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Occupational hazards, health conditions and personal protective equipment used among healthcare workers in hospitals, Thailand

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Abstract

This cross-sectional study aimed to evaluate occupational hazards, health conditions and personal protective equipment used among healthcare workers. Information from the sample size of 1,128 healthcare workers were collected using questionnaires. The healthcare workers participated in this study were from five departments including inpatient, outpatient, surgery and anesthesia, nutrition service and hospital support services departments in five hospitals in Thailand. The results indicated that the majority of healthcare workers were female; these healthcare workers work 9.0 to 11.1 hours/day on average and were exposed to several chemical, biological and physical hazards. The healthcare workers in the nutrition service department reported the highest percentage of musculoskeletal disorder and respiratory problems. The highest percentage of skin problems were reported by healthcare workers in surgery and anesthesia department. The results showed musculoskeletal disorder, respiratory and skin problem significantly differed among healthcare workers in the five departments including the wrists/hands ($p = 0.024$), upper back ($p = 0.009$), chest pain symptoms ($p = 0.004$), and dry/wound symptoms ($p = 0.013$). Healthcare workers did not have adequate protection from work-related hazards in their workplace. Health education programs, control measures and organizational policies should be implemented to mitigate the hazards for healthcare workers in hospitals.

Keywords

Healthcare workers; occupational hazards; health conditions; accidents; musculoskeletal disorders

Introduction

The World Health Organization has estimated the total of 59.2 million full-time healthcare workers (World Health Organization 2006). The distribution of the health workforce in Thailand totaled 2.04 health professionals working in public facilities per 1,000 population (Witthayapipopsakul et al. 2019). Healthcare workers were employed in 1,019 public and 284 private hospitals, as reported by the Bureau of Policy and Strategy, Ministry of Public Health in 2014 (Bureau of Policy and Strategy 2016). A total of 13 occupational disease clinic networks operate in Thailand. Each occupational disease clinic network has around 4 to 13 hospital members. The occupational health clinics aim at diagnosing and treating occupational diseases and providing services for occupational diseases, providing pro-active and passive occupational health services and empowering the staff in providing occupational health services and setting strategic plans for short and long term occupational disease clinic services (Bureau of Occupational and Environmental Diseases 2017). Healthcare workers have long been neglected by their respective governments (Lipscomb and Rosenstock 1997). The misconception exists that the healthcare facility is “clean” and without hazards, when the chemical and blood-borne pathogen exposure can be career- and life-ending (Wilburn and Eijkemans 2004). Statistics showed that a hospital is one of the most hazardous workplaces to work in; U.S. hospitals had 253,700 work-related injuries and illnesses, higher than those in construction and manufacturing companies (OSHA 2013). The use of chemicals is widespread in healthcare facilities including cleaning agents, anesthetic agents, cytotoxic drugs and pharmaceutical substances, disinfecting and sterilizing agents and laboratory chemicals (Gestal 1987; Health and Safety Authority 2020). Physical hazards include slippery floors, electrical hazards, noise, poor lighting, and inadequate ventilation (Triolo 1989). A few examples of biological hazards include bacteria, viruses, fungi, parasites and medical wastes (Rim and Lim 2014). Patient handling has been identified to partially increase musculoskeletal injuries among nurses and nurses’ aides specifically injuries to the back, neck and shoulders (Trinkoff et al. 2003; Byrns et al. 2004). To reduce hazards, occupational health specialists should manage hazards in the workplace, so the staff will not experience injury (WorkCover Corporation 2000). In Thailand, the online report of occupational risk factors among 38,788 healthcare workers in 59 hospitals showed that the healthcare workers were exposed to occupational health hazards including psychosocial risk factors (13.1%), ergonomic risk factors (12.9%), and biological hazard risk factors (10.0%) (Division of Innovation and Research 2019). The healthcare workers were also exposed to other hospital risk factors, which were not shown in the online report. Therefore, this study aimed to evaluate occupational hazards including chemical, physical, biological and ergonomic hazards and health conditions of healthcare workers in hospitals, accidents, contact with chemicals and body fluids and personal protective equipment (PPE) used among healthcare workers in Thailand.

