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Occupational health and safety hazards faced by healthcare professionals in Taiwan: A systematic review of risk factors and control strategies

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Abstract

Background: Healthcare professionals in Taiwan are exposed to a myriad of occupational health and safety hazards, including physical, biological, chemical, ergonomic, and psychosocial hazards. Healthcare professionals working in hospitals and healthcare facilities are more likely to be subjected to these hazards than their counterparts working in other areas.

Objectives: This review aims to assess current research literature regarding this situation with a view to informing policy makers and practitioners about the risks of exposure and offer evidence-based recommendations on how to eliminate or reduce such risks.

Methods: Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses review strategy, we conducted a systematic review of studies related to occupational health and safety conducted between January 2000 and January 2019 using MEDLINE (Ovid), PubMed, PMC, TOXLINE, CINAHL, PLOS One, and Access Pharmacy databases.

Results: The review detected 490 studies addressing the issue of occupational health and safety hazards; of these, 30 articles were included in this systematic review. These articles reported a variety of exposures faced by healthcare professionals. This review also revealed a number of strategies that can be adopted to control, eliminate, or reduce hazards to healthcare professionals in Taiwan.

Conclusion: Hospitals and healthcare facilities have many unique occupational health and safety hazards that can potentially affect the health and performance of healthcare professionals. The impact of such hazards on healthcare professionals poses a serious public health issue in Taiwan; therefore, controlling, eliminating, or reducing exposure can contribute to a stronger healthcare workforce with great potential to improve patient care and the healthcare system in Taiwan. Eliminating or reducing hazards can best be achieved through engineering measures, administrative policy, and the use of personal protective equipment.

Implications: This review has research, policy, and practice implications and provides future students and researchers with information on systematic review methodologies based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses strategy. It also identifies occupational health and safety risks and provides insights and strategies to address them.

Keywords

Occupational health and safety, risk factors, healthcare professionals, control strategies, Taiwan

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Introduction

According to the World Health Organization (WHO),[1] an estimated 59 million people work in healthcare facilities globally, accounting for roughly 12% of the working population. The WHO[2] also reports that all healthcare workers, including healthcare professionals, are exposed to occupational hazards. The International Labour Organization (ILO)[3] reported that millions of healthcare workers suffer from work-related diseases and accidents, and many succumb to occupational hazards. Scholars and practitioners in the field of healthcare and occupational health and safety (OHS) are

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striving to raise awareness of the risk factors and importance of workplace health and safety among this population.[1,3,4]

Schulte et al.[5] defined an occupational hazard as the short-term and long-term dangers or risks associated with unhealthy workplace environments. Tullar et al.[6] and Joseph and Joseph[7] stated that the healthcare workers at greatest risk are doctors, healthcare professionals, nurses, laboratory technicians, and medical waste handlers.

Occupational hazards pose health and safety risks and have negative impact on the economy, which accounts for roughly a 4% loss in global annual gross domestic product (i.e. $2.8 trillion annually).[3] The WHO,[2] ILO,[3] and Nelson et al.[8] noted a lack of universally applicable data on the impact of occupational hazards.

OHS hazards, and their negative impacts on health and well-being among healthcare professionals, is an issue of growing concern in the Asia and Pacific region, particularly in Taiwan; however, research in this area has been somewhat limited. According to the Taiwanese Ministry of Health and Welfare (MOHW)[9] in Taiwan, 182,019 health and medical personnel are working at health care organizations in Taiwan, including 33,516 healthcare professionals and 15,016 pharmacist assistants. The healthcare professionals serve a Taiwanese population of 23,590,744 in 22,384 medical care institutions (490 hospitals and 21,894 clinics).[10] Of the 490 hospitals, 81 are public and 409 are privately owned; of the 21,894 clinics, 440 are public and 21,454 are privately owned.[10]

Taiwanese healthcare professionals face a variety of OHS hazards, which increase the incidences of work-related disease, the country's burden of disease, the total number of accidents, the incidences of job-related health problems, and the number of cases involving incapacitation or disablement.[9] This study reviewed previous works on OHS hazards, as well as their risk factors and control strategies, with a focus on healthcare professionals in Taiwan.

Methods

Search strategy

Cochrane[11] identified eight steps of a systematic review, which are adopted in this study.

