of Public Health “Control of Occupational Diseases and Environmental Disease.” This law opens a chance for occupational medicine physician it determines the criteria for qualification of physicians and nurses who work in occupational medicine service unit and the authority to do the occupational disease investigation and surveillance in workplace.

**Keywords:** Occupational medical physician; Basic occupational medicine 2 months course; Number of occupational medicine physicians in Thailand

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-04-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Introduction of the Network of Occupational Disease and Injuries Service (NODIS) in Taiwan

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**Background:** To evaluate the provision of occupational health services at hospitals following the establishment of the Network of Occupational Disease and Injuries Service (NODIS) since 2007.

**Methods:** An overview of occupational health services during 2008 to 2021 was conducted. The medical practice-based reporting system was compared with the database of compensated occupational diseases (ODs) from Taiwan's Labor Insurance. A new stratagem of improving NODIS will be reported.

**Results:** First-time outpatient visits for occupational evaluation and total visits to NODIS health care institutions increased from 1,777 and 9,435 to 12,092 and 23,210, respectively. Reported ODs increased from 1,626 to 2,043 with a peak of 2,791. Up to 1,380 workers evaluated for work resumption in 2021. Similar to the increasing trend in reported ODs, the number of compensated ODs increased over years. Since January 2023, a new system "Specialized Hospitals for the Diagnosis and Treatment of Occupational Injuries and Diseases" was established by a government-sponsored legal institution, intended to expand the notification system of ODs.

**Conclusions:** The health service needs of Taiwanese workers from ODs evaluation to vocational rehabilitation are increasing. A new stratagem is needed to improve NODIS.

**Keywords:** Occupational diseases; Network reporting; Occupational health services; NODIS

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-04-02

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Introduction of the Korean Occupational Disease Surveillance Center

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The Korean Occupational Diseases Surveillance Center (KODSC) initiative commenced in 2022. As a health surveillance system, it aims for the ongoing, systematic collection, analysis, and interpretation of occupational disease-related data essential to planning, implementing, and evaluating occupational health practice. It especially focuses on the clinical cases suspicious as occupational diseases identified by emergency rooms and outpatient clinics. A total of ten centers were established to construct regional occupational disease surveillance networks, consisting of medical doctors and assistants in emergency rooms and outpatient clinics in general hospitals, the Ministry of Employment and Labor, and the Korea Occupational Safety and Health Agency. The centers receive reports of suspicious occupational disease cases from clinicians and play a pivotal role in the early detection of occupational diseases and preventing workers from the identified risk in the workforce. This presentation will introduce the KODSC, including the background and rationale for why KODSC is needed for comprehensive occupational disease monitoring, how the occupational surveillance system and the regional network were constructed through KODSC, and the current surveillance status via KODSC programs. Furthermore, it will highlight significant occupational disease prevention and management cases through the KODSC framework.

**Keywords:** Surveillance; Occupational disease; Monitoring; Network

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-04-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Occupational cancer surveillance system in-hospital model

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Overall 349,000 deaths in 2016 attributed to previous occupational exposure were estimated by the global burden of disease study. A total of 3.9% of all cancer deaths were estimated due to occupational hazardous material exposure. For lung cancer, the population attributable fraction of lung cancer and malignant mesothelioma due to occupational carcinogen exposure was estimated as 17.6% (13.8%–21.3%) and 91.4% (89.2%–93.2%), respectively. However, the actual detection rate of occupational cancer may be under-reported due to clinicians' lack of interest in occupational exposure. To overcome those under-reported problem in detecting occupational cancers, the occupational cancer surveillance might be important. Once the surveillance have set, it can help to identify new occupational hazards, track trends in occupational cancer rates, and evaluate the effectiveness of prevention programs. There are several preconditions on the successful running of occupational cancer surveillance in hospital setting. First, the nature or clinical feature of occupational cancer should be known well. Second, 'a gatekeeper' in hospital (radiologist, pathologist, and any clinician) should be designated for team approach. Third, priority should be considered for selecting cancer. Fourth, they need to be trained to recognize the clinical features of occupational cancer and to know how to assess occupational exposure, an education for standardizing quality of diagnosis and exposure assessment among the multi-centered recruitment. Fifth, selection of methods between whole case review or sentinel case is pre-set for efficient performance of detection of cases. Sixth, the big data analysis protocol should be applied for detecting missing data. A good example of occupational cancers are asbestos-related lung cancer and malignant mesothelioma. Once radiologist and pathologist (gatekeeper) were educated for looking for asbestos related findings at radiologic study or pathologic slide. If there were any findings of suspicious or possible asbestos case, then gatekeeper remarks the findings at the report and requesting consultation for exposure assessment. For malignant mesothelioma, the pathognomic case of occupational or any other asbestos exposure the whole cases should be involved at the surveillance. However, for asbestos-related lung cancer is better for sentinel cases with pleural plaques. The spreading the hospital based asbestos related lung cancer surveillance, standard education is necessary for quality control of gatekeepers in multi-centers. The expansion of occupational cancer surveillance, effort on looking for the key clinical features on each occupational cancer should be followed to develop a successful model for other occupational cancers.

**Keywords:** Cancer; Surveillance; Occupational disease

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-05-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Best practices in promoting occupational health in the Philippines: topic #1

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Presidential proclamation 1316, signed by the President of the Republic of the Philippines on March 2, 2022, declares the third week of March of every year as “Occupational Medicine Week” in the country. The Philippines is one of the few, if not the only country, which has a national declaration for Occupational Medicine Week. The issuance of the proclamation is a milestone in the history of the Philippines since it paves the way for greater awareness regarding the value of Occupational Medicine in minimizing and preventing occupational diseases among the Filipino workforce, as well as the general population. Occupational Medicine Week is an annual event that aims to promote awareness of the strategies to prevent and control occupational-related disabilities and deaths in the Philippines. The first Occupational Medicine Week was celebrated on March 18–25, 2023, and was organized by the Philippine College of Occupational Medicine, Inc. (PCOM) in coordination with the Department of Labor and Employment through the Occupational Safety and Health Center. The event was attended by various professionals and organizations in the field of occupational health and safety. It was PCOM that introduced, initiated, lobbied for, and painstakingly worked to make the declaration a reality.

**Keywords:** OM Week; Occupational Medicine Week

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-05-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Occupational health in the academe

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Occupational, work-related and environmental diseases and injuries are widespread but preventable. Unfortunately, occupational health is an important aspect of medicine that is often overlooked. In the Philippines, not all medical schools include occupational health as part of the curriculum. Medical schools can contribute to the promotion of occupational health and safety through their integration into the curriculum and research programs. Although there are challenges along the way, academic institutions should continue to innovate ways to teach occupational health and safety and constantly improve these educational programs. This will ensure that the medical graduates will have a general awareness of occupational health and safety issues that can affect a substantial proportion of their patients.

**Keywords:** Occupational health and safety; Medical education; Academe

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-05-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Philippines' roadmap to workplace safety, health, wellness in the future of work

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**Background:** Globally, it is evident that the workplace is constantly evolving, driven by technological advancements, shifting demographics, and changes in societal norms. In addition, the coronavirus disease 2019 pandemic has significantly altered the landscape of workplace safety and health, necessitating swift and extensive adaptations in response to the unprecedented health crisis. The pandemic exposed vulnerabilities in traditional workplace safety protocols. Employers and employees alike have had to navigate a new normal, redefining the way work is conducted, and highlighting the crucial role of technology, communication, and adaptability in ensuring the safety and health of the workforce.

**Methods:** Moving into the future of work, the Philippines' roadmap highlights safety and health programs that prioritize workplace safety, health, wellness, and promoting a healthy lifestyle.

**Results:** The following are critical areas in addressing occupational safety and health in the future of work in the Philippines: I. Technological Integration: To ensure safety, health, wellness, and a healthy lifestyle, organizations should embrace technology-driven solutions, including remote work technology that emphasizes the use of secure and efficient remote work tools, fostering work-life balance, reducing workplace stress, and allowing employees to lead a more balanced life. II. Mental Health Awareness: Mental health is a cornerstone of overall wellness and should be a central focus of any workplace strategy. The Philippine government mandated a policy for private workplaces, "Guidelines for the Implementation of Mental Health Workplace Policies and Programs for the Private Sector." These guidelines require workplaces to commit to mental health programs for their workers. III. Compliance to Safety and Health Standards: In the future of work, organizations must stay updated with evolving health and safety regulations and standard and address issues on climate change and emerging work arrangements which contribute to adverse safety and health outcomes. IV. Collaboration: Collaboration among stakeholders and experts are necessary in providing updated and relevant best practices addressing safety and health concerns.

**Conclusions:** The future of work is dynamic requiring workplaces to adapt and innovate to ensure workplace safety, health, wellness, including the promotion of a healthy lifestyle. By embracing technology, promoting mental health, staying compliant with regulations, optimizing effective collaboration; companies can create a work environment where employees thrive, lead healthier lives, and contribute to their fullest potential.

**Keywords:** Workplace safety; Health; Wellness; Future of work; Mental health

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-06-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Occupational cancer burden – benefits and challenges

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**Background:** The population attributable fraction (PAF) is usually presented as a percentage and represents the estimated proportion of cases that would not have occurred if the exposure had not been present. The PAF is directly determined by the magnitude of risk associated with the exposure, and the prevalence and level of the exposure in the working population.

**Methods:** Levin's formula from 1953  $\{PAF = p(RR - 1)/p(RR - 1) + 1\}$  is used for estimating the PAF in most studies. The methodology has evolved over time to also account for relevant risk exposure periods, workers turnover (which might differ considerable between industries and especially over time) and proportion of workers exposed to high- versus low levels of exposure (commonly without a clear definition of what this means in terms of levels of exposure).

**Results:** PAFs are not easily comparable across studies due to differences in the selection of exposure and cancer combinations, the use of varying criteria to define prevalence and level of exposures, and differences in the selection of risk estimates associated with the exposures. The choice of risk estimates and the employment turnover was identified as the largest contributors to the occupational PAF estimates in the Great Britain study. The overall cancer burden attributable to occupational exposures has most often been estimated between 2% and 5% since the 1980s. The PAFs for selected cancer sites is however much larger, e.g., mesothelioma (70%–100%) mainly due to asbestos and lung cancer (15%–25% in men) associated with many occupational exposures including asbestos, crystalline silica, diesel engine exhaust and welding fume.

**Conclusions:** Estimates of the number and proportion of workers exposed in most countries and on a global scale are generally scarce. When relevant data is available PAFs can be used to assess the public health impact of specific risk factors.

**Keywords:** Cancer; Occupational exposures; Epidemiology; Population attributable fraction; Cancer prevention



## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-06-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Estimation of population attributable fraction of cancer incidence in Korea

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**Background:** Cancer is the most common cause of mortality in Korea. Estimating the burden of cancer due to specific risk factors and comparing them quantitatively is important in prioritize the national cancer prevention program. Population attributable fraction (PAF) is defined as the proportional reduction in disease incidence or mortality which would occur if exposure to a risk factor was completely reduced as a counterfactual scenario. Previously, National Cancer Center (NCC) has estimated PAF due to various risk factors in 2009. As update of PAF is needed, NCC has started PAF project in 2021 and the updated PAF will be announced in 2024.

**Methods:** We organized the Consensus Committee to establish strategy and methodology of PAF estimation. Carcinogens and cancer sites for PAF estimation were selected according to the International Agency for Research on Cancer list of classification with sufficient evidence in human, and also World Cancer Research Funds. Lifestyle factors such as tobacco smoking, alcohol consumption, obesity, physical inactivity, and diet, oral contraceptives, estrogen therapy, infectious agents, and occupational exposures were included in the risk factors. PAF was calculated by using Levin's formula which includes exposure prevalence and relative risk (RR). Exposure prevalence of lifestyle factors was collected from the Korea National Health and Nutrition Examination Survey (KNHANES) in 2005 to estimate PAF in 2020, assuming that latent period was 15 years. RRs were estimated from meta-analysis of RRs from Korean Genome and Epidemiology Study (n = 230,000), KNHANES (n = 80,000), National Health Insurance Services database (n = 8,000,000), and Korean Cancer Prevention Study-II (n = 140,000), each linked with Korea Cancer Registry. We used Cox proportional hazards model adjusted by age group and alcohol consumption.

**Results:** PAF estimation for each risk factor groups are under progress. PAF in each risk factor group will be reviewed in the Consensus Committee.

**Conclusion:** PAF is an important measure to establish evidence for national cancer control programs. Particularly, NCC has prioritized PAF due to occupational exposures in this project and collaboration with occupational health experts is pivotal to the PAF project. Announcing cancer PAF due to occupational factors to the public would enhance awareness to occupational carcinogens.

**Keywords:** Population attributable fraction; Cancer; Tobacco smoking; Alcohol; Occupational

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-06-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### CAREX development and cancer burden study

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**Background:** Occupational cancers are a significant concern, leading to the development of carcinogen exposure information systems in various countries. This study aimed to create a tailored Korean CARcinogen EXposure (K-CAREX) for the Korean labor force, focusing on estimating the number of workers exposed to carcinogens by industry. Additionally, our objective was to assess the intensity of carcinogen exposure within industries, providing complementary information to enrich the K-CAREX database.

**Methods:** For this study, we selected 20 established human carcinogens. We used data from 3 nationwide occupational exposure databases: the Work Environment Measurement Database (WEMD), the Special Health Examination Database (SHED), and the Work Environment Condition Survey (WECS) to calculate reference exposure prevalence estimates categorized by carcinogen and industry. Subsequently, 37 seasoned industrial hygienists, each possessing a minimum of 19 years of field experience, contributed their own exposure prevalence estimates, taking into account the reference estimates derived from the 3 data sources. The final exposure prevalence was determined by calculating the median value of these expert estimates. To quantify the number of exposed workers, we multiplied the final exposure prevalence by the worker count obtained from the 2010 national census data, considering both carcinogen and industry. To gauge exposure intensity, we utilized WEMD data from the years 2013 to 2015. We computed the 95th percentile (X95) levels of measurements for each industry according to carcinogen. Exposure intensity was then classified into 5 exposure ratings (ranging from 1 to 5) for each industry, based on the X95 level relative to the established occupational exposure limit.

**Results:** The analysis yielded exposure prevalence and the number of exposed workers, accounting for 20 carcinogens and 228 minor industrial groups, under the conditions of the year 2010. Notably, the largest exposed population worked with welding fumes (326,822 workers), with subsequent exposures to ultraviolet radiation (238,937 workers), ionizing radiation (168,712 workers), and mineral oil mist (146,798 workers). Furthermore, exposure ratings were determined for 21 carcinogenic agents within each of the 228 minor industry groups. As an illustration, the manufacturing industry of basic chemicals, which had 3,058 samples analyzed for benzene, was assigned a benzene exposure rating of 3.

**Conclusions:** Our findings furnish vital data on carcinogen exposure, significantly contributing to the prevention of occupational cancers. Furthermore, this information will play a pivotal role in guiding targeted control measures and identifying industries warranting heightened attention. Presently, our efforts are directed toward broadening the scope of K-CAREX to encompass International Agency for Research on Cancer group 2A carcinogens. In addition, we are in the process of creating an occupation-based exposure matrix and estimating temporal trends in exposure levels, which will serve as valuable resources for epidemiological studies relying on exposure data.

**Keywords:** Carcinogen; Cancer; CAREX; Exposure; Job-exposure matrix

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-06-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Preliminary results of occupational cancer PAF in Korea

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**Background:** Evaluating the disease burden attributable to occupational exposure is of paramount importance. Korean CARcinogen EXposure (K-CAREX) was first developed in Asia and the risk exposed population in the industrial work environment is now used to be estimated (Koh et al., 2021). Therefore, we aim to estimate preventable cancer incidence attributable to occupational risk factors in Korean adult cancer patients using available data sources and methodology.

**Methods:** Definite human carcinogens (Group 1) were chosen according to International Agency for Research on Cancer standards, considering the possibility of occupational exposure. Population attributable fractions (PAFs) were computed using Levin's Formula (1953). A latency period of 15 years between exposure and cancer was considered in our assessment. The prevalence of exposure, which was derived from prior studies or calculated using K-CAREX and census data in 2000, was assessed. The relevant risk was based on a meta-analysis of the literature that has been published since 1990.

**Results:** In the end, it was possible to calculate PAFs for 11 occupational factors linked with 14 cancer types. The PAF for cancer incidence associated with occupational carcinogens was estimated at approximately 1% in 2020. This estimation was based on a combination of exposure and limited evidence of human carcinogenicity. Asbestos had the highest PAFs among occupational factors, as widely acknowledged. The prevalence of exposure to occupational carcinogens was 35% for males and 9% for females, with Diesel engine exhaust being the most significant source for both genders. prevalence of exposure to Welding fumes and Sulfuric acid also ranked highly for both genders.

**Conclusions:** This study provides an estimate of the burden of occupational cancer in Korea that reflects the characteristics of Korean industry. It is anticipated to establish a crucial foundation for developing methodologies and indicators to measure the burden of occupational cancer in Korea.

**Keywords:** Cancer; PAF; Burden; Occupation

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-07-01

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# Strategies to protect health workers from COVID-19 by occupational health profession in Thailand

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**Background:** At the time of coronavirus disease 2019 (COVID-19) pandemics, occupational health services achieved a recognition in terms of role and responsibility from health authorities and hospital managements.

**Methods:** Management of pandemic COVID-19 in a tertiary care hospital was under emergency operational center (EOC) which included a wide range of experts such as infectious diseases, field epidemiology, patient care teams, family doctors, infection control nurses, occupational health and safety (OHS) management team (safety officers, occupational health nurses and occupational health doctors), etc. The target was the hospital employees accounted for approximately 6,000 workers. There were 3 phases that OHS team involved as follows: 1) early, 2) pandemic, and 3) decline phases. The early phases OHS team categorized the risk levels to design the appropriate hierarchy of hazard control; personal protective equipment (PPE), administrative, and engineering controls were the priorities. The pandemic phases involved: designed the criteria for post exposure risk level for an active surveillance (trace-test-trat). The team also handled the infected cases for treatment and returning to work using telehealth access. The safety officer team monitored hospital ventilation systems and respiratory protection programs whereas occupational health doctors and nurses handled the risk and infected cases, treatment, return to work certificates and cluster investigation. The OHS team reported the statistics of hospital employees to the hospital EOC and modify strategic plans such as using head of medical departments and hospital sections involvement.

**Results:** The results showed no work related COVID-19 reported in the early pandemics however, during Omicron strain, approximately 3% COVID-19 cases were related to their work. During the declined phase OHS team advises the use of appropriate PPE and being a part of hospital infection control and prevention.

**Conclusions:** OHS team played an important role for protection of hospital workers and prevention from work-related COVID-19 and that routine hospital activities can continue.

**Keywords:** COVID-19; Hospital; Health worker; PPE; Infection control

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-07-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Strategies to protect health workers from COVID-19 by occupational health physicians

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Healthcare workers are at high risk of occupational infections due to their work nature. Singapore experienced the severe acute respiratory syndrome (SARS) outbreak in 2003 and several measures have been implemented to safeguard the health of healthcare workers. These measures include surveillance of acute respiratory illnesses among staff, respiratory protection, and work injury compensation for workers who contracted SARS in the course of their work. These measures were further enhanced by the occupational physicians during the coronavirus disease 2019 (COVID-19) pandemic by adopting a multidisciplinary approach, collaborating with infection control experts and epidemiologists. The use of quantitative fit testing for respirators was expanded to complement the qualitative fit testing and staff syndromic and laboratory surveillance was strengthened to identify COVID-19 among staff early. At the same time, occupational physicians researched interventions to prevent occupational dermatitis and developed the diagnostic criteria for work-related COVID-19. Occupational health expertise is valuable in preparing the institution for the next outbreak and pandemic.

**Keywords:** Occupational health; Surveillance; Healthcare workers; Epidemiology; Prevention

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-07-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Protecting healthcare workers (HCWs) during the COVID-19 pandemic in a tertiary hospital in Singapore

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**Background:** The first case of coronavirus disease 2019 (COVID-19) infection in Singapore was diagnosed on January 23, 2020. Learning from SARS in 2003, various control measures were put in place to protect healthcare workers (HCWs) when World Health Organization announced viral pneumonia of unknown cause in China in December 2019.

**Methods:** To discuss the roles of occupational physicians (OP) in protecting HCWs during the COVID-19 pandemic in an acute hospital in Singapore, which is essential to ensure hospital operations are not compromised.

**Results:** During the initial outbreak, the hospital's staff clinic (SC) was split into 2 teams to minimize the risk of cross-transmission of disease, with 1 team tasked to see sick staff with acute respiratory illness. As the waves progressed, SC was responsible for managing staff with close contact, or infected with COVID-19, in order to ensure they were fit to return to work without posing a risk to other co-workers and patients, by performing a COVID-19 polymerase chain reaction test. OP is also involved in managing occupational diseases associated with the pandemic including irritant contact dermatitis secondary to frequent use of alcohol hand rubs and personal protective equipment-associated facial dermatitis. A respiratory protection program is essential to safeguard HCW from this novel virus. To train HCWs working in high-risk areas on how to use power air-purifying respirators within a short timeframe, the department adopted a train-the-trainer approach to train a large group of HCWs. Before the availability of the COVID-19 vaccine and travel restrictions, the department was asked to lead the influenza vaccine exercise for HCW. When the COVID-19 vaccines were available in December 2020, the department co-led the mass vaccine exercise for HCW in the hospitals.

**Conclusions:** Working closely with other departments during the pandemic, OP played vital roles in protecting HCW to ensure the continuity of hospital operations, both at the clinical and program levels.

**Keywords:** Occupational physician; COVID-19; Occupational disease; Vaccine

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-07-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Stage-based strategy for COVID-19 prevention and control in a manufacturing company in South Korea

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**Background:** In the early days of coronavirus disease 2019 (COVID-19), many domestic companies were closed their workplaces by government guidelines, resulting in large economic losses. Therefore, this study sought to establish a systematic response strategy at the workplace to minimize corporate losses from infectious diseases and protect the health of employees while experiencing COVID-19.

**Methods:** To establish a standard manual for workplace response to infectious diseases, we summarized response plans according to the period from the beginning of the outbreak to the downgrading of infectious disease ratings.

**Results:** In early 2020, a World Health Organization pandemic was declared, so activities were focused on blocking inflow into the company. Since August 2020, the pandemic has continued for more than 6 months, to prepare, the workplace's own quarantine guidelines have been strengthened. Starting in 2021, as COVID-19 spread on a large scale nationally, we focused on blocking the spread of infection within the company, and as more than 30% of the country's population was infected in 2022, we focused on preventing serious illness for confirmed cases. By 2023, the national antibody retention rate has exceeded 90%, and the spread of COVID-19 has slowed significantly, focusing on activities to promote recovery of daily life.

**Conclusions:** In the early stages of the infectious disease, workplace quarantine activities to block the inflow into the company were very effective to less than 50% of the national incidence rate per 100,000. However, after the large-scale spread occurred nationally, the effectiveness of quarantine activities was greatly reduced. Therefore, we have confirmed that it is very important to proactively respond early when a new infectious disease occurs, and we will actively utilize the infectious disease response standard manual established based on this experience to reduce the company's economic loss and promote the health of employees.

**Keywords:** COVID-19; Company; Workplace; Quarantine activities; Standard manual

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-07-05

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# Protecting healthcare workers during the COVID-19 pandemic in a tertiary hospital in Korea

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**Background:** The outbreak of coronavirus disease 2019 (COVID-19) has raised the risk of cross-infection in healthcare facilities, emphasizing the importance of effective infection control measures. Healthcare personnel are exposed to a high risk of COVID-19 infection and therefore perform a critical role in the management of infection control. The objective of this study is to assess the efficacy of personal protective equipment (PPE) and hygiene practices in reducing the spread of COVID-19 among healthcare workers (HCWs) in medical settings.

**Methods:** The study assessed COVID-19 cases among HCWs in Incheon Metropolitan City from January 2020 to March 2022, specifically examining the impact of PPE and hygiene practices in a tertiary hospital. The study collected data on HCWs, as well as the local and national population, from the safety and health team and the Korea Disease Control and Prevention Agency.

**Results:** The importance of HCWs practicing proper hand hygiene and using appropriate PPE before and after treating patients was emphasized. The study indicates the increased risk of infection in crowded, confined environments and supports the use of isolated rooms to reduce disease transmission. Additionally, the importance of ventilating, handwashing, and using masks to ensure personal hygiene is underscored.

**Conclusions:** To minimize the transmission of disease to patients and other healthcare providers, HCWs must prioritize the adoption of infection control measures. In order to reduce the transmission of infectious diseases such as COVID-19, the research confirms the indispensability of PPE, especially masks, and hand hygiene. In addition, healthcare facilities should improve their infection prevention protocols by implementing systematic improvements, training and education programs, and fostering a safety-conscious atmosphere in the healthcare sector to ultimately eliminate the problem.

**Keywords:** COVID-19; Prevention; Control; Healthcare worker; Mask



## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-08-01

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# The progress and status of introducing the sickness benefit scheme in the Korea NHI program

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Coronavirus disease 2019 has played a crucial role in increasing societal interest in sickness benefits and shaping a new policy agenda in Korea. Due to the absence of a legal obligation for employers to provide paid leave for personal health issues unrelated to work, sick-pay schemes tend to be concentrated on employees with relatively stable jobs in moderately-sized workplaces or higher-wage workers in Korea. The Ministry of Health and Welfare launched a pilot program in July 2022 to provide sickness benefits to workers without paid leave in six regions. In July 2023, an additional four regions were included for 2 new pilot models, exclusively targeted at employees in low-income families. This study is to share the details of the pilot and the challenges in the future design of the system.

**Keywords:** Sickness allowance; Sickness benefit

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-08-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Sickness allowance system and supports to returning to work for workers with occupational diseases and injuries in Taiwan

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**Background:** To introduce the sickness benefit system for workers with occupational diseases and injuries in Taiwan and provide an overview of the supports provided to them for returning to work.

**Methods:** The regulations on sickness benefit and assistance to returning to work in Taiwan was reviewed and summarized.

**Results:** In Taiwan, the Labor Standards Act (Article 59) mandates that when a worker under medical treatment is not able to work, the employer shall pay him/her compensation according to his/her pre-existing wage. The employer shall be released from such compensation obligation by giving to the worker a lump sum payment equal to 40 months of average wage if the worker failing to recover after 2 years of medical treatment has been diagnosed and confirmed by a designated hospital as being unable to perform the original work and so does not meet the disability requirements. The Labor Occupational Accident Insurance and Protection Act sets out the supports to such worker for returning to work. The National Labor Accident Insurance provides sick leave coverages and appoints occupational medicine specialists to review the claims and determine the length of the coverage. A Center for Occupational Accident Prevention and Rehabilitation was established to provide assistance to workers to return to work after the incidence. In addition, the Occupational Safety and Health Act mandates business entities employing 50 or more laborers employ or contract medical personnel, and the Labors' Health Protection Regulation designates helping workers return to work as one of the duties of the personnel.

**Conclusions:** The Taiwanese government ensures sickness allowance and supports to returning to work for workers with occupational diseases and injuries through various laws and regulations.

**Keywords:** Occupational accident; Return to work; Sickness allowance; Taiwan

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-08-03

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Sickness Allowance System and RTW programs in Japan

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**Outline of Japan's Sickness Allowance System:** Japan's health insurance system is based on the principle of universal coverage, established in 1961. It mandates that all residents of Japan must be covered by health insurance, ensuring access to affordable healthcare services regardless of income or social status. The Sickness Allowance System in Japan is a health insurance benefit that provides financial compensation to employees who are temporarily unable to work due to non-occupational illnesses or injuries. This system is an integral part of the Japanese social security framework, which aims to support individuals' livelihood during periods of health-related work absences. The system is governed by the Health Insurance Law and is managed by health insurance associations or government-operated health insurers.

- Eligibility: Health insurance beneficiaries can receive the benefit from the fourth day of leave due to medical reasons (the first 3 days are considered a waiting period).
- Payment amount: Approximately two-thirds of the average salary is paid out.
- Duration of payment: The benefits can be received for up to a maximum of 18 months.

**Differences from the Workmen's Compensation Insurance and its challenges:** Workmen's Compensation Insurance provides benefits for illnesses or injuries that are work-related or occur during the commute to and from work. It is a separate system from the health insurance.

- Eligibility: There is no waiting period; the benefits are available immediately upon the need for recuperation due to a work-related accident or occupational disease.
- Payment amount: Typically, the full average wage is paid out.
- Duration of payment: The payment is made for the period necessary for recuperation, often without a predefined limit.

**Several challenges in Japan's systems, these are 1) Complexity:** The systems can be complex, and particularly smaller enterprises may avoid using them due to bureaucratic hurdles, 2) Lack of knowledge: Many employers and workers are not fully informed about the details of these systems, leading to underutilization, and 3) Sense of inequity: The reduced payment for non-work-related absences can create a sense of financial inequity based on the cause of the illness or injury.

**Relationship to workers' return to the workplace:** While the Sickness Allowance System provides financial support and enables employees to focus on their recovery, there are issues for those requiring extended leave, such as skill atrophy and higher barriers to re-entry into the workforce. Therefore, the development of workplace environments conducive to health recovery and comprehensive return-to-work programs is critical. Promoting a smooth return to work involves: 1) Enhanced reintegration programs: Systems and programs to assist workers in transitioning back from illness or injury, 2) Gradual return to work: Flexible systems that allow starting with part-time or reduced hours instead of immediately returning to full-time work, and 3) Improved health management: Regular health check-ups at the workplace and establishing health consultation services. With these systems and support mechanisms in place, workers can confidently dedicate themselves to recovery and smoothly transition back to their workplace post-recovery.

Recently, the government has been actively promoting a 'support for balancing work and illness.' Efforts such as training coordinators for this support are progressing. Occupational health professionals play a significant role and are expected to greatly contribute to workers' return to the workplace. It is expected that individuals will effectively utilize the sick leave benefits system to ensure that unexpected illnesses or injuries do not hinder the continuation of employment. Understanding and making use of the system properly is anticipated.

**Keywords:** Universal health insurance system; Japan's Sickness Allowance System; Workmen's Compensation Insurance; Return to the workplace program; Occupational health team

## Symposium

Ann Occup Environ Med. 2023 Nov;35(Supplement):S-08-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### The role of occupational medicine in sickness allowance systems and RTW

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The function of a sickness allowance system from the perspective of a welfare or social security system is different from the function of a sickness allowance system from the perspective of occupational medicine. In particular, from an occupational medicine perspective, the primary objective of a sickness allowance system is to return the worker to work, a concept that is equivalent or similar to patient care. In a sickness allowance system, a medical certificate should be a means of bridging these different perspectives and achieving the goal of return to work. In countries with a long history of sickness allowance, such as Sweden, the process is naturally woven into the healthcare delivery system, while countries with a shorter history, such as the United States, seek to medically prove its effectiveness. Performing a correct and appropriate fitness-for-duty assessment for return to work is an important task for physicians, and many find it challenging. Occupational medicine should be able to help or play an active role in this process. The United Kingdom has designed a system to accomplish this through “the fit note.” The Korean system is currently in the pilot phase and is working to incorporate a return to work and fitness for duty assessment from an occupational medicine perspective. However, the role of the gatekeeper and the burden of proof are major issues, and more discussion is needed to resolve these challenges.

**Keywords:** Sickness allowance; Sickness benefit

# Oral Presentation

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-01-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Introduction of presumption principle in musculoskeletal disorder compensation in South Korea

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**Background:** Musculoskeletal disorders account for 60% of occupational diseases in Korea (2022), with a 70% approval rate for claims. Over 12,000 annual applications require time-consuming on-site investigations, causing delays of up to six months. This research aimed to streamline musculoskeletal disorder compensation claims.

**Methods:** The study was conducted in three phases. In 2018, samples were selected from the 2016 data of musculoskeletal disorder compensation claims, focusing on six specific areas: lumbar spine, cervical spine, shoulder, elbow, hand/wrist, and knee diseases. In 2020, samples from the 2019 data were analyzed, and in 2021, a comprehensive analysis of the 2020 data was performed. The analysis included identifying diseases with an approval rate of over 80%, as well as occupations, average duration of employment, and periods of work interruption.

**Results:** Among the six selected areas, the most frequently claimed diseases were cervical disc herniation, lumbar disc herniation, rotator cuff syndrome and tear, epicondylitis, carpal tunnel syndrome, and meniscal tear. Occupations with an approval rate of over 80% were determined for each disease. Furthermore, it was observed that these occupations consistently had high approval rates across the three surveys and were identified as having a high ergonomic risk in industrial accident compensation investigations. Minimum duration of employment and work interruption criteria were also established for each disease.

**Conclusions:** As an example, the approval rate for rotator cuff tears among welders in shipyards consistently showed high rates. This indicates that welding work in shipyards imposes shoulder stress and, if performed for a certain period, on-site investigations can be omitted due to the high work-relatedness. This study identified six common diseases and occupations with high approval rates, allowing for the omission of on-site investigations in these selected occupations, resulting in approximately 50% reduction in the time taken between claim submission and approval.

**Keywords:** Musculoskeletal disorder; Compensation claims; Presumption principle

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-01-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Health and fitness of firefighter recruits in the first month of academy life: the first step of sustainable functional fitness

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**Background:** Optimum health and physical fitness are essential in enabling firefighters to perform their tasks safely and effectively. Inculcating these essentials start in the earliest life of firefighter recruits. This research aims to demonstrate the effectiveness of Phase 1 of a newly developed physical training module to prime the health and physical fitness of firefighter recruits.

**Methods:** A quasi-experimental study with one group pre-test and post-test design was conducted among 142 male firefighter recruits from a Fire and Rescue Academy in Malaysia. All recruits underwent the first phase of the physical training module, which lasted for 4 weeks. It consisted of a combination of training between aerobic and whole-body exercises. Those recruits were divided into 5 platoons. Each platoon was trained by 5 experienced physical trainers. Health (i.e., systolic and diastolic blood pressure, resting heart rate; body weight, muscle mass, and fat percentage) and physical fitness parameters (cardiovascular capacity, lower limbs muscle power, strength and endurance of abdominal core muscles and upper body, and speediness, quickness, and agility) were collected at baseline (Week 1) and after completion of the first phase (Week 5).

**Results:** All health parameters were significantly improved at the end of 5 weeks ( $p < 0.05$ ) except for systolic blood pressure. Cardiovascular capacity as well as abdominal muscle and upper body strength and endurance showed significant improvement corroborated with researchers' expectations. Participants' systolic blood pressure showed a significant increase of 4.3 mmHg (95% confidence interval of mean difference: 2.37–6.24) ( $p < 0.001$ ) after the 4-week training period.

**Conclusions:** The first phase of the newly developed physical training module, which lasted for four weeks, was effective in priming the health and physical fitness of firefighter recruits before entering more challenging phases. However, the increase in average systolic blood pressure warrants further monitoring and intervention at the academy.

**Keywords:** Firefighter recruits; Functional fitness; Physical training; Cardiovascular capacity; Strength and endurance

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-01-03

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Analysis of factors associated with the recognition of work-related cerebrovascular diseases in Korea

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**Background:** This study aimed to identify recognition factors for work-related cerebrovascular diseases in terms of personal and occupational aspects using Korea's Industrial Accident Compensation Insurance deliberation database.

**Methods:** We included 10,105 subjects for cerebrovascular diseases of the Occupational Disease Adjudication Committee in Korea's Industrial Accident Compensation Insurance during 2017–2021. We conducted descriptive analysis and correlation analysis to examine individual and occupational factors associated with the recognition of work-related cerebrovascular diseases.

**Results:** When analyzing the recognition factors related to individual factors, no significant factors were found to be higher in the group of recognized subjects, except for gender. Regarding occupational factors, it was confirmed that working hours were the decisive factor affecting the recognition of work-related cerebrovascular disease. It was discovered that most of the weighting factors related to work burden have an impact on the recognition of work-related cerebrovascular disease, with the exception of "jobs that involve unpredictable work schedules" outside of working hours.

**Conclusions:** We found that personal risk factors such as underlying diseases are seldom taken into consideration when determining work-related cerebrovascular diseases in Korea. Additionally, working hours have been identified as the most influential among occupational factors.

**Keywords:** Cerebrovascular disease; Work-related disease; Recognition factor; Occupational compensation; Long working hours



## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-01-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Analysis of functional capacity evaluation (FCE) in workability evaluation of patients with occupational ophthalmic injury

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**Background:** Work ability evaluation assesses the actual work performance ability of occupational injury patients to see if they can safely return to work and perform their job efficiently. Although occupational rehabilitation has been mainly focused on the patients with musculoskeletal injuries, COMWEL Incheon Hospital has evaluated the ability to work the patients with occasional occupational injury, other than injuries involving the musculoskeletal system; these patients had been evaluated by their attending physician as being capable of working during the outpatient treatment period. This study analyzes the evaluation conducted on these patients; the analysis focused on ophthalmic injury patients.

**Methods:** We identified occupational injury patients who were referred to COMWEL Incheon Hospital for work ability evaluation with occasional injuries other than musculoskeletal system injuries. Only patients with ophthalmologic injuries were selected for the study.

**Results:** A total of 75 cases were requested from August 2019 to December 2022; 61 cases were ophthalmologic injuries. Construction workers accounted for the largest proportion with 48 cases. Regarding the mechanism of injury, 45 cases were caused by small flying fragments such as broken nails or blades. All patients, except one, did not recover visual acuity after treatment. As a result of the work ability evaluation, 38 cases were unable to return to work, and only 11 cases were able to return immediately.

**Conclusions:** In this study, the previous attending physicians' decision of ability to work were made based on whether work would worsen patients' recovery ophthalmologically, rather than on their actual ability to work. Most patients had not been able to adapt to the change of vision to return to work and despite permanent vision loss already being expected at the time of the injury, there was no occupational rehabilitation system in place that was related to daily adaptation of the change of vision.