Material and method

Sample size determination and sampling procedure

Subjects in this study comprised both healthcare workers with direct patient contact and nondirect patient contact in five hospitals, Nopparat Rajathanee Hospital and Samut Sakhon Hospital in central, Maharat Nakhon Ratchasima Hospital in northeast, Hatyai Hospital in south, and Buddhachinaraj Phitsanulok Hospital in lower north Thailand. All hospitals were the head of an occupational health clinic network except for Buddhachinaraj Phitsanulok Hospital and Nopparat Rajathanee Hospital. Nopparat Rajathanee Hospital served as the occupational disease center for the whole country. Buddhachinaraj Phitsanulok Hospital used to have an occupational disease clinic but stopped services because of the retirement of the occupational disease specialist medical doctor. The recruitment of subjects employed a random sampling technique of subjects in specified departments in proportion to the size of the hospitals; 1,128 healthcare workers consisted of 613 healthcare workers working directly with patients and 515 healthcare workers not working directly with patients. The selected healthcare workers comprised inpatients (n = 290), outpatients (n = 217), surgery and anesthesia department (n = 52) for those working directly with patients; nutrition service (n = 52) and hospital support services departments (n = 160) comprised those not working directly with patients as shown in Figure 1. The healthcare workers are workers in hospitals including doctor, nurses, assistance nurse, officer. Management are heads of healthcare workers who are responsible for controlling and overseeing in the department. The inpatient department referred to healthcare workers taking care of patients with mainly acute and chronic diseases and patients having to be admitted to hospitals. The outpatient department referred to healthcare workers taking care of outpatients coming to see a doctor and involved patients not requiring to stay in the hospital. The healthcare workers in surgery and anesthesia department anesthetized patients and operated on patients and those who helped patients before and after the operation. The three groups of healthcare workers comprised professional healthcare workers providing treatment for patients in hospitals. The healthcare workers in the nutrition service department had to cook, clean, transfer hygienic food for inpatients and some healthcare workers in the hospitals. They also had to collect trays and trolleys. The healthcare workers in the hospital support services department included finance clerks and accountants, equipment maintenance workers, security workers, medical record workers etc. This study was approved by the Faculty of Public Health, Mahidol University Institutional Review Board (MUPH 2013–148).

Questionnaire

The semi-structured questionnaire consisted of four parts: part 1 personal and work characteristics including general characteristics, work characteristic, position, experience and work day/week and hour/day, part 2 health conditions in the past three months including underlying chronic health condition and health problems, accident, hazard in the workplace and musculoskeletal disorders, part 3 chemical, physical, biological and ergonomic hazards in workplaces and part 4 PPE used that complies with safety rules and protocol, correct working posture and using PPE specific to type of work. In part 1, exercise frequencies were expressed as “Regularly” (the average exercise of 3 times/week), “30 minutes” (1 time/week), “Sometimes” (less than 3 times/week), and “Never” (0 time/week). In part 3,

hazards in workplace include chemicals, physicals, biological, and ergonomic hazards. We had a list of different types of hazards and asked healthcare workers whether they have exposed to them or not (Yes, No). From 1,250 questionnaires given to healthcare workers in 5 hospitals, 1,180 questionnaires (94.4% response rate) were returned to our research team. Since 52 questionnaires were not completed, the final sample size of this study was 1,128 healthcare workers.

Data collection

The questionnaires were distributed by the staff at the occupational health clinic to healthcare employees working directly with patients in all departments with a sealed envelope and another envelope with an informed consent form. The completed questionnaires were collected two weeks later. The healthcare workers, not working directly with patients, were interviewed by the staff of the occupational health clinic team.

Data analysis

The data were coded and analyzed using SPSS (Version 18; PASW Statistics Base 18, Serial no. 5082368, ID no. 5071846) from SPSS (Thailand) Co., Ltd., Thailand. Descriptive analysis comprised mean (standard deviation), frequency (percentage), and maximum-minimum. Inferential statistic, Chi-squared test and Fisher's exact tests were used for determining relationships among variables in the five department of healthcare workers. For PPE used, healthcare workers reporting unrelated data were removed from the statistical analysis.