Eligibility criteria

This study employed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol to organize the flow of information through the various steps of the review. We used the following key words in our literature search: occupational health and safety, risk factors, healthcare professionals, control strategies, and Taiwan. Studies conducted between January 2000 and December 2018 were included in the study.

The data sources for this systematic review included Cengage, PsycINFO, MEDLINE (Ovid), ProQuest, PubMed, PMC, TOXLINE, PLOS ONE, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Scopus, Access Pharmacy, Web of Science, ScienceDirect, NIOSHTIC-2, and National Health Insurance Research Database (NHIRD); unpublished government, academic, and agency articles, research or reports mainly WorldCat, AHRQ EPC, Google Scholar, and the WHO research database.

Inclusion and exclusion criteria

To ensure specificity and exclude irrelevant studies, we employed Boolean logic (*AND, OR, NOT*) in combining terms as search strings.[12] The operator *AND* was used to reduce the search yield for two key terms (e.g. "healthcare professionals (P) *AND* occupational health and safety"). The operator OR was used to increase the search yield (e.g. "healthcare professionals *AND* occupational health and safety *OR* risk factors"). Note that in this example, the two search terms are synonyms. The operator "NOT" was used to exclude specific terms or term combinations.[13]

This research obtained a large number of initial articles (n initial = 490); however, the application of inclusion and exclusion criteria considerably reduced the number of articles for inclusion in the review (n = 30 articles). The 30 articles focused on OHS, occupational hazards, and healthcare professionals in Taiwan. Figure 1 presents a flow diagram depicting the application of eligibility criteria, the process of identification and screening, and the reasons for inclusion and exclusion.

Data extraction: validity and reliability

In documenting and assessing individual publications, we collected key information from the relevant studies to populate an evidence table (see Appendix C) and conducted a critical appraisal of the included studies.[12] The study population included adult pharmacy workers (male and female). Data were extracted only from studies that included samples that were deemed significant given the justification of the authors of the studies. A critical appraisal of all studies was performed to assess their quality in terms of validity and reliability, as based on performance bias, information bias, selection bias, and detection bias. Cochrane[11] and Khan et al.[16] reported that biases tend to exaggerate or underestimate the "true" outcome of exposure to an occupational hazard. Our ultimate objective was to compare (without any form of bias) groups that were exposed to occupational hazards and those that were not exposed in terms of risk factors and outcomes.[16]

For the sake of validity and reliability, all of the studies selected for inclusion were prospective in nature and included data pertaining to exposure and outcomes, while controlling confounding factors. We also looked for studies