**Keywords:** Return to work; Ocular trauma; Functional capacity evaluation; Work-ability evaluation; Occupational rehabilitation

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-01-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## A preliminary study on the active case management model of workers with work-related injuries in Kaohsiung city: association between return to work, instrumental activities of daily living, and business category

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**Background:** To improve the labor insurance compensation and return to work rate, this study proposes a new model for workers with work-related injuries in Kaohsiung City. There are 300–400 deaths in Taiwan every year due to major occupational accidents. Most common problem faced by workers in major occupational accidents is that victims do not have access to immediate occupational medical resources. Therefore, our goal is to provide workers with immediate occupational medical resources and case management, and to assess what are important factors for successful recovery and return to work (RTW).

**Methods:** We arranged case management for workers with work-related injuries and hospitalization. Our implementation strategies for the new model included: (1) occupational medicine team visit workers in wards daily; (2) assist workers to follow up in the occupational medicine outpatient clinic after discharge; (3) phone visit after three months to confirm the recovery, RTW, functional status of workers, business category, and labor insurance usage.

**Results:** During November 2022 and May 2023, our team took care of a total of 83 hospitalization workers. The score of Activities of Daily Living (ADL) after 3 months was  $96.63 \pm 11.90$  ( $p < 0.001$ ), Instrumental Activities of Daily Living (IADL) after 3 months was  $22.89 \pm 2.32$  ( $p < 0.001$ ), compared with initial status. Regression model revealed successful RTW was significantly positively associated with IADL after 3 months ( $\beta = 0.755$ ; odds ratio [OR]: 2.128; 95% confidence interval [CI]: 1.215–3.724;  $p = 0.008$ ) while negatively associated with patients who working in manufacturing business category ( $\beta = -2.601$ ; adjusted OR: 0.074; 95% CI: 0.006–0.894;  $p = 0.04$ ).

**Conclusions:** The new case management model can facilitate occupational accident worker recovery and RTW smoothly. Workers who have better IADL after 3 and who work in non-manufacturing business category have higher successful RTW after 3 months of occupational accident.

**Keywords:** Return to work; Instrumental Activities of Daily Living; Occupational injury; Case management; Occupational medicine

## Service Area

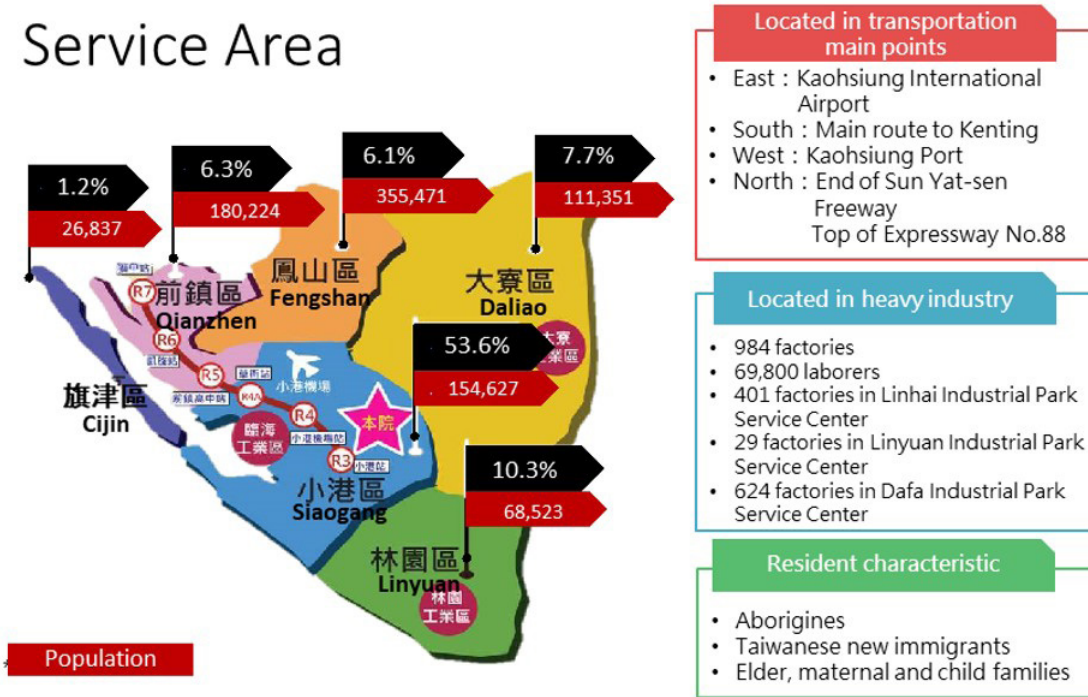


Fig. 1. Characteristics of service area in Kaohsiung Municipal Siaogang Hospital.

## Six Strategies

To Establish a Complete Occupational Injury and Disease Hospital in Kaohsiung



Fig. 2. Six strategies to establish a complete occupational injury and disease diagnosis and treatment hospital in Kaohsiung.

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-01-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Cohort profile: The National Health Insurance Service–Korean Worker’s Compensation Authorizer cohort (NHIS-KoWorCA)

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**Background:** The purpose of this cohort is to find out long-term health outcomes and long-term change of finance and social implications for workers who authorized worker’s compensation. Industrial accidents cause social, occupational, and economic problems and are very stressful for the affected parties. The damage caused by industrial accidents is not limited to short-term effects but also has long-term health consequences. There are many studies on the excess deaths and loss of labor due to industrial accidents. Diseases and injuries sustained in industrial accidents can leave behind chronic physical symptoms and sequelae. These include chronic pain, disability, and reduced physical function. Cancer can be caused by the hazardous substances to which a worker was exposed at the time of the industrial accident or by the damage caused by the industrial accident. Since there is an incubation period between exposure to a hazard and the onset of cancer, long-term studies are needed to determine the relationship between cancer and the hazard. In addition, workers who have suffered an industrial accident often complain of occupational and economic problems due to losing their ability to work. This hurts their mental health, leading to substance abuse and depression.

**Methods:** People who authorized worker’s compensation from 2004 to 2015 were included. And only employee was included. Self-employed workers were excluded. The cohort was followed up through 2022.

**Results:** The age-standardized prevalence of psychiatric disease was estimated. And also the age-standardized prevalence of musculoskeletal disease and cancer was calculated. The age-standardized mortality was also calculated.

**Conclusions:** Long-term cohort studies are needed to evaluate the long-term mental health effects of occupationally injured workers and to analyze the risk factors that influence the incidence, which can be used to develop preventive policies. This cohort would be valuable data for evaluating longitudinal health outcomes of work-related injured workers.

**Keywords:** Worker’s compensation; Cohort profile; Risk factor; Psychiatric disorder; Cancer

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-02-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## The red blood cell acetylcholinesterase as a biomarker of chlorpyrifos exposure and its determinant factors among male pesticide applicators in Central Java, Indonesia

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**Background:** Chlorpyrifos (CPF), one of the most frequently used agricultural insecticides, has an adverse effect on the nervous system through inhibition of acetylcholinesterase (AChE). This study aimed to evaluate the red blood cell AChE activity among male pesticide applicators with primary exposure to CPF.

**Methods:** We analyzed data from a total of 137 male pesticide applicators aged 18–65 years who were actively using CPF for at least 1 year. A validated quantitative method was used to estimate the cumulative exposure level (CEL). AChE activity was determined photometrically. Independent t-test was used to determine the mean difference in AChE according to participant characteristics and multiple linear regression was performed to analyze the association of AChE and its contributing factors. All *p*-values were 2-sided, and *p* < 0.05 was considered statistically significant.

**Results:** The mean age was 50.3 years, while the mean AChE activity was 23.8 U/g hemoglobin (Hb). The pesticide handling practices among participants were generally poor. Significantly lower mean AChE activity levels were found among those categorized as high CEL compared to low CEL (mean difference: -3.19 U/g Hb; 95% confidence interval: -5.09, -1.28; *p* = 0.001). Following the stepwise procedure, CEL, age, post-spraying days, re-entry of the treated area, and type of knapsack sprayer were retained in the final model as the contributing factors to AChE activity levels ( $R^2 = 0.39$ ; Adjusted  $R^2 = 0.37$ ).

**Conclusions:** The piece of evidence presented here suggests the presence of exposure-dependent AChE inhibition among pesticide applicators. Therefore, multisectoral collaboration to provide comprehensive knowledge and training on the proper handling of pesticides is important as part of a strategy to prevent pesticide-related health impacts.

**Keywords:** Agrochemical toxicity; Exposure-dependent; Exposure reduction; Pesticide applicators; Red blood cell acetylcholinesterase

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-02-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Improvement measures to overcome problems due to enforcement of hiring a health manager at workplace

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**Background:** As the Act on Special Measures for Corporate Deregulation was amended and enforced (October 21, 2021), the businesses with 300 or more workers must hire a health manager as an independent job position. The occupational field requires the integrative and comprehensive framework including management in personal protection equipment, occupational disease, chronic disease, health promotion, chemistry, risk assessment, etc. Hiring additional health manager in a specific field due to the minimum legal requirements, will not be sufficient to deal with various workforce health issues. In this study, we investigated the limitations and difficulties in performing tasks of the health managers who are qualified in a specific field but not in other areas, and suggested the alternatives to solve the potential problem.

**Methods:** We reviewed occupational safety and health laws and related regulations regarding the work of health managers. In addition, in-depth interviews and surveys were conducted with workplace health managers and the occupational health personnel of Group Occupational Health Service (GOHS) institutions.

**Results:** A survey for health managers at workplaces showed that qualified nurses focused mainly on health management while occupational hygienists and the managers in other licenses, demand the necessity of partial entrustment for health management. This can lead the owner of business to perform comprehensive health management by selecting proper and necessary services for health management. We proposed amendments to the Korean Occupational Safety and Health Act and related regulations on specialized management tasks, classified by GOHS institutions.

**Conclusions:** In order to prevent occupational diseases in the workplace properly, health management tasks require systematic and comprehensive performance without being limited by certificates and qualifications. The government should guide the business owners for autonomous monitoring and promotion of health management with strong supports.

**Keywords:** Health manager; GOHS

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-02-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
 eISSN 2052-4374

## Effects of digitization system on occupational health management

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**Background:** There is a growing realization that enterprises must attach importance to occupational health management to comply with national laws and regulations, and establish a mature occupational health management system to pursue better occupational health performance. Based on the analysis of China's digitization development and trend, combined with China's occupational health management requirements for enterprises, this paper explores the realization of all-round occupational health management through digitization system platform under the new situation, and expresses the promoting, efficient, positive, and mediating effects on occupational health performance through practice descriptions.

**Methods:** The occupational health management approach of the enterprise (a machining company) refers to the Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises and laws and regulations in China. And Occupational Health & Safety Assistances (OHSA)-Cloud Environmental Health & Safety (EHS) Management System is designed and used to help the enterprise to establish, maintain, review and improve their occupational health management systems.

**Results:** The enterprise uses the OHSA-Cloud EHS Management System for occupational health management. The workplace module is used for linking the workplaces, jobs and chemicals exposed to the workers through Cas No., then chemical occupational hazard factors are identified through the uniqueness of chemicals automatically, and it generates warning signs and notification cards directly; The occupational health monitoring module is used to archive the records of workers' physical examination files to protect the rights and interests of employees on time. It also can analyze the health trend, and play an auxiliary decision-making role in occupational health management; Through the training module to enhance all-staff awareness and ability, and workers can upload their own micro-courseware to improve cultural construction.

**Conclusions:** Digitization system promotes to improve the work efficiency of occupational health management and truly achieve the goal of occupational health compliance and sustainable development.

**Keywords:** Occupational health; Digitization; Cloud computing

Process Name	Chemical/Products/Intermediate	Hazard
electroplating	化学品 copper sulfate 化学品 silicon etch solution 化学品 sulfuric acid	Sulfuric acid and sulfuric acid

Fig. 1. Identification for occupational health hazard by CAS No. of chemicals automatically.

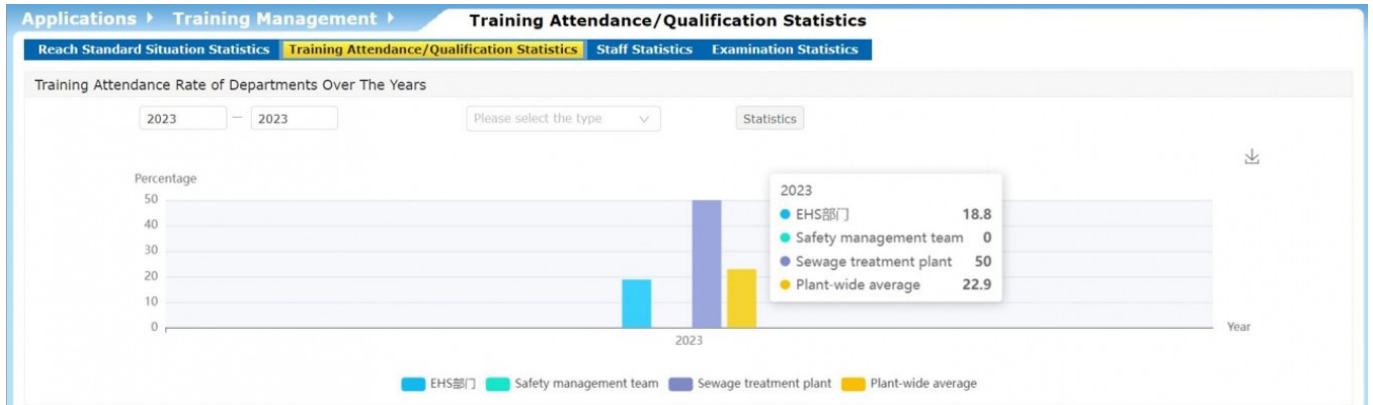


Fig. 2. Statistical analysis for occupational health training in the system.



## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-02-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Autoimmune diseases: is there linkage with occupational hazard factors?

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**Background:** The lungs are not only responsible for respiration but also act as an immune organ. Due to their direct contact with the occupational environment, the lungs serve as a primary target for a diversity of airborne pathogens, toxins, and allergens causing acute and chronic lung disease. The immune system of the lungs plays a vital role in protecting the body against respiratory pathogens. Thus, we investigated to elucidate the relationship between occupational lung diseases and the risk of autoimmune diseases by categorizing types of occupational dust exposure.

**Methods:** From the NHIS-NSC (2002–2019), 17,984,963 person-years were included in the data analysis. Autoimmune diseases were categorized based on the InterLymph classification. We estimated the incidence and rate ratio of autoimmune diseases according to type of pneumoconiosis. Association between exposure and autoimmune diseases was investigated using logistic regression analysis, adjusted for potential confounders.

**Results:** Of the 1,082,879 participants, 86,376 (8.0%) were diagnosed with autoimmune diseases, among these, 208 (14.1%) participants with occupational lung diseases. Occupational lung diseases were significantly associated with autoimmune disease, specifically organ-specific diseases. Occupational lung diseases due to inorganic dust exposure was associated with organ-specific diseases. Occupational lung diseases due to exposure to other dust was significantly associated with both of connective tissue diseases and organ-specific diseases. Finally, we found occupational lung diseases were predominantly related to psoriasis, rheumatoid arthritis (RA), and type 1 diabetes mellitus (T1DM).

**Conclusions:** We found that occupational lung diseases are a potential risk factor for autoimmune diseases, especially psoriasis, RA, and T1DM. Our findings provide insight into the role of occupational environment in the pathogenesis of autoimmune diseases.

**Keywords:** Occupational lung disease; Pneumoconiosis; Autoimmune diseases; Occupational dust

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-02-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Mitochondrial dysfunction in pancreatic beta-cells causing FAM3A-PDX1-mediated insulin insufficiency after carbon monoxide poisoning

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Carbon monoxide poisoning (COP) primarily affects oxygen transport in the body and causes systemic impacts not only in the brain and heart but also in the pancreas. CO binds to hemoglobin or mitochondria, reducing oxygen supply and mitochondrial electron transport chain dysfunction. Such conditions might cause changes in the pancreatic beta-cell due to altered mitochondria failure, reduced adenosine triphosphate (ATP) production, and increased reactive oxygen species (ROS). However, limited research directly links COP to changes in the pancreatic beta-cell and relative physiological function. Since we have found COP increased the risks of diabetes and hyperglycemic crisis, which might be attributable to damage in the pancreas. In the present study, we take advantage of both *in vivo* and *in vitro* studies to discuss the underlying mechanism of COP-induced pancreatic beta-cell failure via the FAM3A-PDX1 pathway causing mitochondrial dysfunction. As the results, the cytoarchitecture of the rat pancreas manifested severe disorganization on the 28<sup>th</sup> day. Immunofluorescence staining also showed significantly decreased FAM3A, PDX1, and insulin expression in the COP pancreatic beta-cell. In addition, NLRP3-mediated pyroptosis including NLRP3, caspase-1, GSDMD, ASC, and interleukin (IL)-1 $\beta$  were up-regulated in the pancreas. *In vitro*, CORM2 induced massive ROS in the INS-1 832/3 cells at the early stage and reduced mitochondria membrane potential in a time manner. We also found that the protein level of FAM3A and PDX1 significantly diminished in the mitochondria after CO intoxication, leading to down-regulated ATP production. Meanwhile, CO also prompted the level of NLRP3, caspase-1, GSDMD, ASC, and IL-1 $\beta$  in INS-1 832/3 cells. These indicated CO-induced pancreatic beta-cell death via apoptosis and pyroptosis. The collective results suggested that CO intoxication causes mitochondria dysfunction via FAM3A-PDX1-mediated insulin insufficiency in the pancreatic beta-cell.

**Keywords:** Carbon monoxide poisoning; Pancreas; Mitochondria; FAM3A-PDX1; Insulin

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-02-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Occupational and environmental noise exposure and extra-auditory effects on humans: a systematic literature review

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**Background:** In the studies on health effects by noise, most studies have investigated the auditory effect of noise exposure. However, few studies have focused on the extra-auditory effects of occupational or environmental noise. The purpose of this study was to systematically review previous studies on the extra-auditory effects of occupational or environmental noise exposure on human health.

**Methods:** We reviewed literature from databases such as PubMed, using Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines to identify studies that address extra-auditory effects of occupational or environmental noise exposure on human health. The search terms are as follows.

(noise[Medical Subject Headings (MeSH) Terms] or noise, occupational[MeSHTerms]) AND (worker\*[Title/Abstract] OR occupation\*[Title/Abstract] or environment\*[Title/Abstract] or Environmental Exposure[MeSH]) NOT (Hearing Loss, Noise-Induced[MeSHTerms]).

**Results:** A total of 263 articles were initially identified, from which 36 articles were ultimately selected for this review (13 articles for circulatory system effects, 7 articles for nervous system effects, 5 articles for immunological responses, 3 articles for endocrine system effects, 3 articles for oncological effects, 2 articles for respiratory system effects, 2 articles for gastrointestinal system effects, and 1 article for obstetrics effects). Regarding cardiovascular effects, the selected studies provide evidence that noise exposure is associated with elevated blood pressure, hypertension, decreased endothelial function, and an increased risk of developing cardiovascular diseases, such as ischemic heart disease, stroke, and heart failure. In terms of nervous system effects, the selected studies demonstrate that noise exposure has detrimental effects on the nervous system, including sleep, cognitive performance, and mental health problems. For immune response and endocrine system effects, the selected studies have suggested an association between noise exposure and systematic inflammatory response and an increased risk of metabolic diseases. The oncological and respiratory effects of noise exposure were also reported, and an increased risk of acoustic neuroma and respiratory diseases such as asthma and bronchitis were identified. Finally, the gastrointestinal and obstetric effects of noise exposure were studied, and the selected studies suggested an association between noise exposure and an increased risk of gastrointestinal dysfunction and preterm delivery.

**Conclusions:** This review suggests that people who were exposed to occupational or environmental noise could have extra-auditory effects on human health. Various human health effects have been reported to be related to noise exposure, such as circulatory, respiratory, immunological, gastrointestinal, and oncological effects. Further studies are needed to investigate the effects of noise exposure on extra-auditory human health and our review will provide insight into the correlation between noise exposure and its effects on human health, including underlying mechanisms of disease, and can serve as a valuable resource for future research.

**Keywords:** Noise; Noise exposure; Occupational noise; Environmental noise; Extra-auditory effects

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-03-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Roles of locally adjusted action checklists in participatory work improvement programs for varied jobs

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**Background:** Participatory work improvement programs are spreading in various sectors in many countries. These programs utilize similar action checklists listing feasible improvements suited to targeted workplaces. It is useful to know what types of improvements are involved and actually implemented in those varied workplaces.

**Methods:** Practical types of workplace improvements included in action checklists used in participatory action-oriented training programs in varied sectors were compared. Attention was drawn to technical areas covered and types of improvements implemented. The roles of action checklists listing multifaceted actions were discussed for facilitating group-work steps in achieving meaningful improvements.

**Results:** The reviewed programs utilized locally adjusted versions of action checklists for planning feasible improvements. These action checklists were found suitable for organizing group-work steps by working people. A clear focus was placed on low-cost actions for improving teamwork methods. A trend is seen to include communication and social support to address psychosocial factors. As a result, these participatory programs led to multifaceted improvements including a substantial number of actions addressing stress reduction and emergency preparedness. Improvements in work operations and physical environment also tended to be combined with improved work organization or teamwork. Notably, handy action-checklists comprising illustrated 20–30 action-items proved effective for planning multifaceted work improvements in different jobs. The exchange of positive experiences in the design and use of such short action checklists has been found useful for facilitating the participatory steps reflecting local good practices.

**Conclusions:** Participatory steps focusing on feasible work improvements reflecting local good practices can be facilitated in different jobs by utilizing locally adjusted action checklists. They can contribute to multifaceted improvements including those addressing work organization and psychosocial factors, team work and emergency preparedness. It is suggested to organize participatory steps in various jobs by utilizing locally adjusted action checklists reflecting these multifaceted aspects.

**Keywords:** Work improvement; Participatory program; Action checklist; Psychosocial factor; Stress prevention

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-03-02

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# Role of sleeping time as a protective factor on commuting time toward psychological distress among workers

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**Background:** Commuting time is part of workers' daily time-use and might be assigned either as a demands or resources toward outcomes. Although, it may affect family conditions, scholars have grouped it within employment related activities. Sleeping time, as part of the personal and domestic activities, may alter the effect of commuting time, since both are interacting within daily time-use. The study intended to define the role of sleeping time in moderating the effect of commuting time toward psychological distress.

**Methods:** A nation-wide, online survey, cross sectional study was conducted in Japan. Sample was stratified by workers status, age, sex, and region to meet actual Japanese workforce condition. Psychological distress was measured using Kessler-6 for psychological distress questionnaire. Commuting time was defined using the Likert scale question defining daily one-way commuting time. Sleeping time was measured with the Likert scale question: "How long have you slept on average per day over the past month? Please select the option that applies to you." Data was analyzed with multiple linear regression.

**Results:** There were 7,810 participants. As many as 62% and 71% participants spent 15 minutes or more to less than 1-hour for one-way daily commuting time and took 5 hours or more to less than 7 hours sleeping time, respectively. Multiple linear regression for commuting time toward psychological distress showed  $B = 0.149$  (unstandardized), standard error (SE) = 0.051,  $p = 0.003$  when adjusted with age, sex, education, income, family member, type of industry and working time. And when additionally adjusted with sleeping time, the result became  $B = 0.094$  (unstandardized), SE = 0.051,  $p = 0.063$ .

**Conclusions:** Commuting time is concluded as a demand contributed to psychological distress. But the effect was reduced when participants had proper sleeping time.

**Keywords:** Commuting time; Sleeping time; Psychological distress; Workers

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-03-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Beyond working hours: the impact of long working hours and the use of work-related communication devices outside regular working hours on anxiety symptoms

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**Background:** Recently, the use of communication devices in the workplace has been expanding. While its convenient, using these devices for work outside regular working hour can lead to psychological burden to workers. The aim of the present study was to identify and compare the impact of long working hours and the use of work-related communication devices outside of regular working hours on anxiety symptoms and to provide insight into the redefinition of working hours.

**Methods:** This study utilized cross-sectional data from the 6th Korean Working Conditions Survey, specifically the responses from 46,055 workers. To investigate the impact of using work-related communication devices outside regular or long working hours on anxiety symptoms, odds ratios (ORs) and 95% confidence intervals (CIs) were calculated using multiple logistic regression models, with gender, age, occupational classification, education level, and income level as covariates.

**Results:** Compared to the reference group, individuals who used work-related communication devices outside of regular working hours, but did not work long hours, had higher OR of experiencing anxiety symptoms (OR: 2.18; 95% CI: 1.97–2.41) compared to those who worked long hours but did not use work-related communication devices during off-hours (OR: 1.32; 95% CI: 1.09–1.59). Furthermore, the group that both worked long hours and used work-related communication devices outside of regular working hours exhibited the highest OR of experiencing anxiety symptoms (OR: 2.57; 95% CI: 2.24–2.97).

**Conclusions:** The use of work-related communication devices outside regular working hours is associated with a higher risk of developing anxiety symptoms compared to working long hours alone. This result suggests that when redefining working hours, it is necessary to consider work-related device use outside of working hours as well as regular work time.

**Keywords:** Communication devices; Working hours; Anxiety; Korean Working Conditions Survey

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-03-04

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# How psychosocial safety climate indirectly affects the psychological health of working couples?

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**Background:** The study aimed to investigate the effect of psychosocial safety climate (PSC) on job demands, work-family conflict (WFC), family-work conflict (FWC), and psychological health. First, the study proposed that PSC moderates the association between job demands and WFC for both husband and wife. Second, the study predicted FWC mediates the relationship between WFC and depression through the “crossover” process.

**Methods:** The study design used a multi-source sample that involved 350 teachers and their working spouses (n = 700).

**Results:** For the teacher’s sample, the hierarchical regression analysis showed that PSC moderates the relationship between physical demand and WFC of behavior-based ( $\beta = 0.107, p < 0.05$ ) and strain-based ( $\beta = 0.109, p < 0.05$ ). The results also found that PSC moderates the relationship between emotional demand and WFC of time-based ( $\beta = 0.103, p < 0.05$ ). Next, the analysis found that PSC moderates the association between cognitive demand and WFC of strain-based ( $\beta = 0.179, p < 0.05$ ). For the spouse’s sample, the analysis showed PSC moderate the relationship between physical demand and WFC of strain-based ( $\beta = 0.091, p < 0.05$ ). The analysis also showed that FWC mediated the relationship between WFC and depression among husband and wife.

**Conclusions:** Overall, this study added crucial knowledge to the existing literature by determining the effect of PSC on individuals’ and others’ psychological health through the crossover process.

**Keywords:** Psychosocial safety climate; Job demands; Work-family conflict; Family-work conflict; Depression

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-03-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Is the prevention of loneliness at work important in occupational health and safety?: development of a concept of the connected workplace for worker well-being

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**Background:** Loneliness in the workplace is an emerging concern in the COVID-19 pandemic. This presentation aims to examine if the prevention of workplace loneliness is an important target to be integrated into occupational health and safety (OHS) activities, based on the literature review and opinions of employers, unions, and the government.

**Methods:** A literature review was conducted of the determinants and consequences of workplace loneliness. Opinions of employers and unions were collected at a stakeholder meeting. Interviews were conducted with departments of Ministry of Economy, Trade and Industry and Ministry of Internal Affairs and Communications, Japan, which are relevant to loneliness at work.

**Results:** Most previous studies focused on workplace loneliness, as a subjective feeling. Workplace loneliness was determined not only by personal characteristics, but also by organizational psychosocial factors. Workplace loneliness affected poor physical and mental health, lack of job satisfaction, low work performance, and high intention to leave. Employers and unions showed positive opinions to tackle with workplace loneliness, while a concern was expressed to consider values and decisions of individual employees. The Interviews revealed that the prevention of workplace loneliness may be relevant to the human capital management and mental health promotion component of the health and productivity management, and human rights due diligence.

**Conclusions:** Prevention of workplace loneliness may be an important component of OHS activities in future. “The connected workplace for worker well-being” may be a new OHS agenda. Prevention of workplace loneliness could also contribute to other business-related frameworks such as human capital and human right at work.

**Keywords:** Workplace social support; Social inclusion; Organizational factors; Policy analysis



## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-03-06

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Burnout in emergency department personnel: a continuing concern post pandemic

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**Background:** High incidences of burnout has been reported amongst emergency department (ED) personnel during the coronavirus disease 2019 (COVID-19) pandemic. Emerging from the pandemic, organisational support for psychological health may dwindle and become secondary to economic priorities. We aimed to ascertain the level of burnout within ED staff at our hospital, identify professional groups which were more vulnerable and domains which contributed most towards burnout.

**Methods:** We conducted a cross-sectional study approximately 8 months after major moves to remove COVID-19 restrictions in Singapore. Data was collected via a self-administered survey employing the Copenhagen Burnout Inventory (CBI). Demographics, occupational details, work satisfaction and motivation to stay in the job were also collected and analysed.

**Results:** A total of 115 ED staff participated. The mean overall CBI score was  $62.3 \pm 22.0$ . Mean scores for personal, work-related and client burnout were  $64.9 \pm 23.2$ ,  $61.6 \pm 23.1$  and  $60.4 \pm 26.1$ , respectively. Nurses had higher CBI scores ( $67.5 \pm 20.5$ ) than doctors ( $54.6 \pm 23.0$ ) and the difference was statistically significant ( $p = 0.01$ ). The 44.5% had to take medical leave as a result of burnout. The difference in CBI scores in (a) those satisfied with their present job compared to those not satisfied ( $42.7 \pm 17.9$ ;  $84.0 \pm 14.4$ ;  $p < 0.0001$ ) and (b) those motivated to continue in their current job vs. those who were not ( $50.1 \pm 16.3$ ;  $79.0 \pm 15.1$ ;  $p < 0.0001$ ) were statistically significant.

**Conclusions:** ED staff continue to record high rates of burnout as we transit out of the pandemic. Accompanying rates of medical leave and low levels of motivation to remain in the job are serious occupational health concerns. Personal and work-related factors contribute most towards burnout and interventions should be focused accordingly. It is imperative that a multi-pronged approach is taken to mitigate the growing reality of more ED staff calling it quits.

**Keywords:** Burnout; Emergency department; Pandemic

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-04-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### The fit factor of alternative well-fit masks used by healthcare workers

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**Background:** During the coronavirus disease 2019 pandemic, the World Health Organization and Centers for Disease Control and Prevention recommended that healthcare workers (HCWs) who perform non-aerosol-generating procedures (AGPs) don a properly fitted mask. Our objective was to evaluate the fit factors (FFs) of 8 alternative well-fit masks (AWMs) used by Thai HCWs.

**Methods:** This comparative descriptive study was conducted on 33 HCWs between October and November 2022 and was categorized into 3 facial sizes, small, medium, and large. Each participant wore 8 types of AWMs in random order: surgical mask under adjustable ear-loop (AEL)-KF94 (SK), surgical mask under AEL-KN95 with a hook (SN), surgical mask under fabric mask (SF), AEL-KF94 (KF94), AEL-KF94 under fabric masks (KF), AEL-KF94 with a hook (KF94H), AEL-KN95 with a hook (KN95), and AEL-KN95 with a hook under fabric mask (NF). FFs were measured using a quantitative fit test.

**Results:** The number of HCWs in size small, medium, and large was 12, 12, and 9, and the means  $\pm$  standard deviation of face width and length was  $132.98 \pm 10.49$  and  $114.92 \pm 10.10$  mm. The highest respective median of FF was KN95 = 200, NF = 200, SN = 185, and KF94H = 171, and the respective passing fit-test rate was 97%, 84.8%, 63.6%, and 60.6%. There was no difference in FFs between the N95 and KN95 ( $p$ -value = 0.72), the N95 and NF ( $p$ -value = 0.202), and the 3 facial sizes.

**Conclusions:** The AEL-KN95 with a hook and sponge at the nosepiece is an effective respirator for use by HCWs in non-AGPs, as the FF and fit test pass rates were comparable to those of N95, and there were no differences in FFs between facial sizes.

**Keywords:** COVID-19; Fit factors; KN95; KF94; Masks

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-04-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Working condition survey of plant construction workers in Korea

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**Background:** This study evaluates and presents the occupational hazards of plant construction workers. Plant construction workers are individuals who work in the maintenance and construction industry of plants, including oil refining, power generation, and steel production. They may face elevated levels of hazards in certain tasks, such as pipeline removal, compared to their routine exposures. However, due to their predominantly temporary employment status, regular assessments of their working conditions are often lacking. Therefore, it is crucial to identify and present the specific occupational hazards associated with plant construction workers and compile pertinent resources for future reference.

**Methods:** A survey was conducted on 2,000 plant construction workers. The questionnaire adopted items similar to the Korean Working Conditions Survey to enable standardized comparisons with the general working population in Korea. This study also analyzed the working environment measurement data regularly conducted in representative facilities of the petrochemical complex. Utilizing the data reported to the Korea Occupational Safety and Health Agency over the past 10 years, a list of major hazards that have been measured was compiled. The outliers of prominent hazards were presented, and their annual variations were visualized.

**Results:** Plant construction workers were found to have a significantly higher level of exposure to environmental hazards compared to the general working population. Furthermore, it was noted that these workers face increased burdens related to musculoskeletal tasks. The presence of carcinogenic substances, including benzene, among the hazards in the facilities of the petrochemical complex was confirmed. Besides, measurement locations exceeding the exposure limits were also identified.

**Conclusions:** It has been confirmed that plant construction workers are exposed to various hazards at a high level. Due to the current lack of health management measures for these workers, it is urgent to address this issue and make necessary improvements.

**Keywords:** Plant construction; Working conditions survey; Working environment measurement; Benzene; Carcinogen

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-04-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
 eISSN 2052-4374

## A challenge through joint research in Japan: development of rapid and highly accurate method to measure concentration of fibers in atmosphere using artificial intelligence and phase contrast microscopy

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**Background:** The aim of this study was to investigate methods for measuring asbestos concentration in the air, which is the key to monitoring asbestos leakage during demolition and renovation of buildings containing asbestos, and to propose more effective monitoring measures. Since the manufacture, import and use of asbestos products have been completely abolished in Japan, the main cause of asbestos emission to the atmosphere is the demolition and removal works of buildings using asbestos containing building materials. In order to detect and correct asbestos emission from demolition and removal work due to inappropriate works at an early stage, a rapid measurement method for atmospheric asbestos fibers is required.

**Methods:** Firstly, we compared 8 measurement methods described in the Japanese Ministry of the Environment's "Asbestos Monitoring Manual" were compared in terms of portability, sampling conditions, analysis accuracy, price, good points and improvement points. The results show that the phase contrast microscopy (PCM) method was the most balanced analysis method. Secondly, we studied fiber detection by image analysis using artificial intelligence (AI) for in PCM images. A series of simulated atmospheric samples prepared from amosite and chrysotile standard samples were observed with a PCM, images were taken, and teaching data created from the counting results of expertized analysts. We adopted two kinds of AI models, an instance segmentation model Mask R-CNN, and a semantic segmentation model MA-Net. The AI models learned to detect fibers.

**Results:** The accuracy of fiber detection was 57% in recall and 46% in precision for Mask R-CNN, and 95% in recall and 91% in precision for MA-Net. The time required for fiber detection was less than one second per image in any AI model.

**Conclusions:** Satisfactory results were obtained with the MA-Net model. And AI analysis was faster than the time required for counting by expertized analyst.

**Keywords:** Asbestos; Artificial intelligence; Phase contrast microscopy; Demolition and renovation of buildings; Demolition and renovation of buildings

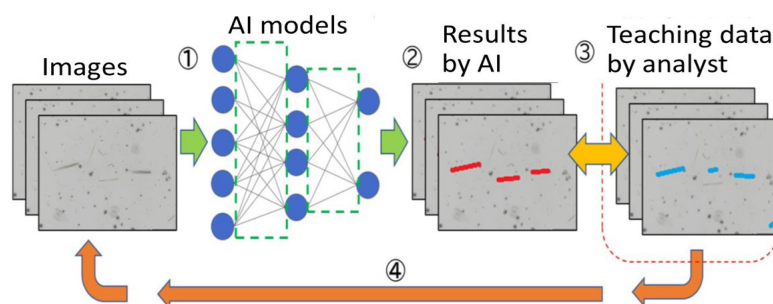


Fig. 1. Learning procedure of the AI models. AI: artificial intelligence.

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-04-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Prevention of occupational exposure to mpox among healthcare workers – role and results of telemedicine use in a national home recovery programme

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**Background:** Mpox poses a risk for occupationally acquired infections among healthcare workers (HCWs). We share Singapore's experience using telemedicine for the clinical management of mpox patients via a home recovery model and its concomitant advantage in eliminating risks of occupational exposure.

**Methods:** We describe mpox patient management protocols adopted by the Ministry of Health, Singapore. Data was extracted from the database maintained by the Home Recovery Task Group, which was assessed to be a comprehensive information source given that official notification of mpox infection is mandated under the Infectious Diseases Act.

**Results:** Apart from transmission-based precautions adopted to protect HCWs during direct patient contact, telemedicine played a major role in mpox case management. There were zero mpox transmission incidents amongst HCWs involved in patient care duties. Telemedicine was a valuable tool given mpox's highly visual presenting features, and especially relevant in the Home Recovery Programme for clinically stable patients. Out of 17 mpox patients who recovered outside the hospital setting, 16 benefited from telemedicine consultations. There were no documented escalations that required hospital review or admission. No concerns were highlighted over the patients' mental health and psychological well-being. The mean duration of illness was 26.1 days for the 16 mpox patients who had recovered in an isolation facility or their own homes, consistent with the natural disease course reported in the literature.

**Conclusions:** Although patient contact was eliminated through telemedicine, not all cases could be reviewed remotely and in-person consultations with the appropriate personal protective equipment were still required. With technological advances such as 5G networks and availability of newer diagnostic devices for remote healthcare delivery, and increasing acceptance of telemedicine by HCWs and patients, its role will become more significant in healthcare, as well as in preventing occupationally acquired infections among HCWs.