Results

General characteristics of healthcare workers

The characteristics of healthcare workers in this study varied by the selected departments (Table 1). Most healthcare workers in these departments were female working in the inpatient (95.8%), outpatient (81.4%), surgery and anesthesia units (86.3%), nutrition service (90.4%) and hospital support services departments (60.8%). Their average ages were 38.8, 40.4, 42.9, 39.0 and 41.7 years old, respectively. More than 50.0% of healthcare workers were married, graduated at bachelor degree or higher education level except the nutrition service department. Only a few healthcare workers (less than 2.0%) smoked cigarettes except the hospital support services healthcare workers (12.7%). For consuming alcoholic beverages, the highest group comprised hospital support services healthcare workers (32.7%), while the lowest group consisted of healthcare workers in the surgery and anesthesia department (2.0%). For exercise, those healthcare workers in surgery and anesthesia department had the least exercise (34.6%).

Work characteristic, position, experience and working days/week and hours/day

The type of work reported was administration (2.5-8.2%) and healthcare workers (91.8-97.5%) in different departments. The nurses were the highest group participating from inpatient department (69.9%), surgery and anesthesia department (53.8%) and the outpatient department (43.7%); the doctors were the lowest group participating (Table 2). More than 46.2% of healthcare workers worked less than or equal to 10 years and more than 43.1%

had worked more than 10 years. Regarding healthcare workers in the inpatient department, 83.7% had shift work, followed by healthcare workers in surgery and anesthesia department (62.7%) and nutrition service department (60.8%). All selected healthcare employees worked ranging from 3 to 7 days/week. The average working hours/day (range) including overtime work was 11.1 (4-18) for healthcare workers in the surgery and anesthesia department, 10.7 (7-16) in the inpatient department, 9.6 (6-16) in the out-patient department, 9.0 (7-13) for nutrition service and 9.4 (7-18) for hospital support services departments.

Underlying chronic health conditions and health problems in the past three months

Surgery and anesthesia healthcare workers reported the highest number of underlying diseases (44.2%) such as allergy, high blood pressure, asthma etc., followed by hospital support services healthcare workers (41.3%), and nutrition service healthcare workers (40.4%). For skin problem, the surgery and anesthesia healthcare workers reported the highest number of skin problems, itchy (59.6%), rash (44.2%), nettle rash (23.1%) and dry/wound (32.7%) (Table 3). The dry/wound symptoms reported by healthcare workers significantly differed in the five departments ($p = 0.013$). Regarding respiratory tract symptoms, the nutrition service healthcare workers reported the highest number of signs such as nasal congestion/runny nose (68.6%), cough/cough with phlegm (70.6%), chest tightness (27.5%), chest pain (34.6%), wheezing (15.7%) and hearing loss (38.8%). The chest pain symptoms were significantly different among healthcare workers in five departments ($p = 0.004$). The hospital support services healthcare workers reported the highest incidences of eye pain (50.9%) and eye irritation/red eye/watery eyes (43.7%), often urinate (34.8%) and depression (17.7%). The nutrition service workers also reported the highest incidence of blurred vision (56.0%), headache (66.0%), dizziness (55.8%), arm and leg fatigue (30.8%), mild fever (34.6%) and loss of appetite/weight loss (14.0%). With regards to eye, ear and nonspecific symptoms, the healthcare workers reported significantly different symptoms in the five departments including eye pain ($p = 0.001$), blurred vision ($p = 0.005$), eye irritation/red eyes/watery eyes ($p = 0.005$), hearing loss ($p = 0.012$), arm and leg fatigues ($p < 0.001$), mild fever ($p = 0.003$) and frequent urination ($p < 0.001$) (Table 3).

Accidents in the past three months

Nutrition service healthcare workers reported the highest number of sharp object injury (57.7%) and falling from slippery floor (30.8%). The surgery and anesthesia healthcare workers reported the highest number of needle stick (27.5%) and contact with chemicals or body fluid (12.0%). Healthcare workers of the hospital support services reported the highest number of falls from height (8.9%) (Table 4). Using the Chi-square and Fisher's exact tests, the reported accidents significantly differing among healthcare workers in the five departments included sharp object injury ($p < 0.001$), needle stick ($p < 0.001$), fall from height ($p = 0.030$), falling from slippery floor ($p < 0.001$) and contact with chemicals and body fluids ($p = 0.026$) (Table 4).