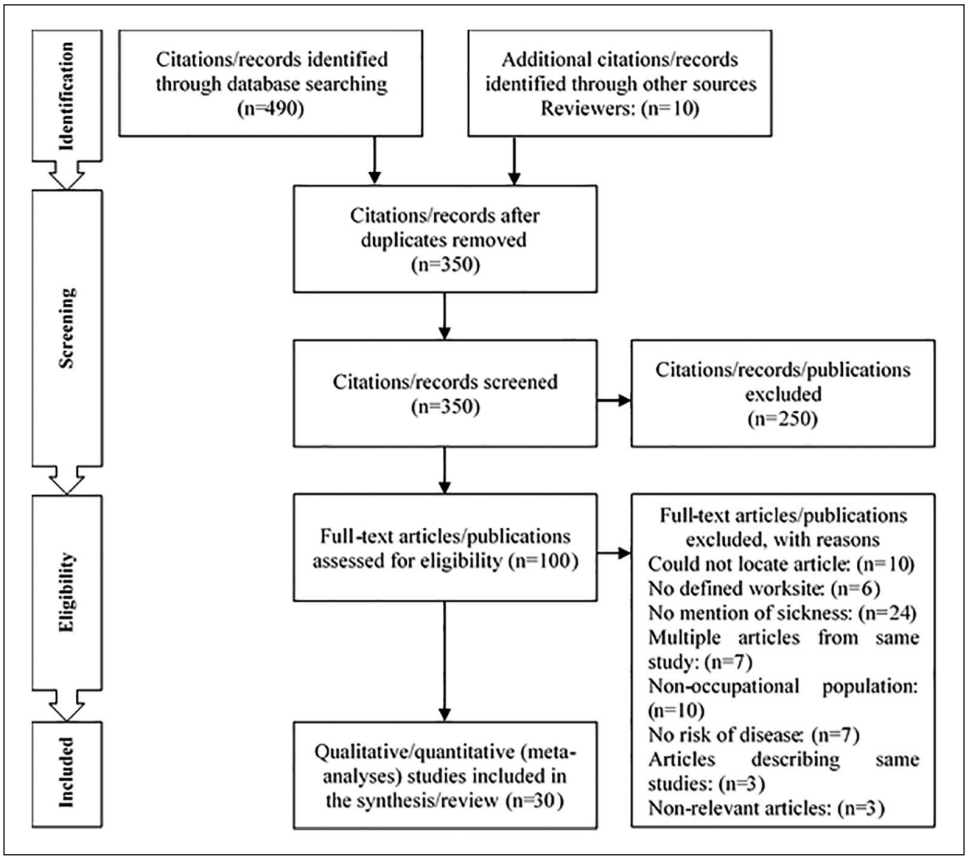

Figure 1. PRISMA flow diagram.
Source: Beltrami et al.[14] and Ozturk and Babacan.[15]

with high internal reliability (consistency across items within a test) and high external reliability (consistency in agreeability between uses/rates).[12] In our final analysis, we considered whether the research had been conducted in an appropriate manner (internal validity).[13] We also considered the generalizability of the results, that is, whether the results were pertinent to other situations (external validity).

Data synthesis. The final step involved the synthesis of evidence from the included studies; that is, organized into homogeneous categories, under which the results were to be summarized. The evidence was also graded (i.e. assessed in terms of quality) and integrated (i.e. weighted across categories to address the multidisciplinary nature of OHS research).[12] In this review, the synthesis, grading, integration, interpretation, and summary of the evidence were presented in narrative form, due to difficulties in textual and statistical pooling. After completing our systematic review, we employed the PRISMA reporting scheme, which is endorsed for OHS studies by Hempel et al.[12] Briefly, the PRISMA structure is laid out in the following format: topic, summary/abstract, introduction, methods, results, conclusion, and recommendations.[12] A meta-analysis was not conducted.

Results

The ILO categorizes OHS hazards that affect healthcare professionals as biological, chemical, physical, ergonomics, and psychosocial.[17] From the 30 studies in this review, this study identified the OHS hazards, injuries, and diseases affecting healthcare professionals working in hospitals and healthcare facilities.

Biological hazards

This section provides the biological hazards, as identified in the review, as the most commonly encountered in hospitals and healthcare facilities in Taiwan. According to WHO, the managers and administrators of hospital and healthcare facilities, in our case those in Taiwan, should carefully assess the potential for exposure to biohazards and put effective biohazard control plans in place. The following chart provides a summary of the identified biological hazards, their risk factors, and control strategies (Table 1).

Chemical hazards

The review established some of the most commonly faced chemical hazards present in hospitals and healthcare

Table 1. Biological hazards.

Biological hazards	Risk factors	Risk of infection	Control strategies
1. Exposure to blood-borne pathogens transmitted through contact with infected body fluids or secretions to mucous membranes or non-intact skin.[14,17]	Percutaneous or mucosal exposure to the blood or body fluids of infected patients.[14] Infection from human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV)[14] Needle-stick injuries (NSI) and accidents with other sharp objects: occupational exposure resulting in HIV, HBV surface antigen-positive, or HCV transmission is largely due to inoculation of pathogens into cutaneous abrasions, lesions, scratches, or burns, as well as mucocutaneous exposure involving inoculation or accidental splashes onto non-intact mucosal surfaces of the nose, mucous membranes, mouth, or eyes.[24–26]	HCV transmission (1.8%), HBV transmission (6%–30%), and HIV transmission (0.3%).[14]	Engineering (controlling/eliminating risk at source): controlling access to hospital or medical equipment spaces; monitoring of microbial growth in ventilation systems and immunizing healthcare facility staff against infectious pathogens;[5,18,19] immunization and vaccines;[18] and biological safety cabinets, needleless systems or safety-engineered needles, suitable ventilation, and an appropriate medical waste management system.[15] Administrative controls: written and documented infection control plans; decontamination procedures; enforcement of these systems; and the training of hospital staff in the implementation of occupational health and safety measures.[20] Immunization programs; detection and follow-up of infections; periodic screening; codes of practice; and staff orientation. Designing all work systems with the aim of minimizing the risk of exposure. Personal protective equipment (PPE): includes devices for the protection of the eyes (e.g. face shields, goggles), respiratory system (e.g. surgical masks), and skin (e.g. latex gloves, protective aprons, gown.[20] Based on risk assessments and careful training.[21–23]
2. Exposure to air-borne pathogens transmitted through contaminated food, water, ventilation systems, or other environmental contaminants.[14]	Contact with the air-borne pathogens that cause tuberculosis (TB), particularly during testing and when in close contact with patients. The risk is magnified in cases of undiagnosed TB or when patients not adhering to recommended precautionary measures to prevent disease spread.[27–29]	Severe acute respiratory syndrome (SARS) H1N1 influenza Middle East respiratory syndrome (MERS) TB[28,30]	