**Keywords:** Mpox; Healthcare workers; Occupationally acquired infection; Telemedicine

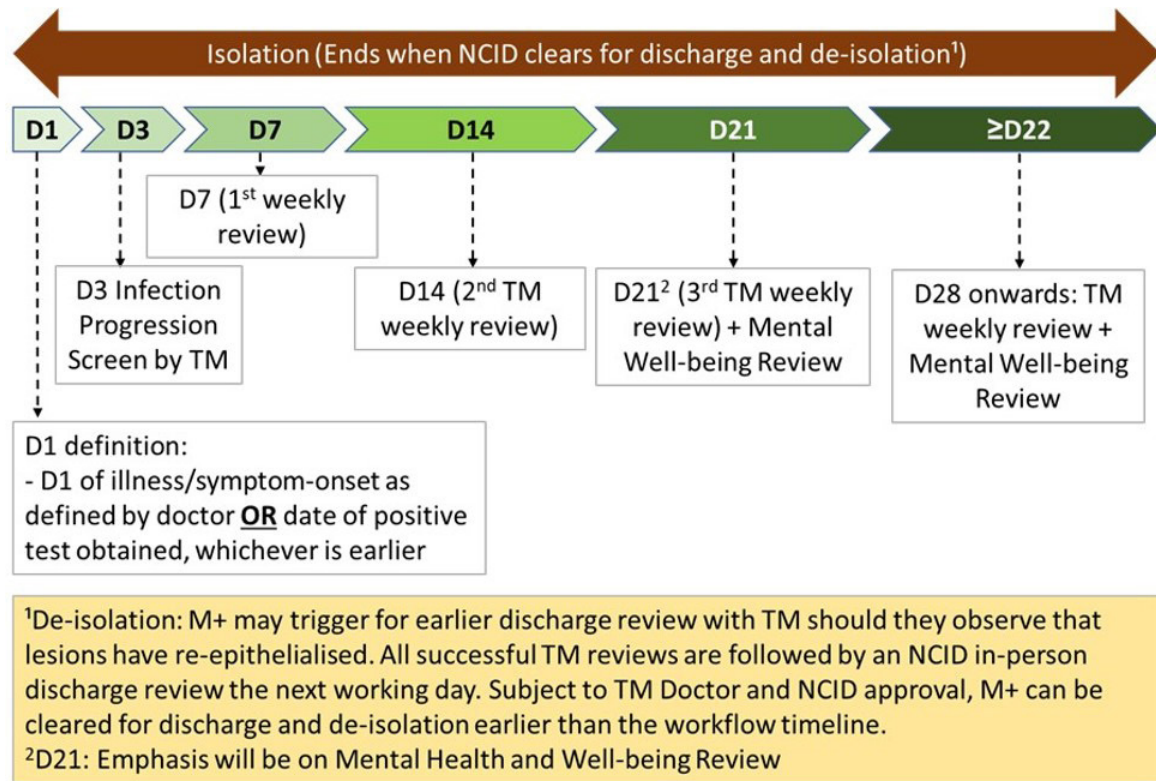


Fig. 1. Timeline of telemedicine support for mpox patients (effective 22 August 2022).  
 TM: telemedicine; NCID: National Centre for Infectious Diseases.

S/N	Age	Gender	Isolation Location	Day of Decant from NCID to Isolation Location	No. of Telemedicine Reviews	Pre-discharge Review	Duration of Isolation
1	45	Male	Isolation Facility	Day 30	Day 39: Fail Day 41: Fail	Day 44: Fail Day 48: Pass	48
2	30	Male	Isolation Facility	Day 30	NA	Day 34: Pass	34
3	48	Male	Isolation Facility	Day 24	Day 27: Pass	Day 28: Pass	28
4	41	Male	Isolation Facility	Day 20	Day 23: Pass	Day 24: Pass	24
5	26	Male	Isolation Facility	Day 21	Day 24: Pass	Day 25: Pass	25
6	31	Male	Isolation Facility	Day 9	Day 20: Pass	Day 21: Pass	21
7	28	Male	Isolation Facility	Day 9	Day 20: Pass Day 22: Fail Day 25: Fail Day 28: Pass	Day 21: Fail Day 29: Pass	29
8	32	Male	Isolation Facility	Day 18	Day 21: Pass Day 24: Pass	Day 22: Fail Day 25: Pass	25
9	59	Male	Isolation Facility	Day 9	Day 21: Pass	Day 22: Pass	22
10	33	Male	Isolation Facility	Day 8	Day 21: Fail Day 28: Fail Day 35: Pass	Day 36: Pass	36
11	54	Male	Isolation Facility	Day 2	Day 14: Pass	Day 15: Pass	15
12	35	Male	Home	Day 6	Day 7: Fail Day 14: Fail Day 21: Pass	Day 22: Pass	22
13	28	Male	Isolation Facility	Day 6	Day 7: Fail Day 14: Fail Day 23: Fail Day 27: Pass	Day 28: Pass	28
14	18	Male	Isolation Facility	Day 12	Day 14: Fail Day 21: Fail Day 29: Pass	Day 30: Pass	30
15	34	Male	Isolation Facility	Day 9	Day 14: Fail Day 21: Pass	Day 22: Pass	22
16	41	Male	Isolation Facility	Day 11	Day 13: Fail Day 20: Pass	Day 21: Pass	21
17	36	Male	Isolation Facility	Day 3	Day 3: No issues Day 7: Fail Day 14: Pass Day 21: Pass	Day 15: Fail Day 22: Pass	22

Fig. 2. Timeline of telemedicine support for mpox patients (effective 22 August 2022).  
NCID: National Centre for Infectious Diseases.

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-04-05

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# The strategy for improving work environment and working conditions among long-term health care workers in Korea

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**Background:** This study aimed to establish a strategy to improve the poor working environment and working conditions among long-term healthcare workers in Korea.

**Methods:** A total of 600 questionnaires with which long-term health care workers participated in the targeted base areas of each city and province nationwide were distributed directly and 525 responses were collected and 506 responses were analyzed. Surveys, on-site field visits, and in-depth interviews were also conducted to understand the working environment as well as conditions and establish a strategy for improving the working environment among long-term healthcare workers to understand the demands of working conditions and working conditions.

**Results:** Korean long-term care workers firstly and mostly enumerated their risk factors for ill-health when lifting or moving elderly recipients directly by hand (69.9%), followed by increased physical workload with old beds, tools, and facilities (42.3%) in the workplaces, shortage of manpower (32%), and source of infection (30%). To improve the working environment as well as conditions, Korean long-term care workers considered improving low-wage structures, ergonomic improvements to solve excessive physical loads, and increasing various bonus payments as well as implementing the salary system, positive social awareness, and increasing resting time. Of 506 responses, 92.3% replied that the long-term care insurance system for the elderly should be developed to expand publicization at the national level.

**Conclusions:** This study proposes to improve the low-wage structure of Korean long-term care workers, automation and improvement of facilities, equipment, and tools to eliminate excessive physical loads (beneficiary elderly lifting), and reduction of night labor.

**Keywords:** Risk factors; Strategy for improving working environment and conditions; Long-term health care workers



## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-04-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Workplace adjustments for a worker with thyroid cancer and para-occupational exposure to radiation in a university hospital: a case study

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**Background:** A 44-year-old female with a history of thyroid goiter was diagnosed with papillary thyroid carcinoma during a follow-up in April 2023. Since July 2021, she has been employed as a research assistant at a tertiary university hospital in Taiwan. Her office is located adjacent to the Linear Accelerator (LINAC) Radiotherapy Rooms and is classified as a controlled area. The objectives of this study are to 1) assess the work-relatedness of the thyroid cancer case; 2) evaluate the risk of thyroid cancer recurrence for the case; and 3) devise appropriate workplace adjustments.

**Methods:** We have obtained and analyzed the related medical records of the aforementioned case and the routine environmental radiation monitoring data at her workplace. Furthermore, we have conducted real-time and continuous radiation measurements around her workplace before and after implementing temporary radiation protection with a portable lead shield. Literature on the association between radiation exposure and the occurrence and recurrence of thyroid cancer has been collected.

**Results:** The radiation dose rate measured at the gateway of her office can reach up to 2.9  $\mu\text{Sv/h}$  when the LINAC beam is fully operational. This value is below the required upper limit for a controlled area in Taiwan (10  $\mu\text{Sv/h}$ ) but higher than the limit for a non-controlled area (0.5  $\mu\text{Sv/h}$ ). The estimated cumulative radiation exposure in less than 2 years of employment is unlikely to be causative for the occurrence of thyroid cancer. However, the current literature is limited regarding the risk of recurrence. Following the principle of precaution, we recommend implementing engineering controls, including steel wall protection, along with other auxiliary measures, to reduce overall radiation exposure and exclude her workplace from the radiological controlled area.

**Conclusions:** In order to protect hospital workers and patients, precautionary measures of radiation protection are needed.

**Keywords:** Environmental radiation monitoring; Risk assessment; Exposure assessment; Radiation protection; Engineering controls

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-05-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### COVID-19 management in the large organization: ensuring health and operational continuity in the post-pandemic era

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The coronavirus disease 2019 (COVID-19) pandemic has had a significant impact on the global industry, with demand for many products declining and supply chains disrupted. Reliance, one of the world's largest organisations, has taken a comprehensive approach to managing the pandemic, with a focussed approach through resources on a war footing to help stakeholders. The mission was designed to safeguard the stakeholders and community simultaneously, ensuring business continuity. Reliance's COVID-19 management strategy includes several key elements, including:

- Health and safety protocols
- Risk reduction - symptom checker online, robust COVID testing modalities for early identification and testing of cases, COVID pass authenticator
- COVID-19 task force
- Infrastructure - COVID care centres across locations
- Medical assurance - emergency care cell, contact tracing and isolation of infected individuals
- Digital health - Jio Health hub, teleconsultation, real-time dashboard
- Communication - travel advisory, social distancing, enhanced hygiene and sanitation measures, and work-from-home arrangements.
- India's largest vaccination drive for of employees, family members, stakeholders, and the community.

Reliance has also implemented several other measures to support its employees during the pandemic, including:

- We care policy - providing financial assistance, medical support, and other necessary support
- Physical and mental wellbeing - 24 X 7 mental health support
- Regular advisories as educational resources to employees about COVID-19

With a proactive and holistic approach, Reliance effectively managed the impact of COVID-19, sustaining operational resilience. This strategy serves as a valuable example for other organizations, safeguarding health and ensuring uninterrupted services. These measures also supported employees and fostered a strong sense of community within the company. Post-pandemic in view of global challenges of mental health and well-being, as an organisation we have focused and strengthened our concept of holistic health across Reliance for employees and family members.

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**Keywords:** COVID-19 pandemic; Health and safety protocols; Risk reduction; Holistic health; Digital health

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-05-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Competencies required for occupational health nurses in the COVID-19 respond

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**Background:** This study aimed to clarify the competencies required of occupational health nurses in response to coronavirus disease 2019 (COVID-19).

**Methods:** This study employed a qualitative descriptive design using semi-structured online interviews. The study participants included nine occupational health nurses using network sampling. The researchers read transcripts of the interviews verbatim and extracted subcategories and categories, seeking points of commonality among homogeneous and heterogeneous elements while identifying content related to the competencies of occupational health nurses in the responses to the COVID-19 pandemic. This study was approved by Research Ethics Committee of the Japanese Red Cross College of Nursing (2021-061).

**Results:** Eight categories and 27 subcategories were extracted. The eight categories were “utilizing and gathering appropriate information quickly,” “assessing risks of infection and considering measures,” “incorporating effective infection control measures adjusted workplace,” “enhancing the significance and value of OHNs existence,” “coordinating and collaborating based on understanding the organization,” “utilizing the relationship of trust built through daily occupational health practices,” “having the risk communication skills tailored to the target,” and “connecting past experiences to occupational health practice.”

**Conclusions:** The competencies required for occupational health nurses in response to the COVID-19 pandemic revealed flexibility and responsiveness according to the infection phase that changes time, establishes good relationships, collaborates, and coordinates with the entire organization. In the midst of repeated waves of infection spread, occupational health nurses play an important role in dealing with the concerns of workers in highly uncertain situations. It is suggested that these competencies are based on high ethics as a professional, and consist of comprehensive concepts supported by values. It is necessary to further research the development of educational programs to improve competencies based on these findings.

**Keywords:** Competency; COVID-19; Occupational health nurse

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-05-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Management of occupational mental burnout in COVID-19: a scoping review

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**Background:** Healthcare workers have played critical role in the current coronavirus disease 2019 (COVID-19) pandemic. Managing healthcare workers and supporting them during the pandemic to enable them to perform their jobs to the best of their abilities has been at the forefront. Although there are abundant academic papers reporting the state of the mental health of healthcare workers in different countries and interventions; there are hardly any studies examining the challenges, lessons learnt and best practices that would help understand the complexities and analyze advantages and disadvantages of each intervention for the future pandemic. The main objective is to identify the lessons learnt and best practices of interventions taken against of COVID-19 on the mental health of the healthcare workers.

**Methods:** This is the scoping review covered the period of January 2020 and August 2022. Three databases yielded a total of 863 articles, of which 25 were used in the analysis.

**Results:** Interventions on occupational mental burnout can be classified into 1) mental health consultation service that were offered via the phone, in-person, peer discussion, resilience coaching and special therapies as needed; 2) IT-based interventions including application and QR code for information on required mental services and self-evaluation application for mental well-being; 3) improvement of the working environment through providing free drinks and meals, creating relaxing areas, offering individualized interventions and providing overnight staying place inside hospital for healthcare workers; and 4) other support including financial incentives and child care service for healthcare workers.

**Conclusions:** Interventions were likely to be more organizational-level interventions that encouraged interdisciplinary teamwork and participative leadership. These interventions had positive effect on the mental health of the healthcare workers. However, more systematic level interventions where all health care workers would benefit equally and supported unconditionally during the healthcare emergencies.

**Keywords:** COVID-19; Mental burnout; Occupational health

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-05-04

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

### The necessity of engineering control for COVID-19

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This paper advocates the superiority and preventiveness of engineering control methods in the fight against coronavirus disease 2019 (COVID-19). Biomedical tools such as vaccines and antiviral drugs take time to develop and can only be regarded as the second line of defense against COVID-19. Engineering methods are more practical and preventive than biomedical measures and should be deployed as the first line of defense. New engineering containment methods/devices that could change how World Health Organization and National Centers for Disease Control and Prevention manage viral aerosols in current and future pandemics are being developed. This study analyzes and summarizes the importance and necessity of developing a complete set of “fire extinguishers” to stop the spread of COVID-19 and other respiratory infections. From the perspective of the control hierarchy, source control is the most effective way to eliminate emissions, followed by pathway and receptor control. From the user’s point of view, these devices are designed and used separately by infected and healthy people. Control devices should be used according to the wearer’s health status and the dispersion condition of the bioaerosols. Breath-Taking Hoods are designed for infected and asymptomatic people to remove the exhaled aerosols and protect the environment. The breath-responsive powered-air purifying respirators are designed to protect healthy people. Indoor air purifiers with adequate Clean Air Delivery Rate should be used to reduce health risks. Critical ill patients can use portable medical quarantine hoods when negative isolation wards are unavailable. Walk-in hoods with filtered incoming or outgoing flow for dining or other activities can be used by healthy or infected people, respectively. Aerosol-free toilets are also essential in the overall control scheme. Notice that many new products still need to be added to the U.S. Food and Drug Administration certification list, and performance testing methods and accredited laboratories still need to be prepared. We need to move fast before the next virus hits us.

**Keywords:** Source control; Personal protection; Exhaled breath; Air cleaner; Prevention

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-05-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Adapting hospital environments by using the “new normal” medical services model to mitigate COVID-19 transmission and manage healthcare-associated infections in Thai hospitals

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**Background:** The present study examines the implementation and efficacy of the “new normal” health services delivery practices in managing hospital environments to control healthcare-associated infections in Thai hospitals during the coronavirus disease 2019 pandemic.

**Methods:** A mixed-method research approach was employed, with questionnaire to healthcare division heads which involving the evaluation of hospital environments adaptation, using the “new normal” health services delivery practices and the detection of indoor bacterial loads using culture techniques.

**Results:** The evaluation involved 543 healthcare division heads from 30 healthcare facilities, including private hospitals, general hospitals, and community hospitals. The findings indicate that the majority of respondents reported that their respective hospitals had made changes to the physical structure, process, and personnel management components in line with the new normal measures to prevent infections and disease transmission. Moreover, 71.7% of the investigated hospitals were found to have pathogenic bacteria in the air, albeit below permissible limits. Notably, the front office area exhibited a higher bacterial concentration compared to other hospital rooms, with statistical significance ( $p < 0.05$ ).

**Conclusions:** These new normal practices, for managing the hospital environment are the same concept of hierarchy of control in occupational health control, should be consistently and regularly implemented, even after the pandemic subsides, to control indoor contamination by other pathogens. Such measures are crucial in mitigating health risks for both patients/service users and healthcare staff within the hospital setting.

**Keywords:** New normal practice; COVID-19; Healthcare worker

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-05-06

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

### Characteristics of confirmed cases of COVID-19 among tertiary hospital employees

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**Background:** The coronavirus disease 2019 (COVID-19) pandemic increased the burden of infection risk on the health workforce. This research aimed to study the characteristics of hospital employees (HEs) confirmed infected with COVID-19 in a tertiary hospital in northeastern Thailand.

**Methods:** This descriptive study was conducted between April 2021 and January 2022. Data for analysis were obtained from hospital electronic records, while contact tracing information for clinician was obtained from the Occupational Health and Safety Office.

**Results:** The study population included 115 HEs (1.6% of the total HE). Frontline HEs were more infected than back-office HEs (55.7% vs. 44.3%). The proportion of infected back-office HEs was greater than the frontline HEs (2.5% vs. 1.2%). The most common sources of infection were contact with family (40.0%), social event (23.5%), and co-worker (11.3%) contact, consecutively. Most of the cases received one booster dose of vaccine (41.7%) and had mild symptoms (76.9%). All severe cases were not immunized.

**Conclusions:** During the COVID-19 pandemic, most of the sources of COVID-19 infection among HEs were not work-related where protective strategies were adequate, including policies, contact tracing, and effective personal protective equipment. We, therefore, conclude that restricting off-work social activities would be protective.

**Keywords:** COVID-19; SARS-CoV-2; Hospital employees

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-06-01

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

### Work-related musculoskeletal disorders and its associated factors among retail shop employees

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**Background:** Work-related musculoskeletal disorders (WMSDs) are the most common work-related problems reported worldwide and rapidly increasing among employees in the era of job evolution and growing economy. Sparse literature is available on WMSDs among retail shop employees. This study aimed to determine the prevalence of WMSDs and its association with sociodemographic characteristics and occupational characteristics among retail shop employees in a town.

**Methods:** This was a cross-sectional analytical study conducted between September 2022 till January 2023 using two-stage sampling technique. Data collection was conducted by face-to-face interviews using questionnaires comprising of sociodemographic characteristics and occupational characteristics, validated Nordic Musculoskeletal Questionnaire (NMQ), and Minnesota Satisfaction Questionnaire (MSQ) Short Form. Descriptive and multiple logistic regression analysis were computed.

**Results:** Almost  $\frac{3}{4}$  (74.6%) of the retail shop employees reported musculoskeletal disorders in at least one anatomical region in the last 12 months. 20.3% of them were prevented from working due to WMSDs in the last 12 months. 49.2% of them reported WMSDs in the last 7 days. The prevalence of musculoskeletal disorders was the highest in neck (39.0%), followed by lower back (38.6%), shoulder (36.4%), and the lowest in ankles/feet (3.8%). Among sociodemographic characteristics, only gender (female) (adjusted odds ratio [aOR]: 1.97; 95% confidence interval [CI]: 1.05–3.70) was significantly associated with WMSDs. Among occupational characteristics, work experience more than 5 years (aOR: 2.91; 95% CI: 1.01–8.35), work overtime (aOR: 1.92; 95% CI: 1.01–3.66) and moderate level of job satisfaction (aOR: 2.18; 95% CI: 1.10–4.30) were significantly associated with WMSDs.

**Conclusions:** Nearing 75% of the retail shop employees reported WMSDs. Health promotion activities were carried out for the participants. Preventive ergonomic measures are highly recommended to prevent WMSDs and promote retail shop employees' health and well-being.

**Keywords:** Work-related musculoskeletal disorders; Retail shop employees; Associated factors; Sociodemographic; Occupational



## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-06-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Job exposure matrix development for musculoskeletal disorders: a study in South Korea

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**Background:** Musculoskeletal disorders (MSDs) constitute approximately 60% of all work-related diseases in South Korea, with an annual incidence exceeding 12,000 cases. The approval of occupational MSD claims varies, leading to inconsistent outcomes due to divergent judgments on workloads. Therefore, standardized criteria for workload assessment are urgently needed. This study aims to develop a Korean-specific Job Exposure Matrix (JEM) for MSDs.

**Methods:** Data from the Occupational Environment Survey conducted by the Ministry of Employment and Labor and Korea Occupational Safety & Health Agency were analyzed. The survey included variables like working hours, vibrations, temperature, postures, task repetition and speed, psychosocial factors, and MSD-related outcomes. Occupational classification used the standardized Korean Standard Occupational Classification (7th edition). Risk levels for MSDs were determined for 156 occupations, categorized into three grades (high, medium, and low) based on occupational risk factors. Correlation analyses were performed to explore the association between risk factors and musculoskeletal symptoms.

**Results:** Based on the Korean Standard Occupational Classification subcategories, the risk levels for MSDs were classified into 3 grades across 156 occupations. Correlation analyses revealed a significant association between occupational risk factors and symptoms such as back pain and upper extremity pain, while the association with lower extremity pain was comparatively weaker.

**Conclusions:** This study represents the pioneering effort to construct a JEM for MSDs in South Korea. It provides insights into the correlation between occupational risk factors and symptoms of MSDs across diverse occupations, employing the standardized Korean Standard Occupational Classification. The observed associations between back pain, upper extremity pain, and various occupations offer valuable reference material for the identification of occupational risk factors in the diagnosis of work-related diseases in the future. These findings contribute to the development of unified criteria for assessing workloads, enhancing consistency and fairness in occupational MSD claims evaluations.

**Keywords:** Job Exposure Matrix; Musculoskeletal disorders; Occupational risk factors

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-06-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Case series of work-related carpal tunnel syndrome: experience in South Kaohsiung City from January 2023 to April 2023

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**Background:** To discuss the case series of work-related carpal tunnel syndrome (WRCTS) about their demographic characteristics, examination, treatment, and status of return to work in South Kaohsiung. In 2018, there were 2,158 notifications of occupational injury and disease diagnosis in Taiwan. The highest rate was 813 cases of work-related musculoskeletal diseases, accounting for 37.7%. “Manufacturing” accounted for the most at 29.2%, followed by “construction industry” at 19.4%, “Accommodation and Catering Industry” accounted for 12.3%. Carpal tunnel syndrome (CTS; 57%) is the most common occupational disease in women.

**Methods:** Kaohsiung Municipal Siaogang Hospital became an Occupational Injury and Disease Diagnosis and Treatment Medical Institution in January 2023, taking care of approximate 100,000 workers in South Kaohsiung. We use the retrospective International Classification of Diseases 10th Revision diagnostic code of the information technology system as a case of CTS. After telephonic interviews by case managers, the worker is invited to return to the clinic, and the occupational medical team arranges work assessment, on-site visits, work simulation, and related inspections to assist the case in confirming that it is WRCTS.

**Results:** From January to April 2023, a total of eight workers were confirmed cases of WRCTS, of which seven were female and one was male. The age distribution is 34–63 years old, and the seniority is 0.58–34 years. Among them, 25.0% of the workers in the manufacturing industry and 25.0% of the catering industry are the main ones. The cause of the disease is human-induced hazards caused by repetitive movements. At present, seven workers treated with surgery, medication, rehabilitation exercise, or work style adjustments, have successfully returned to the workplace.

**Conclusions:** With the medical care of the occupational medicine team, we wish that workers with WRCTS can recover smoothly. It is hoped that after professional guidance and work adjustment, the risk of recurrence can be reduced.

**Keywords:** Occupational medicine; Carpal tunnel syndrome; Case series; Return to work; Work hardening

No.	Name	Age	Sex	Occupation	Seniority	Affected side	Surgery	Work harden	Return to work	NCV delay (msec)	
										Left	Right
1	Ms. Chen	62	Female	Hair stylist	30	Bilateral	No	Yes	Yes	4.04	4.46
2	Mr. Chang	62	Male	Form worker	6	Bilateral	No	No	No	4.65	5.19
3	Ms. Chen	57	Female	Caregiver	6	Bilateral	Yes	Yes	Yes	5.88	7.31
4	Ms. Lin	43	Female	Catering	0.58	Right	Yes	Yes	Yes	2.81	3.33
5	Ms. Juan	34	Female	Catering	5	Right	No	No	Yes	4.10	5.82
6	Ms. Lee	43	Female	manufacturing	5	Bilateral	No	No	Yes	4.85	4.08
7	Ms. Chen	50	Female	manufacturing	15	Bilateral	No	No	Yes	4.70	4.58
8	Ms. She	63	Female	Farmer	34	Bilateral	No	No	Yes	4.60	4.54

Fig. 1. Cases of work-related carpal tunnel syndrome from January 2023 to April 2023.



Fig. 2. Cases of work-related carpal tunnel syndrome.

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-06-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Interaction effect of vibration and manual handling on occupational injury among Korean blue-collar workers

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**Background:** Many occupations involve exposure to vibration or manual handling in the workplace. Occupational exposure to vibration can cause hand-arm vibration syndrome. Manual handling is associated with the risk of developing musculoskeletal disorders. Both are work activities that impose a burden on upper limbs and have risk of occupational injury. Thus, there rises a possibility that vibration and manual handling are interrelated on incidence of occupational injury. However, there are few studies about interaction between vibration and manual handling on occupational injury. This study aimed to investigate the interaction effect among Korean blue-collar workers.

**Methods:** We used data of 28,744 employed blue-collar workers who participated in 2nd-5th Korean Working Conditions Survey (KWCS). The differences in occupational injury according to general characteristics and occupational hazards were calculated using  $\chi^2$  test. Vibration, manual handling, and occupational injury were defined by questionnaire about working condition. Age-standardized prevalence ratios and odds ratios (ORs) with 95% confidence interval (CI) were calculated according to vibration and manual handling on occupational injury. Interaction between vibration and manual handling on occupational injury was estimated using relative excess risk due to interaction and attributable proportion with 95% CI.

**Results:** The age-standardized prevalence ratios and odd ratios for occupational injury were estimated according to exposure to vibration and manual handling. Age-standardized prevalence ratio and OR were 2.29 (2.02–2.56) and 1.94 (1.49–2.54) respectively, for workers exposed to both vibration and manual handling. Relative excess risk due to interaction and attributable proportion were 0.84 (0.41–1.27) and 0.89 (0.44–1.33) respectively.

**Conclusions:** There was increased prevalence and risk of occupational injury for workers exposed to both vibration and manual handling. Interaction effect was found between vibration and manual handling. Further study is needed to investigate the mechanism of occupational injury due to interaction between vibration and manual handling.

**Keywords:** KWCS; Manual handling; Occupational injury; Vibration

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-06-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Examining the long-term effects of whole-body vibration on musculoskeletal health through biomechanical models: a case study in an Indian mine

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**Background:** Ensuring the well-being of workers lies at the core of sustainable mining frameworks. Exposure to whole-body vibration (WBV) is associated with musculoskeletal disorders with chronic low back pain and lumbar disc herniation being prevalent manifestations. Chronic low back pain (LBP) not only affects an individual's quality of life but has been reported to have potential psychological impacts. Existing health risk prediction methods based on popular ISO 2631-1:1997 only account for up to 8 hours of exposure and do not consider the long-term health effects that take years to manifest.

**Methods:** We adapted a methodology based on biomechanical models, as documented in ISO 2631-5:2018, to predict long-term health risks associated with WBV exposure and its cumulative effect on operator's lumbar spine. WBV exposure levels of dumper operators were quantified during routine operation from an open-cast iron ore mine. The methodology included dynamic response models, a biomechanical model, a dose model for repeated shocks, and an injury risk model.

**Results:** Fast Fourier transform of the input seat-pad acceleration showed peaks dominant in the lower frequency range of 2–8 Hz. Risk factor I and equivalent daily compressive dose ( $S_d^A$ ) values were calculated for 6 spinal levels i.e., T12/L1 to L5/S1. Only one operator having 25 years of driving experience crossed the lower limit of health risk ( $R = 0.8$ ) whereas the rest of the operators were within safe limits. The evaluation demonstrated that  $R$  and  $S_d^A$  underestimated the risk involved.

**Conclusions:** It is found that there is an urgent need to revise the boundary limits associated with the health risk as documented in ISO 2631-5:2018 for its industrial applications.

**Keywords:** Musculoskeletal disorder; Whole-body vibration; Mining vehicle operators; ISO 2631-5:2018; Occupational health

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-06-06

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# Relationship between obstructive sleep apnea and low back pain in night shift workers

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**Background:** Low back pain is a major health problem for production workers at industrial sites. Insufficient sleep is a risk factor for physical and mental recovery. This study evaluated obstructive sleep apnea through the STOP-Bang questionnaire in male production workers who work night shifts.

**Methods:** A structured questionnaire identified the presence of low back pain and clinical aspects of back pain. The obstructive sleep apnea status of each worker was identified through the STOP-Bang questionnaire.

**Results:** We observed that the risk of low back pain increased significantly as the risk of obstructive sleep apnea increased ( $p < 0.01$ ). In addition, low back pain showed a significant relationship with snoring and daytime sleepiness.

**Conclusions:** It is necessary to consider sleep management together in managing musculoskeletal diseases of production night shift workers.

**Keywords:** Apnea; Low back pain; Night work; Sleepiness; Snoring

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-07-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Decompression sickness aftereffects and occupational accident compensation among diving fishermen: a study on coastal fisheries using Japanese-imported air supply equipment

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**Background:** Decompression sickness was common among fishermen utilizing helmet diving with air supply systems during the period of Japanese rule in South Korea, and the repercussions continue to be felt. Our study aims to explore the long-term effects of decompression injuries and the state of occupational accident compensation in coastal diving fisheries that employ air supply devices originally imported from Japan.

**Methods:** A Japanese occupational physician specializing in underwater medicine, in conjunction with a Korean cultural anthropologist, visited sites of diving fisheries utilizing air supply systems. We conducted interviews with helmet diving fishermen to investigate their decompression sickness history and occupational accident compensation.

**Results:** We have confirmed 91 cases of air-supply submersible diving in South Korea, but no helmet diving. There are at least 13 ongoing helmet dive fisheries in Japan. One case involved a 64-year-old Korean, who had helmet dived until age 46, losing consciousness at 32 due to sudden pressure increase when his suit depressurized. His remaining side effect is partial blindness. In Geoje's fishing port, a hyperbaric treatment device was installed for decompression sickness treatment. Older diving fishermen undergo daily post-work hyperbaric treatments as a preventive measure against decompression sickness, even when asymptomatic. Daily safety checks are performed by the captain, but the annual safety education course, designed for shallow depth construction divers, is not adequately suited for other divers. Many fishermen in Japan, primarily those working alone, are unable to access industrial accident insurance.

**Conclusions:** The practice of air-supply submersible fishing, introduced from Japan, is currently not being used.

**Keywords:** Decompression sickness; Compression diving; Fisherman; Worker's compensation; Coastal fishery

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-07-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Global prevalence of hypertension among professional drivers: a systematic review and meta-analysis

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**Background:** Hypertension is a major modifiable risk factor for cardiovascular diseases, the leading cause of death worldwide. Professional drivers are exposed to various occupational hazards and unhealthy lifestyle factors, predisposing them to a higher prevalence of hypertension. Previous studies have reported higher hypertension prevalence among professional drivers compared to the general population, but there is a lack of global and World Health Organization (WHO) region-wise estimates. This study aimed to conduct a systematic review and meta-analysis to determine the global and WHO region-wise prevalence estimates of hypertension among professional drivers.

**Methods:** We conducted a literature search in Medline and Embase, focusing on studies reporting the prevalence of hypertension among professional drivers. Studies published in English between 2000 and 2017 were considered. Data were extracted using a predefined proforma, and the Newcastle-Ottawa scale was used to assess the risk of bias in the included studies. Meta-analysis was performed using STATA 12 with random effects models. Subgroup analyses were conducted based on WHO regions, and meta-regression was performed to explore potential sources of heterogeneity.

**Results:** A total of 26 studies with 15,702 participants were included in the analysis. The overall global prevalence of hypertension among drivers was 34% (95% confidence interval [CI]: 27%–40%), with significant heterogeneity among the studies. The highest prevalence estimates were observed in the Western Pacific region (56%; 95% CI: 55%–58%) and the European region (51%; 95% CI: 32%–70%). The lowest estimates were found in the African (21%; 95% CI: 12%–32%) and Eastern Mediterranean regions (21%; 95% CI: 20%–23%). Multivariable meta-regression explained 31.8% of the between-study variability, and no publication bias was detected.

**Conclusions:** This systematic review and meta-analysis revealed a high global prevalence of hypertension among professional drivers, with significant variations across WHO regions. Targeted interventions and prevention strategies are needed to address this public health issue in this vulnerable population.

**Keywords:** Hypertension; Occupational health; drivers; Meta-analysis; Epidemiology



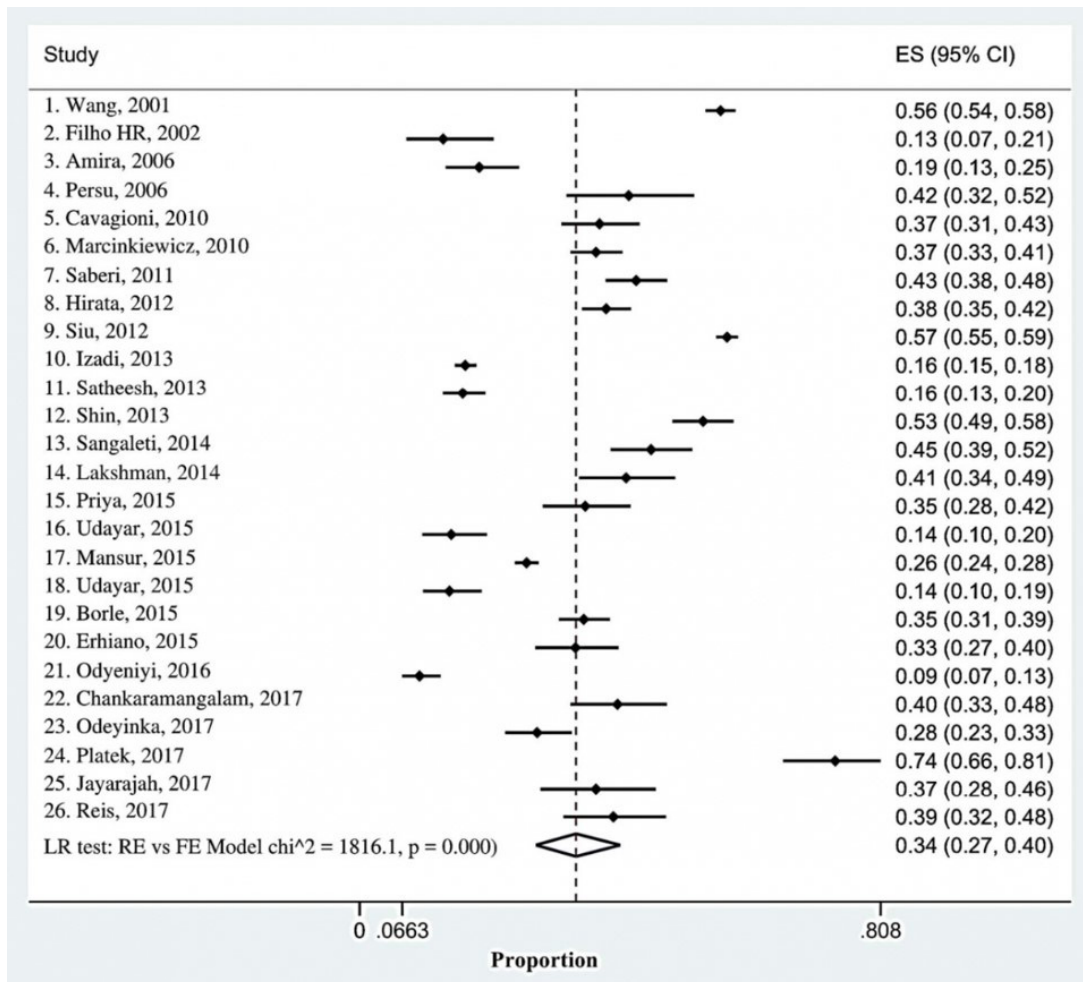


Fig. 1. Forest plot showing the pooled prevalence of hypertension amongst professional drivers. ES: effect size; CI: confidence interval.