Hazards in the workplace in the past three months

Chemical hazards—The healthcare workers in surgery and anesthesia department reported the highest exposure to chemical hazards, formaldehyde (55.1%), ethylene oxide

(35.3%), cleaning chemicals (43.1%), glutaraldehyde (48.0%), anesthetic gas (80.0%), mercury (19.6%), lead (19.6%), hand cleaners (100.0%), and gloves or dust from powdered medical gloves (100.0%) (Table 5). The healthcare workers in inpatient department reported the highest exposure to chemotherapy (49.1%). The nutrition service healthcare workers reported lower exposure to chemical hazards than those healthcare workers in the other four departments except for hand cleaners, gloves or dust from powdered medical gloves exposure. The Chi-square and Fisher's exact tests showed that chemical exposure encountered by healthcare workers significantly differed among the five departments: formaldehyde ($p < 0.001$), ethylene oxide ($p < 0.001$), chemotherapy ($p < 0.001$), cleaning chemicals ($p < 0.001$), glutaraldehyde ($p < 0.001$), anesthetic gas ($p < 0.001$), mercury ($p < 0.001$), lead ($p = 0.003$), hand cleaners ($p < 0.001$), and glove or dust from powdered medical gloves ($p < 0.001$) (Table 5).

Physical hazards—The nutrition service healthcare workers reported the highest exposure to loud noise (86.0%), heat (82.4%) and cold (43.1%) while surgery and anesthesia healthcare workers reported the highest exposure to glare (65.4%), inadequate lighting (69.2%), radiation (80.4%) and vibration (42.3%). Radiation exposure totaled 60.1% for healthcare workers in the inpatient department and 21.9% of those in the outpatient department. Inadequate lighting exposure was reported by healthcare workers in the inpatient department (59.6%), nutrition service department (54.0%), outpatient department (53.7%) and hospital support services department (43.6%) (Table 5). Physical hazard exposure significantly differing among the five departments included loud noise ($p < 0.001$), inadequate lighting (0.005), heat ($p < 0.001$), cold ($p < 0.001$), radiation ($p < 0.001$) and vibration ($p = 0.008$) (Table 5).

Biological hazards—The surgery and anesthesia healthcare workers reported the highest contact with biological samples (94.2%), infected patients (90.4%) and sources of disease vectors such as food waste and garbage (70.6%). Inpatient healthcare workers reported the second highest contact with biological samples (92.7%) and infected patients (87.5%). The nutrition service healthcare workers reported the highest exposure to disease vectors such as rats, cockroaches and flies (88.2%) (Table 5). It seemed that healthcare workers in all departments selected were exposed to biological hazards from disease vectors such as rats, cockroaches and flies. Significant differences were found for contact with biological samples ($p < 0.001$), contact with infected patients ($p < 0.001$), source of disease vectors such as food waste or garbage ($p < 0.001$) and area containing disease vectors such as rats, cockroaches and flies ($p = 0.014$) among these healthcare workers in the five departments using the Chi-square test (Table 5).

Ergonomics hazards—Surgery and anesthesia healthcare workers reported the highest ergonomic hazards including moving heavy materials over 20 kg (73.1%), using fingers, hands and arms repeatedly and continuously (69.2%), using fingers or hand-held tools with vibration (30.8%), twisting the body or stoop (78.8%), sitting or standing on vibrating machinery (11.5%) and standing most of the time (94.2%). The hospital support services healthcare workers reported the highest number of ergonomic hazards, i.e., sitting on a chair most of the time (68.4%) and sitting on the ground most of the time (24.8%). Inpatient

department healthcare workers reported the highest number of ergonomic hazards from squatting most of the time (33.6%) (Table 5). Using the Chi-square and Fisher's exact tests, significantly differing of ergonomic problems encountered among healthcare workers in these five departments comprised moving heavy materials over 20 kg ($p < 0.001$), using the fingers or hand-held tools ($p = 0.006$), twisting the body ($p < 0.001$), sitting or standing on vibrating machinery ($p = 0.036$), sitting on a chair most of the time ($p < 0.001$), sitting on the ground most of the time ($p = 0.002$), and standing most of the time ($p < 0.001$) (Table 5).