facilities, as well as the documented control strategies, which are summarized in Table 2.

Physical hazards

Physical hazards, which are defined as environmental risk factors that can harm the body without contact, were found to account for a substantial proportion of risks among healthcare professionals in Taiwan.[4,42–44] The physical hazards, risk factors, and control strategies are summarized in Table 3.

Ergonomic hazards

The review established that healthcare professionals are exposed to musculoskeletal disorders and injuries, such as low back pain due to the nature of their work, such as lifting patients.[44] Table 4 summarizes the risk factors and control strategies for this hazard.

Psychosocial hazards

Psychosocial hazards have attracted considerable attention in the research community, as well as among policy makers and practitioners in healthcare.[53–55] This study found that in Taiwan, psychosocial hazards have prompted a larger number of studies combining physical, chemical, and biological hazards. The WHO[56] reported that psychosocial hazards are closely linked to work-related stress, workplace violence (e.g. violent patients), and other workplace stressors. Table 5 provides a summary of the risk factors and control strategies of psychosocial hazards.

Discussion

This review provides detailed information regarding the OHS hazards that affect healthcare professionals working in hospitals and healthcare facilities in Taiwan. The review summarizes the risk factors for hazards, as well as the control strategies to control, eliminate, or reduce them. From the reviewed studies, it was clear that OHS hazards can potentially result in a number of injuries, sickness, and harm. A wide range of OHS hazards were identified, including biological hazards[14] chemical hazards,[65] ergonomic hazards, psychosocial hazards, and physical hazards.[59,62]

The review has shown that healthcare professionals are at a significantly high risk of occupational related hazards.[56] Injuries and sickness prevent healthcare workers from discharging their duties effectively, which can have negative impact on the overall healthcare system in Taiwan. Physical hazards, such as falls, noise, and mechanical hazards, could have long-term physiological effects, such as hearing impairments; therefore, there is need to introduce various control strategies, such as engineering noise control measures. There should be the provision of good PPE for healthcare professionals to protect themselves from physical harms in the workplace.

According to our findings, it is evident that healthcare professionals are exposed to chemical hazards, some of which can be carcinogenic. There is also the risk of exposure to occupational dermatitis. It is therefore important that healthcare professionals are screened for cancer on a regular basis. The workers can also be trained about skin care and be provided with safety equipment and other useful interventions, such as sunscreen cream. Such efforts can help in early detection, prevention, and intervention.

As part of their routine occupation, biological hazards can affect healthcare professionals due to contact with patients and visitors. The review of healthcare professionals on duty demonstrates how important it is to manage blood borne and airborne biological pathogens in the healthcare workforce.[20] There should be administrative guidance and training on how healthcare professionals can deal with biological hazards, and these professionals should be encouraged to report work-related incidents as soon as they occur or are suspected to have occurred to aid early intervention.

Ergonomic hazards in healthcare professionals tend to arise from lifting patients and hospital equipment. This requires careful prevention, assessment, and intervention, as the impact of ergonomic hazards on the musculoskeletal system of the affected healthcare professionals cannot be ignored.[34] Hospital administrators need to alleviate frequent job pressures by providing the necessary safe and ergonomic equipment, and hiring an adequate number of personnel. The professionals can work in properly planned shifts and teams to reduce fatigue, they should be trained in the correct techniques for lifting patients and equipment, and policies should be enforced to ensure compliance.