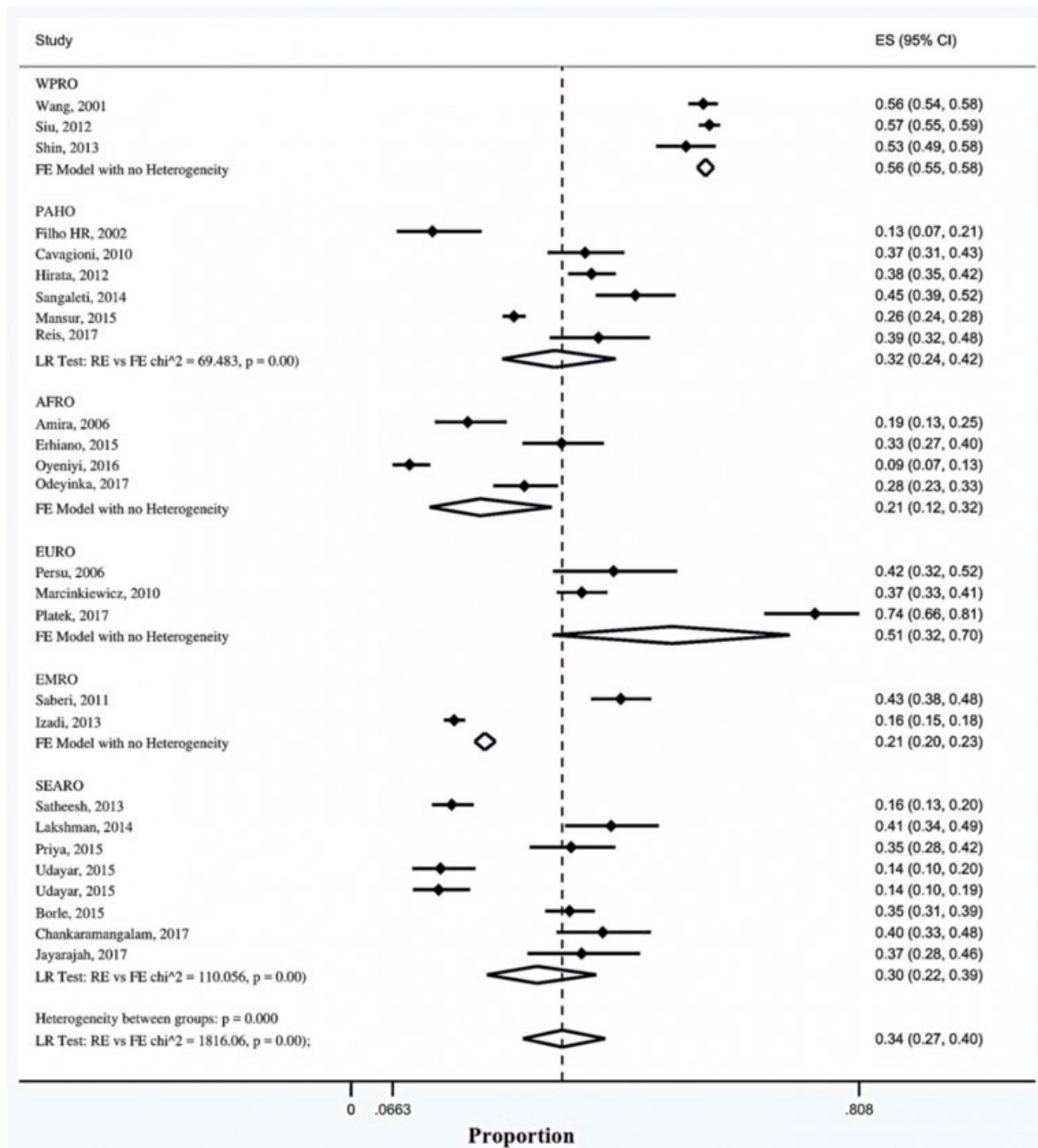


Fig. 2. Subgroup analysis showing the WHO region wise pooled prevalence of hypertension amongst professional drivers. WPRO: Western Pacific Region; PAHO: Pan American Health Organization; AFRO: African Region; EURO: European Region; EMRO: Eastern Mediterranean Region; SEARO: South-East Asia Region; ES: effect size; CI: confidence interval.

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-07-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Related factors of cerebro-cardiovascular diseases in Korean civil servants: analysis of 2016–2021 Civil Servants Accident Compensation approval data

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**Background:** As overwork-related cerebro-cardiovascular diseases among Korean civil servants has been a social issue, this study attempted to identify occupational factors that increase the risk of cerebro-cardiovascular diseases for developing effective preventive measures of occupational diseases among civil servants.

**Methods:** Civil Servants Accident Compensation approval data from 2016 to 2021 was analyzed. Eight hundred seventy-six cases of cerebro-cardiovascular diseases and 33,051 cases of accident-related diseases were included in final analysis. To identify the related factors of cerebro-cardiovascular diseases, a multiple logistic regression analysis model was performed including variables such as gender, age, month of occurrence, length of tenure, workplace location, and occupation. Analysis stratified by occupation were performed.

**Results:** There were statistically significant differences in the proportions of cerebro-cardiovascular diseases compared to accident-related diseases according to gender, age, length of tenure, year of review, month of occurrence, and occupation. A multiple logistic regression analysis for all civil servants revealed that the risk of cerebro-cardiovascular disease were higher in general civil servants in local governments (odds ratio [OR]: 5.168), firefighters (OR: 2.211), and police officials (OR: 2.721) compared to educational officials. The month of occurrence was higher in December known as a period of increased workload compared to January (OR: 1.679). The risk tended to increase with the length of tenure. The analysis stratified by occupation revealed that postal officials in metropolitan areas had a higher risk of cerebro-cardiovascular disease than in non-metropolitan areas (OR: 5.686). The above results were statistically significant.

**Conclusions:** Occupational factors related to cerebro-cardiovascular disease identified in this study can provide a basis for establishing effective prevention policies. This result should be interpreted with a caution as this study is a cross-sectional study that does not establish a causal relationship between occupational factors and cerebro-cardiovascular diseases, and there might be selection bias due to the characteristics of the control group.

**Keywords:** Cerebrocardiovascular diseases; Civil servants; Civil Servants Accident Compensation; Overwork; Increased workload

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-07-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Medical accessibility and under-reporting of occupational diseases: effect of travel distance and travel time

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**Background:** In Taiwan, outpatients' average travel distance (TD) is 17.68 km, and TD is the major factor determining patients' medical seeking behavior, especially for clinic service. Thus, poor medical accessibility of occupational outpatient service can also lead to under-reporting of occupational diseases (ODs).

**Methods:** In Taiwan, Network of Occupational Diseases and Injuries Service (NODIS) is an important surveillance system of ODs. Using NODIS's reporting data and manpower survey from 2008 to 2018, we calculate each town's incidence rate of occupational diseases (IROD) and expected IROD according to workers' occupations and job titles, and each town's shortest TD and travel time (TT) to 9 major reporting hospitals is estimated by Google Maps' Distance Matrix API. We then use quasi-Poisson regression model to investigate effect of TD and TT on IROD.

**Results:** There are 8,017 cases of suspected ODs in NODIS from 2008 to 2018, and 3,420 cases are confirmed as definite ODs. Adjusted by workers' occupations and job titles, as TD and TT increases by 10 km and 10 minutes, IROD significantly decreases by 12.54% and 12.06%, and less-disabled workers who have never stopped working or lost their jobs are more impeded by long TD and TT. Also, there is a clear dose-response relationship between IRODs and TD/TT groups. Generally, around 40% ODs are under-reported due to poor medical accessibility, and Hsinchu and Miaoli are identified as areas with poorest medical accessibility.

**Conclusions:** Our study shows how poor medical accessibility leads to serious under-reporting, and about 44% to 47% ODs are under-reported. Using this method, we can identify areas with poor medical accessibility and evaluate cost-effectiveness of adding reporting hospital.

**Keywords:** Medical accessibility; Under-reporting; Geographical Information Systems; Taiwan; NODIS

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-07-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Systematic review and meta-analysis of the association between long working hours and hypertension risk

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**Background:** Hypertension, a major public health problem worldwide, has been linked to lifestyle factors and work conditions, with conflicting evidence on the association between long work hours and risk of hypertension.

**Methods:** We conducted a systematic review and meta-analysis of observational studies to investigate the relationship between working hours and hypertension or blood pressure, assessed the risk of bias, and performed subgroup analyses. The protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) (Registration No. CRD42023406961).

**Results:** Nineteen studies were included in the meta-analysis. The meta-analysis found that long working hours were associated with a statistically non-significant increased risk of hypertension (pooled odds ratio [OR]: 1.09; 95% confidence interval [CI]: 0.88–1.35) in the 15 studies that used hypertension as the outcome, and a significantly higher diastolic blood pressure (1.24 mmHg, 95% CI: 0.19–2.29 mmHg) in the studies that used blood pressure as the outcome. In subgroup analysis, long working hours were associated with a higher risk of hypertension in women (pooled OR: 1.30; 95% CI: 1.04–1.63) but not in men (pooled OR: 0.96; 95% CI: 0.61–1.53).

**Conclusions:** Long working hours may be associated with an increased risk of hypertension, particularly in women. More reliable research is needed to establish causality. Reducing working hours could be considered as a public health policy for hypertension prevention.

**Trial Registration:** International Prospective Register of Systematic Reviews Identifier: CRD42023406961

**Keywords:** Hypertension; Blood pressure; Systematic review; Meta-analysis; Working hours

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-07-06

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# Outdoor agricultural workers and cataract: a cross sectional study in Taiwan

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**Background:** Outdoor agricultural workers are at risk of developing cataracts due to prolonged exposure to sunlight and its ultraviolet radiation. Cataracts, characterized by the clouding of the eye's natural lens, can lead to visual impairment and blindness. However, as agricultural workers age, it becomes challenging to determine the factors contributing to cataract development.

**Methods:** This study employed a cross-sectional design and utilized a questionnaire-based approach. The study was conducted in Yunlin County, Taiwan, a region known for its concentration of agricultural activities. The participants, who were sampled with the probability proportional to size method, consisted of individuals covered by Farmers' Occupational Injury Insurance. The questionnaire collected information on participants' gender, age, duration of agricultural work, work environment, smoking habits, and history of hypertension, diabetes, and cataracts. All the data were self-reported by the participants. Participants categorized as outdoor workers include those engaged in outdoor farming, breeding, grazing, fish farming, and fishing. Independent sample t-tests and  $\chi^2$  tests were conducted to compare the demographic characteristics between outdoor and non-outdoor workers. Multiple logistic regression analysis was employed to investigate the relationship between outdoor work and the development of cataract.

**Results:** Among the 941 respondents, 845 were identified as outdoor agricultural workers. The outdoor group exhibited a significantly higher mean age, mean duration of agricultural work, and prevalence of cataracts. Multiple logistic regression analysis revealed that individuals aged over 60 (odds ratio [OR]: 11.96; 95% confidence interval [CI]: 6.14–23.33), with more than 15 years of outdoor work experience (OR: 2.19; 95% CI: 1.50–3.20), and with a history of diabetes (OR: 1.77; 95% CI: 1.24–2.53) showed significantly higher ORs for cataracts.

**Conclusions:** This study revealed a higher risk of cataracts among outdoor agricultural workers in Taiwan. It emphasizes the need for ongoing policies and interventions to prevent and manage cataracts in this population.

**Keywords:** Occupational health; Agricultural medicine; Sunlight exposure; Cataract; Cross-sectional study

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-08-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Development of occupation-based exposure matrix of lead for Korean workers: challenges and opportunities

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**Background:** Industry-based or occupation-based carcinogen exposure matrices are essential tools in occupational cancer prevention. The Korean CARcinogen EXposure matrix has been developed in recent years to evaluate exposure prevalence and intensity based on industry. However, the feasibility of creating an occupation-based exposure matrix has not been explored. Therefore, this study aims to investigate the potential of combining the nationwide Work Environment Measurement Database (WEMD) and the Special Health Examination Database (SHED) to develop an occupation-based exposure matrix.

**Methods:** The WEMD provides information on airborne lead exposure measurements but lacks occupation-related data. In contrast, the SHED contains information on both occupation and blood lead levels. By integrating these two databases, we were able to assess airborne lead exposure levels by occupation. Additionally, we conducted a rank correlation analysis to compare the airborne exposure levels with corresponding blood lead levels according to occupation.

**Results:** We extracted a total of 35,425 workers who wore air samplers for lead and underwent special health examinations for lead between 2019–2021. Rank correlation analyses revealed strong positive correlations between airborne lead and blood lead measurements.

**Conclusions:** The findings of this study suggest that combining two nationwide surveillance databases can be an effective approach for creating an occupation-based exposure matrix. However, the results also highlight several limitations that need to be addressed in future studies to enhance the accuracy and reliability of such matrices.

**Keywords:** Lead; Exposure; Cancer; CAREX; JEM

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-08-02

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# Lymphohematopoietic cancers occurred in workers with asbestos-related health disorders

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**Background:** We encountered eight cases of lymphohematopoietic cancers occurred among workers with asbestos-related health disorders. This study aims to discuss the relationship between asbestos exposure and those cancers.

**Methods:** The subjects are the above-mentioned cases found in our occupational health consultation activities. We investigated their occupational histories, asbestos exposure duration, asbestos-related health disorders, and occurrences of lymphohematopoietic cancers.

**Results:** The cases' occupations included shipbuilding (1 case, hereafter only the number of case is shown), insulation material manufacturing (n = 4), spraying asbestos (n = 1), and carpentry (n = 2). The age of initial asbestos exposure ranged from 15 to 35 years old. The asbestos exposure duration ranged from 2 weeks to 45 years. Pleural plaques were found in 8 cases and calcified in 6 cases. The asbestos-related diseases included asbestosis (n = 3), pleurisy (n = 1), diffuse pleural thickening (n = 1), secondary bronchitis (n = 1), lung cancer (n = 3), and mesothelioma (n = 1). According to the occupational history and the radiological findings, 7 cases seemed to be exposed to asbestos heavily. The lymphohematopoietic cancers included myelodysplastic syndrome (n = 1), acute myelocytic leukemia (n = 2), malignant lymphoma (n = 4), and multiple myeloma (n = 1). It was remarkable that the intervals between the diagnosis of mesothelioma/lung cancer and lymphohematopoietic cancer were within a year in 3 cases. Another remarkable point was that 3 cases (1 with leukemia and 2 with lymphoma) had worked in the same factory manufacturing insulation material with 300 employees and the calculated morbidity was higher than general population.

**Conclusions:** There have been many case reports similar with the present study, and many epidemiologists tried to clarify the relationship. Although the results of epidemiological studies are inconsistent, as a whole, a positive relationship tends visible in heavily exposed workers. The present study shows a need of further research. Since asbestos is a common health issue in Asia, international collaboration is desirable.

**Keywords:** Asbestos; Asbestosis; Mesothelioma; Lung cancer; Lymphohematopoietic cancers



## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-08-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Two retrospective cohort studies on cancer incidence of Korean healthcare workers: in nationwide data and a general hospital

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**Background:** Healthcare workers in hospitals (HHCWs), a notably increasing workforce, face various occupational hazards. A high incidence of cancer among HHCWs has been observed; however, the cancer incidence status among HHCWs in South Korea is yet to be studied. This study aimed to assess cancer incidence among HHCWs in South Korea.

**Methods:** First, we constructed a retrospective cohort of HHCWs using National Health Insurance claims data, including cancer incidence status and vital status, from 2007 to 2015. Standardized incidence ratios (SIRs) for all cancer types and standardized mortality ratios were calculated. Second, we constructed a retrospective cohort of nurses in a general from January 1, 2011 to June 30, 2021. The SIR for breast cancer, defined using sick leave data was calculated.

**Results:** In the first study, a total of 107,646 HHCWs were followed up, and the total follow-up duration was 905,503 person-years. Compared to the total workers, female HHCWs showed significantly higher SIR for all cancers (observed cases: 1,480; SIR: 1.25; 95% confidence interval [CI]: 1.06–1.47). The incidence of breast cancer among female HHCWs was significantly higher compared to that among total workers (observed cases: 376; SIR: 1.21; 95% CI: 1.09–1.36). In the second study, the SIR for breast cancer was significantly higher among nurses who handled anticancer drugs (total 3,110 person-years of follow-up) at 2.73 (95% CI: 1.00–5.94; observed: 6; expected: 2.20) and among all nurses (total 30,404 person-years of follow-up) at 1.65 (95% CI: 1.08–2.41; observed: 26; expected: 15.78).

**Conclusions:** Our findings indicate that female HHCWs have an elevated probability of developing cancer, which suggests that occupational risk factors such as night-shift work, anti-neoplastic medications, stressful jobs, and ionizing radiation should be assessed. Further investigation and occupational environment improvement activities are required.

**Keywords:** Healthcare workers; Cancer incidence; Breast cancer; Hospital

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-08-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Perceptions of smoking hazards and competent of smoking cessation intervention among healthcare professionals: the role of training experience

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**Background:** Occupational health nurses (OHNs) in South Korea who visit the workplace periodically could play a key role in smoking cessation. It would be helpful to assess their understanding of smoking hazards and smoking cessation methods to encourage them to provide smoking intervention services at the workplace. This study aimed to investigate the knowledge of smoking hazards and perceptions of smoking cessation methods among OHNs.

**Methods:** We conducted an anonymous self-administered cross-sectional questionnaire survey of 108 OHN nurses employed in an occupational health service outsourcing specialized agency with 19 regional branches in Korea from July to August 2019. We assessed the perceptions of the OHNs about smoking interventions, hazards of smoking, and perceived competence to counsel smokers according to training experience.

**Results:** The majority of the nurses underestimated the smoking-attributable fraction for lung cancer (78.7%), chronic obstructive pulmonary disease (64.8%), and mortality (49.0%), regardless of training experience on smoking cessation, while more than half perceived their skill and knowledge to counsel patients concerning smoking as inadequate (56.5%). However, those trained in smoking cessation interventions felt more competent in smoking cessation counselling, with 52.2% and 29.3% in the trained and non-trained groups, respectively ( $p = 0.019$ ).

**Conclusions:** The OHNs in this study underestimated smoking hazards and perceived themselves as lacking counselling skills regarding smoking interventions. It is necessary to encourage OHNs to promote smoking cessation by increasing their knowledge, skills and competence in smoking cessation interventions.

**Keywords:** Cancer; Cigarette smoking; Occupational health nurses; Smoking cessation; Workplace smoking cessation

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-08-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
 eISSN 2052-4374

## Enterprises' expectation on competencies of occupational physicians and occupational health administration in Thailand

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**Background:** The Association of Occupational and Environmental Diseases of Thailand has a supervisory role in occupational medicine competencies by developing curricula to match international standards. A part of this task concerns work in the occupational health field of collaboration with enterprises. The objectives of this study are to determine enterprises' expectations of each competency of occupational medicine; the provision of occupational health administration in enterprises; and the related factors on the provision of occupational health administration in enterprises.

**Methods:** This cross-sectional study collecting information through self-administered questionnaires which were sent to the occupational health and safety departments in enterprises that have more than 100 employees, excluding hospitals and educational institutions. Descriptive statistics and Multivariable Gaussian regression were applied in this study.

**Results:** From a total of 135 respondents, it was found that enterprises were most concerned with occupational physician competencies in the role of medical surveillance (domain number 3) which included a walk-through survey to identify hazards in the workplace, designing medical examinations based on hazards, and analyzing the results of environmental measurements. Moreover, most services in occupational health administration in the enterprises were done as required by law, except return-to-work examinations. Positive factors in the provision of occupational health administration in enterprises include international companies or international occupational health policy (mean difference percent [MD%]: 4.35; 95% confidence interval [CI]: 1.00–7.70), large enterprises (MD%: 4.33; 95% CI: 0.07–8.59), and having a physician present at the enterprise (MD%: 3.70; 95% CI: 0.11–7.28).

**Conclusions:** This study reveals important data for medical schools and professional associations regarding how to improve training courses. In addition, our study should also help to promote new policies for enterprises in the provision of occupational health administration in the future.

**Keywords:** Occupational physician; Occupational health; Enterprise

**Table 1.** Expectation on competencies of occupational physicians by occupations (n = 135)

OEM competencies (1-5 points)	Nurse		Safety officer		Others		Total	
	mean	SD	mean	SD	mean	SD	mean	SD
1. Medical examination	4.32	0.98	4.36	0.93	4.42	0.93	4.36	0.94
2. Health promotion	4.31	1.04	4.40	0.75	4.34	0.89	4.37	0.85
3. Medical surveillance	4.69	0.70	4.65	0.61	4.62	0.68	4.66	0.64
4. Diagnosis and Treatment	4.54	0.81	4.62	0.61	4.68	0.56	4.62	0.65
5. Work-related investigation	4.64	0.72	4.57	0.68	4.53	0.71	4.58	0.69
6. OEM-related law and regulation	4.55	0.82	4.50	0.83	4.51	0.82	4.52	0.82
7. Communication	4.50	0.91	4.57	0.65	4.54	0.78	4.55	0.74
8. OEM-related management and administration	4.50	0.83	4.34	0.90	4.36	0.82	4.38	0.87
9. Environmental health	4.52	0.72	4.46	0.73	4.30	0.91	4.44	0.77
10. Research	4.57	0.70	4.51	0.67	4.35	0.97	4.49	0.75

**Table 2.** Expectation on competencies of occupational physicians by companies's size (n = 135)

OEM competencies (1–5 points)	Small (<200)		Middle (200-1,000)		Large (> 1,000)	
	mean	SD	mean	SD	mean	SD
	1. Medical examination	4.42	0.89	4.39	0.90	4.28
2. Health promotion	4.49	0.65	4.38	0.81	4.28	1.03
3. Medical surveillance	4.64	0.61	4.65	0.64	4.67	0.68
4. Diagnosis and Treatment	4.72	0.53	4.59	0.67	4.60	0.69
5. Work-related investigation	4.54	0.71	4.58	0.66	4.60	0.75
6. OEM-related law and regulation	4.55	0.80	4.46	0.81	4.60	0.85
7. Communication	4.59	0.62	4.55	0.68	4.50	0.91
8. OEM-related management and administration	4.29	1.01	4.39	0.82	4.43	0.84
9. Environmental health	4.47	0.71	4.41	0.76	4.47	0.83
10. Research	4.59	0.66	4.54	0.67	4.33	0.90

**Table 3.** Factors related to occupational health and safety management in the workplace

Factors	Mean Difference* (percentage)	95% Confident Interval		p-value
		Lower	Upper	
Located in Bangkok				
No	Reference			
Yes	-0.58	-4.21	3.06	0.756
Located in industrial estate				
No	Reference			
Yes	2.26	-1.51	6.04	0.240
Company size				
Small (< 200 worker)	Reference			
Middle (200-1,000 worker)	4.33	0.07	8.59	0.046
Large (> 1,000 worker)	4.60	-0.42	9.61	0.072
International company				
No	Reference			
Yes	4.35	1.00	7.70	0.010
Having company doctor				
No	Reference			
Yes	3.70	0.11	7.28	0.040

\* Difference of percentage of occupational health and safety management

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-08-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Shift workers, their brain

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**Background:** It is widely known that shift work has a negative impact on the health of workers. The main and most direct health effects associated with shift work are sleep disturbance and depression due to disruption of circadian rhythms. While there are many observational studies linking these mental health problems to shift work, there has been a lack of evidence on the basic science. We try to examine the health effects of shift work from a neuroscience perspective.

**Methods:** This study did not find for clinical abnormalities in brain imaging. We aimed to assess key preclinical changes of brain structure (surface area, thickness, voxel-based morphometry, and myelination) in 34 different brain regions. Ninety hospital workers were divided into two groups: shift workers and non-shift workers. They underwent T1 and T2-enhanced imaging magnetic resonance imaging, and the images were post-processed and modelled using FreeSurfer for comparison.

**Results:** The shift worker's brain was different. Statistically significant differences in surface area, thickness, and volume were observed in a variety of regions. Moreover, we could describe significant differences in regions associated with the melatonin pathway, which regulates circadian rhythms.

**Conclusions:** The health effects of shift working may be a greater potential threat than current reports. The brain structure differences identified in this study between shift and non-shift workers are found in a variety of regions, that related with cognition, decision-making, attention, and emotion. Given the growing concern about the health effects of shift working on workers, there is a need for more research to provide basic science evidence.

**Keywords:** Shift work; Brain structure; Evidence; MRI

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-09-01

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

### A realist review of effective university programs on physical activity, occupational balance, and vocal health

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**Background:** Wellness programs can be implemented in organizations, such as universities, and may include varied elements such as physical activity, occupational balance, and vocal health. However, there is limited information that synthesizes why and how these programs work. The study aimed to understand effective programs on physical activity, occupational balance, and vocal health for university staff and students. The findings may contribute to services and policy recommendations responsive to calls for strengthened wellness promotion, including the Sustainable Development Goal on good health and wellbeing.

**Methods:** This study utilized a realist review design and the Health Belief Model as theory base for an in-depth understanding of the mechanisms and contexts that may explain the outcomes of the programs. The researchers conducted an iterative search among seven peer-reviewed electronic databases in the health and education fields using a predetermined set of eligibility criteria. Data were synthesized through a summary of the document characteristics and the generation of the context-mechanism-outcome (CMO) configurations.

**Results:** The search identified 6,219 records, of which programs from 18 records contributed to data synthesis. Nine CMO statements were created, with physical activity programs accounting for most configurations. Key themes identified were tailored and individualized interventions, medium-term incentivization, lifestyle education programs utilizing information and communications technology, interdisciplinary multi-component programs, use of self-monitoring strategies, social support, and shared experiences among staff and students. The mechanisms of these effective university programs featured processes and structures that were consistent with the elements of the Health Belief Model.

**Conclusions:** Effective university-based programs result from a health-supporting culture among staff and students, utilizing self-based, technological, and social approaches that target and address individual and organizational behaviors in physical activity, occupational balance, and vocal health. This realist review provides practical information that may guide the development of university-based programs and policies targeting these areas of wellness.

**Keywords:** Healthy settings; Wellness; Exercise; Work-life balance; Voice care

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-09-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Changes in injury rates and types of accidents among fixed-term field workers in basic local governments in Korea: analysis of industrial accident approval data from 2016 to 2018

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**Background:** This study aims to provide basic data for establishing prevention measures for occupational injuries by identifying changes in the injury rate and the types of accidents among field workers performing high-risk tasks, such as street cleaning and greenery management, in local governments.

**Methods:** We analyzed the data provided by the Ministry of Employment and Labor for all 226 basic local governments (BLGs) from 2016 to 2018, which included information on the number of field workers and injured workers, gender, age, and types of accidents among the injured workers.

**Results:** The injury rates among field workers in BLG were 0.46% in 2016, 0.44% in 2017, and 0.62% in 2018. These rates are comparable to or higher than those of all wage workers covered by industrial accident compensation insurance. In institutions where the number of field workers decreased in 2017 compared to 2016 (n = 131), the injury rate was 0.54%. In 2017 compared to 2016, the injury rate of BLG with a decreased number of field workers (n = 131) was 1.46 times higher than that of the institutions with an increased number of field workers (n = 95). For 2018, it was 1.59 times higher. In 2016, the types of industrial accidents among field workers in BLG were as follows: tripping (36.4%), cuts, lacerations, punctures (9.8%), falls (7.1%), and work-related diseases (7.0%). These types were different from those covered by industrial accident compensation insurance. The proportion of work-related diseases, such as cardiovascular diseases, among field workers in BLG increased from 7.0% in 2016 to 9.4% in 2018.

**Conclusions:** The increase in the injury rate and the proportion of work-related diseases during the period of understaffing suggests the possibility that manpower shortage could cause overwork and be an important cause of occupational injuries.

**Keywords:** Occupational injury; Overwork; Understaffing; Fixed-term field worker; Basic local government

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-09-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Prevalence of high blood pressure in pesticide applicators and its contributing factors: a cross-sectional study at three vegetable farming centers in Indonesia

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**Background:** According to the 2018 Indonesian Basic Health Research (RISKESDAS), hypertension was found among approximately one out of 3 Indonesian adult populations. It is unknown, however, if hypertension is more prevalent in the agricultural community than in the general population or whether any occupational characteristics may contribute to the development of hypertension in pesticide applicators. This study aims to evaluate the prevalence of high blood pressure (BP) and its contributing factors in pesticide applicators.

**Methods:** We retrieved the data on individual and occupational characteristics and also the results of BP measurements for a total of 285 pesticide applicators from 2 recent epidemiological studies located in 3 vegetable farming locations in West and Central Java Indonesia. Data were described descriptively, and statistical analysis was performed using the  $\chi^2$  and logistic regression. For these tests, significance was set at  $p < 0.05$  and all  $p$ -values were 2-sided.

**Results:** The mean age of the study participants was 48.2 years, and the majority were men with low levels of education. They had been applying pesticides for approximately 25 years, with a median frequency of 104 spraying days annually. Combining multiple pesticides in one spraying activity was found in 92% of participants. The overall prevalence of high BP in this study was 47.7%. Age > 50 years, body mass index  $\geq 25$  kg/m<sup>2</sup>, and lifetime pesticide exposure > 10 years were found to be the determinants of high BP.

**Conclusions:** In this study, the prevalence of high BP was higher than the Indonesian average. The piece of evidence presented here suggests that pesticide exposure was associated with high BP; however, it warrants further studies to confirm the causal relationship between pesticide exposure and hypertension. Our results also support the notion of the importance of multisectoral collaboration in pesticide exposure reduction through proper handling of pesticides.

**Keywords:** Agrochemical toxicity; Hypertension; Obesity; Occupational exposure; Pesticide applicators



## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-09-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Development for an App and Web platform for managing blood pressure and diabetes mellitus

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**Background:** In an aging society, the increasing prevalence of hypertension and diabetes mellitus (DM) among workers has led to higher healthcare issues. The Worker's Health Protection System in Korea includes health check-ups; however, it lacks sufficient post-management as it primarily focuses on simply checking the disease status. Digital devices are required for continuous management, emphasizing the need for individualized care. However, healthcare providers' limited experience with digital healthcare solutions highlights the absence of appropriate health management tools in this context. To address this, a new approach to worker health management is necessary, focusing on individualized care and lifestyle improvements.

**Methods:** We developed a hypertension and DM management algorithm based on the latest clinical practice guidelines and created customized content for each disease. OMRON (HEM-7155T) was used for blood pressure monitoring, and i-SENS (GM01AAB) for DM measurement. To build the mobile App and Web platform, we utilized the cross-platform App framework Flutter and implemented the programming language Dart. Patients use healthcare devices to measure health data, which is transmitted to smartphones via Bluetooth. The data is displayed on the device's screen and sent to the infrastructure domain.

**Results:** The health data measured using the devices is synchronized with smartphones using Bluetooth and stored in the infrastructure domain through the App. The App platform consists of screens for measuring blood pressure and blood glucose levels, a summary screen presenting data in graphical form to visualize trends, and a health management content screen. Through a Web portal integrated with the backend system in the infrastructure domain, patient health data, measurement trends, and target values are displayed.

**Conclusions:** By allowing patients and healthcare professionals to utilize the implemented product according to the proposed management algorithm, we anticipate that it will facilitate efficient collaboration among the medical staff and enable systematic and continuous healthcare services.

**Keywords:** Digital healthcare; Monitoring; Application; Web; IOT

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-09-05

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# Hotels 2.0: what the pandemic taught us and implications for health and safety

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The tourism and hospitality industries took a hard hit during the coronavirus disease 2019 (COVID-19) pandemic. Hotels doubled up as isolation and quarantine facilities, exposing their staff at unprecedented risk of COVID-19 infection. Through a scoping review and interviews with tourism and hospitality, building health, work and wellbeing experts and hotel general managers, we delineated threats to physical and mental health among hotel workers, and constructed an approach towards preparing for the next pandemic. We found that the COVID-19 pandemic had worsened health disparities in various ways: 1) frontline hotel staff tend to be of minority ethnicities, who are also at increased risk of severe COVID-19 infection; 2) subject to volatile situations, including job insecurity and layoffs, amidst poor benefit and medical compensation systems, exacerbating mental health; 3) at risk of low job satisfaction, exacerbating mental health; and 4) low remuneration in exchange for high risk exposure. Hotels present unique ground for learning given that many instituted pandemic measures were rigid and focused on social distancing, whilst hospitality is personal requiring face-to-face interactions. After conducting a qualitative analysis, we present a three-pronged road map for the way forward for hotels: 1) React and Enact (first 2 to 3 months), a highly uncertain period with strong direction taken from authorities, 2) Rectify and Adapt (3 months to 3 years), with better understanding of disease but possible pandemic fatigue, and 3) Rethink and Refocus (3 years and beyond), focusing on the employee experience. Each step underlines 5–7 concrete recommendations, spanning organizational and sectoral entities, concerning personal protective equipment, building health measures, design and construction, leadership, harnessing technology, organizational restructuring and sustainability. This roadmap aims to provide reformed direction and purpose to enable hotels and their workers to be resilient and remain healthy, physically and mentally, in preparation for future pandemics.

**Keywords:** Pandemic preparedness; Hotel; Hospitality; Measures

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-09-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Healthy lifestyle intervention to control cardiovascular risk of workers at an LNG site Central Celebes, Indonesia

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**Background:** Workplace based health promotion is effective to control cardiovascular risks. This study aim is to evaluate the effectiveness of food-based workplace health promotion to control cardiovascular risk factors among a remote liquefied natural gas (LNG) site workers.

**Methods:** This pre-post intervention study involved 146 participants in the integrated local food based nutrition education, standardized physical exercise and Education on self-reflection. Balanced diet through Food Based Recommendation and Nutrient Dense Menu design to reduce carbohydrate, extra salt and saturated fat and increase polyunsaturated fatty acid, calcium, fiber, and omega 6. Physical activity based on low impact exercise that has been standardized to achieve optimum daily physical exercise was given as part of education. Education on self-reflection, self-assessment, self-evaluation, and self-efficacy was also integrated to ensure compliance of the participants to the program. The blood pressure, fasting blood glucose, lipid profile, body mass index, and waist circumference, were repeated measured at pre, the end of 3rd and 6th month intervention.

**Results:** Participants consists of 18 female and 128 males. 20 participants from medical profession while the rest of 126 was non-medical profession. There were some drop out subjects after 3rd month to 132 participants and after 6th month to 126 participants. The oldest participant was 59 years and the youngest was 25 years old. There were significant changes on baseline waist circumference ( $p < 0.05$ ), blood pressure ( $p = 0.038$ ), and blood glucose ( $p = 0.018$ ) compared to 6th month post intervention measurement.

**Conclusions:** This integrated workplace health intervention is effective to control cardiovascular risk factors might be implemented continuously as part of occupational health program in remote site plant.

**Keywords:** Cardiovascular risk reduction; Local food based nutrition; Physical activity; Self-awareness; Health promotion

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-10-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### New and more targeted work on occupational health are expected in China

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In China, to improve occupational health work of industrial enterprises, the government established the National Occupational Disease and Health Hazard Monitoring Information System, and the Monitoring System of Occupational Hazards at Workplaces. The occupational health service agencies or related partners are legally required to submit their acquired data related occupational health work, such as occupational hazards monitoring data and occupational physical examination data, to these systems on time. However, such data bank is not open to public, even to the professionals and the non-official information indicated that most agencies did not submit the data fully. In Shanghai, since 2020, a simplified APP program named Occupational Hazards Declaration System was introduced for enterprise and related agencies to push occupational health work. But recently, we checked the part of data in this system and compared with the available public data shown in the Enterprise Business Information Inquiry System and noted that not all enterprises reported occupational hazards and related work into this system, and that there is still data-missing existed, since some enterprises can't understand clearly occupational hazards in their workplaces. Fortunately, we collected some occupational physical examination data in a hospital and analyzed the health outcomes of 18,257 workers with records of occupational exposure to hepato-toxicants listed in the Appendix B of Diagnostic criteria for occupational toxic hepatopathy (GBZ 59-2010, an occupational health standard in China). The data from various sources indicated that their occupational exposure levels were lower than occupational exposure limits, although no exact figures were gathered. These health data showed that the health condition of these examined workers was not poorer than reported public data of general population in China, which indicated the effectiveness of occupational health work in Shanghai. But if we divided them into different sub-exposure groups, it is noted that the workers exposed to a group of non-metallic and non-halogenated hydrocarbon chemicals had a higher incidence of fatty liver and abnormal liver function, and that the workers exposed to 2 or 3 groups of hepatotoxicants had a higher risk of liver dysfunction, compared with the workers exposed to one group of hepatotoxicants. The analysis, in another way, showed that indexes reflecting hepatocyte injury, alanine transaminase, aspartate aminotransferase, gamma-glutamyl transferase, and alkaline phosphatase remained association with exposure time based on age stratification. The age stratification analysis showed a clear age trend of abnormality of liver dysfunction. Though this data was not complete and/or there were missing of key information and uncertainty existed, these results obviously implied that more work should be done to protect health of working population, from not only occupational hazards at workplaces, but also individual risk factors.

**Keywords:** Occupational health work; Hepatotoxicants; Reporting system

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-10-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Association between changes in employment type and unmet health care needs stratified by gender

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**Background:** Indirect employment is prevalent in various industries like manufacturing, telecommunications, distribution, and construction. The focus has been primarily on subcontracting in manufacturing, but the growth of e-commerce, transportation, and warehousing has expanded indirect employment in these sectors. Previous studies have shown that indirect employment poses higher risks, such as health hazards and accidents, compared to direct employment. Job insecurity resulting from changes in employment status may also lead to unmet medical needs. However, research on the relationship between employment status changes and unmet medical needs is lacking, especially regarding gender differences. This study aims to investigate the association between employment status and unmet healthcare needs using data from the Korea Health Panel Survey.

**Methods:** This study analyzed data from the Korea Health Panel Survey, including 168,132 economically active individuals aged 19 to 60. Participants were categorized based on their employment status as direct or indirect. Changes in employment status were examined, and participants were grouped accordingly. The  $\chi^2$  test was used to analyze demographic factors, and the Generalized Estimating Equation model was employed to assess the impact of employment status changes on unmet healthcare needs, with gender as a covariate.

**Results:** The prevalence of unmet medical needs among men was 10.45% (9,670 person-years), while that among women was 13.77% (10,406 person-years). Regression analysis on unmet medical needs according to changes in employment status showed that in the crude male model, all groups had a higher risk of experiencing unmet medical needs than group 4 (odds ratios, ORs [95% confidence intervals, CIs]: 1.15 [1.03–1.29], 1.14 [1.02–1.29], 1.26 [1.12–1.41] for each group). In contrast, among females, groups 1 and 3 had a higher risk of experiencing unmet medical needs than group 4 (OR [95% CI]: 1.16 [1.06–1.28], 1.22 [1.10–1.35] for each group). After adjusting for all variables, the male group had a higher risk of experiencing unmet medical needs in group 3 than group 4 (OR [95% CI]: 1.14 [1.01–1.29]).