Musculoskeletal disorder in the past three months

Healthcare workers in the nutrition service department reported the highest number of musculoskeletal disorders in the five departments, namely, the shoulders (50.0%), elbow (10.2%), wrist/hand (34.7%), fingers (20.4%), upper back (30.0%), lower back (39.6%), hip (28.0%), knee (38.0%) and ankle/feet (24.0%). Neck pain was reported the highest among surgery and anesthesia healthcare workers (36.0%), followed by nutrition service healthcare workers (34.0%) and outpatient healthcare workers (33.0%) (Figure 2). Using the Chi-square test, the significantly differing musculoskeletal disorders encountered in these five departments involved the wrists/hands ($p = 0.024$) and upper back ($p = 0.009$).

Compliance with safety rules and protocols, correct working posture and PPE used among healthcare workers

The results of determining compliance with safety rules and protocols, correct working posture and PPE used are presented in Table 6. Nutrition service healthcare workers reported the highest percentage of regular compliance with safety rules and protocols (80.0%), followed by surgery and anesthesia (77.6%), hospital support services (68.9%) outpatient (67.5%) and inpatient healthcare workers (65.8%). Concerning regularly correct working posture at work, outpatient healthcare workers was reported the highest at 51.7%, followed by inpatient healthcare workers (50.7%), surgery and anesthesia healthcare workers (47.1%), nutrition service healthcare workers (46.0%) and hospital support services healthcare workers (45.2%). Regarding using PPE specific to type of work, frequent use ("always") of using ear plugs or muffs, goggles, mask, protective clothing, gloves and face shield were reported the highest at 35.8%, 58.1%, 59.5%, 60.6%, 81.8% and 50.0%, respectively, by the surgery and anesthesia healthcare workers. The surgery and anesthesia healthcare workers reported the highest incidence of wearing surgical mask, N-95 mask and cloth or rubber gloves at the highest rates at 86.2%, 66.0% and 89.8%, respectively. They also reported the highest incidence of wearing lead coveralls and film badges while working with radioactive materials at 76.7% and 56.8%, respectively (Table 6).

Discussion

Underlying chronic health conditions and health problems in the past three months

The healthcare workers in the surgery and anesthesia department reported the highest incidence of skin problems (Table 3) which may be due to chemical exposure; they reported the highest exposure to all chemicals excepting chemotherapy and gloves or dust from powdered medical gloves (Table 5). In the surgery and anesthesia department, the skin problem regarding itch and rash among the healthcare workers exposed to formaldehyde

and not exposed to formaldehyde showed significant difference at $p = 0.008$ and $p = 0.047$ in Chi-squared test, respectively. Long-term exposure to low levels of formaldehyde in the air or skin could lead to asthma-like respiratory problems and skin irritation such as dermatitis and itching (ATSDR 2020). Dermal contact with ethylene oxide can cause dry, red, and cracked skin (dermatitis) (CCOHS 2019). Glutaraldehyde exposure may cause irritant effects, sensitize the skin and produce respiratory effects (Takigawa and Endo 2006). Health problems from exposure to chemical and biological hazards were investigated for operating room (OR) nurses and technicians, revealing 50% experienced dermatological problems (Ugurlu et al. 2015). Comparing between inpatient and outpatient departments, the healthcare workers in the inpatient department reported a higher number of skin problems than those in the outpatient department (Table 3) probably due to higher exposure to chemical hazards, especially chemotherapy chemicals (Table 5). The healthcare workers in the nutrition service department reported the highest number of respiratory symptoms (Table 5) that may have been caused by the strong smell of the food they cooked. The respiratory problems were possibly caused by exposure to toxic compounds from cooking fumes (Svendsen et al. 2003; Juntarawijit and Juntarawijit 2017) or possible risk factors such as job description, restaurant size, type of cooking oil and hours of stay in the kitchen area (Juntarawijit and Juntarawijit 2017). Nutrition service healthcare workers also reported the most cases of hearing loss; they also reported the highest exposure to loud noise (Table 5). The sources of noise included metal-to-metal contact between utensils and the use of industrial-size blenders in the hospital kitchen (Achutan 2009). Additionally, nutrition service healthcare workers reported regular wearing ear plugs or muffs at only 17.1% (Table 6). They also reported the highest number of nonspecific symptoms (Table 3); possibly due to heavy work. Surgery and anesthesia healthcare workers reported the highest exposure to glare and inadequate lighting (Table 5), and reported eye irritation, eye pain and blurred vision ranging from 30.8 to 34.6% (Table 3). Surgeons were exposed to nonionized radiation and ionized radiation from laser-based instruments and exposed to scattered radiation such as from the operative fluoroscope and x-ray (Memon et al. 2016).