The findings on psychosocial hazards show that healthcare professionals can be affected by mental and psychological hazards, such as stress, as it is evident that healthcare professionals who suffer from stress are likely to suffer from fatigue and exhaustion. Healthcare professionals are trained to show less emotion, and thus, find it difficult to seek medical intervention. There is need for counseling and stress management for healthcare professionals, and the workers should be trained to manage stress. The workplace should be designed in such a manner as to prevent invasion, harassment, and violence against healthcare professionals. Overall, hospital administrations and healthcare professionals should focus on evidence-based strategies (engineering, administrative, and PPE) to manage OHS hazards.

Conclusion

The increasing prevalence of occupational hazards and work-related diseases among healthcare professionals in Taiwan is a concern.[66] Risk factors include exposure to hazards and a failure to follow hierarchical control strategies. Health care workers and administrators must work together to eliminate or minimize these hazards through the introduction of and strict adherence to engineering, administrative, and personal protective equipment (PPE) controls. The

Table 2. Chemical hazards.

Chemical hazards	Risk factors	Risk of injury/disease	Control strategies
Healthcare professionals are exposed to numerous types of chemicals, including those used to treat infections and cancers, such as antibiotics, aerosolized drugs, antineoplastic, and hormonal drugs, many of which are cytotoxic.[31] Healthcare professionals are susceptible to poisoning, allergic reactions, toxicity risks, dermatitis, cancer, and maternal health effects following exposure to hazardous chemicals. Exposure to hazardous drugs and chemicals can occur during the unpacking of materials, during compounding (particularly when this involves crushing and splitting) and unit dose packaging, and during spillage situations and clean-up.[32,33]	The main routes of exposure to chemical hazards include ingestion, injection, skin contact or absorption, and inhalation.[34,35] Contamination and exposure are both affected by the duration and frequency of exposure, the quantity of drugs undergoing preparation, and the use of PPE.[23]	The adverse health effects can be attributed to compounds deemed carcinogenic (cancer causing), mutagenic (promoting mutations), teratogenic (causing birth defects), or toxic to various organs.[36] Alcohol hand sanitizers commonly used by healthcare professionals are flammable and harmful to the skin. There have also been reports on the dangers of detergents used to clean surfaces, which can lead to irritation and promote allergies of the skin, eyes, and respiratory tract.[35,37] There is also evidence that some detergents can react with other products commonly stocked in healthcare facilities to produce toxic vapors.[31,35,38] It has been found that low concentration disinfectants, such as quaternary ammonium salts, alcohols, hydrogen peroxide, iodophors, and phenolic and chlorine compounds, can have toxic effects and irritate the skin, eyes, and respiratory system.[23] The inhalation of powdered medications and vapors exposes healthcare professionals to the risk of poisoning and allergic reactions.[39,40]	Engineering control strategies: isolating and segregating hospital or healthcare facility areas and equipment; providing exhaust hoods to provide local ventilation when compounding and mixing drugs; providing biological safety cabinets to safeguard chemicals; and providing containers to prevent needle stick injuries. Flammable chemicals should be stored away from sources of ignition and dangerous chemicals substituted with less harmful ones.[36] Administrative control strategies: implementation of safety procedures for the handling and waste management of chemical products and educating hospital or healthcare facility workers on the nature of chemical hazards, as well as the use of all tools, facilities, and PPE equipment.[33] Procure ready to use drugs and chemicals and comply with safe spill procedures in accordance with the active hospital or healthcare facility ingredients (APIs) in the manufacturer's instructions pertaining to spilled product.[36] PPE: use face shields, protective clothing/gowns, gloves, and eye protection. When administering aerosolized drugs, it is important to perform a risk assessment beforehand and to use respirators at all times.[41]

PPE: personal protective equipment; API: active pharmaceutical ingredient.

Table 3. Physical hazards.