**Conclusions:** The results suggest that there may be an imbalance in access to healthcare services among indirect workers in the employed population. In particular, women working as indirect workers or experiencing a transition to indirect employment status may be at higher risk of experiencing unmet healthcare needs. To address these issues, there may be a need for improvements in the working conditions of employed individuals and the accessibility of healthcare services.

**Keywords:** Employment type; Unmet health care needs

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-10-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# Job insecurity in the technology-dependent work environment: a systematic review

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**Background:** Technology has penetrated all aspects of people's lives, from the simplest to the most sophisticated ways. In the context of the working environment, people tend to rely heavily on the technological assistance to pursue the work's objectives at the operational and strategic levels. However, previous studies found that this phenomenon reduces workers' job security. This analysis aims to investigate the job insecurity resulting from technology dominance in the workplace, especially the form and cause of the state.

**Methods:** This analysis uses a systematic review to synthesize job insecurity forms and causes. Existing literature from 2000 to 2023 is analyzed to draw conclusions on the issue.

**Results:** Job insecurity generally tends to be higher in the era of technology dominance in all industries. First, the finding suggests that the current insecurity can mainly be categorized into two based on the type of employees: white-collar and blue-collar. For white-collar workers, job insecurity is mostly in terms of psychological stress due to the fast-paced and overload work accelerated by technology. On the other hand, blue-collar society feels the threat of being displaced by technology, i.e., the job sustainability issue. Second, the analysis also found that the factors that lead to job insecurity in this technological-dependent job are the level of technology awareness, speed of technology advancement, technostress, and the ambiguity of organization orientation.

**Conclusions:** The antecedents of job insecurity now shift from technology anxiety, which differentiates the workforce based on the technological competence, to much more varied factors. It shows that today's workers should deal with multiple concerns at the workplace; thus, it indicates the need for a more worker-friendly work setting by the management to maintain employees' psychological well-being in this age.

**Keywords:** Job insecurity; Technology-dependent workplace; Blue-collar; White-collar; Systematic review

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-10-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Prevalence of osteoporosis in female workers: impact of employment status on disease management

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**Background:** This study aims to examine the prevalence of osteoporosis among female workers and analyze the variations in prevalence rates between non-working and working women. It seeks to shed light on how employment status affects disease management and medical treatment for osteoporosis. Osteoporosis is a condition characterized by reduced bone mineral density and structural deterioration, which increases the risk of bone fractures. The prevalence of osteoporosis has risen, particularly among aging women, with inadequate treatment posing a significant concern. Understanding the impact of employment conditions on osteoporosis prevalence and treatment rates is crucial for this population.

**Methods:** We analyzed claims data from the Korean National Health Insurance covering the period from 2015 to 2020. Osteoporosis cases were identified using diagnostic codes M81 and M82 of the International Classification of Diseases, 11th Revision, along with relevant prescription records. We removed redundant claim data and included patients who met the defined criteria at least once a year. Population-based analysis was conducted using SAS Enterprise Guide 7.1.

**Results:** Among women in their 40s, the prevalence rates of osteoporosis were 205.3 and 239.7 per 100,000 individuals for working and non-working women, respectively. In the 50s age group, the prevalence rates were 2,281.4 and 3,060.5 per 100,000 for working and non-working individuals, respectively. Furthermore, the prevalence rates across all ages were 8,513.1 and 10,392.6 per 100,000 for working and non-working women in their 60s, respectively. To assess the impact of non-working status on osteoporosis risk, prevalence rate ratios were calculated, yielding values of 1.11, 1.34, 1.17, 1.34, and 1.22 for the respective age groups of 20s, 30s, 40s, 50s, and 60s. These ratios consistently indicate a higher prevalence of osteoporosis among non-working women compared to their working counterparts across different age categories.

**Conclusions:** These findings highlight the significant influence of age and employment status on osteoporosis prevalence among women. The results also suggest the presence of disparities in medical care and potential healthy-worker effects. Further research should focus on identifying the extent of undertreatment of osteoporosis among working individuals and exploring strategies to enhance disease management and treatment in this population.

**Keywords:** Osteoporosis; Employment; Working women

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-10-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Implementation of social norms: do unemployment fresh graduate trigger stress, hypertension, and GERD?

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**Background:** The increase in unemployment, especially post-coronavirus disease 2019 has reached its peak. This situation is worsened because many fresh graduates without or limited experience could not afford to obtain a job for a certain period. This condition triggers the stress behavior of fresh graduates, especially female graduates (FG). This research aims to investigate the social norms in society that has the perspective to directly got a proper job after graduation can lead to stress, and early symptoms of hypertension and gastroesophageal reflux disease (GERD).

**Methods:** Online questionnaires are collected from female university graduates post-covid situations. One hundred and sixty-six data are collected, then this study was analyzed by partial least squares structural equation modeling to do hypothesis tests.

**Results:** The results of this study found that descriptive and injunctive norms as constructs for social norms have a positive association with stress in FG with coefficients 0.411 ( $p = 0.000$ ) and 0.416 ( $p = 0.000$ ) respectively. This means that social norms, the unspoken rule has created a negative stigma towards unemployment FG then lead them to have stress. Meanwhile, stress did not have a positive association with GERD. Although having unhealthy mental health, FG confirmed that they did not have GERD symptoms coefficient of  $-0.009$  ( $p = 0.0354$ ). Other than that, in the long-term stress experience, it is shown that FG has hypertension that requires raising their awareness, it is supported by hypothesis testing, that stress has a positive association with hypertension 0.528 ( $p = 0.000$ ). Therefore, social norms can have a bad impact on unemployment FG in both their mental and physical health.

**Conclusions:** FG needs help with their long uncertain transition from students to workers. The hard social norms could trigger the unstable mental health of unemployment FG. Then, feeling stress in the long term will result in hypertension at a young age.

**Keywords:** Social norms; Unemployment; Stress; Hypertension; GERD



Table 1. Path coefficient

**Table: Path Coefficient**

Hypothesis		Coefficient	Sample Mean (M)	Standard Deviation	T-Statistics	P-Values	Result
H1	Descriptive Norm Stress Related ->	0.411	0.408	0.088	4.673	0.000	Supported
H2	Injunctive Norm Stress Related ->	0.416	0.418	0.080	5.186	0.000	Supported
H3	Stress Related GERD ->	-0.099	-0.093	0.107	0.927	0.354	Not Supported
H4	Stress Related Hypertension ->	0.528	0.531	0.076	6.964	0.000	Supported

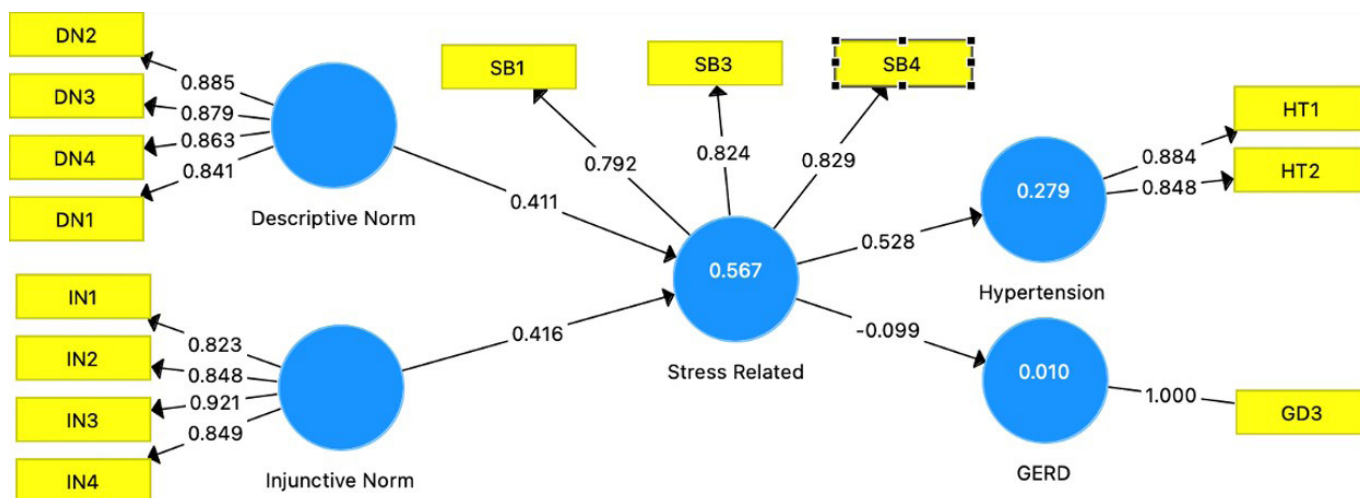


Fig. 1. Path coefficient.

## Oral Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):O-10-06

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

# Occupational and leisure time physical activity in contrasting relationship to work ability and health-related productivity loss

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**Background:** Contrary to the notion that physical activity is beneficial to health, occupational physical activity (OPA), in contrast to leisure time physical activity (LTPA), may have adverse effects on health in a phenomenon known as the physical activity paradox. Therefore, this study investigated the relationship of OPA and LTPA with work ability (WA) and health-related productivity loss (HRPL).

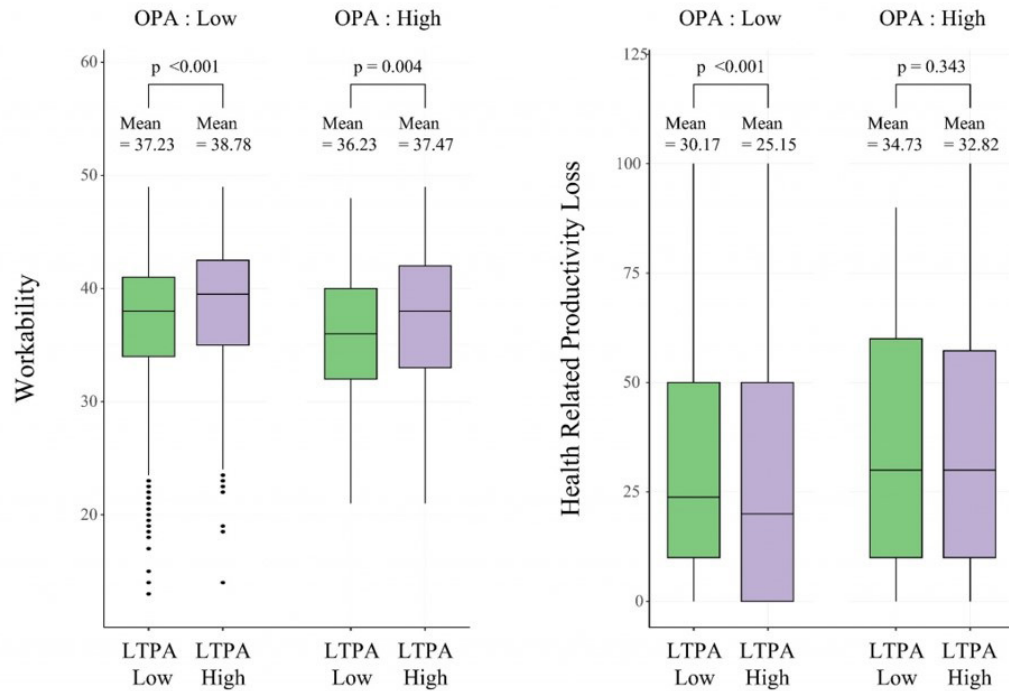
**Methods:** This study incorporated 5,501 workers in Korea, recruited through a web-based cross-sectional questionnaire in 2021. The Global Physical Activity Questionnaire was used as a tool to measure OPA and LTPA. Metabolic Equivalents were used in this study to quantify the intensity of physical activities. WA was measured using the Work Ability Index and HRPL was measured using the Work Productivity and Activity Impairment Questionnaire. The mean differences in WA and HRPL according to OPA and LTPA were examined using linear regression models after adjusting for covariates such as gender, age, alcohol consumption, smoking history and insomnia severity index.

**Results:** The results showed that an increase of LTPA resulted in an increase in WA and a decrease in HRPL. The opposite was true for OPA. With an increase of OPA, WA decreased and HRPL increased. In the linear regression analysis adjusted with covariates, the LTPA high group showed a mean WA increase of 1.183 (95% confidence interval [CI]: 0.906, 1.459) and showed a HRPL decrease with a mean difference of -3.803 (95% CI: -5.142, -2.462) compared to the LTPA low group. However, within the OPA high group, HRPL was not decreased in the LTPA high group when compared to the LTPA low group; -1.917 (95% CI: -5.423, 1.588). This trend is emphasized in the worker group aged 60 and over.

**Conclusions:** High LTPA was associated with increased WA and decreased HRPL. In contrast, high OPA was associated with decreased WA and increased HRPL.

**Keywords:** Occupational physical activity; Leisure time physical activity; Work ability; Health related productivity loss; Physical activity paradox

Leisure Time Physical Activity



**Fig. 1.** Mean and the linear regression *p*-value of work ability and health related productivity loss according to the level of LTPA within each OPA subgroup. LTPA: leisure time physical activity; OAP: occupational physical activity.

# Poster Presentation

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-01

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Demographic and clinical features of occupational injury and disease in the emergency department

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**Background:** Occupational injury and disease are significant concerns in Taiwan, yet their characteristics in the emergency department (ED) are rarely reported. This study aimed to describe the demographic and clinical features of occupational injury and disease in the ED.

**Methods:** We analyzed electronic medical records of patients aged 20 and above who self-reported occupational injuries or diseases at three hospitals between 2016 and 2020. Variables included age, sex, triage, disposition, and injury characteristics. Occupational injuries and diseases were categorized as work-related or commuting accidents. We compared the characteristics between these categories and described the overall features.

**Results:** From 2016 to 2020, the ED recorded 36,744 occupational injuries and diseases. Work-related injuries and diseases accounted for 59.1%, while commuting accidents comprised 40.9%. Almost 70% of patients were male, and most of the patients were between 20 and 44 years old. Discharge and admission rates were 86.0% and 12.2% respectively, with most incidents occurring on weekdays. Work-related injuries and diseases had a higher proportion of male patients (83.1% vs. 49.6%,  $p < 0.001$ ) and an older average age (40.4 vs. 35.4 years,  $p < 0.001$ ) compared to commuting accidents. Additionally, work-related cases were associated with a higher likelihood of eye injuries, foreign bodies in soft tissue, burns, and toxic exposure.

**Conclusions:** In the ED, occupational injuries and diseases predominantly affected males and patients between 20 and 44 years old. Work-related cases were more prevalent among males and linked to specific injuries such as eye injuries, foreign bodies in soft tissue, burns, and toxic exposure. These findings underscore the need for preventive strategies.

**Keywords:** Commuting accident; Emergency department; Occupational injury and disease; Work-related

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## The access system of history taking, health and workplace assessment through the patient care team collaboration in diagnosing occupational diseases

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**Background:** Occupational disease diagnosis is a process that assessing health issues and work characteristics to identify work-related causes of illness. This study focuses on utilizing specialized knowledge and expertise in medical history taking and health and work assessments to identify occupational health hazards. The aim is to develop a system that allows workers to access occupational disease diagnosis and receive guidance on health care in any hospital department.

**Methods:** The model development of an occupational disease diagnosis system involves collaboration with a patient care team, training the team in occupational history taking and conducted the diagnosis by the Thailand 9-step in diagnosing occupational diseases. The study involves cooperation with general practitioner (GP) department, orthopedic department, the Ear, Nose and Throat department, and the geriatrics department.

**Results:** There were complete work-related data in 504 patients in the working-age group, with 299 cases (59.3%) accurately diagnosed. The diagnosis rate increased by 119.9% compared to the previous year. Among the departments, the GP clinic had the highest number of occupational diseases diagnosed, accounting for 49.2%, followed by the orthopedic clinic at 63.7%.

**Conclusions:** The history taking, health and workplace assessment are importance to accurately work-related diagnosis, occupational disease patients can access in any department in the hospital to diagnose to occupational diseases by the development of the help of the patient care team collaboration.

**Keywords:** Occupational disease diagnosis; Collaboration

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Referral criteria for occupational musculoskeletal disease

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**Background:** Diagnosis of occupational diseases (ODs) rely on both clinical physicians and occupational physicians to make clinical diagnoses and evaluate work-relatedness, respectively. Thus, referral mechanism is important for diagnosing ODs. Novel ODs, like musculoskeletal diseases (MSDs), usually have multiple etiologies, which makes International Classification of Diseases (ICD) codes bad referral criteria with low positive predictive values. The aim of our study is finding criteria additional to ICD codes to enhance positive predictive values.

**Methods:** In Taiwan, Network of Occupational Diseases and Injuries Service (NODIS) is an important surveillance system of ODs. In NODIS, MSDs are most reported cases. Using NODIS's reporting data from 2012 to 2018, we compare demographic factors between probable case and possible/non-related cases, and binomial regression model is used to investigate effect of these factors on work-relatedness. We further carry out subgroup analysis for each MSDs diagnosis.

**Results:** There are 4,651 cases of confirmed cases of occupational MSDs, and 62.37% (2,901/4,651) cases are classified as probable cases. In binomial regression model, longer tenure, ever taking leaves due to MSDs, construction and manufacturing industries, craft and related trades workers, technicians and associate professionals, elementary labourers, and main MSDs in OD list are all significant predictors of work-relatedness. In subgroup analysis, predictors of work-relatedness vary between different MSDs.

**Conclusions:** Each MSD has its unique predictor of work-relatedness, which can be different from others, and we can identify high-risk characteristics, like age, gender, tenure, job title, industry, sick leave status, employment status, for each MSD. Using each predictor's coefficient, we can generate a set of referral criteria to refer cases with odds ratio of 2 or above, which enables better referral mechanism, which is more precise and more efficient.

**Keywords:** MSDs; Referral criteria; Work-relatedness; Taiwan; NODIS

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Association between high low-density cholesterol and its related risk factors among young workers in southern Taiwan

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**Background:** Low-density cholesterol (LDL) is highly correlated with cardiovascular diseases. In previous studies, the prevalence of LDL was found to be elevated among these years, but only few studies focus on young workers. Therefore, we conducted a study to evaluate the risk factors with high LDL among young workers in southern Taiwan.

**Methods:** We recruited young workers working in southern Taiwan during routine annual health examination from May 1 to December 31, 2022. Participants accept blood sampling and received anthropometric measurements. The younger worker defined by age less than 40 years old and high LDL defined by LDL  $\geq$  190 mg/dL.

**Results:** A total of 10,016 young workers participated in this study, and 389 young workers with LDL  $\geq$  190 mg/dL. The prevalence rate of LDL  $\geq$  190 mg/dL was 4.7% in total study population and 3.9% in younger workers. We observed positive associations between LDL  $\geq$  190 mg/dL and male, body mass index (BMI), hypertension, waist, fasting sugar  $\geq$  100 mg/dL, high uric acid (UA), metabolic syndrome and high HbA1c (all with  $p < 0.05$ ) among young workers. Through further analyses using logistic regressions in younger workers, we found male, hypertension, BMI, high UA and HbA1c were predictors of LDL  $\geq$  190 mg/dL. After adjusting for other factors, we found male (adjusted odds ratio [AOR]: 1.49; 95% confidence interval [CI]: 1.18–1.89), BMI  $>$  24 (AOR: 1.39; 95% CI: 1.04–1.87), BMI  $>$  27 (AOR: 1.51; 95% CI: 1.12–2.02), hypertension (AOR: 1.31; 95% CI: 1.05–1.63), high UA (AOR: 1.49; 95% CI: 1.18–1.87), and HbA1c (5.7%–6.4%) (AOR: 1.67; 95% CI: 1.32–2.12), were independent predictors of LDL  $\geq$  190 mg/dL.

**Conclusions:** In young workers less than 40 years old, LDL  $\geq$  190 mg/dL is associate with male, BMI, hypertension, high UA and HbA1c. However, further studies still need to be constructed to clarify the association between LDL and possible risk factors.

**Keywords:** Low-density cholesterol; Young workers; Body mass index; Hypertension



## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Assessment of exposure to carbon monoxide in food deliverers

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**Background:** To assess the exposure to carbon monoxide (CO) in food deliverers and make comparison with a reference group without exposure to ambient CO at work.

**Methods:** We recruited food deliverers who delivered food by riding motorcycles and thus were exposed to CO in the ambient air. For comparison, we recruited hospital worker and students who were not exposed to ambient CO at work. We used both the level of CO in exhaled breath and the level of carboxyhemoglobin (COHb) in the blood as indicators of exposure to CO. The differences in the two groups were evaluated using independent t test or Wilcoxon rank-sum test.

**Results:** A total of 156 food deliverers participated in this study. The reference group include 49 members. The food deliverer group had a higher mean CO level in exhaled breath than the reference group ( $4.79 \pm 8.05$  vs.  $1.51 \pm 2.48$  ppm), and the difference (3.28 ppm) reached statistical significance (95% confidence interval [CI]: 1.83–4.73 ppm). They also had a higher mean COHb level in blood than the reference group ( $1.36\% \pm 1.31\%$  vs.  $10.73\% \pm 0.52\%$ ), and the difference (0.62%) reached statistical significance (95% CI: 0.37%–0.87%). When we limited the analyses to those who were not smokers, differences in the CO (0.43 ppm, 95% CI: 0.15–0.71 ppm) and COHb (0.16%, 95% CI: 0.03%–0.27%) levels still reached statistical significance.

**Conclusions:** Our study observed a higher level of exposure to CO in food deliverers compared to the reference group. Further studies are needed to evaluate the associated health effects.

**Keywords:** Carbon monoxide; Carboxyhemoglobin; Exposure assessment; Food deliverers

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Case study: medico-legal ethical issues of fitness for work assessment

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**Background:** Many companies in Singapore offer medical benefits as part of perks for employees via private medical insurance coverage. However, prospective employees with pre-existing medical conditions can still proceed with the employment, but their pre-existing medical condition(s) would be excluded from this medical benefit. Under the hospital's human resource policy, it is mandatory for all prospective employees to undergo a pre-employment medical examination, with the aim of ascertaining the prospective employees are physically and mentally fit of performing essential duties of the job which are being considered efficiently and without hazards to themselves and patients as well as identifies any pre-existing medical condition(s), which may be exacerbated by workplace hazards and for the above mentioned medical insurance coverage purpose.

**Methods:** This case study discusses various medico-legal ethical issues of a case of pre-employment medical examination for a prospective employee who applies to work as an administrative staff in a hospital, and he has a pre-existing blood-borne disease that was potentially socially stigmatized.

**Results:** As he did not perform exposure-prone procedures, he was deemed fit for work. However, he requested strict confidentiality from the examining doctor for not revealing his medical condition to the Human Resources Department, claiming that he would utilize his own expenses to pay for his medical condition. His request positioned the examining doctor in a conflict situation between the prospective employee and the hiring employer. Eventually, we sought advice from a medical protection organization on how to solve this dilemma, which has potential medical, legal, and ethical implications.

**Conclusions:** It is important to study local guidelines and other relevant legislations on blood-borne disease, and its implications on fitness for work assessment. An organization should also establish a clear, non-discriminatory workplace policies on their pre-employment medical examination.

**Keywords:** Fitness for work; Ethical issues; Stigma; Blood-borne disease; Exposure-prone procedures

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-07  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Case report: a sanitation worker diagnosed with infectious endocarditis and *Streptococcus suis* bacteremia

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**Background:** The carrier rate of *Streptococcus suis* in pigs is nearly 100%, and it has been found in wild cats, birds, and dogs. When transmitted to humans, it can lead to zoonotic diseases. Such cases have been rare in Taiwan and are under close surveillance. *S. suis* type 2 can cause meningitis, endocarditis, and sepsis. The infection is typically transmitted through contact with contaminated raw pork meat or via typical Asian dishes ingested orally or through skin lesions. The mortality rate ranges from 7% to 20%. This disease is considered to be underdiagnosed and underreported in several countries.

**Methods:** Sharing a case diagnosed with infectious endocarditis and *S. suis* bacteremia at Chi-Mei Hospital. A walk-through survey was conducted to assess biological hazards during work.

**Results:** A 43-year-old male with no chronic diseases previously presented with symptoms of fever, right chest pain, and cough on November 5. A chest X-ray revealed pneumonia in the right lower lung, leading to hospitalization for infection control. Blood culture results showed the presence of *S. suis* the following day, and a cardiac ultrasound detected a 0.7 cm vegetation on the tricuspid valve. After 8 weeks of treatment, a blood culture relapse occurred, and the vegetation grew to 1.8 cm. The case was referred to the cardiovascular surgery service for tricuspid valve replacement. After inspecting the work history 14 days prior to symptom onset, a traditional market was highly suspected as the source of exposure to this pathogen. A walk-through survey of the traditional market was conducted, but the relationship between occupational exposure and the disease was inconclusive. Co-workers and market workers did not report any discomfort, and the source of infection remained unknown.

**Conclusions:** Infectious diseases caused by *S. suis* may be considered occupational hazards for individuals involved in pig slaughter, veterinary work, pig breeding, and butchery. This zoonotic disease can lead to fatal outcomes if not treated promptly and adequately. It is crucial to prioritize the management of biological hazards in high-risk occupations.

**Keywords:** *Streptococcus suis*; Zoonotic disease; Endocarditis; Occupation; Biological hazard

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-08  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Survey of employer's recognition and practical situation on occupational safety and health disclosure in small and medium-sized enterprises

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**Background:** The aim of this study was reveal the employer's recognition and practical situation on occupational safety and health disclosure in small and medium-sized enterprises (SME) in Japan.

**Methods:** A questionnaire was conducted targeting employers of companies selected as "2020 Excellent Health and Productivity Management Organizations" in the SME category nationwide. The survey items were whether information on the status of employees and safety and health conditions was quantified and grasped, and whether occupational safety and health information should be disclosed outside the company. Responses were obtained on a percentage basis for grasping status, and on a Likert scale of 0 to 7 for intention to disclose, and the average value was used as the evaluation target.

**Results:** Among 4,686 companies, 1,176 companies (25.1%) completed the survey for analysis. The indicators that employers evaluated using numerical data were the number of occupational accidents (68.6%), the frequency of occupational accidents (40.5%), and the severity of occupational accidents (36.8%). Furthermore, employers believed that information such as the number of occupational accidents (5.07), the frequency rate of occupational accidents (4.92), and employee safety awareness (4.92) should be publicly disclosed.

**Conclusions:** The study highlights a robust understanding and prioritization of safety and health metrics among Japanese SMEs, with considerable support for public disclosure. This result suggests that employers perceive occupational safety and health not only as a legal requirement, but also as a component of their Corporate Social Responsibility. We need to further explore the specific methods of disclosing health and safety information, and how it impacts business performance and employee wellbeing.

**Keywords:** Occupational safety and health

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-09  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Occupational diseases from biological agents: a 5-year retrospective study

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**Background:** Occupational disease (OD) from biological agents is a rare but serious issue. In Taiwan, there are 16 kinds of OD from biological agents, most of them are nationally notifiable diseases. However, only a few infectious disease cases have been diagnosed as OD. The objective of this study was to evaluate OD from biological agents in a regional hospital during a 5-year period.

**Methods:** We collected all nationally notifiable diseases from 2018 to 2022 in Chi-Mei Hospital, Liouying, using the National Infectious Disease Registry System. We used the labor insurance ODs list to identify possible cases of occupational infectious disease (OID). Medical and occupational histories were obtained from medical records. Coronavirus disease 2019 cases were excluded due to lack of occupational records. Possible OID cases with an associated occupational history were defined as probable OID cases. Cases confirmed by an occupational medicine physician were defined as confirmed OID cases.

**Results:** In total, we identified 78 possible OID cases, including scrub typhus, tuberculosis, legionella's disease, dengue fever, and leptospirosis. After review, only three cases were defined as probable OID: a 42-year-old farmer with scrub fever, a 37-year-old engineer with dengue after a business trip to Vietnam, and a 44-year-old nurse with active tuberculosis after caring tuberculosis patient without proper personal protective equipment. Only the nurse with active tuberculosis was confirmed as OID by an occupational medicine physician.

**Conclusions:** Our study found only one confirmed case of OID in the past 5 years, emphasizing the importance of recognizing probable OID cases and the need for occupational medicine referrals.

**Keywords:** Occupational disease; Occupational infectious disease; Biological agents

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-10  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Sero-prevalence of *Coxiella burnetii* infections among pig farmers in southern Taiwan

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**Background:** Q fever is a worldwide zoonosis caused by *Coxiella burnetii*. Previous studies showed that pigs could be infected with *C. burnetii* and became seroconvert, but studies on the risk of people frequently contact with pigs are rare. We conducted an epidemiology study to compare the sero-prevalence of antibodies to *C. burnetii* in pig farm workers with the general population in southern Taiwan and assess the associated factors.

**Methods:** We collected blood samples from 96 pig farm workers as the study group and 96 pharmaceutical company workers as the reference group; both groups were in southern Taiwan. We measured the antibodies against phase I and phase II antigens of *C. burnetii* using the indirect immunofluorescence assay. The seroprevalence rates of *C. burnetii* antibodies were compared between the 2 groups. A questionnaire survey was conducted together with a liver function test and a complete blood count on pig farm workers. Comparisons between seropositive and seronegative pig farm workers were conducted to identify the associated factors for *C. burnetii* infections.

**Results:** The *C. burnetii* seropositive rate was 20.0% in pig farm workers, much higher than the 2.0% positive rate in pharmaceutical company workers (odds ratio: 11.6; 95% confidence interval: 2.6–51.3). The comparisons between seropositive and seronegative pig farm workers did not identify any significant factors for *C. burnetii* infections.

**Conclusions:** The seroprevalence rate of antibodies to *C. burnetii* in pig farm workers was much higher than that in the reference group. *C. burnetii* infection poses a potential occupational hazard to workers in pig farms. Further studies need to confirm the association between contacts with pigs and *C. burnetii* infections.

**Keywords:** *Coxiella burnetii*; Pig farm; Q fever; Sero-prevalence

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-11

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

### Association of workplace toilet use with female urinary symptoms

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**Background:** Lower urinary tract symptoms (LUTS) such as urinary incontinence and overactive bladder are common in women, and they affect not only physical symptoms but also mental health and quality of life. They are also strongly influenced by environmental factors, and there is a need to study their association with the social environment. Therefore, we conducted a study to investigate the workplace related to LUTS in Korean working women.

**Methods:** An online survey of currently employed women was conducted to examine their demographics, occupational risk factors, and urinary symptoms. Occupational risk factors included three survey questions about access to toilet at work: A) putting up with urinary symptoms at work, B) being able to go to the restroom at will during work, C) having to go to the restroom during work but not being able to. LUTS were assessed using the Overactive Bladder Symptom Score (OABSS) and International Consultation on Incontinence Questionnaire-short form (ICIQ-SF) tools, which have been widely used in the literature. Frequencies and proportions were determined for workplace toilet access, LUTS, and labor productivity. Multiple logistic regression was used to correlate workplace toilet access with LUTS and labor productivity.

**Results:** Of the 1,057 participants, 260 (24.6%) and 294 (27.8%) had overactive bladder and urge incontinence, respectively. Regarding access to toilet at work, more than 50% reported poor access for each question. The results of the multiple logistic regression analysis showed that the lower the access to toilet in the workplace, the higher the incidence of LUTS and the lower the labor productivity.

**Conclusions:** Poor access to toilet in the workplace can lead to untimely resolution of urinary symptoms, worsening of the condition, and poor urination habits. This can lead to worsening of urinary symptoms and decreased quality of life. In addition, these conditions can lead to a decrease in labor productivity, so interventions to improve the environment are necessary.

**Keywords:** LUTS; Toilet access; Labor productivity; OABSS; ICIQ-SF

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-12  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

# A case report of occupational heat injury with acute kidney injury resulting in ischemic brain infarction

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We present a case report of heat injury with acute kidney injury resulting from occupational heat exposure and was further complicated by ischemic brain infarction. Heat injury could be a serious medical illness due to multi-organ dysfunction and would cause damage to the central nervous system resulting in delirium, coma, ataxia or difficulty with balance and coordination. Furthermore, heat injury carries a critical potential risk of thrombotic ischemic brain infarction. This can be attributed to a combination of factors, including hypoperfusion and other mechanisms that increase inflammatory response and promote thrombosis.

**Keywords:** Heat injury; Occupation; Heat exposure; Ischemic infarction



## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-13  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## The prevalence of musculoskeletal pain symptoms among semiconductor workers in South Korea

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**Background:** Work-related musculoskeletal disorders are a leading cause of work disability, loss of productivity, and increased health care costs. However, there are few studies regarding prevalence of musculoskeletal pain symptoms in semiconductor manufacturing. Therefore, we tried to examine the prevalence of musculoskeletal pain and to compare differences by gender, age, and type of job.

**Methods:** A total of 21,398 semiconductor workers completed general questionnaires and underwent health examinations in the SK Hynix Employees cohort study. Self-administered questionnaire was used to ask the presence of job-related musculoskeletal pain in 6 areas, namely neck, shoulder, waist, arm, hand, and leg. The prevalence of musculoskeletal pain over years according to the gender was calculated. In addition, 2022 data was used to investigate the prevalence of musculoskeletal pain according to the age, shift work status, working years and job exposure group (fabrication workers, package and test workers, process and equipment engineers, or office workers).

**Results:** The prevalence rates of musculoskeletal pain were as follow: in 2018, 22.0% (male) vs. 43.3% (female); in 2019, 32.7% (male) vs. 50.7% (female); in 2020, 34.3% (male) vs. 52.2% (female); in 2021, 20.4% (male) vs. 38.2% (female), in 2022, 19.2% (male) vs. 37.2% (female). When divided by body part, the prevalence of musculoskeletal pain in most parts such as neck, shoulder, waist, and hand was higher in female, non-shift workers, and office workers. However, in the case of legs, the prevalence of musculoskeletal pain was higher in shift workers, especially in package and test workers.

**Conclusions:** Prevalence rates of musculoskeletal pain differed according to the gender and type of job. Therefore, it is necessary to prepare a customized intervention plan rather than a uniform intervention plan in order to prevent and manage musculoskeletal disease.

**Keywords:** Musculoskeletal pain; Semiconductor workers

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-14  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Effect of muscle stretching on musculoskeletal discomfort among workers in a distillery: a one-year follow-up study

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**Background:** To evaluate the effects of stretching on musculoskeletal discomfort (MSD) among the workers in a distillery in Tainan, Taiwan.

**Methods:** In this intervention study, we used the Modified Nordic Musculoskeletal Questionnaire to evaluate the prevalence of MSD in 2 surveys, one before our team having started promoting stretching in the distillery and the other one year after the promotion. We used the  $\chi^2$  test and Cochran-Armitage trend test to evaluate the effects of muscle stretching on MSD prevalence among the workers.

**Results:** In the total of 343 workers, the response rate to the survey was 83.7% in the first survey and 63.8% in the second. More workers reported MSD in the second survey compared to that in the first one (odds ratio [OR]: 1.7, 95% confidence interval [CI]: 1.2–2.4). For individual bodily parts, only the prevalence of right shoulder pain was significantly higher in the second survey (OR: 1.6, 95% CI: 1.0–2.5). Using the results of the first survey as reference, we found a significant decreasing trend in the prevalence of MSD with pain score > 2 in lower back, right shoulder, right elbow/forearm, and right hand/wrist (all with  $p$ -value < 0.05) among workers with optimal stretching program adherence.

**Conclusions:** Our study observed a decreasing trend in the prevalence of MSD in lower back and right upper limb in workers who complied with the stretching program every day for 6–8 months, demonstrating the effects of stretching on reducing MSD.

**Keywords:** Distillery; Ergonomics; Intervention; Muscle stretch; Musculoskeletal disorder

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-01-15  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Association between job stress and work-related musculoskeletal pain symptoms among semiconductor workers in South Korea

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**Background:** A growing body of literature has documented that psychological factors are associated with musculoskeletal disorders. The prevalence of job stress and musculoskeletal disorders were higher in female than in male, but gender-specific associations between job stress and musculoskeletal pain have not been fully studied. Therefore, we investigated whether the effects of job stress on musculoskeletal pain was different according to gender in semiconductor workers.

**Methods:** The 21,398 semiconductor workers completed general questionnaires in the SK Hynix Employees cohort study. Job stress was measured using 24 items of the short form of Korean Occupational Stress Scale. Self-administered questionnaire was used to ask the presence of job-related musculoskeletal pain in 6 areas, namely neck, shoulder, waist, arm, hand, and leg. Logistic regression analysis was conducted to assess the relationship between job stress and musculoskeletal pain after adjusting for confounding factors as follows: gender, age, marital status, shift work status, working years, job exposure group (fabrication workers, package and test workers, process and equipment engineers, or office workers), obesity, exercise, strength training, household labor time, diseases known to be related to musculoskeletal disease, musculoskeletal injuries caused by sports or accidents, and physical burden of work.

**Results:** The prevalence of musculoskeletal pain was higher in female (37.2%) than in male (19.2%) workers. As a result of multivariate logistic regression analysis, workers with higher job stress had a significantly higher probability of having musculoskeletal pain than those with lower job stress in both male (odds ratio [OR]: 1.53; 95% confidence interval [CI]: 1.35–1.73) and female (OR: 1.69; 95% CI: 1.50–1.91).

**Conclusions:** There is an independent association between job stress and musculoskeletal pain both in male and female workers.

**Keywords:** Musculoskeletal pain; Semiconductor workers; Job stress

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement): P-01-16  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Relationship between occupational health staff activities and measures against infectious diseases (respiratory infection) in the workplace

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**Background:** The current outbreak of novel coronavirus infection has prompted the promotion of measures to control infectious diseases in the workplace. It is assumed that the activities of occupational health staff contribute significantly to infection control measures in the workplace, but little evaluation has been conducted in this regard. The purpose of this study was to review the relationship between the activities of occupational health staff and infection control measures in the workplace (i.e., respiratory tract infections).

**Methods:** This study is a prospective cohort study using an Internet-based survey. The survey was contracted to Cross Marketing, Inc. The baseline survey was conducted October 1–7, 2021. The follow-up survey was conducted from October 6–13, 2022. The target population was those aged 20–69 who were employed at the time of the survey. There were 7,300 respondents to the screening survey and 5,111 respondents to the main survey. A total of 571 respondents with inconsistent responses or extremely short response times were excluded, leaving a total of 4,540 valid responses.