Accidents in the past three months

The accident report was highest in two departments, surgery and anesthesia and the nutrition service departments (Table 4). The nutrition service healthcare workers use knives to cut and prepare food; they reported 57.7% cases of sharp object injury. Similarly, 300 randomly selected restaurant workers reported the prevalence of work-related injuries from cuts and lacerations (67.7%), caused by using knives (Jahangiri et al. 2019). Additionally, nutrition service healthcare workers reported 30.8% cases of falling from a slippery floor that could come from a wet floor or a contaminated surface in the kitchen. Floor coefficient of friction and contamination such as dishwashing spray or run-off, leaking equipment or pipes and food debris in kitchen area were associated with workers' slipping, trips and falls (Courtney et al. 2010). Needle stick (27.5%) was reported the highest among healthcare workers in the surgery and anesthesia department (Table 4); contact with chemicals and body fluids (12.0%) (Table 4) was also the highest probably due to the reported the highest contact with chemicals and the highest contact with biological samples (Table 5). Similarly, in a study on work-related health problems of 33,327 Taiwanese nurses; the operating room (OR) nurses had the highest risk for needle stick injuries compared with all nurses (Chiou et al. 2013).

Among the OR nurses and technicians, 75.7% stated they had been injured by sharp objects (U urlu et al. 2015).

Chemical, physical, biological and ergonomic hazards

Healthcare workers reported the highest exposure to most chemical, physical and biological hazards were in the surgery and anesthesia department, followed by inpatient and outpatient departments due to characteristics of their works (Table 5). Similarly, one study in Taiwan reported that nurses working in the OR were exposed to the highest levels of radiation and 40% of OR nurses were affected by anesthetic gas (Chiou et al. 2013). The healthcare workers at nutrition and hospital support services departments were exposed to a low number of chemical and biological hazards except areas containing disease vectors such as rats, cockroaches and flies and source of disease vectors such as food waste and garbage in the nutrition department (Table 5). Healthcare workers in all departments reported having more than 50% of ergonomic hazards, namely, moving heavy materials over 20 kg, using the fingers, hands and arms repeatedly all the time, twisting the body or stooping while sitting or standing at work and standing most of the time (Table 5). Related reports from India found that ergonomic hazards of healthcare workers included lifting heavy objects (42%) and standing for long hours (37%) (Senthil et al. 2015). One half of healthcare workers in all departments were always concerned about correct working posture at work and the other half were sometimes concerned about correct working posture (Table 6). More attention should be paid to ergonomic hazards to reduce musculoskeletal disorders among healthcare workers.

Musculoskeletal disorder in the past three months

Nutrition service healthcare workers had lower regular concerns about correct working posture at work (46.0%) than those in the inpatient, outpatient and surgery and anesthesia departments (Table 6); they reported the highest number of musculoskeletal disorders in the five departments selected (Figure 2). They had to cook three meals every day to serve patients in the hospital; the size of pots, pans and other utensils were large. Trolleys and trays were used for serving food, and the dish washing task was considered hard work (Chim 2006). The study reported that nurses in nondirect patient care units had 2.05 times more back pain than nurses in direct patient care units (Sopajareeya et al. 2009). In our study, low back pain among healthcare workers in the nutrition service department (39.6%) was the highest, followed by in-patient (27.1%), outpatient (26.5%), hospital service staff (25.5%) and the surgery and anesthesia departments (18.0%) (Figure 2).