Physical hazards	Risk factors	Risk of injury and disorder	Control strategies
1. Exposure to extreme temperatures, such as extreme cold	Accessing cold rooms and extreme heat generated by steam from autoclaves, hot plate surfaces, and cryogenic materials.[45]	Exhaustion and heatstroke, as well as hypothermia and frostbite[45]	Personal protective equipment (PPE): use of appropriate footwear, gloves, eye and nose protection, and protective clothing[18]
2. Exposure to mechanical and electrical hazards	Poorly maintained equipment, overloaded sockets, improper use of equipment, and faulty electrical sockets.[46] Noise	Cuts, burns, hearing loss, motion sickness, and muscle cramps.[47]	Engineering controls: minimize the use of sharp tools, use machine guarding, use quality sockets, and close water faucets when not in use.[48] Administrative controls: promote and practice safe work procedures, such as when using electrical equipment (e.g. cords).[18] Educating workers about the cleaning equipment and cleaning up broken glass is also recommended.[49] PPE: use of appropriate footwear, gloves, eye and nose protection, and protective clothing[18]
3. Tripping, slipping, cuts, and falling	Poor housekeeping, poor layout, and slippery tiled floors.[50] Open power cables, live wires, broken glassware, lancets, knives, scissors, and scalpels.[47]	Bruised skin, cuts, broken bones, and muscular injuries.[50]	Engineering control: proper lighting, the construction of safe stairwells, and regular building maintenance (e.g. floors and workspaces).[44] PPE: use of appropriate footwear, gloves, eye and nose protection, and protective clothing[18]
4. Exposure to microwave radiation, and ionizing and non-ionizing radiation.[50]	Risks imposed by radiation from X-ray machines and other diagnostic imaging systems, and the radionuclides used in nuclear medicine and radiation therapy. Workers face risks from non-ionizing radiation, lasers, ultraviolet rays, and magnetic resonance imaging.[51] The risk increases when using heat sealers and poorly maintained or insulated radio-diagnostic equipment.[48]	Tissue damage, risk of cancer, and abnormal cell mutation (e.g. abnormal leukocytes).[48,51]	Engineering control: reducing the time of exposure, increasing the distance to X-ray machines, and increasing the amount of shielding.[20] PPE: use of appropriate footwear, gloves, eye and nose protection, and protective clothing[18]

Table 4. Ergonomic hazards.

Ergonomic hazards	Risk factors	Risk of injury	Control strategies
Ergonomic hazards include the design of the hospital workplace and workstation, working in an awkward work position, and repetitive work procedures.	Musculoskeletal disorders (MSDs) due to repetitive actions, less than optimal computer equipment, and a poorly engineered workspace in which healthcare professionals are forced to overreach and/or sit while maintaining an awkward posture.[43] Healthcare professionals are tasked with lifting and transferring equipment, tools, and instruments. One's physical fitness level and demographic background were shown to affect the risk of developing MSDs.[52] Workplace and job-related demands, poor administrative and team support, and a negative attitude toward job tasks were all strongly correlated with MSDs.[47]	Ergonomic hazards can lead to chronic pain in the arms, back, or neck. Frequently, they lead to MSDs, such as carpel tunnel syndrome, which tends to reduce work performance and productivity and can have a serious detrimental effect on one's health-related quality of life.[50] Strained movement due to localized pain, stiffness, sleep disturbances, twitching muscles, burning sensations, and feelings of overworked muscles.[47]	Engineering control strategies: redesign workstations with appropriate chairs and computer equipment.[43] Workstations should be configurable to a wide range of medical personnel with different body shapes and sizes. It is also recommended that lifting and handling equipment, such as trolleys, be installed in areas requiring heavy lifting. Automation should be adopted when resources and practicability allow.[46]

perceptions of workers can greatly affect their implementation of risk-mitigation strategies.[20]

Study limitations

Selection bias is a concern here, despite the fact that we selected published and peer-reviewed articles, as well as unpublished but authoritative gray articles; the fact is that other unverifiable but potentially valuable reports were no doubt excluded.[67] Our reliance on observational studies (to the exclusion of intervention studies) and the heterogeneity of the included articles (in terms of methodology) posed a risk of bias and limited standardization.[68]

Implications for further research

This study discovered relatively little research focusing on hospital workers in Taiwan, and thus, further empirical studies focusing on this group of healthcare givers are required and recommended.[68] Researchers should focus on the health status, work performance, and workplace retention of healthcare professionals, including the prevalence of morbidity and mortality.[67]

Implication for policy and practice

The insights in this review provide a valuable reference for policy makers in establishing goals to deal with workplace hazards.[68] Hazard control strategies must be based on objective assessments of existing risks and the most appropriate measures to deal with them.[20]

Conclusion

This systematic review confirmed a positive correlation between OHS hazards (biological, physical, chemical, and psychosocial), and work-related injuries, occupational health problems, and work-related diseases. The burden of disease and attributable fraction of work-related diseases and occupational injuries has been shown to cause considerable social and economic losses for employees, families, companies, countries, and societies at large.[8] Generally, the burden of disease is assessed using disease/disability adjusted life years. The burden of disease is measured as the impact of morbidity and premature mortality within a given area.[2,69]