**Results:** Regarding the presence of occupational physicians and occupational health staff and the 2-year trend of infection control measures against respiratory tract infections, more than 90% of both the “with occupational physicians” and “with occupational health staff” groups sustained measures compared to the “without occupational physicians” and “without occupational health staff” groups. On the other hand, the percentages of the no-countermeasures group were 4.8% and 4.3% for the groups who answered that they had appointed an occupational physician or had industrial health staff, respectively, while the percentages were 9.4% and 9.7% for the groups who answered that they did not have such staff, respectively.

**Conclusions:** The results suggested the importance of the presence of occupational health staff in relation to measures.

**Keywords:** Respiratory infection; Occupational physician; Workplace; Countermeasures

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-02-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
 eISSN 2052-4374

## Relationship between health and productivity management score and occupational injury frequency rate in Japan

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**Background:** It is believed that workers' health conditions, such as fatigue, sleep deprivation, and mental disorders, are closely related to the occurrence of occupational accidents. Investing in employees' health through health and productivity management (HPM) is expected to increase employees' vitality and productivity. However, it is not yet clear whether it is effective in reducing occupational accidents. The purpose of this study was to determine the relationship between the HPM score and the frequency of occupational accidents.

**Methods:** In this study, we used the 2019 HPM Survey Sheets (which reflect the actual status of companies in 2018) and the corporate social responsibility (CSR) database published by Toyo Keizai Inc. in 2021. This analysis was based on company-level data, and included 675 companies that responded to both the 2019 HPM Survey Sheet and the CSR survey. A multiple regression analysis was conducted using the HPM score as the explanatory variable, and the occupational accident frequency rate in FY2018 and FY2019 as the target variable. Industry, company size, proportion of female employees and age over 50 years were adjusted as covariates.

**Results:** Six hundred seventy-five companies were analyzed. Manufacturing was the most common industry, accounting for 50.5% of the total, and in terms of company size, 68.9% of all companies had 1,000 or more employees. As a result of the multiple regression analysis, the non-standardized regression coefficient for the occupational injury frequency rate in FY2018 and FY2019 was  $-0.02$  (standard error [SE]: 0.01;  $p < 0.05$ ) and  $-0.02$  (SE: 0.01;  $p < 0.05$ ), respectively.

**Conclusions:** We found that the higher the HPM score, the lower the frequency of occupational accidents. Companies that implement HPM may inevitably have a lower the frequency of occupational accidents because they have sound corporate governance and a high level of safety awareness.

**Keywords:** Occupational accidents; HPM

**Table 1.** Relationship between health management deviation and frequency rate of occupational accidents (multiple regression analysis)

	Occupational injury frequency rate (FY2018)			Occupational injury frequency rate (FY2019)		
	Coefficient*	SE	p value	Coefficient*	SE	p value
HPM score (FY2018)	-0.02	0.01	0.005	-0.02	0.01	0.017

Adjusted for industry and company size, female, over 50 years old.

HPM: health and productivity management; SE: standard error.

\*Non standardized coefficient.

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-02-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Association between hypertension and sick leave: prospective cohort study

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**Background:** The purpose of this study was to determine the relationship between blood pressure levels and sick leave.

**Methods:** This retrospective cohort study included seven companies in Japan. Blood pressure was classified into 5 categories based on systolic and diastolic blood pressure: (1) < 120/80; (2) 120–129/80–84; (3) 130–139/85–89; (4) 140–159/90–99; and (5)  $\geq$  160/100 mmHg based on health checkup in 2014 fiscal year. Sick leave due to all disease was defined as 30 days or more until the end of 2020 fiscal year. Data were analyzed using cox regression adjusted for age, sex body mass index, and antihypertensive drug.

**Results:** We analyzed 33,153 workers with 20–59 years old. Hazard ratio and 95% confidence interval were (2) 1.29 (1.10–1.51), (3) 1.15 (0.92–1.44), (4) 1.40 (1.10–1.78), and (5) 1.70 (1.15–2.51) refer to (1) ( $p$  for trend = 0.001).

**Conclusions:** The risk of sick leave increased as blood pressure increased. Controlling blood pressure levels is important to prevent sick leave.

**Keywords:** Hypertension; Sick leave; Workplace

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-02-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Integrating deep learning techniques for real-time occupational health monitoring and risk prediction

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**Background:** Effective occupational health monitoring and risk assessment are crucial for maintaining workplace safety. However, traditional approaches often rely on manual reporting and retrospective analysis, limiting their preventive capabilities. This study aims to utilize deep learning techniques to develop a real-time monitoring system that proactively detects potential hazards, predicts injury risks, and offers actionable insights for enhanced occupational health management in various industries within Yogyakarta City.

**Methods:** We collected a comprehensive dataset from diverse workplaces in Yogyakarta City, including employee demographics, environmental parameters, physiological measurements, and historical injury records. To extract meaningful features, we employed deep learning architectures, including convolutional neural networks and recurrent neural networks. Additionally, we applied transfer learning techniques, leveraging pre-trained models to enhance generalization. The system was trained using a large-scale dataset and validated through cross-validation to ensure robustness and accuracy.

**Results:** The deep learning-based monitoring system showcased exceptional performance, achieving an overall accuracy of 95% in identifying hazardous situations and predicting injury risks. Through real-time capabilities, the system enabled instant risk detection, facilitating timely interventions to prevent accidents. By integrating environmental parameters, physiological measurements, and historical injury records, the system provided valuable insights into the factors contributing to occupational health risks within Yogyakarta City industries. Furthermore, the system significantly reduced false-positive rates compared to conventional methods, enhancing efficiency and resource allocation.

**Conclusions:** Deep learning techniques have the potential to revolutionize occupational health management in Yogyakarta City industries. Our real-time monitoring system, powered by deep learning models, detects risks proactively, enabling timely interventions and injury prevention. Leveraging diverse data sources and extracting meaningful features, it provides a comprehensive understanding of workplace injury factors. Integrating this advanced technology improves safety measures, enhances employee well-being, and reduces occupational hazards. Embracing technological advancements is crucial for driving innovation in occupational health and creating a safer work environment.

**Keywords:** Deep learning techniques; Real-time monitoring system; Occupational health management; Yogyakarta city; Risk detection and prevention

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-02-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Trends and risk factors of workplace verbal abuse among service and sales workers in Korea

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**Background:** This study aimed to assess the trend in the prevalence of workplace verbal abuse among service and sales workers in Korea and identify the associated risk factors of workplace verbal abuse by period.

**Methods:** This study analyzed data from the 3rd–6th Korean Working Conditions Survey conducted in 2011, 2014, 2017, and 2020. The study subjects consisted of 63,425 Korean service and sales workers (25,033 men, 38,392 women). Workplace verbal abuse within the past month served as the dependent variable. Covariates included gender, age, company size, employment status, working hours, educational level, and income. Prevalence ratios of workplace verbal abuse were estimated using binomial regression analysis.

**Results:** The prevalence of workplace verbal abuse was 5.2%, 10.0%, 6.6%, and 5.2% in 2011, 2014, 2017, and 2020, respectively, indicating a declining tendency in recent years. Working hours consistently and significantly emerged as a risk factor in all 4 years. Younger individuals, and those employed in sales jobs than in service jobs faced a higher risk of workplace verbal abuse. Gender did not show a significant association with workplace verbal abuse.

**Conclusions:** Despite the potential limitation of a low response rate to workplace violence in Korean society, it is encouraging to observe a decreasing prevalence of workplace verbal violence since 2014. Further research is necessary to develop targeted strategies for preventing workplace violence and implementing public interventions effectively.

**Keywords:** Workplace violence; Verbal abuse; Service workers; Sales workers



## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-02-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Determining aerobic fitness standards for police officers required to perform self-defence: a study comparing the metabolic expenditure of 9 VIP protection officers undergoing Police Defence Tactics (PDT) versus a 2.4 km run

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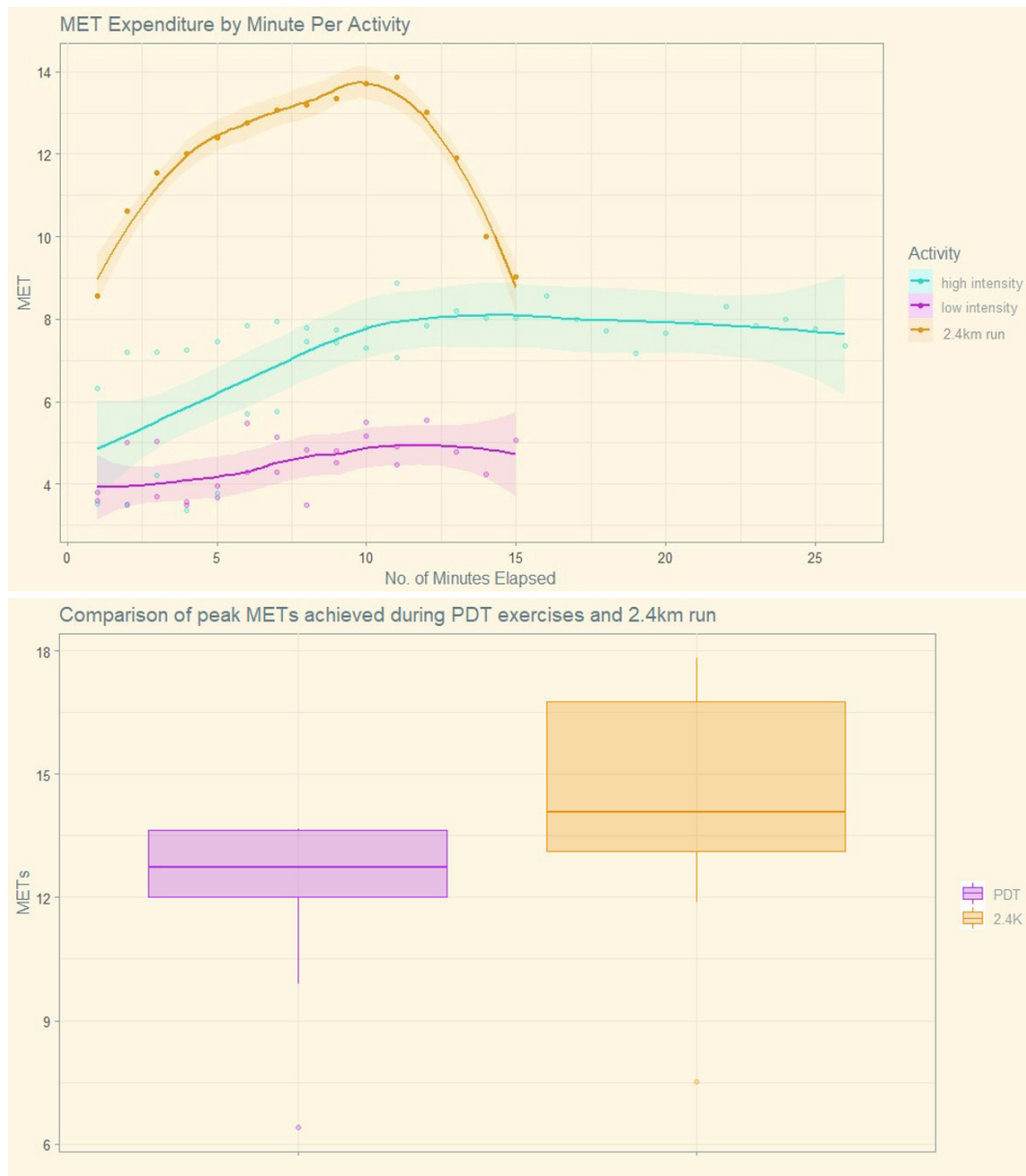
**Background:** Police officers undergo martial arts training (Police Defence Tactics, or PDT) with annual re-certification in the event melee combat is required for self-defence. It is critical that police officers possess a sufficient physical fitness standard to perform PDT effectively. We sought to measure the metabolic expenditure while performing PDT exercises compared to a 2.4 km run, with the intention to understand the relative intensities, and to inform fitness-for-deployment standards.

**Methods:** Nine VIP protection officers participated in 2 low-intensity and 2 high-intensity PDT exercises, designed to simulate a range of real-world scenarios. They underwent a maximal-effort 2.4 km run a week later to assess their aerobic capacity. The officers' metabolic rates (METs) were derived from their heart rates and ambient temperature through a thermoregulatory model. Their median METs, peak METs, and proportion of time in vigorous exercise (defined as > 6 METs) were compared between the PDT exercises and the 2.4 km run.

**Results:** The officer's median METs were significantly lower for all PDT exercises compared to the 2.4 km run (5.0 vs. 12.5), with a lower proportion of time spent in vigorous exercise (42% vs. 100%). However, peak METs achieved were marginally lower than for the 2.4 km run (12.7 vs. 14.1). These findings likely reflect the nature of PDT exercises which typically involve intense but momentary maneuvers.

**Conclusions:** Performing effective PDT requires brief but intense physical activity, with a maximum metabolic expenditure almost comparable to a 2.4 km maximal-effort run. A high standard of physical fitness is therefore required to perform PDT effectively and officers should be assessed pre-deployment and during re-certification. The study was limited in that other demands of PDT, such as musculoskeletal ability and situational judgement, were not measured. There are also inherent limitations in simulating real-world hostile encounters which cannot be replicated in a study.

**Keywords:** Police; Martial-arts; Fitness-to-work; METs



**Fig. 1.** Officers' METs for each minute were plotted by activity per a synchronized start time. Local Polynomial Regression (Loess regression) was performed to fit a smooth curve. The median METs for low and high intensity PDT activities were significantly lower than for the 2.4 km run (graph created using 'R' analytics software). MET: metabolic rate; PDT: Police Defence Tactics.

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-02-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Exposure of carcinogens in electronics industries and strategy for control of carcinogens: using work environment measurement database (2013–2017) in Korea

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**Background:** The objective of this study is to investigate exposure to occupational carcinogens in the nationwide electronics industries and to establish a strategy for control of occupational carcinogens in South Korea.

**Methods:** We evaluated occupational carcinogens as defined by International Agency for Research on Cancer (IARC) using a nationwide work environment measurement database on the electronics industry in South Korea measured between 2013 and 2017 in accordance with the Occupational Safety and Health Act.

**Results:** The number of occupational carcinogens found in the electronics industry in South Korea were: 20 for IARC group 1, 14 for group 2A, and 30 for group 2B. The occupational carcinogens (group 1) most frequently exposed were strong-inorganic-acid mists containing sulfuric acid (sulfuric acid), welding fumes, mineral oils (untreated or mildly treated), nickel compounds, silica dust, crystalline substances in the form of quartz or cristobalite, formaldehyde, arsenic and inorganic arsenic compounds, chromium (VI) compounds, trichloroethylene, cadmium and cadmium compounds, vinyl chloride, ethylene oxide, wood dust, beryllium and beryllium compounds, 1,3 butadiene, benzene, and others. Among them, the carcinogens (group 1) exceeding the acceptable standard were trichloroethylene, formaldehyde, and ethylene oxide. The working environment measurement system as regulated by Occupational Safety and Health Act is not properly assessed and managed for occupational carcinogens in South Korea. A component analysis for all materials used should be set up to practically reduce occupational carcinogens. A ban on the use of occupational carcinogens and the development of alternative materials are needed. The occupational carcinogens below the acceptable standards should be carefully examined and a new standard for exposure needs to be established.

**Conclusions:** The Occupational Safety and Health Act should be improved to identify and monitor occupational carcinogens at work sites. A strategy for occupational safety and health systems should be provided to give direction to workers' needs and right to know.

**Keywords:** Electronics industry; Occupational Safety and Health Act; Work environment measurement system; Workers' health and safety; Occupational carcinogens

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-02-07  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Mandating Manganese biomonitoring: a timely re-evaluation of policies?

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**Background:** Excessive exposure to Manganese (Mn) causes irreversible neurological deficits. This is of particular concern in high-exposure industries, necessitating reliable exposure limits and biomarkers as preventive measures. Though international consensus recommends against Mn biomonitoring due to its unreliability, its continued use as routine screening in some countries prompts a need for policy review in line with advances in Mn research.

**Methods:** An online literature search was conducted on February 2023 to identify various countries' Mn screening guidelines as well as current evidence on Mn biomonitoring.

**Results:** Of the 9 countries and international organizations reviewed, only Singapore continues to adopt mandatory biomonitoring for high Mn occupationally exposed individuals. Malaysia has prescribed urine and blood Mn exposure limits though its employment is not mandated. Other countries such as US, UK, Australia, Korea, Germany as well as the European Union and World Health Organization have retracted the need for Mn biomonitoring in occupationally Mn-exposed individuals, citing high variability and poor correlation with airborne Mn levels. However, promising new modalities of Mn biomonitoring research such as eMIR, brain magnetic resonance imaging and bone sampling have recently been shown to correlate with airborne Mn levels and biological effects, although further validation is required.

**Conclusions:** Present international consensus on Mn biomonitoring agrees on the limited value of testing for urine and blood Mn levels, suggesting that it may be timely for countries with statutory Mn biomonitoring to review these requirements. Recent developments of novel biomarkers, if validated, may allow for dependable Mn biomonitoring amongst Mn-exposed workers in the future.

**Keywords:** Manganese; Biomarkers; Policy review

Table 1. Country specific occupational exposure limits for Manganese and its compounds

Country/countries	Choice of screening tool	Cut-off values
United States (OSHA)	Environmental sampling	8-hour TWA ceiling limit of 5mg/m <sup>3</sup> of respirable fraction of air and 0.2mg/m <sup>3</sup> for compounds and fumes
Australia (SWA), Korea (MoEL)	Environmental sampling	8-hour TWA TLV of 1mg/m <sup>3</sup> of dust, compounds and fumes
European Union (SCOEL)	Environmental sampling	8-hour TWA TLV of 0.05mg/m <sup>3</sup> and 0.2mg/m <sup>3</sup> of respirable and inhalable fraction of air respectively
United Kingdom (HSE)	Environmental sampling	8-hour TWA TLV of 0.2mg/m <sup>3</sup> and 0.05mg/m <sup>3</sup> of inhalable and respirable fraction of air respectively
World Health Organization (WHO)	Environmental sampling	8-hour TWA TLV of 0.3mg/m <sup>3</sup> of respirable fraction of air
Germany	Environmental sampling & Biomarker	MAK of 0.5mg/m <sup>3</sup> of total dust BTLV for blood Mn of 15mcg/L
Malaysia (DOSH)	Environmental sampling & Biomarker	8-hour TWA TLV of 0.2mg/m <sup>3</sup> of element and inorganic compounds BLTV for blood Mn 7.1-10.4mg/L BLTV for Urine Mn 19ng/L
Singapore (WSH)	Environmental sampling & Biomarker	8-hour TWA TLV of 1mg/m <sup>3</sup> of dust, compounds and fumes BTLV for U-Mn = 50mcg/L

OSHA: Occupational Safety and Health Administration, SWA: Safe Work Australia, MoEL: Ministry of Employment and Labor, SCOEL: Scientific Committee on Occupational Exposure Limits, HSE: Health and Safety Executive, DOSH: Department of Occupational Safety and Health, WSH: Workplace Safety and Health Council, MAK: maximum workplace concentration, TWA: time-weight average, TLV: threshold limit value, BTLV: biological threshold limit value, U-Mn: urine Manganese.

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-02-08  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Study on the VDT workstation and posture affecting musculoskeletal pain of office workers in IT company

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**Background:** Visual Display Terminal (VDT) syndrome refers to symptoms such as musculoskeletal system, neuropsychiatry system, and eye strain. Office workers are particularly susceptible to VDT syndrome. Although several studies have examined VDT syndrome, there have been few studies on the field-oriented research. Therefore, this study aimed to evaluate the VDT workstation and posture of office workers on-site and investigate the relationship between work posture and musculoskeletal pain.

**Methods:** A total of 150 office workers were included in this study. Musculoskeletal pain (neck, shoulder, arm/elbow, hand/wrist/finger, lumbar, leg/foot) was defined as symptoms lasting at least a week, or occurring at least once a month over the past year, and the intensity of pain was moderate or severe. Through one-on-one on-site observations, 11 factors related to the VDT workstation and posture were evaluated. An independent t-test was conducted to compare the evaluation results of these 11 factors in relation to musculoskeletal pain. Additionally, a  $\chi^2$  test was employed to identify associations between each factor and musculoskeletal pain.

**Results:** In the comparison of the evaluation results of the 11 factors with musculoskeletal pain, a significant difference was found only for neck pain ( $p < 0.05$ ). The  $\chi^2$  test revealed a significant association only with the viewing distance to the screen ( $p < 0.05$ ). In the group with neck pain, the proportion of individuals using the standard viewing distance was 60.7%, whereas among those without neck pain, the proportion was 76.6%.

**Conclusions:** In order to prevent musculoskeletal pain of office workers, it is crucial to improve workstation setting and posture, considering individual differences through on-site evaluation. Particularly, for preventing neck pain, it is important to maintain the display within the recommended distance range of 50–75 cm.

**Keywords:** VDT workstation; Musculoskeletal pain; Ergonomics; Working posture; Office worker

**Table 1.** Comparison of evaluation results for 11 factors of Visual Display Terminal workstation and posture according to musculoskeletal pain

Factors		Neck Pain		$\chi^2$	P value <sup>†</sup>
		No(n=94)	Yes(n=56)		
Display angle	Standard (10-20°)	9 (9.6)	2 (3.6)	1.86	0.173
	Non-standard	85 (90.4)	54 (96.4)		
Display height	Standard (Eye level)	15 (16.0)	5 (8.9)	1.50	0.221
	Non-standard	79 (84.0)	51 (91.1)		
Viewing distance	Standard (50-75cm)	72 (76.6)	34 (60.7)	4.27	0.039*
	Non-standard	22 (23.4)	22 (39.3)		
Elbow position	Standard (0-25°)	41 (43.6)	23 (41.1)	0.09	0.760
	Non-standard	53 (56.4)	33 (58.9)		
Elbow angle	Standard (90-115°)	42 (44.7)	24 (42.9)	0.05	0.828
	Non-standard	52 (55.3)	32 (57.1)		
Wrist angle	Standard (0°)	35 (37.2)	14 (25.0)	2.39	0.122
	Non-standard	59 (62.8)	42 (75.0)		
Backrest fixation	Standard (Non-Flexible)	49 (52.1)	30 (53.6)	0.03	0.864
	Non-standard	45 (47.9)	26 (46.4)		
Lumbar support	Standard (C-curve support)	26 (27.7)	18 (32.1)	0.34	0.560
	Non-standard	68 (72.3)	38 (67.9)		
Knee angle	Standard (90°)	31 (33.0)	14 (25.0)	1.06	0.302
	Non-standard	63 (67.0)	42 (75.0)		
Chair height	Standard (Individual)	30 (31.9)	12 (21.4)	1.91	0.167
	Non-standard	64 (68.1)	44 (78.6)		
Foot position	Standard (Flat on floor)	50 (53.2)	26 (46.4)	0.64	0.423
	Non-standard	44 (46.8)	30 (53.6)		

\* $p < 0.05$ .<sup>†</sup>Statistical significance was evaluated by  $\chi^2$  test.

**Table 2.** Association between neck pain and evaluation factors of Visual Display Terminal workstation and posture

Variables	MSK Pain	11 Evaluation Factors	P value <sup>†</sup>
		Mean±SD	
Neck	No(n=94)	4.26±2.1	0.048*
	Yes(n=56)	3.61±1.7	
Shoulder	No(n=106)	4.05±2	0.742
	Yes(n=44)	3.93±1.7	
Arm/Elbow	No(n=143)	4.07±1.9	0.108
	Yes(n=7)	2.86±1.6	
Hand/Wrist/Finger	No(n=114)	4.04±2	0.734
	Yes(n=36)	3.92±1.7	
Lumbar	No(n=94)	3.88±1.8	0.289
	Yes(n=56)	4.23±2.1	
Leg/Foot	No(n=137)	3.98±2	0.473
	Yes(n=13)	4.38±1.8	

MSK: musculoskeletal, SD: standard deviation.

\* $p < 0.05$ .

†Statistical significance was evaluated by independent t-test.



## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-03-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Impact of nurse staffing and work schedules on actual nurse turnover in hospitals: a systematic review

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**Background:** The study aimed to examine and synthesize the impact of nurse staffing and work schedules on nurses' turnover in acute hospitals. During the coronavirus disease 2019 (COVID-19) pandemic, the demand for nurses has increased, making retention of nurses a critical issue. Among the multifaceted factors contributing to nurse turnover, it is worth examining nurse staffing and work schedules, while considering policy intervention. It is important to provide evidence to support the implementation of this policy in relation to nurse turnover and retention.

**Methods:** This systematic literature review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta Analysis. Using 8 databases, including CINAHL and PubMed, research articles published between January 2000 and May 2021 were reviewed. The inclusion criteria were original peer-reviewed research, non-experimental studies published in English or Korean languages, and studies examining the impact of nurse staffing and work schedules on nurses' actual turnover.

**Results:** Twelve of 9,029 articles were reviewed. Eleven studies examined the relationship between nurse staffing and turnover. Nurse staffing levels had a strong relationship with nurse turnover in the expected direction. Few studies have examined the impact of work schedules on nurse turnover.

**Conclusions:** In the present review, nurse staffing and work schedules were examined as factors that contribute to nurses' actual turnover. From the synthesis of empirical studies, nurse staffing significantly affected nurses' actual turnover. Specifically, the nurse staffing level is an important factor. Several states have adapted the nurse staffing policy during the COVID-19 pandemic. Hospitals and the government should adopt and implement more policies to regulate nurse staffing, reduce nurse turnover, and increase retention. Policy intervention in nurse work schedules should also be considered to prevent nurse turnover. Further studies are needed to investigate the impact of work schedules on nurse turnover.

**Keywords:** Nurse turnover; Nurse staffing; Nursing shortage; Work schedules

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-03-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## The role of skill development programs in mitigating the adverse effects of unemployment, job insecurity, and mental health: a quasi-experimental study in Yogyakarta, Indonesia

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**Background:** This quasi-experimental study aimed to assess the effectiveness of skill development programs in mitigating the adverse effects of unemployment and job insecurity on mental health outcomes among individuals in Yogyakarta, Indonesia. Unemployment and job insecurity are known to contribute to increased mental health problems, emphasizing the need for targeted interventions. By investigating the impact of skill development programs on mental health, this research provides valuable insights into potential mechanisms for promoting resilience and well-being in the face of employment-related challenges.

**Methods:** The study involved a sample of 500 unemployed individuals from Yogyakarta, divided into an intervention group and a control group. The intervention group participated in a structured skill development program focused on enhancing employability and resilience, while the control group did not receive any intervention. Pre- and post-intervention assessments were conducted using validated scales such as the Depression, Anxiety, and Stress Scale (DASS-21) to measure mental health outcomes. Statistical analysis, including mixed-effects regression models and controlling for relevant factors, was employed to evaluate the impact of the skill development program on mental health outcomes.

**Results:** Preliminary results indicated that the intervention group experienced a significant reduction in symptoms of depression ( $p < 0.001$ ), anxiety ( $p < 0.001$ ), and stress ( $p < 0.01$ ) compared to the control group. Additionally, participants in the intervention group reported increased self-efficacy and perceived social support, which mediated the relationship between the skill development program and improved mental health outcomes.

**Conclusions:** In conclusion, this study shows that skill development programs can help reduce the negative effects of unemployment and job insecurity on mental health in Yogyakarta. These programs enhance employability skills, self-confidence, and support networks, promoting resilience and well-being. The findings contribute to evidence-based policies and interventions for individuals facing unemployment and job insecurity in Yogyakarta and beyond.

**Keywords:** Skill development programs; Unemployment; Job insecurity; Mental health; Yogyakarta

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-03-03

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Relationship between workplace social capital and access to medical care among workers with mental disorders

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**Background:** The prevalence of mental disorders among workers in Japan remains high, leading to productivity losses. When workers have any symptoms of mental disorders, it is important to see a doctor at an early stage and appropriately continue medical care to reduce productivity losses. Previous studies have shown lack of workplace social capital (WSC) is associated with refraining from seeking medical care, but few studies have limited to mental disorders. This study aimed to examine the relationship between WSC and access to medical care among workers with mental disorders.

**Methods:** We conducted an online self-administered questionnaire survey to workers aged 20 years or older in Japan in March 2022. Out of 27,693 participants, 569 workers with mental disorders and 13 and more K6 score were included in the analysis. The independent variable was WSC, classified into three categories. The dependent variable was access to medical care for mental disorders. We examined the relationship between WSC and access to medical care for mental disorders using logistic regression analysis.

**Results:** Out of the total 569 participants, 339 were classified into low WSC group, 128 into medium WSC group, and 102 into high WSC group. Compared to low WSC group, the odds ratios for access to medical care for mental disorders were 1.03 (95% confidence interval [CI]: 0.68–1.58) for medium WSC group and 1.74 (95% CI: 1.07–2.82) for high WSC group.

**Conclusions:** Our results suggested there was a significant relationship between WSC and access to medical care for mental disorders. Previous studies have shown WSC is associated with trust. High WSC may make it easier for workers to report their mental health problems to supervisors or colleagues, and request adjustments to work schedules to seek medical care. This study suggests that increasing WSC may help workers with mental disorders appropriately receive medical care and reduce productivity losses.

**Keywords:** Workplace social capital; WSC; Medical care

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-03-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Exploring the differential impact of rotating shift work schedules and overtime hours on occupational health: a groundbreaking study in the petroleum industry of Gresik City, Indonesia

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**Background:** This study investigates the effects of rotating shift work schedules and overtime hours on occupational health outcomes in Gresik City's petroleum industry. The aim is to examine specific outcomes such as sleep disturbances, fatigue, injury rates, musculoskeletal disorders, and psychological well-being, with the goal of informing targeted interventions.

**Methods:** Data was collected from 500 petroleum industry workers in Gresik City using a mixed-methods approach. Surveys captured demographic information, rotating shift work details (duration, frequency, direction), weekly overtime hours, and occupational health outcomes. In-depth interviews provided additional insights into participants' perceptions and experiences. Advanced statistical analyses, including regression models and thematic analysis, were conducted to explore the relationships between rotating shift work schedules, overtime hours, and health outcomes.

**Results:** Findings showed that 60% of petroleum industry workers in Gresik City engaged in rotating shift work schedules with varying durations and directions. Additionally, 40% reported weekly overtime hours. Clockwise rotating shift workers experienced higher rates of sleep disturbances (55%) compared to counterclockwise rotating shift workers (25%). Fatigue levels were significantly higher among individuals working overtime hours (47%) compared to those without overtime (32%). Injury rates were higher among rotating shift workers (18%) compared to regular day shift workers (8%). Musculoskeletal disorders were more prevalent among individuals working overtime hours (38%) compared to standard hours (22%). Psychological well-being was also impacted, with higher levels of stress and burnout reported among rotating shift and overtime workers.

**Conclusions:** This study emphasizes the need for targeted interventions to mitigate the negative impact of rotating shift work schedules and overtime on occupational health in Gresik City's petroleum industry. Implementing fatigue management strategies, workload balancing initiatives, ergonomic measures, and supportive resources can foster healthier and safer work environments, promoting well-being and productivity.

**Keywords:** Rotating shift work; Overtime hours; Occupational health; Interventions; Well-being

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-03-05

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Characteristics of work-related non-fatal injuries among aged workers in South Korea

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**Background:** The objective of this paper is to investigate whether the aging workforce is prone to experience a higher rate of work-related non-fatal injuries and, if that is the case, to identify the underlying reasons behind this increase.

**Methods:** Aged workers were defined as those who were at least 55-years-old. Work-related non-fatal injuries were assessed in aged and young workers who were registered with the workers' compensation system in 2017–2021 of South Korea.

**Results:** Aged workers who were employed in the construction sector, working in elementary occupations (unskilled occupations), or had a daily worker employment status were more susceptible to work-related non-fatal injuries. The estimated incidence of work-related non-fatal injuries was significantly higher in aged workers when compared to younger workers. Aged workers were more likely to experience trip and slip accidents and falls at work compared to their younger counterparts. Furthermore, the cause of work-related non-fatal injuries in the category of buildings, structures, and surfaces was found to be more frequent in aged workers than younger workers.

**Conclusions:** Aged workers in South Korea had a higher probability of experiencing work-related non-fatal injuries compared to their younger counterparts. This disparity is thought to be a result of their frequent involvement in precarious employment/jobs and greater physical vulnerability. Therefore, it is recommended that employers take steps to improve workplace safety and health level for aged workers, particularly in employment/jobs that are commonly occupied by them. Additionally, preventive measures such as exercise programs that enhance balance and muscle strength of aged workers may help to prevent non-fatal injuries.

**Keywords:** Aged worker; Work-related injury; Non-fatal

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-03-06

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Breaking barriers in the capital: unveiling LGBTQ+ workplace inequality in Jakarta and its impact on occupational health

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**Background:** In Jakarta, LGBTQ+ individuals face unique challenges and systemic discrimination in the workplace, significantly impacting their occupational health outcomes. This study aims to quantitatively examine the extent of workplace inequality experienced by LGBTQ+ individuals in Jakarta and assess its implications. By utilizing advanced statistical analysis techniques and focusing on key variables, we aim to shed light on the specific disparities faced by the LGBTQ+ community in Jakarta and provide evidence-based insights for organizations, policymakers, and advocacy groups.

**Methods:** A comprehensive dataset specifically focusing on LGBTQ+ individuals in the workplace was collected in Jakarta. Variables such as employment rates, wages, career advancement opportunities, job satisfaction, and mental health outcomes were meticulously measured. State-of-the-art statistical methods, including logistic regression, propensity score matching, and structural equation modeling, were applied to analyze the data and quantify the magnitude of LGBTQ+ workplace inequality, as well as its relationships with occupational health outcomes.

**Results:** The findings reveal significant workplace inequality faced by LGBTQ+ individuals in Jakarta. Compared to their heterosexual counterparts, LGBTQ+ employees experienced a 28% higher likelihood of unemployment and were 37% less likely to hold top leadership positions. Moreover, LGBTQ+ individuals encountered a wage penalty of approximately 25% when compared to their heterosexual counterparts. These disparities in employment and career advancement contribute to elevated levels of job stress and decreased job satisfaction among LGBTQ+ employees in Jakarta. Notably, LGBTQ+ individuals reported a 40% higher prevalence of mental health issues linked to workplace discrimination and marginalization.

**Conclusions:** LGBTQ+ individuals in Jakarta face workplace inequality, including unemployment, limited career growth, and lower wages, leading to stress, dissatisfaction, and mental health issues. Urgent action is needed to eliminate bias and discrimination. Inclusive policies, LGBTQ+ affirmative workplaces, and diversity training improve well-being. A safe and equitable work environment is essential for a thriving Jakarta workplace.

**Keywords:** Workplace inequality; LGBTQ+; Jakarta; Occupational health outcomes; Discrimination

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-03-07

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Are farmers a risk occupation for cardio-cerebrovascular diseases? A scoping review on the cardio-cerebrovascular disease risk factors in farmers

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**Background:** In the society of the Republic of Korea (ROK), cardio-cerebrovascular disease (CCVD) is recognized as an occupational disease. In 2021, about 27% of occupational disease insurance payments under the Industrial Accident Compensation Insurance Act were used for CCVDs. However, due to the nature of insurance for farmers, CCVD is not recognized as an occupational disease as an occupational disease in farmers.

**Methods:** Through a literature review, risk factors for CCVDs that farmers may be exposed to were described. We investigated the differences between Farmers' Safety Insurance and Industrial Accident Compensation Insurance Act in the ROK.

**Results:** The risk factors for CCVD in farmers through literature review were as follows: long working hours, night shift work, lack of holidays, high physical burden, physical factors (noise, cold, high temperature, humidity, vibration), hazardous gas (diesel exhaust, carbon monoxide, hydrogen sulfide, carbon disulfide, nitrogen oxides, polycyclic aromatic hydrocarbons), pesticides, dust (particulate matter, silica, organic dust), hypoxic environment, job-related stress. In addition, due to the social characteristics of rural areas, medically vulnerable areas and social isolation can also be risk factors. Farmers are exposed to various harmful factors, but unlike the Industrial Accident Compensation Insurance Act, CCVDs are not compensated for by Farmer Safety Insurance.

**Conclusions:** According to the International Labor Organization, agriculture is one of the top three hazardous occupations, along with construction and mining. The government must create an environment where farmers can work with peace of mind through a more advanced insurance safety net.

**Keywords:** Agriculture; Heart diseases; Insurance; Stroke

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
 eISSN 2052-4374

## Determination of serum ferritin levels in Mongolian miners and its correlation to liver function

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**Background:** Serum ferritin is particular importance for the pathogenesis of unexplained hepatitis. Mongolia has the highest prevalence of hepatitis and viral infections caused by cancer worldwide. Miners are at a high risk of exposure to heavy metal poisoning due to the unique nature of their occupations such as crushing, beneficiation, and extraction of alluvial deposits, which affects ferritin levels and can happen liver disease. The aim of the study is to determine ferritin levels and compare them by gender as well as to study of serum ferritin level and liver function of viral hepatitis.

**Methods:** "Erdenet Medical" affiliated to "Erdenet Mining Corporation" conducted a cross sectional study (610 male and 290 female) clients of working age who underwent preventive examination. The normal level of ferritin was calculated as 64–434 ng/mL for men, 9–159 ng/mL for women under the age of 45, and 24–278 ng/mL for women over the age of 45, and statistical processing was done using the SPSS ver. 23.