Compliance with safety rules and protocols, correct working posture and PPE used among healthcare workers

Healthcare workers' regular compliance with safety rules and protocols was not high in the inpatient (65.8%), outpatient (67.5%), surgery and anesthesia (77.6%), nutrition service (80.0%) and hospital support services departments (68.9%) (Table 6). Healthcare workers encountered serious safety and health hazards including blood-borne pathogens and biological hazards, potential chemical and drug exposures, waste anesthetic gas exposures, respiratory hazards, ergonomic hazards from lifting and repetitive tasks, laser hazards, radioactive materials and x-ray hazards. Some of the potential chemical exposures included

formaldehyde, used to preserve specimens for pathology, ethylene oxide and glutaraldehyde, used for sterilization, and numerous other chemicals used in healthcare laboratories (OSHA 2019). They needed to strictly comply with safety rules and protocols to reduce exposure to the mentioned chemical, biological and ergonomic hazards. In addition, their concern with regular correct working posture was also not high (51.7% or lower) (Table 6), which could predict that healthcare workers may have a high prevalence of musculoskeletal disorders in the future.

Healthcare workers in the surgery and anesthesia department were exposed to various chemicals resulting in some health problems (the highest number of skin problems reported); they reported regular use of goggles (58.1%), mask (59.5%), protective clothing (60.6%), gloves (81.8%) and face shield (50.0%). Inpatient healthcare workers exposed to chemotherapy, reported regular use of goggles (28.6%), mask (48.9%), protective clothing (48.2%), gloves (81.0%) and face shield (42.0%) (Table 6). For physical hazards of healthcare workers, the regular use of ear plugs or muffs at work was low (less than 35.8%) (Table 6); the exposure to noise among nutrition service healthcare workers could lead to noise hearing loss. With regard to radiation exposure, the surgery and anesthesia healthcare workers reported being exposed to radiation (80.4%) (Table 5) but they regularly wore lead suit cover (76.7%) and film badges (56.8%) (Table 6). Inpatient healthcare workers, exposed to radiation (60.1%) (Table 5), regularly put on lead suit covers (34.7%) and film badges (26.1%) (Table 6). Healthcare workers in the surgery and anesthesia department reported the highest exposure to biological hazards (90.4-94.2%) (Table 5); they regularly used surgical mask (86.2%), N-95 mask (66.0%) and cloth or rubber gloves (89.8%) (Table 6). Inpatient healthcare workers reported 87.5 to 92.7% exposure to biological hazards (Table 5), but regularly used surgical masks (67.1%), N-95 mask (36.8%) and cloth or rubber gloves (75.4%) (Table 6). For cleaning work, surgery and anesthesia healthcare workers regularly put on coveralls (64.5%), boots (48.6%), cloth or rubber gloves (85.7%) and dust and surgical masks (79.1%), followed by the inpatient healthcare workers and outpatient healthcare workers (Table 6). Clearly, healthcare workers did not have adequate protection regarding work-related hazards in their workplaces. The reasons for not wearing PPE could result from not having adequate PPE provided or not having risk perceptions (Harrod et al. 2020) about work-related hazards encountered.

Limitations of this study

This was a cross-sectional study. The information regarding personal and work characteristics, health condition in addition to musculoskeletal disorders, chemical, physical, biological and ergonomic hazards in workplaces, PPE used was collected using a questionnaire. No medical verification of these outcomes was conducted. This study may have recall bias since healthcare workers may not be able to recall all of their underlying chronic health conditions and health problems in the past three months. In the further study, a longitudinal study should be performed to confirm the effect of the occupational hazards in healthcare workers.

Conclusion

Healthcare workers were exposed to occupational hazards such as overtime work, chemical, physical, biological and ergonomic hazards in their workplaces. These hazards affected health problems, musculoskeletal disorders and accident rate. Furthermore, protection from work-related hazards of healthcare workers was insufficient. The information explained here could help target education efforts, control measures and organizational policies to mitigate the hazards facing healthcare workers in hospitals.

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Figure 1.
Participant flow diagram of subject's recruitment.

Figure 2.
Musculoskeletal disorders of selected departments of healthcare workers in the past three months (significant differences at $p < 0.05$ Chi-square (*)).

Table 1.

General characteristics of selected departments of healthcare workers.