Scholars and professionals agree that reducing, substituting, or eliminating OHS hazards in healthcare facilities is important for healthcare workers, helps to ensure patient safety, and enhances the overall quality of healthcare.[7] Many researchers have used the "hierarchy of controls," which is based on the assumption that interventions are most effective when implemented at the source and least effective when applied at the worker level.[20]

Gorman et al. listed control interventions from most to least effective as follows: elimination, substitution, engineering, administrative, and PPE. Researchers have also emphasized the importance of eliminating hazards or substituting hazardous materials with less hazardous materials.[20,70]

Taimela et al.[71] argued that administrative controls, such as training and ensuring adequate staffing, are crucial to eliminating or minimizing occupational hazards. Engineering controls, such as redesigning work spaces, ensuring adequate ventilation, and introducing automated systems for repetitive tasks, were emphasized by Liberati et al.[72] PPE, such as the use of gloves, clothing, and eye wear, are considered the least effective and have the most profound consequences in the event of failure by exposing the individual directly to the hazard.[20] Nonetheless, many researchers and professionals agree that all such controls should be applied collectively, in order to minimize the effects of hazards.[20,70–72]

Table 5. Psychosocial hazards.

Psychosocial hazards	Risk factors	Risk of harm	Control strategies
1. Psychological (e.g. trauma) 2. Organizational (e.g. shiftwork)	Long working hours, which has been closely associated with health disorders; administrative work schedules (e.g. shift work), and workplace bullying.[57,58] Workplace violence; verbal violence; tarnished reputation where they were accused of negligence; aggressive behavior from patients; intimidation from colleagues and seniors; and sexual harassment.[59] Healthcare professionals also face violence during robberies and the theft of addictive prescription pain killers, such as Oxycontin and Vicodin.[54] We also identified organizational culture and structure, interpersonal relationships at work, job content and satisfaction, home-work balance, and the changing nature of work as important psychosocial hazard risk factors among healthcare professionals.[54,57,60]	Work-related stressors have a detrimental impact on worker's health and safety, in terms of mental, musculoskeletal, chronic degenerative disorders, metabolic syndrome diabetes, and cardiovascular diseases.[61] Psychological hazards at work were associated with heart disease, depression, physical health problems, and psychological strain.[54] Low back pain was the most common work-related ailment among healthcare workers in Taiwan.[53] Employees who experience job insecurity and/or workplace injustice were more likely to suffer from burnout.[54] Job demands and the level of control experienced by the worker were significantly associated with fatigue; exposure to workplace violence affects psychological stress, sleep quality, and subjective health status among healthcare professionals.[59]	Engineering control strategies: creation of isolation areas for agitated patients and designing an office layout that prevents the healthcare professionals from coming into direct contact with customers/patients or being trapped.[57] Spaces should be well lit and separated to ensure that client-care provider contact is controlled and access is allowed only when absolutely necessary. Proper working communication devices and video surveillance, as well as panic buttons and alarm systems.[62] Administrative control: management policies make unequivocal declarations of non-violence/anti-abuse.[63] Management can encourage workers to participate in the design of forward-rotating (day-evening-night) shifts and work schedules that impose gradual shift changes and ease the adaptation to non-regular work shifts to ensure that all concerned get adequate sleep.[61] Educate healthcare professionals about the risks associated with shift work.[20] Well-trained security personnel should be hired to deal with unruly customers.[59] Training in conflict management and problem-solving could also help workers to prevent or de-escalate violence.[60,64] Nametags should be used by employees, and reporting and response procedures should be enhanced.

Authors' note

The manuscript has not previously been published and is not under consideration by another journal.

Author contributions

Conceptualization was done by L.M.H., L.C.H., and W.J.Y. Data curation was done by L.M.H., L.C.H., W.J.Y. All authors did the Investigation and arrived at a Methodology together. Validation was done by Y.C.M., L.Y.W., and H.L.C. Resources were collected by L.M.H. and J.Y.W. Supervision was done by L.M.H. and L.C.H. Writing—original draft was done by L.M.H., L.C.H. Writing—review and editing was done by all the authors.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

The ethical approval was not sought for this study because this is a systematic review and all the literature has been published.

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Supplemental material

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