**Results:** The average age of the subjects was 47.2 ( $\pm$  10.9) years and the average serum ferritin level was 339.18 ng/mL. Among all participants, 32.7% (233 males, 62 females) had high serum ferritin levels. In this group, serum ferritin and laboratory parameters were compared by gender. Liver virus infection is correlated with serum ferritin ( $r=0.07$ ;  $p < 0.05$ ), gamma glutamyl transferase ( $r=0.086$ ;  $p < 0.05$ ), hemoglobin ( $r=0.082$ ;  $p < 0.05$ ), aspartate aminotransferase ( $r=0.29$ ;  $p < 0.001$ ), alanine aminotransferase ( $r=0.25$ ;  $p < 0.001$ ) levels. Especially in the case of co-infection with hepatitis B virus and hepatitis C virus, liver cell damage and serum ferritin levels were high.

**Conclusions:** Serum levels of ferritin, iron, red blood cell, hemoglobin, and transaminase are greater in males ( $p < 0.001$ ). Liver virus infection is associated with liver injury and increased serum ferritin ( $p < 0.001$ ). Serum ferritin levels and laboratory parameters were compared by gender. Serum ferritin levels and laboratory parameters were compared by gender.

**Keywords:** Serum ferritin; Miners; Mongolia

	Female n=62	Male n=233	P value
Ferritin (ng/ml)	439.82 (181.88)	723.71 (249.07)	0.000**
RBC ( $10^9/\mu\text{l}$ )	4.66 (0.26)	5.18 (0.39)	0.000**
HGB (g/L)	138.35 (6.76)	157.39 (9.95)	0.000**
Iron ( $\mu\text{mol/L}$ )	15.87 (4.89)	18.85 (6.64)	0.002*
GGT (u/L)	53.9 (57.69)	75.67 (64.1)	0.000**
ALT (u/L)	38.17 (39.69)	60.81 (146.42)	0.000**
AST (u/L)	28.7 (29.11)	40.02 (103.35)	0.011*
ALP (u/L)	100.62 (34.17)	106.37(53.26)	0.24
LDH (u/L)	201.75 (48.6)	188.42 (49.0)	0.006*

Description: \*\*P<0.001, \*P<0.05, Mean (St.D)

Fig. 1. Compared by gender

	HCV (n=77)	HBV (n=104)	HCV+HBV (n=9)	P value
Ferritin (ng/ml)	284.24(269.86)	423.63(298.87)	372.08(328.82)	0.001**
RBC ( $10^9/\mu\text{l}$ )	4.93(0.43)	5.00(0.48)	4.96(0.30)	0.56
HGB (g/L)	146.73(12.12)	152.9(14.65)	148.33(12.8)	0.000**
Iron ( $\mu\text{mol/L}$ )	15.76(4.82)	20.56(7.64)	17.28(9.1)	0.000**
T.bil ( $\mu\text{mol/L}$ )	13.31(7.33)	14.86(7.3)	13.85(9.27)	0.005*
GGT (u/L)	51.01(65.62)	58.49(52.45)	53.0(50.5)	0.03*
ALT (u/L)	32.91(33.84)	62.79(56.47)	62.44 (69.93)	0.000**
AST (u/L)	27.01(22.75)	41.37(30.82)	55.66 (60.05)	0.000**
ALP (u/L)	100.84(37.98)	107.36(36.95)	109.66(18.96)	0.017*
LDH (u/L)	193.52(37.83)	194.51(49.05)	242.0(131.34)	0.001**

Description: \*\*P<0.001, \*P<0.05, Mean (St.deviation)

Fig. 2. Liver virus infection and laboratory references



## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Effects of exposure to multiple heavy metals on renal tubular damage markers in Janghang refineries: Bayesian kernel machine regression analysis

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**Background:** Exposure to cadmium (Cd), arsenic (As), and mercury (Hg) is known to be associated with renal tubular damage, and residents living near the refinery had higher urinary Cd, As, and Hg levels compared to the control group. This study was performed to investigate the joint association of urinary As, Cd, and Hg with the level of renal damage markers in residents living near smelter plant.

**Methods:** Study subjects were 871 residents living near the Janghang refinery plant and control area in R. of Korea. Concentrations of urinary Cd, As and Hg as well as N-acetyl- $\beta$ -D-glucosaminidase (NAG) activity and  $\beta$ 2-microglobulin ( $\beta$ 2-MG) were measured. The joint effects of Cd, As, and Hg on renal tubular damage markers were evaluated using the Bayesian kernel machine regression (BKMR) model and compared with linear regression results. The BKMR model was compared by stratified analysis into the exposed group and the control group.

**Results:** In linear regression, just only Cd concentration showed significant association with urinary NAG level ( $\beta = 0.447, p < 0.05$ ). In the BKMR model, urinary Cd and Hg were significantly associated with NAG level. The joint effect of the 3 heavy metals (Cd, Hg, and As) was found to be statistically significant in relation to urinary NAG level. This effect was higher in exposed group than in control group. On the other hand, no relationship was observed between exposure concentrations of the three heavy metals and urinary  $\beta$ 2-MG.

**Conclusions:** These results suggest that BKMR can be one of the very useful methods for assessing the health effects of vulnerable residents exposed to heavy metals. Further evaluation should be paid to the health effects of multiple exposure to heavy metals.

**Keywords:** Refinery; Heavy metals; Renal tubular damage; BKMR analysis

**Table 1.** Demographic characteristics of study participants

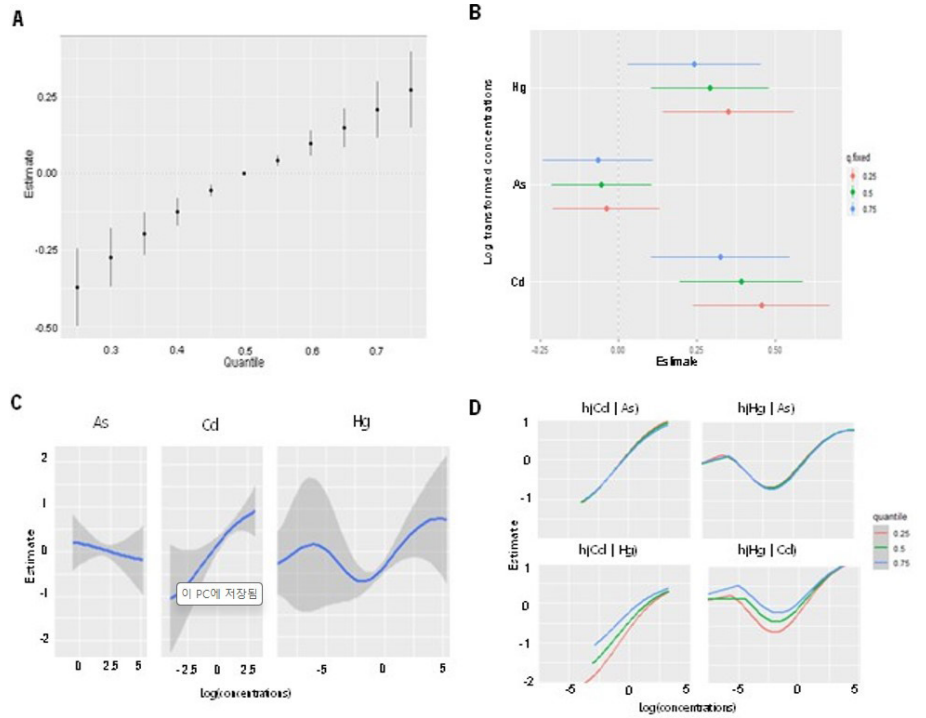
	Total (n = 871)	Exposed group (n = 498)	Control group (n = 373)
Sex			
Male	360 (41.33)	217 (43.57)	143 (38.34)
Female	511 (58.67)	281 (56.43)	230 (61.66)
Smoking status			
Non-smoker	739 (84.85)	413 (82.93)	326 (87.40)
Smoker	132 (15.15)	85 (17.07)	47 (12.60)
Drinking status			
Non-drinker	443 (50.86)	243 (48.80)	200 (53.62)
Drinker	428 (49.14)	255 (51.20)	173 (46.38)
Economic status			
High	177 (20.32)	126 (25.30)	51 (13.67)
Low	694 (79.68)	372 (74.70)	322 (86.33)
Age	64.14 ± 11.42	63.12 ± 11.33	65.51 ± 11.42
Urinary As	8.01 (1.87)	8.35 (1.87)	7.57 (1.88)
Urinary Cd	2.02 (2.50)	2.51 (2.33)	1.50 (2.53)
Urinary Hg	0.46 (6.11)	0.51 (5.54)	0.39 (6.85)
NAG	2.55 (5.14)	2.83 (4.45)	2.23 (6.08)
β2-MG	0.02 (12.22)	0.02 (11.88)	0.02 (12.71)

As: arsenic; Cd: cadmium; Hg: mercury; NAG: N-acetyl-β-D-glucosaminidase; β2-MG: β2-microglobulin.

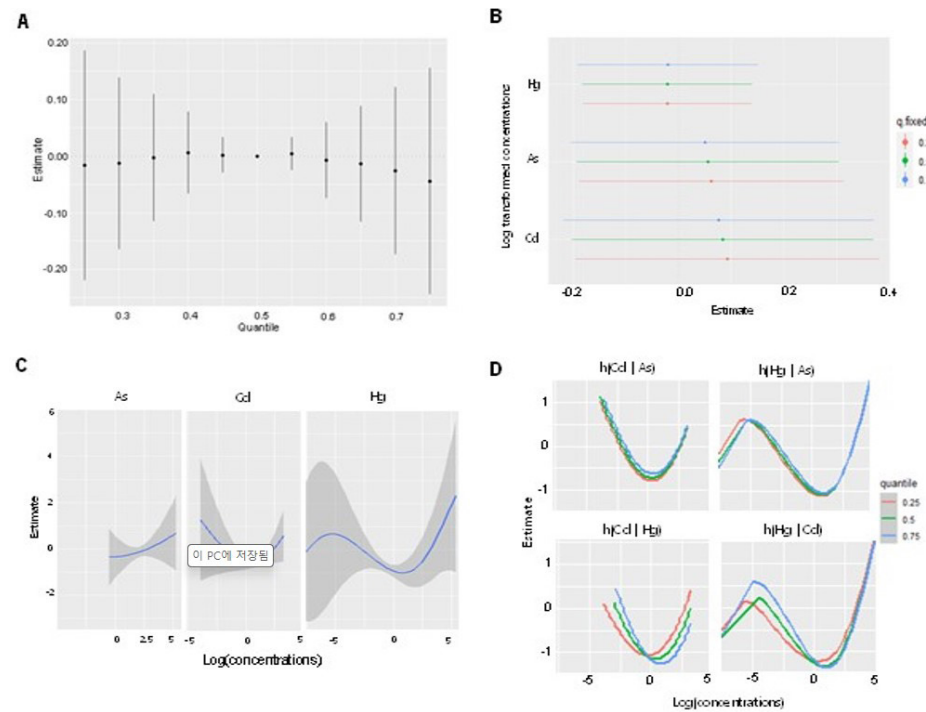
**Table 2.** Association of urinary As, Cd, and Hg with renal damage biomarkers

	β (95% CI)	
	NAG	β2-MG
<b>Total</b>		
As	-0.053 (-0.271, 0.165)	0.098 (-0.266, 0.463)
Cd	0.447 (0.290, 0.603)	0.061 (-0.199, 0.323)
Hg	-0.002 (-0.065, 0.062)	-0.265 (-0.133, 0.080)
<b>Exposed group</b>		
As	0.048 (-0.215, 0.310)	0.184 (-0.303, 0.671)
Cd	0.458 (0.255, 0.661)	-0.010 (-0.388, 0.367)
Hg	0.016 (-0.062, 0.063)	-0.027 (-0.171, 0.118)
<b>Control group</b>		
As	-0.118 (-0.493, 0.257)	0.044 (-0.522, 0.609)
Cd	0.358 (0.062, 0.654)	0.072 (-0.374, 0.518)
Hg	-0.010 (-0.114, 0.095)	-0.014 (-0.172, 0.144)

As: arsenic; Cd: cadmium; Hg: mercury; CI: confidence interval; NAG: N-acetyl-β-D-glucosaminidase; β2-MG: β2-microglobulin.



**Fig. 1.** The combined effect of the heavy metals on urine NAG concentration using the BKMR model. NAG: N-acetyl-β-D-glucosaminidase; BKMR: Bayesian kernel machine regression; As: arsenic; Cd: cadmium; Hg: mercury.



**Fig. 2.** The combined effect of exposure to the mixture of the metals on urinary β2-MG concentration using the BKMR model. β2-MG: β2-microglobulin; BKMR: Bayesian kernel machine regression; As: arsenic; Cd: cadmium; Hg: mercury.

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-03  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

### Prevalence of dyslipidemia among mining company workers in Mongolia

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**Background:** Miners are at high risk for dyslipidemia due to poor lifestyle due to abnormal working conditions, night work and shiftwork. Elevated blood cholesterol is recognized as an important risk factor for developing coronary heart disease. Cardiovascular diseases are the leading cause of death among Mongolians, and life expectancy for men is 10 years lower than for women. The aim of the study is to detect and compare by gender dyslipidemia among concentration plant workers who work in abnormal working conditions.

**Methods:** A cross-sectional study of lipid profiles was conducted based on the findings of the preventative examination of 887 employees (615 males and 272 females) of the concentration factory between July 2022 and December 2023 at Erdenet Medical Hospital. Dyslipidemia was determined by serum lipid levels. According to Mongolian guidelines for dyslipidemia, total cholesterol (TC) < 5.2, triglycerides (TGs) < 2.3, high-density lipoprotein cholesterol (HDL-C) < 1.0 and low-density lipoprotein cholesterol (LDL-C) < 3.4 were considered abnormal. The data was analyzed in SPSS version 25.0.

**Results:** The mean age of patients was  $42.33 \pm 8.60$  years. Mean levels of TC, TGs, and LDL-C were higher in males (TC:  $5.16 \pm 0.97$ , TG:  $1.51 \pm 1.34$ , and LDL-C:  $3.11 \pm 0.81$  mmol/L) compared to females (TC:  $4.77 \pm 0.87$ , TG:  $1.01 \pm 0.6$ , and LDL-C:  $2.75 \pm 0.78$  mmol/L), while HDL-C was higher in women ( $1.55 \pm 0.28$  mmol/L) than in men ( $1.35 \pm 0.26$  mmol/L) ( $p < 0.0001$ ). Additionally, 74.90% of participants had a high TC level, 7.9% had a low HDL-C level, 71.1% had a high LDL-C level, and 20.4% had a high TG level.

**Conclusions:** There was a high level of TC and LDL among miners. Men had a higher prevalence of dyslipidemia.

**Keywords:** Mongolia; Dyslipidemia; Miners; Shiftwork

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## The proportion comparison of insulin resistance correlation based on blood lead level: a cross sectional study on lead exposed workers in Java, Indonesia

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**Background:** Many studies results showed that chronic lead exposure causes an endocrine disruption among other is the insulin resistance. This study is aimed at exploring the insulin resistance abnormality proportion among the lead exposed workers in Java Indonesia.

**Methods:** A total of 68 informal sector workers were consecutively selected from 3 regions in Java. Fasting venous blood samples were collected and analyzed for homeostasis model assessment of insulin resistance (HOMA-IR) using Elecsys Insulin Analyzer and the blood lead levels (BLLs) using inductively coupled plasma mass spectrometry. HOMA-IR of > 2.9 is classified as insulin resistance. We divide HOMA-IR index into  $\leq 2.9$  as non-insulin resistance and  $> 2.9$  as insulin resistance group.  $\chi^2$  analysis is used to see the proportion difference between insulin resistance event with the group of BLL (BLL  $\leq 10$   $\mu\text{g/dL}$  and  $> 10$   $\mu\text{g/dL}$ ).

**Results:** This study shows a statistically significant higher proportion of insulin resistance event (29.5%) on groups with BLL  $< 10$   $\mu\text{g/dL}$  compared (8.3%) to BLL  $> 10$   $\mu\text{g/dL}$  ( $p = 0.044$ ).

**Conclusions:** This study found that the proportion of Insulin resistance was higher in the lower BLL group than its proportion in the higher BLL group. The further study to explore the other risk factors of insulin resistance among lead exposure workers is necessary.

**Keywords:** Blood lead level; Lead exposure; Insulin resistance; HOMA-IR

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Epidemiology of work-related injuries and occupational diseases and its relationship with workplace health and safety culture among hospital food service workers in a tertiary hospital in Singapore

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**Background:** The prevalence of workplace safety and health (WSH) issues in hospital food service workers is not well studied, with most published studies focusing on food service workers in restaurants and food stalls. To describe the epidemiology of work-related injuries and occupational diseases among food services workers in a tertiary hospital and investigate the hypothesis that a strong WSH culture reduces the prevalence of workplace injuries and occupational diseases.

**Methods:** A cross-sectional self-administered questionnaire was distributed to all food service workers employed at a tertiary hospital in Singapore. The study incorporated validated questionnaires such as the Nordic Musculoskeletal Questionnaire and a locally developed questionnaire to assess WSH culture.

**Results:** The response rate was 96% (n = 122). The overall prevalence of workplace injuries and musculoskeletal symptoms was 35% (n = 43) and 53% (n = 65), respectively. The most common workplace injuries were cuts/lacerations (35.8%), muscle strain (25.4%) and burns (19.4%). The prevalence of workplace injuries among staff performing food preparation duties was higher at 56.3% as compared to 21.6% among staff with no food preparation duties ( $p < 0.01$ ). The prevalence of workplace injuries of staff performing cooking duties was also higher at 47.5%, compared to 29.3% among staff with no cooking duties ( $p = 0.048$ ). Staff performing food preparation duties had a higher prevalence of musculoskeletal symptoms at 66.7% as compared to 44.6% among staff with no food preparation duties ( $p = 0.017$ ). The mean WSH culture scores for staff who suffered a workplace injury was lower than that of staff who did not have a history of workplace injury, however the difference was not statistically significant ( $p = 0.19$ ).

**Conclusions:** Food service workers with job demands involving cooking and preparation of food are at higher risk of workplace injuries and musculoskeletal diseases. Targeted interventions should be implemented to mitigate these risks.

**Keywords:** Hospital; Food service workers; Workplace injury; Occupational disease; Workplace safety and health culture

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Generation of nano-sized particles by the characteristics of the working environment in welding workplaces

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**Background:** Exposure to nano-sized particle welding fumes is a known risk factor for cardiovascular disease. Workers exposed to nano-sized particles at work are expected to be at increased risk of cardiovascular disease, but measurement data on occupational nano-sized particle exposure are lacking. The purpose of this study was to characterize the occurrence and concentration of welding fumes generated during actual welding in workers exposed to nano-sized particles.

**Methods:** A particle aerosol spectrometer (11-A; Grimm GmbH) was used to measure nano-sized particles in real-time next to workers performing welding tasks in 2 welding workshops where nano-sized particles is generated, and measurements were taken at 1-min intervals during working hours.

**Results:** At workplace A, there was a local exhaust ventilation system, but it was damaged and not functioning properly, which may have increased workers' exposure. The average concentration of PM10 was 238.9  $\mu\text{g}/\text{m}^3$ , the average concentration of PM2.5 was 172.9  $\mu\text{g}/\text{m}^3$ , and the average concentration of PM1.0 was 138.3  $\mu\text{g}/\text{m}^3$ . The highest concentrations of PM10, PM2.5, and PM1.0 were 1,041.7  $\mu\text{g}/\text{m}^3$ , 902.7  $\mu\text{g}/\text{m}^3$ , and 580.0  $\mu\text{g}/\text{m}^3$  during working hours. Local exhaust ventilation systems were installed in workplace B, and it was relatively well managed. The average concentration of PM10 was 84.0  $\mu\text{g}/\text{m}^3$ , the average concentration of PM2.5 was 60.0  $\mu\text{g}/\text{m}^3$ , and the average concentration of PM1.0 was 49.6  $\mu\text{g}/\text{m}^3$ . The peak concentrations of PM10, PM2.5, and PM1.0 were 327.4  $\mu\text{g}/\text{m}^3$ , 211.1  $\mu\text{g}/\text{m}^3$ , and 200.8  $\mu\text{g}/\text{m}^3$  during working hours.

**Conclusions:** We have shown that welding industry workers can be exposed to nano-sized particles, so further research is needed to determine if inflammatory response markers can be selected for welding workers as a basis for analyzing the correlation between exposure levels and inflammatory response markers.

**Keywords:** Nano-sized particles; Welding; Exposure; Local exhaust ventilation

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-07

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## **Don't brush it off: musculoskeletal disorder (MSD) symptoms amongst dentists in a tertiary dental centre in Singapore**

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**Background:** Musculoskeletal disorder (MSD) symptoms not only have significant effects on an individual's physical and psychosocial health, but also negatively impact productivity and quality of care rendered. Studies have shown increased prevalence of MSD symptoms amongst dentists. As such, there is a pressing need to protect the health of dentists to maintain the strength of the workforce. The study aims to ascertain the 1) prevalence of MSD symptoms, 2) factors associated with symptoms, and 3) severity and impact of symptoms amongst dentists working in a tertiary dental centre in Singapore.

**Methods:** A cross-sectional questionnaire survey was administered to full-time dentists working in a tertiary dental centre in Singapore. The questionnaire used the Standardized Nordic Questionnaire (SNQ), Work Ability Index (WAI), and the Perceived Stress Score (PSS). Workplace assessments were also undertaken to identify ergonomic hazards and co-relate the questionnaire findings.

**Results:** The 98.1% of the study participants experienced MSD symptoms over at least one body region in the past 12 months whilst 47.1% experienced symptoms in the past 7 days. The neck region was commonly affected, followed by the shoulder and the lower back. Higher proportion of dentists who worked more than 10 hours of clinic per week reported MSD symptoms ( $p < 0.05$ ). Sustained awkward posture, poor ergonomic workstation and lack of regular breaks were the main risk factors identified during workplace assessments. Furthermore, of those who reported MSD symptoms, only 17.1% saw a physician. Those who had seen a physician for MSD symptoms had significantly higher pain score and lower WAI ( $p < 0.05$ ).

**Conclusions:** The high prevalence of MSD symptoms amongst dental specialists in tertiary dental centre can likely be attributed to the ergonomic hazards identified during workplace visits and is compounded by the fact that the dentists do not seek treatment early. There is a need for targeted ergonomic interventions and for a MSD surveillance system so as to prevent the progression of MSD amongst dentists.

**Keywords:** Musculoskeletal Disorder; Workplace assessment; Dentists



## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-08  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Impact of the COVID-19 pandemic on the mental health of Vietnamese healthcare workers and associated factors

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**Background:** Coronavirus disease 2019 (COVID-19) has resulted in unprecedented morbidity, mortality, and health system crisis leading to significant psychological distress among healthcare workers (HCWs). The primary goal of this cross-sectional study was to determine the psychological effects of COVID-19 on HCWs and factors associated with this issue in order to provide appropriate recommendations to support the mental health status of HCWs.

**Methods:** HCWs working in hospitals/preventive health facilities in Ho Chi Minh City, Vietnam, during the first wave of the COVID-19 pandemic (April 2020) were asked to complete a structured questionnaire through face-to-face interviews. Symptoms of post-traumatic distress (PTSD) were assessed using the Impact of Event Scale (IES-R). Socio-demographic and job-related characteristics were also collected. A multivariable logistic regression analysis was performed to identify factors associated with PTSD.

**Results:** A total of 448 HCWs participated in this study. The most significant percentage of respondents were female (67.2%), between the ages of 18 and 34 years (44.3%), nurses (58.7%), worked at treatment facilities (hospitals) (66.7%), and had worked for more than 10 years (44.4%). Most study participants had a risk of exposure to COVID-19 daily/several times per week (60.9%) and had good knowledge about COVID-19. Overall, 14.7% of survey respondents developed possible PTSD during the COVID-19 pandemic in 2020. Multivariable logistic regression analysis showed that HCWs who had daily/several times per week contact with someone who had COVID-19 (odds ratio [OR]: 2.55; 95% confidence interval [CI]: 1.05–6.17) and did not have good knowledge about the disease prognosis (OR: 2.69; 95% CI: 1.27–5.70) were at increased risk for possible PTSD compared with who did not know about contact history and who had good knowledge, respectively.

**Conclusions:** The results of this study reinforce the need to implement interventions to improve the mental health status of HCWs who work in pandemic situations.

**Keywords:** COVID-19; Mental health; Vietnamese; Healthcare workers; Associated factors

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-09

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

### Cancer cluster in a waterproof material factory in Taiwan

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In a waterproof material factory in Taiwan, a case of bladder cancer linked to 4,4'-methylenebis(2-chloroaniline) (MOCA) exposure was identified. The worker worked in the factory which produce epoxy resin-based adhesives, acid alkali resistant coatings, and polyurethane waterproof coatings for more than 20 years. For the most time, the worker was responsible for polyurethane waterproof materials manufacturing. MOCA has to be used and was heated to manufacture a polyurethane elastomer. The worker was not wearing any gloves, safety glasses or respirator. In the polyurethane manufacturing process, the melting MOCA was then mixed with other plasticizers. Then he added calcium carbonate with stirring. The plasticizers include Cereclor S52, chlorinated paraffin, polymer polyols, di-(2-propyl heptyl) phthalate, epoxy resin, and polyether polyol, etc. Titanium dioxide, black, yellow and green dyes were also used sometimes. During the whole process, there was an odor that smells like burning plastic. At the work site, there was no ventilation equipment, and the air around there was much hotter than room temperature. The worker had the risk of contact with or exposure to MOCA with mist or aerosol form during the mixing. Absorption in the respiratory tract is important. Chemical splash can penetrate the body through the skin, and the hot weather and increased skin temperatures can result in increased skin absorption rate. There are 6 workers in this factory, among them there were 3 persons who had cancer and all of them worked more than 20 years. The other 3 workers only worked for less than 10 years in this factory. Besides the case of bladder cancer, the other 2 had lymphoma and breast cancer in recent 2 years. But until now, we only linked the relationship between bladder cancer and MOCA. We still need to investigate suspected cancer cluster in this waterproof material factory.

**Keywords:** MOCA; Waterproof; Bladder cancer; Cancer cluster

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-10  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Association between the safety climate and occupational injury among Korean working population: a cross-sectional study

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**Background:** Preventing occupational injury has been an important challenge in Korean society. In order to prevent occupational injury, in addition to legal regulation, a safety culture should be improved in the workplace so that all working process is safely carried out. Safety climate can reflect one of the most important features of safety culture, and safety climate is closely related to workplace safety. Yet, the role of safety climate in preventing occupational injury has not been sufficiently elucidated in Korea. Therefore, this study investigates the relationship between perceived safety climate and occupational injury among the general Korean working population.

**Methods:** A total of 5,512 (jm1) people were surveyed. The safety climate was also measured by 5 questions: providing necessary information on safety, following safety rules under tight schedules, employees' involvement in decision-making regarding safety, mutual help for safe work, and neglecting minor accidents. A poor safety climate can be determined when individuals report two or more safety-related concerns on questionnaires. The association between safety climate and occupational injury was examined by logistic regression analysis.

**Results:** Out of 5,512 study participants, 77 people experienced occupational injuries within 12 months. Study participants with an occupational injury within a year were likelier to report poor workplace safety culture. The association between occupational injuries and poor safety climate was significant even after adjusting confounders. In particular, the items not encouraging employees to follow safety rules when their working schedule is tight and not helping each other to work safely were associated with occupational injuries.

**Conclusions:** Unfavorable safety climate was linked to occupational injury among the Korean working population. Promoting a safe climate and improving a safety culture may reduce occupational injuries in Korea.

**Keywords:** Safety climate; Occupational injury; Korean working population; Safety culture

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-04-11  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Association of sleep problems and early turnover in newly employed female nurses

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**Background:** In the medical system, the problem of nurse turnover causes great social concern. The average annual nurse turnover rate in Korea in 2018 was 13.9%. Many nurses experience a number of health problems, including sleep problems, due to irregular shift work and excessive work demands. In this study we aim to investigate the association between sleep problems and early turnover of newly employed nurses at a university hospital.

**Methods:** This study used health checkup data of 319 new female nurses hired from March 2020 to February 2021. Data were collected twice, before the start of the work and 6 months after the start of the work. Emergency room was defined as the case of voluntary resignation within 6 months of starting work. To investigate association between sleep problems, perceived stress, and early turnover, logistic regression model was used.

**Results:** We observed that the risk of early turnover was significantly increased in nurses with poor sleep quality ( $p < 0.05$ ). Poor sleep quality was found to be associated with early turnover in new nurses. Sleep quality could be used to predict and manage turnover in nurses.

**Conclusions:** It is necessary to manage health problems at an early stage so that nurses do not leave the medical field.

**Keywords:** Sleep problem; Early turnover; Sleep quality; Nurse

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-05-01  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Mental health in junior doctors: a systematic review and study on its implications on personal wellbeing and patient safety

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**Background:** The discussion of physician health surrounding the psychological well-being of junior doctors is a topic that is gaining traction worldwide. The varied duties of a typical junior doctor, including clinical practice and rigorous training, bear psychological burden for a budding clinician which in turn has an impact on patient care. This study examines the protective and risk factors for burnout and mental health outcomes within the junior doctor community, and how this eventually affects the personal wellbeing and patient safety.

**Methods:** Searches were performed on PubMed and PsycINFO in April 2023. Studies that did not include validated scales of measure for mental health outcomes or had unclear outcomes were excluded. Quality assessment was carried out via the Newcastle–Ottawa Scale. This is in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

**Results:** We included 85 studies out of the 4,157 identified. Common mental health outcomes reported include burnout, depression, and suicidal ideation. Protective factors include high resilience, emotional quotient, mindfulness, and gratitude. Important contributing factors include excessive workload or administrative duties, long working hours, and lack of structured breaks, autonomy, or development opportunities. These outcomes were shown to affect social skills and result in conflicts of personal and professional life. In terms of patient safety, a significant increase in self-reported error rate is found in junior doctors with burnout and depression, with one study highlighting association of depression with increased harmful preventable adverse events. Furthermore, burnout individuals reported lower empathy scores and poorer communication, impacting patient care.

**Conclusions:** There is thus a strong impetus to examine the psychological burden on new clinicians so that meaningful advancement in hospital management and policymaking can take place in addressing the root causes, which may in turn lead to better physician health and patient care.

**Keywords:** Mental health; Junior doctors; Patient safety; Personal wellbeing; Occupational health

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-05-02  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Association between occupational exposure to hazards and depression in the Republic of Korea Navy

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**Background:** The Navy is an occupational group that is vulnerable to depression due to its specialized mission environments such as ships and submarines, but there are no relevant studies in Korea. Therefore, this study aims to identify occupational hazards that significantly affect depression among the members of the Republic of Korea Navy (ROK Navy) for the first time.

**Methods:** A questionnaire-based survey was conducted among naval officers and military personnel at Jinhae Naval Base in 2021. In addition to personal and occupational characteristics, the survey assessed exposure to noise, vibration, high and low temperatures, solvent vapors, and chemicals during the workday. A depression scale was utilized in the survey, with depression being measured using the Patient Health Questionnaire-9. After dividing the subjects into depressed and non-depressed groups,  $\chi^2$  tests were employed to examine the distribution of each characteristic. Multiple logistic regression analysis was used to explore the association between each occupational exposure and depression, calculating odds ratios and 95% confidence intervals. Additionally, we analyzed the association between the number of exposures and depression.

**Results:** The final number of subjects was 1,175, with 59 (5.0%) in the depressed group. In the adjusted model, individuals who were exposed to high temperatures (odds ratio [OR]: 2.38; 95% confidence interval [CI]: 1.00–5.64), low temperatures (OR: 3.52; 95% CI: 1.52–8.11), vapors of solvent (OR: 4.42; 95% CI: 1.97–9.95), and chemical products (OR: 3.55; 95% CI: 1.57–8.04) for more than half of their working hours showed significantly higher ORs for depression. In addition, exposure to three or more hazards was associated with a 3.24 times higher odds ratio for depression.

**Conclusions:** To alleviate depression in Navy personnel, it is important to minimize prolonged exposure to hot or cold environments while on duty and provide proper protective gear when working with organic solvents or chemicals. Special attention should be given to Navy personnel who are exposed to multiple hazards.

**Keywords:** ROK Navy; Depression; Occupational factor; Low temperature; Organic solvents

Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-05-03  
 https://doi.org/10.35371/aoem.2023.35.Supplement  
 eISSN 2052-4374

# Individual interventions to reduce burnout in resident physicians: a systematic review and meta-analysis

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**Background:** A high proportion of resident physicians in training experienced burnout. Many training centers have begun to implement individual interventions aimed at reducing burnout. However, empirical evidence should be obtained before implementing such programs. To assess the mean difference of each domain in the 22-item Maslach Burnout Inventory after individual interventions targeted at preventing burnout in resident physicians.

**Methods:** Five databases: PubMed, Scopus, ScienceDirect, Embase, and Cochrane Library were searched from 3 to 19 December 2022. Full-text, published controlled trials of individual intervention targeted at burnout, conducted in resident physicians, measured with the 22-item Maslach Burnout Inventory (emotional exhaustion, depersonalization, and personal accomplishment) in any language and publication date. Preferred Reporting Items for Systematic Reviews and Meta-Analyses statements were used to elaborate the study selection process. Study recruitment was done by 2 investigators followed by pre-specified subgroup and sensitivity analyses. The random-effect model performed all analyses with quantification of heterogeneity included.

**Results:** Fourteen studies were eligible (n = 460), consisting of 9 (64.3%) individual intervention studies. Mean differences of individual intervention vs. control were an emotional exhaustion score of -4.24, 95% confidence interval (CI): -6.56, -1.92,  $p < 0.001$ ,  $I^2 = 51.71\%$ , and a personal accomplishment score of 2.27, 95% CI: 1.06, 3.49,  $p < 0.001$ ,  $I^2 = 31.86\%$ . Leave-one-out sensitivity analyses are robust in all domains. Contributors to heterogeneity were the differences in intervention description and design.

**Conclusions:** In resident physicians, the individual intervention was significantly associated with decreased emotional exhaustion and increased personal accomplishment.

**Keywords:** Burnout; Resident physicians; Intervention; Coaching; Graduate medical education

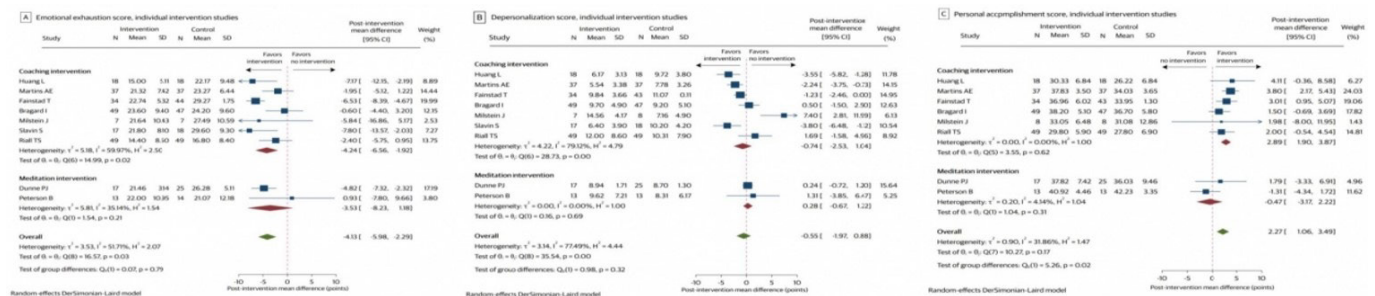


Fig. 1. Post-intervention mean score difference in individual intervention. SD: standard deviation, CI: confidence interval.

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## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-05-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
 eISSN 2052-4374

## Treatment status of psychiatric disorders and falls in the workplace among Japanese workers: a longitudinal study

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**Background:** In Japan, the most common injury requiring sick leave is a fall in the workplace; therefore, it is very important to prevent falls. Most measures to prevent falls involve aspects of the workplace environment and safety. However, few measures consider the perspective of individual health. We investigated the relationship between psychiatric disorders and falls in the workplace and whether treatment status for a psychiatric disorder is associated with workplace falls.

**Methods:** We conducted a longitudinal study among workers aged 20 years or older in Japan from 2022 to 2023. In total, the data of 16,629 participants were analyzed. We used a questionnaire to query participants' status of treatment for any psychiatric disorder and whether they had experienced a fall in the workplace. The association between treatment for a psychiatric disorder and workplace falls was examined using logistic regression analysis.

**Results:** Compared with participants receiving appropriate treatment for a psychiatric disorder, the odds ratio of a workplace fall was significantly lower among participants who did not require treatment for a psychiatric disorder at 0.59 (95% confidence interval [CI]: 0.48–0.72;  $p < 0.001$ ); the odds ratio of a workplace fall was significantly higher among participants whose treatment for a psychiatric disorder was interrupted, at 1.39 (95% CI: 1.05–1.83;  $p = 0.02$ ), after adjusting for age, sex, household income, number of workplace employees, sleeping hours, and exercise habits.

**Conclusions:** Our findings suggest that receiving appropriate treatment for psychiatric disorders may contribute to preventing falls in the workplace.

**Keywords:** Falls; Psychiatric disorder; Treatment; Workplace

**Table 1.** Association between the status of psychiatric treatment and falls in the workplace

	Age-sex adjusted				multivariate*			
	OR	95%CI	p value	OR	95%CI	p value	p value	
Status of psychiatric								
No need to	0.57	0.47	0.69	<0.001	0.59	0.48	0.72	<0.001
Treatment   reference					reference			
Interrupt of	1.39	1.07	1.80	0.013	1.39	1.05	1.83	0.02

A multilevel logistic model was used nested by industry.

OR: odds ratio, CI: confidence interval.

\*Adjusted for age, sex, household income, number of workplace employees, sleeping hours and exercise.



## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-05-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Occupational future time perspective mediates the association of perceived organizational support with work engagement and learning motivation

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**Background:** In developed countries, the retirement age is being extended due to rapid technology development and the decline in the working-age population. This makes it necessary to improve both work engagement (WE) and learning motivation among older workers. It has been found that there is a positive relationship between age and WE, but emotional regulation mediates the relationship, and learning motivation declines with age. The occupational future time perspective (OFTP), which is based on lifespan development psychology, has been found to be positively correlated with both WE and learning motivation. Perceived organizational support (POS) has been found to be positively related to WE and learning motivation. Therefore, we examined the mediating effects of subscales of OFTP on the relationship between POS and WE and learning goal orientation (LGO) among older workers.

**Methods:** An online survey company was commissioned to conduct a questionnaire survey of workers aged 20 years and older. Of the total participants, 1,043 persons aged 45 years or older were analyzed. Variables were the subscales of OFTP; focus on opportunities (FOO) and perceived remaining time (PRT), POS defined as “a generalized perception developed by employees concerning the extent to which the organization values their contributions and cares about their well-being,” WE, LGO, and some demographic factors.

**Results:** Multiple linear regression analysis showed that POS was significantly related to WE ( $\beta = 0.547, p < 0.01$ ) and LGO ( $\beta = 0.130, p < 0.01$ ). The coefficients on the relationship to WE decreased by adjusting for FOO ( $\beta = 0.366; p < 0.01$ ) or PRT ( $\beta = 0.422, p < 0.01$ ) and the relationship between POS and LGO was not significant after adjusting for FOO ( $\beta = 0.029, p = 0.057$ ).

**Conclusions:** Higher POS was associated with higher WE and LGO, but was strongly mediated by OFTP for LGO. The results suggest that improving OFTP through enhancing POS is important for older workers to maintain and improve both WE and learning motivation.

**Keywords:** Occupational future time perspectives; Perceived organizational support; Work engagement; Learning goal orientation; Older workers

**Table 1.** Linear multiple regression analysis of POS and subscales of occupational future time perspective toward “work engagement” among Japanese workers aged 45 and more

Variables	Model 1			Model 2			Model 3		
	Coefficient	SE	p value	Coefficient	SE	p value	Coefficient	SE	p value
Constant	-5.744	3.220	0.075	-15.260	3.070	<0.001	-14.955	3.162	<0.001
POS	0.547	0.035	<0.001	0.366	0.035	<0.001	0.422	0.035	<0.001
FOO				1.277	0.094	<0.001			
PRT							1.381	0.035	<0.001

Model 1: adjusted for sex, age, education, income, and job type.

Model 2: adjusted for sex, age, education, income, job type, and FOO.

Model 3: adjusted for sex, age, education, income, job type and PRT.

POS: perceived organizational support, FOO: focus on opportunities, PRT: perceived remaining time, SE: standard error.

**Table 2.** Linear multiple regression analysis of POS and subscales of occupational future time perspective toward “learning goal orientation” among Japanese workers aged 45 and more

Variables	Model 1			Model 2			Model 3		
	Coefficient	SE	p value	Coefficient	SE	p value	Coefficient	SE	p value
Constant	11.111	1.462	<0.001	5.779	1.334	<0.001	5.131	1.349	<0.001
POS	0.130	0.016	<0.001	0.029	0.015	0.057	0.049	0.015	<0.001
FOO				0.715	0.041	<0.001			
PRT							0.897	0.052	<0.001

Model 1: adjusted for sex, age, education, income, and job type.

Model 2: adjusted for sex, age, education, income, job type, and FOO.

Model 3: adjusted for sex, age, education, income, job type and PRT.

POS: perceived organizational support, FOO: focus on opportunities, PRT: perceived remaining time, SE: standard error.

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-05-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Association between occupational stress and sleep disturbance among Korean working population: a cross-sectional study

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**Background:** The present study aims to investigate the relationship between occupational stress and sleep disturbance among the general Korean working population.

**Methods:** The Survey was conducted on an online platform. Occupational stress was measured by KOSS (Korean Occupational Stress Scale). Sleep disturbance was assessed by Insomnia Severity Index (ISI), Pittsburgh Sleep Quality Index (PSQI), and Epworth Sleepiness Scale (ESS). The logistic regression analysis was employed to analyze the association between occupational stress and sleep disturbance.

**Results:** Hazardous physical working environment, high job demand, low social support, job insecurity, organizational injustice, effort-reward imbalance, and work-life imbalance were related to sleep disturbance.

**Conclusions:** This study observed the liking between job stress and sleep health among Korean workers. Improving psychosocial working conditions may contribute to promoting workers' sleep health.

**Keywords:** Job stress; Psychosocial working conditions; Insomnia; Sleep quality; Sleepiness

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-05-07  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Type-D personality trait and sleep quality as mediators of work stress-related depression among healthcare workers in Taiwan

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**Background:** There is evidence suggesting that work stress can have a negative impact on psychosocial health. However, the interaction between personality traits, work stress, sleep quality, and depressed mood remains unclear. This study aims to investigate the role of type D personality (distressed personality) in the pathways linking work-related stress, sleep quality, and depression among healthcare workers in a medical center in Kaohsiung, Taiwan.

**Methods:** In 2020, we recruited 555 healthcare workers with at least one year of seniority in a medical center in Kaohsiung, Taiwan. Information on distressed personality traits, work-related stress, sleep quality, and depression was collected using structured questionnaires: the self-reported type D Personality Scale, Burnout Inventory, Pittsburgh Sleep Quality Index (PSQI), and Center for Epidemiological Studies Depression (CES-D), respectively. Mediation analysis was conducted to examine the role of distressed personality and sleep quality in the associations between work-related stress and depression.

**Results:** The mean age of participants was  $37.9 \pm 7.8$  years and 87.5% were females. Subjects with type D personality traits had higher scores in the work-related Burnout Inventory, PSQI, and CES-D. After adjusting for individual characteristics, work-related stress was significantly associated with higher PSQI and CES-D scores ( $b = 0.067$  and  $b = 0.089$ , respectively). Type D personality traits and sleep quality mediated the relationship between work-related stress and depression, which accounted for 53.8% of the total effect.

**Conclusions:** Work-related stress is associated with depressive symptoms. Individuals with distressed personality traits and poor sleep quality may exacerbate work stress-related depression. Our findings can contribute to the prediction and implementation of suitable intervention strategies for healthcare workers at a high risk of work burnout.

**Keywords:** Work stress; Type D personality; Sleep quality; Depression

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-05-08  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
 eISSN 2052-4374

## The association of emotional labor and workplace violence with health-related productivity loss

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**Background:** Emotional labor and workplace violence are known to have adverse effects on health. Henceforth, this study investigated the relationship of emotional labor and workplace violence with health-related productivity loss (HRPL).

**Methods:** This study incorporated 5,501 workers in Korea, recruited through a web-based cross-sectional questionnaire in 2021. After excluding individuals with incomplete surveys, there were a total of 4,877 individuals who responded to the workplace violence survey and 2,386 individuals who reported themselves as exposed to emotional labor. The Korean Emotional Labor Scale 11 and the Korean Workplace Violence Scale 13 were used to survey the extent of emotional labor and workplace violence. The mean differences in HRPL according to the level of emotional labor and workplace violence were examined using linear regression models after adjusting for covariates such as gender, age, occupation, alcohol consumption, smoking history and insomnia severity index.

**Results:** The results showed that an increase in the emotional labor score and an increase in the workplace violence score were each associated with an increase in HRPL. In a model adjusted for all covariates, the emotional labor 'high' group showed a mean increase in HRPL of 8.739% ( $p < 0.001$ ) compared to the 'low' group. The workplace violence 'high' group showed a mean increase in HRPL of 10.212% ( $p < 0.001$ ) compared to the 'low' group. This trend was upheld in further analysis performed by grouping according to occupation type: white collar, pink collar, blue collar. Regardless of occupation type, HRPL increased as emotional labor and workplace violence increased.

**Conclusions:** Decrease of productivity within the workplace is associated with the increase in emotional labor and workplace violence. This result emphasizes the need to prevent and reduce emotional labor and workplace violence not only for the welfare of the employees but also to increase the productivity of the workplace.

**Keywords:** Emotional labor; Workplace violence; Health related productivity loss; Productivity

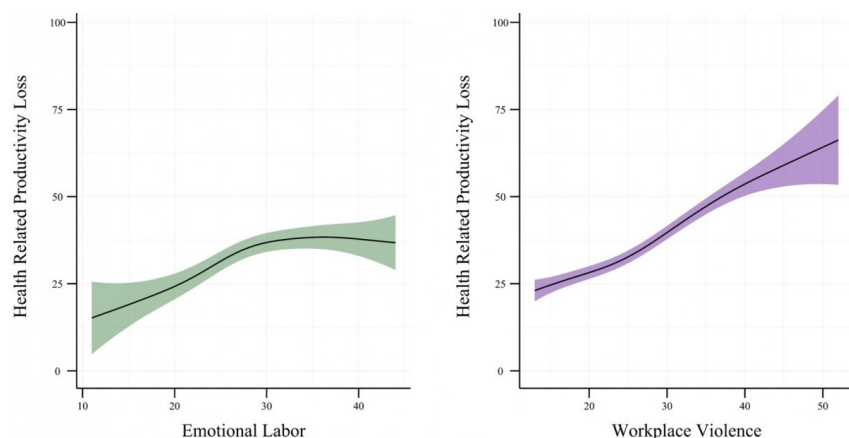


Fig. 1. Generalized additive model of health-related productivity loss according to emotional labor and workplace violence.

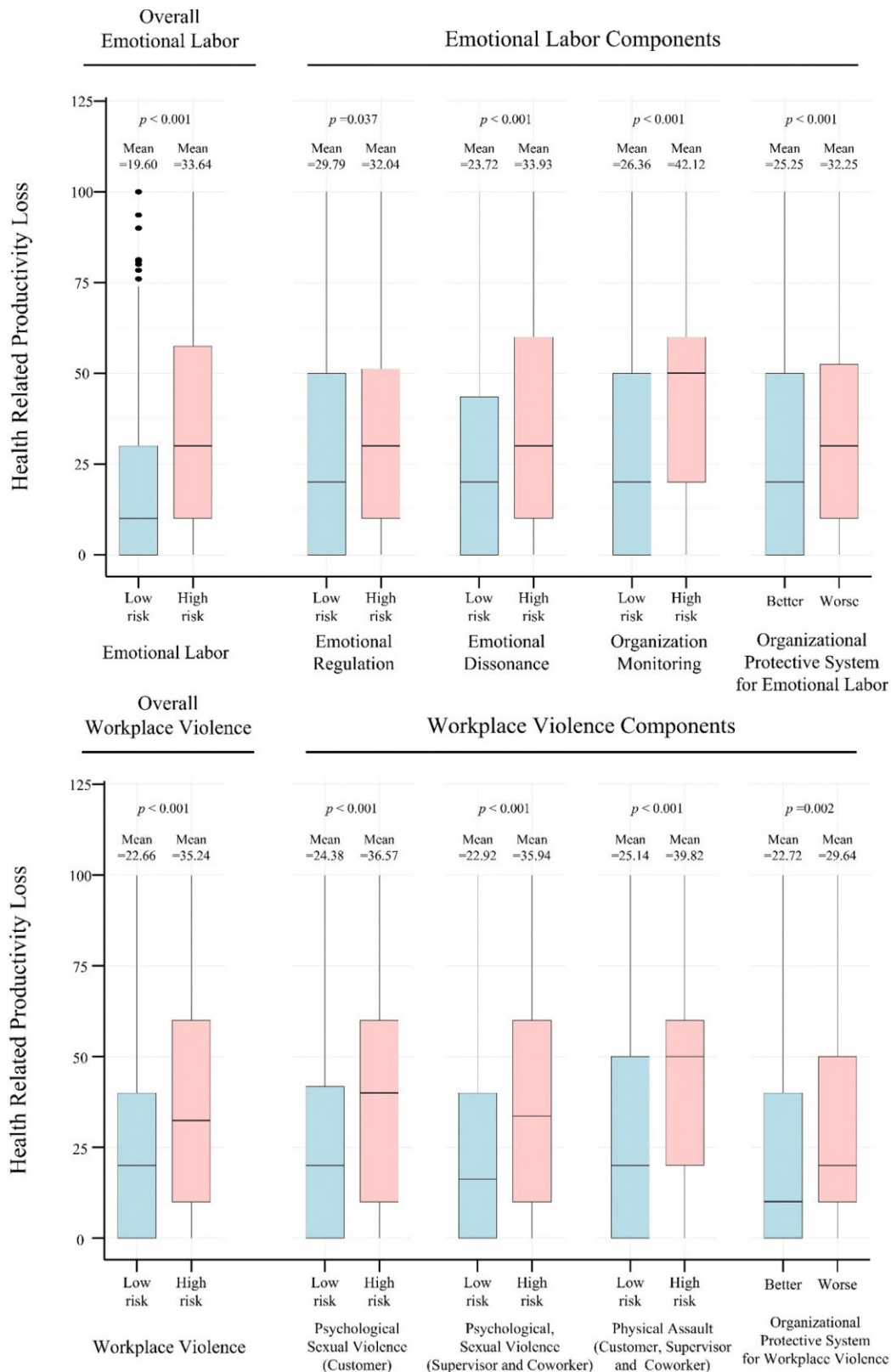


Fig. 2. Mean and the linear regression p-value of health-related productivity loss according to the level of emotional labor and workplace violence.

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-05-09  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## The impact of artificial intelligence in the workplace on psychosocial factors at work and mental health of workers: a cross-sectional study in Japan

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**Background:** the mental health impact of the use of artificial intelligence (AI) in the workplace was understudied. The present study reports the cross-sectional association between AI use at work and psychosocial factors at work and mental health of workers in Japan.

**Methods:** The study sample included participants (n = 1,448) of a longitudinal panel survey of full-time employees in Japan during the coronavirus disease 2019 (COVID-19) pandemic (Employee Cohort Study conducted during the COVID-19 pandemic in Japan, E-COCO-J), starting in March 2020. Data were collected from participants of the 13th wave survey in April 2023. Experiences of digital transformation (DX) and the AI use were asked single item questions, and further categorized into 3 groups: AI use, non-AI use DX, and none of these. The New Brief Job Stress Questionnaire scales were used to measure selected psychosocial factors at work (job demands, job control, job insecurity, and workplace support). Mental health variables (depression/anxiety and work engagement) were measured by using the K6 and the 9-item Utrecht Work Engagement Scale, respectively. Averages of these variables were compared among the 3 groups adjusting for sex, age, and occupation.

**Results:** A total of 907 responded to the survey, with 135 for AI use group, 231 for non-AI use DX group, and 541 for none group. The AI use group had significantly higher scores of qualitative job demand, and job insecurity, lower scores of job control, but higher scores of supervisor and coworker support, compared to the none group ( $p < 0.05$ ). The AI use group had significantly higher scores of both depression/anxiety and work engagement, compared to the none group ( $p < 0.05$ ).

**Conclusions:** Participants in the used of AI at work may experience both negative (increased job demand, lack of job control, and job insecurity) and protective psychosocial factors (better workplace support), which could lead to a mixed mental state with higher psychological distress and work engagement.

**Keywords:** AI; Mental health; Psychosocial factors at work; New technology

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-05-10  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## The relationship between job stress and metabolic syndrome among semiconductor workers in the Republic of Korea

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**Background:** Many literatures have reported the relationship between job stress and deterioration in blood pressure, fasting blood glucose, and serum lipid profiles, leading to metabolic syndrome. However, the majority of the studies have used cross-sectional designs, which cannot guarantee causality. Therefore, we investigated the effect of job stress on the incidence of metabolic syndrome in semiconductor workers using a prospective cohort design.

**Methods:** A total of 14,982 semiconductor workers from the SK Hynix Employees cohort 2017–2022 were included. An annual health examination was conducted and job stress was measured using a self-administered questionnaire, namely the Korean Occupational Stress Scale. The total score was used and job stress was dichotomized as either low or high. Cox regression was used to assess the effect of job stress on metabolic syndrome after adjusting for age, sex, smoking status, and alcohol consumption status, where job stress, smoking status, alcohol consumption status were treated as time dependent variables.

**Results:** The covariate-adjusted result of the Cox regression analysis showed a statistically significant causal relationship between job stress and metabolic syndrome. The hazard ratio (95% confidence interval) for the incidence of metabolic syndrome was 1.163 (1.046–1.293) in the high job stress group compared with the low job stress group.

**Conclusions:** This study revealed the temporal relationship between job stress and metabolic syndrome in semiconductor workers. Therefore, workplace health management needs to address mental health including job stress in order to control metabolic syndrome.

**Keywords:** Job stress; Chronic diseases; Semiconductor workers



## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-06-01

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

### Long COVID: challenges in diagnosis and managing return-to-work

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**Background:** Long coronavirus disease (COVID) may be a public health concern resulting in a hidden toll of the pandemic years later, on workers and their work ability in the workforce. We illustrate the challenges in diagnosing long COVID in a patient, its associated psychological impact on work and how return-to-work can be better managed and supported from an occupational health perspective.

**Methods:** An occupational health trainee working as a government public health officer experienced persistent fatigue, decreased effort tolerance, and difficulties in concentration after contracting COVID-19. There were unintended psychological effects arising from the functional limitations that were not explained with a proper diagnosis. This was further complicated with a lack of access to occupational health services for return-to-work.

**Results:** He developed his own rehabilitation plan to improve his physical tolerance. Progressive efforts to build up his physical fitness complemented with workplace adjustments helped to overcome his functional limitations and allowed him to effectively return-to-work.

**Conclusions:** Diagnosing long COVID continues to remain challenging due to a lack of consensus on a definitive diagnostic criterion. This may give rise to unintended mental and psychological impact. Workers with long COVID symptoms can return-to-work, involving a complex individualized approach to the symptoms' impact on work, and workplace adjustments and job modifications available. The psychological toll on the worker must also be addressed. Occupational health professionals are best placed to facilitate these workers in their journey to return-to-work, with multi-disciplinary delivery models providing return to work services.

**Keywords:** COVID-19; Fitness to work; Long COVID

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-06-02

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Association preinfection psychological status and long COVID in Japanese workers: a longitudinal cohort study

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**Background:** Coronavirus disease 2019 (COVID-19) has been reported to cause prolonged symptoms in approximately 10%–35% of people after infection and is referred to as long COVID. The causes of long COVID are not yet understood, and there is an urgent need to elucidate risk factors. Since long COVID has been reported to occur even in the working-age population, it is important to clarify the association of long COVID with risk factors in worker populations. Therefore, we investigated the association between pre-infection lifestyle and psychological status and the development of long COVID in a Japanese worker population.

**Methods:** A prospective cohort study was conducted among Japanese workers. Study participants were recruited from an Internet research company, and 33,302 workers participated. The baseline survey was conducted in December 2020, and the follow-up survey was conducted in December 2022. Those who reported a history of COVID-19 infection and reported persistent symptoms for two months after infection were included in the analysis as having long COVID.

**Results:** Of the 1,722 patients with a history of infection, 275 had long COVID. Obesity, smoking, alcohol consumption, exercise habits, and breakfast frequency at baseline were not associated with long COVID, while sleep deprivation was significantly associated (odds ratio [OR]: 1.33; 95% confidence interval [CI]: 1.02–1.73;  $p < 0.03$ ). Regarding medical history, diabetes, hypertension, and cancer were not associated, while depression (OR: 2.51; 95% CI: 1.50–4.09;  $p < 0.001$ ) was significantly associated; poor psychological status at K6 (cutoff 13 points) was significantly associated with long COVID (OR: 2.54; 95% CI: 1.71–3.71;  $p < 0.001$ ).

**Conclusions:** In this cohort study, we found an association between pre-infection psychological status and the development of long COVID in a large group of workers across Japan. The findings of this study will contribute to a better understanding of the pathophysiology of long COVID and minimize its impact on the lives of workers globally.

**Keywords:** Long COVID; COVID-19; Psychological status; Occupational health; Worker

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-06-03

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Situation of knowledge and practice of employees in preventing and responding to COVID-19 in manufacturing facilities in Vietnam in 2022

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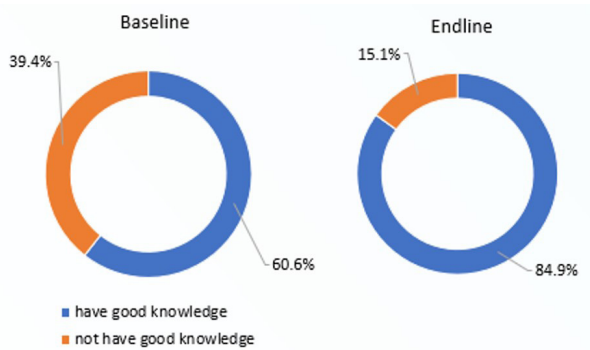
**Background:** The coronavirus disease 2019 (COVID-19) pandemic has caused great upheaval to businesses and workers worldwide, including Vietnam. In an effort to safeguard the health of workers and maintain production chains in response to the pandemic, we have undertaken an intervention project aimed at enhancing the knowledge, attitudes, and practical measures for COVID-19 prevention among employees working at manufacturing facilities in Vietnam.

**Methods:** A cross-sectional study assessed the COVID-19 prevention knowledge and practices of 442 workers across four manufacturing sectors (garments, electronics, woodworking, and jewelry) in 12 factories. This study employed a structured questionnaire and was conducted between February 1 and December 15, 2022.

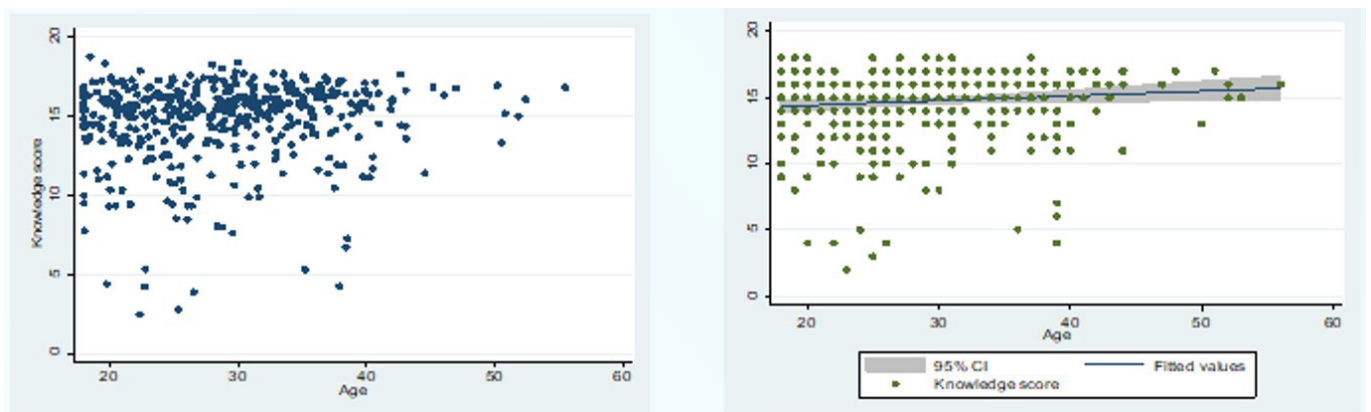
**Results:** The number of workers with good knowledge accounted for 84.9%. Age is a factor affecting the knowledge of surveyed workers (Coef: 0.040; 95% confidence interval: 0.002–0.069). Several behaviors related to COVID-19 prevention such as wearing a mask, washing hands with soap, and washing hands with a quick hand sanitizer solution had a reduced frequency of implementation. It may be the result from the fact that the regulations on COVID-19 prevention in the workplace have been loosen since the number of COVID-19 cases and deaths in the community decreased significantly. It's vital to sustain these preventive practices to reduce the risk of future disease transmission, including new severe acute respiratory syndrome coronavirus 2 strains. Factories must focus on reinforcing and maintaining effective workplace disease prevention regulations.

**Conclusions:** Workers' knowledge of COVID-19 prevention and response has improved significantly. Age is a factor affecting the knowledge of respondents. In terms of practice, some related to COVID-19 prevention such as wearing masks, washing hands have observed a reduced frequency compared to that in the baseline assessment, but this is not due to reduced skill and knowledge but due to the state easing regulations on COVID-19 prevention in the workplace.

**Keywords:** Knowledge; Practice; Manufacturing facility; COVID-19; Worker



**Fig. 1.** Knowledge classification on COVID-19 prevention before and after the project implementation. It shows that most workers at factories had significantly improved their knowledge. Many knowledge-enhancing training and communication activities are also highly appreciated by the factories, including: edutainment training about COVID-19 and other diseases; radio programs with useful updated topics; posters providing extra information; the info hub website with official information from government and national authorities. COVID-19: coronavirus disease 2019.



**Fig. 2.** Scatter plot chart show the relationship between age and COVID-19 prevention knowledge perspective after the project implementation. Specifically, for every one-year increase, the knowledge score increases by 0.04 points (Coef: 0.04; 95% CI: 0.002–0.069). This relationship is significant at the 0.05 statistical level. This means that the group of older workers has improvement on knowledge of COVID-19 prevention. CI: confidence interval; COVID-19: coronavirus disease 2019.

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-06-04  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Moving towards covid resilience: an analysis of COVID-19 staff management protocols at a tertiary hospital

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**Background:** On 11 March 2020, World Health Organization declared the coronavirus disease 2019 (COVID-19) outbreak a pandemic. Thereafter, the world lived through successive COVID-19 waves and is transitioning towards an endemic COVID-19 state. As nation-wide restrictions are relaxed, hospitals remain as high-risk settings and healthcare workers as critical resources. We describe how a large tertiary hospital successfully employed risk-based protocols to safeguard staff health and preserve manpower capacity through the transition from pandemic to endemic.

**Methods:** Hospital protocols relating to staff management before and after key shifts in Singapore's COVID-19 strategy were studied. These included the COVID-19 staff vaccination program, disease surveillance and testing procedures, the risk-based return to work approach and cluster identification and containment protocols. Relevant data such as vaccination rates, staff infection numbers and hospital COVID-19 clusters were collected and analyzed.

**Results:** Ninety-four percent of eligible hospital staff had completed the primary course of COVID-19 vaccination by the end of August 2021. Despite high community transmission rates, the rate of infection in hospital staff was kept below 0.03%. For exposed staff placed on quarantine or isolation order, infection rate was significant at 6.5% to 7.9%. Staff to staff transmission was uncommon and over a period of 4 weeks in October, there were 3 COVID-19 hospital clusters. Only 13 staff and 6 patients were infected in those clusters.

**Conclusions:** An effective vaccination drive helped in attaining a well-protected workforce. Active surveillance allowed early identification and isolation of infected individuals. A vaccination differentiated and risk-based approach enabled a safe yet timely return to work, preserving staff capacity. Rigorous screening and infection control measures contributed to truncated hospital outbreaks. A multi-pronged approach focused at upstream prevention remains relevant and necessary for staff protection and workforce preservation. Healthcare facilities should continue exercising vigilance so as not to be caught off-guard by new infection waves.

**Keywords:** COVID-19; Staff management; Hospital protocols; Prevention; Risk-based

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-06-05  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Job insecurity and “corona blue”: the cross-sectional study between self-perceived job insecurity of employees and depressive symptoms after the COVID-19 pandemic in Korea

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**Background:** “Corona blue” is a term known by the Korean media to the phenomenon of depression due to social distancing or life change after the coronavirus disease 2019 (COVID-19) pandemic. This study aims to analyze the prevalence of depressive symptoms after the COVID-19 pandemic by sociodemographic characteristics in Korean employees and to investigate the association between job insecurity and the COVID-19 pandemic-related depressive symptoms.

**Methods:** We analyzed the 2020 data of the Korean Labor and Income Panel Study (KLIPS). Among the total 22,964 subjects of KLIPS in 2020, 8,972 employees were the study participants. The independent variable was self-perceived job insecurity, and the dependent variable was measured as those who answered ‘sometimes,’ ‘frequently’ or ‘always’ on Likert scale when asked how often they felt sorrow due to COVID-19 in March 2020. Covariates were sex, age, marital status, education, and income. Using  $\chi^2$  test, we calculated the prevalence of depressive symptoms after the COVID-19 pandemic by sociodemographic characteristics. Adjusted odd ratios (AORs) and 95% confidence intervals (95% CIs) of job insecurity for depressive symptoms after COVID-19 pandemic were calculated using multiple logistic regression analysis. IBM SPSS statistics version 28.0 was used for statistical analyses, and the statistical significance was set at *p*-values of < 0.05.

**Results:** The mean age of all subjects was 47.27 (standard deviation 13.686). The youngest was 17, and the oldest was 92. The overall prevalence of depressive symptoms after the COVID-19 pandemic was 28.3%. COVID-19 pandemic-related depressive symptoms was associated with age, education, income, and job insecurity. Adjusting all covariates used, the AORs of job insecurity were statistically significant at 1.185 (95% CI: 1.044–1.345).

**Conclusions:** Job insecurity was associated with depressive symptoms after the COVID-19 pandemic in Korea. We suggest that policy intervention is needed for the depression of employees with job insecurity in this pandemic era.

**Keywords:** Corona blue; COVID-19; Pandemic; Depressive; Job insecurity

**Table 1.** Prevalence of depressive symptoms after the coronavirus disease 2019 pandemic by sociodemographic characteristics and self-perceived job insecurity in Korean employees (n = 8,972)

Characteristics	%	Depressive symptoms (%)	p-value
Overall	100.0	28.3	
Sex			0.964
Male	56.7	28.3	
Female	43.3	28.2	
Age			<0.001*
≤29	10.4	24.7	
30-39	20.4	26.6	
40-49	28.0	26.2	
50-59	21.3	29.5	
≥60	19.9	33.4	
Marital status			0.323
Spouse	68.4	27.9	
No spouse	31.6	29.0	
Education			<0.001*
College graduate or higher	52.9	26.3	
High school graduate	32.7	29.9	
Middle school graduate or lower	14.4	33.7	
Monthly Income (10,000 KRW)			<0.001*
≥300	36.3	25.7	
200-299	30.9	28.1	
100-199	23.5	29.8	
<100	9.3	35.0	
Self-perceived job insecurity			<0.001*
Secure	80.7	27.0	
Insecure	19.3	33.5	

The  $\chi^2$  test.

\*p-value < 0.05.

**Table 2.** The association of sociodemographic factors and self-perceived job insecurity with depressive symptoms after the coronavirus disease 2019 pandemic in Korea

Characteristics	AORs	95% CI	
Sex			
Male	1.000		
Female	0.910	0.819	1.010
Age			
≤29	1.000		
30-39	1.214	1.002	1.471
40-49	1.214	1.000	1.475
50-59	1.278	1.125	1.688
≥60	1.426	1.144	1.777
Marital status			
Spouse	1.000		
No spouse	1.084	0.969	1.214
Education			
College graduate or higher	1.000		
High school graduate	1.017	0.907	1.140
Middle school graduate or lower	1.056	0.883	1.263
Monthly Income (10,000 KRW)			
≥300	1.000		
200-299	1.130	0.997	1.280
100-199	1.163	1.001	1.351
<100	1.343	1.091	1.653
Self-perceived job insecurity			
Secure	1.000		
Insecure	1.185	1.044	1.345

Multiple logistic regression analysis adjusted all covariates used.

AOR: adjusted odd ratio; 95% CI: 95% confidence interval.

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-06-06  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Challenges of COVID-19 pandemic response from the perspective of public health centers in Japan: a cross-sectional study using topic model analysis

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**Background:** In Japan, local governments, including approximately 450 public health centers, play a central role in response to health and hygiene problems. During the coronavirus disease 2019 pandemic, they conducted epidemiological surveys, assisted patients at home, managed the hospitalization of severe patients, and provided consultation services to the citizens. The purpose of this study was to identify the issues that should be discussed for future pandemics.

**Methods:** We conducted an online questionnaire survey targeting workers at public health centers in Japan in January 2023. About 10 respondents were recruited per health center. We asked for open-ended responses regarding what needs to be improved for future pandemics. We identified issues in the descriptions with morphological analysis and topic models using KHCoder3.0. The number of topics was estimated using Perplexity as a measure, and Latent Dirichlet Allocation was used for meaning identification.

**Results:** We collected open-ended responses from 784 (48.6%) out of the 1,612 survey respondents. They included 111 physicians, 330 nurses, and 172 clerical workers; 274 were in their 50s, and 162 were in their 40s. Morphological analysis formed the descriptions with 36,632 words. In the topic model, they were summarized into the following eight issues; establishment of a crisis management system, division of functions among public health centers, prefectures, and medical institutions, clear role distribution in public health center staff, training of specialists, information sharing system (information about infectious diseases and government policies), response to excessive workload (support from other local governments, cooperation within public health centers, and outsourcing), streamlining operations, and balance with usual work.

**Conclusions:** We identified eight issues for public health centers to address in preparation for future pandemics. For health centers to be able to effectively provide services in response to changing situations, it will be important to collaborate with the government, medical institutions, and other organizations.

**Keywords:** COVID-19; Pandemic; Management system; Topic model; Text-mining



## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-06-07  
<https://doi.org/10.35371/aoem.2023.35.Supplement>  
eISSN 2052-4374

## Telecommuting-related health outcomes during the COVID-19 pandemic differ by job demand-control interaction: a national population-based cross-sectional study

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**Background:** Coronavirus disease 2019 (COVID-19) pandemic drastically modified the occupational system wherein telecommuting has risen as the dominant form of work. Few studies have incorporated Karasek's job demand-control model into explaining the working conditions of telecommuters. This study aimed to investigate the health risk in South Korean telecommuters during the pandemic era, and its distribution according to job stress-related factors.

**Methods:** Nationwide population-based cross-sectional study of South Korean laborers was conducted, utilizing the 6th Korean Working Conditions Survey (2020–2021). Following the previously described concept of telecommuting, 14,478 white-collar employees were eligible study participants. Telecommuting, job demand, job control, and various health indicators were measured by the responses to the survey. Participants were stratified into four job profiles classified by the job demand-control model. We conducted multiple logistic regression analyses between telecommuting and health-related outcomes to estimate the odds ratio (OR) with a 95% confidence interval (CI).

**Results:** One hundred forty-six low-strain, 223 active, 69 passive, and 148 high-strain workers were screened as telecommuters. Compared to office workers, telecommuters had a higher proportion in low-strain and active groups. Telecommuting status was significantly associated with musculoskeletal pain (OR: 1.64; 95% CI: 1.21–2.22), headache/eye strain (OR: 1.78; 95% CI: 1.34–2.35), and presenteeism (OR: 1.48; 95% CI: 1.06–2.07). Subgroup analysis demonstrated different relationships among job profiles, where only active telecommuters showed a higher prevalence of depression (OR: 1.86; 95% CI: 1.05–3.29) and high-strain telecommuters had the most health variables significantly affected including insomnia (OR: 2.47; 95% CI: 1.43–4.27).

**Conclusions:** This study revealed significantly increased odds of multiple health outcomes among South Korean telecommuters during the COVID-19 pandemic era. High-strain job holders were prominently susceptible to the negative health impacts of working from home. Occupational health management towards telecommuters should adopt different approaches based on job demand and job control status.

**Keywords:** Telecommuting; Job demand; Job control; Occupational health; Pandemic

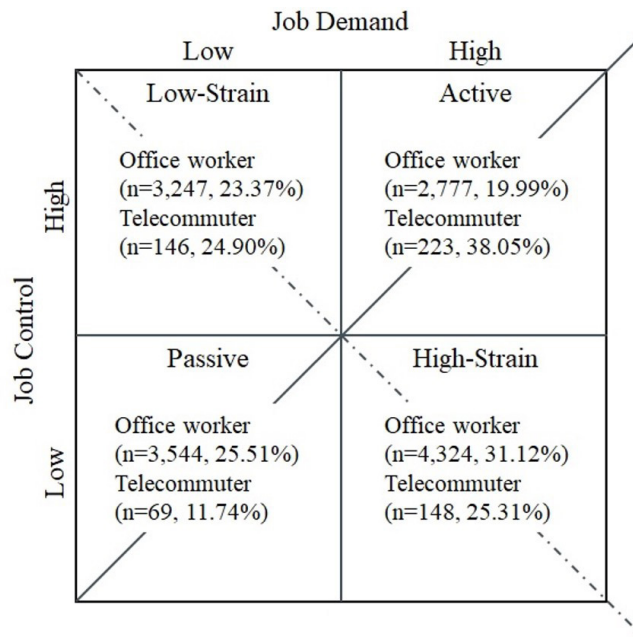


Fig. 1. Distribution of study participants stratified by Karasek's job demand-control model.

## Poster Presentation

Ann Occup Environ Med. 2023 Nov;35(Supplement):P-06-08

<https://doi.org/10.35371/aoem.2023.35.Supplement>

eISSN 2052-4374

## Identifying stressors for public health center workers during the COVID-19 pandemic

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**Background:** Public health centers (PHCs) in Japan played a central role in local governments during the coronavirus disease 2019 (COVID-19) pandemic. In addition to their regular duties, they had to work to prevent the spread of infection, putting significant mental health strain on them. It is important to identify stressors for PHC workers during the COVID-19 pandemic to sustainably engage in their work in the next pandemic.

**Methods:** A nationwide Internet survey of PHC workers was conducted from December 2022 to January 2023. Burnout scale and stressful experiences in dealing with COVID-19 were asked to respond in the form of open-ended questions. Text mining (morphological analysis, co-occurrence network, etc.) was used to conceptualize the stressors in the responses. To reveal the relationship between burnout scores and stressors, the respondents were divided into quartiles by burnout, and the mentioned rate for each concept was calculated in each group.

**Results:** Of the 1,612 respondents to the questionnaire, 464 (28.8%) provided open-ended responses. There were 290 females, including 73 doctors and 186 nurses. The content was formed with 23,610 words. Text mining revealed 9 stressor concepts: overwhelming workload, work-induced sleep deprivation, work-life imbalance, inadequate satisfaction, sense of inequality in work, anxiety about the future, the burden in handling complaints, lack of information sharing, and sense of being pushed around due to changes in national and prefectural policies. The concept that correlate with the burnout level was work-life imbalance.

**Conclusions:** We have identified stressors related to the burnout of PHC workers during the COVID-19 pandemic through qualitative research of open-ended descriptions. We suggest that by addressing the stressors identified in this study, PHC workers may be able to sustainably engage in their work during the next pandemic.

**Keywords:** PHC (Public health centers); Stressor; Burnout; Text-mining; COVID-19



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