General characteristic n (% reported)	Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)
Sex					
Male	12 (4.2)	40 (18.6)	7 (13.7)	5 (9.6)	62 (39.2)
Female	276 (95.8)	175 (81.4)	44 (86.3)	47 (90.4)	96 (60.8)
Age					
<40 year old	157 (56.1)	95 (46.3)	17 (36.2)	26 (52.0)	70 (44.6)
40 year old	123 (43.9)	110 (53.7)	30 (63.8)	24 (48.0)	87 (55.4)
Mean (SD)	38.8 (9.6)	40.4 (9.5)	42.9 (10.2)	39.0 (9.7)	41.7 (10.1)
Min-Max	21-60	20-61	23-57	23-57	20-60
Marital status					
Single	112 (39.0)	66 (30.7)	15 (29.4)	15 (28.8)	43 (27.0)
Married	150 (52.3)	134 (62.3)	32 (62.7)	33 (63.5)	101 (63.5)
Widow/Divorced	25 (8.7)	15 (7.0)	4 (7.9)	4 (7.7)	15 (9.5)
Education					
<Bachelor degree	84 (29.3)	71 (32.7)	22 (42.3)	29 (55.8)	72 (45.6)
Bachelor degree	182 (63.4)	111 (51.2)	23 (44.2)	22 (42.3)	72 (45.6)
>Bachelor degree	21 (7.3)	35 (16.1)	7 (13.5)	1 (1.9)	14 (8.8)
Smoking					
Nonsmoker	281 (97.6)	203 (94.0)	51 (98.1)	50 (98.0)	123 (77.8)
Exsmoker	2 (0.7)	9 (4.1)	–	–	15 (9.5)
Current smoker	5 (1.7)	4 (1.9)	1 (1.9)	1 (2.0)	20 (12.7)
Alcohol consumption					
Nondrinker	235 (83.3)	165 (77.5)	44 (86.2)	38 (82.6)	86 (56.2)
Exdrinker	6 (2.2)	10 (4.7)	6 (11.8)	1 (2.2)	17 (11.1)
Current Drinker	41 (14.5)	38 (17.8)	1 (2.0)	7 (15.2)	50 (32.7)
Exercise					
Regularly	30 (10.4)	29 (13.6)	6 (11.5)	6 (11.8)	18 (11.3)
Sometime	176 (60.9)	129 (60.6)	28 (53.8)	38 (74.5)	100 (62.5)
Never	83 (28.7)	55 (25.8)	18 (34.6)	7 (13.7)	42 (26.2)

Table 2.

Work characteristic, position, experience and working day/week and hour/day of selected departments of healthcare workers.

Work parameter n (% reported)	Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)
Type of work					
Management	9 (3.3)	5 (2.5)	4 (8.2)	3 (6.5)	6 (4.4)
Healthcare worker	265 (96.7)	193 (97.5)	45 (91.8)	43 (93.5)	129 (95.6)
Position					
Doctor	4 (1.4)	15 (7.0)	2 (3.8)	–	–
Nurse	197 (69.9)	93 (43.7)	28 (53.8)	–	12 (7.7)
Assistance nurse	15 (5.3)	9 (4.2)	6 (11.5)	1 (2.1)	3 (1.9)
Officer	12 (4.3)	44 (20.7)	4 (7.7)	17 (36.2)	81 (52.3)
Other	54 (19.1)	52 (24.4)	12 (23.2)	29 (61.7)	59 (38.1)
Working experience in the position					
10 years	137 (47.7)	118 (54.9)	24 (46.2)	29 (56.9)	85 (54.5)
> 10 years	150 (52.3)	97 (45.1)	28 (53.8)	22 (43.1)	71 (45.5)
Shift work					
Yes	242 (83.7)	68 (31.6)	32 (62.7)	20 (60.8)	39 (24.4)
No	47 (16.3)	147 (68.4)	19 (37.3)	31 (39.2)	121 (75.6)
Working day/week					
5 day/week	83 (40.3)	112 (78.3)	21 (60.0)	19 (41.3)	92 (71.9)
> 5 day/week	123 (59.7)	31 (21.7)	14 (40.0)	27 (58.7)	36 (28.1)
Mean (SD)	5.7 (0.9)	5.2 (0.7)	5.3 (1.0)	5.5 (0.8)	5.3 (0.8)
Min-Max	3-7	3-7	3-7	3-7	3-7
Working hour/day					
8 hour/day	113 (54.9)	88 (61.5)	15 (42.9)	29 (63.0)	77 (60.2)
> 8 hour/day	93 (45.1)	55 (38.5)	20 (57.1)	17 (37.0)	51 (39.8)
Mean (SD)	10.7 (3.5)	9.6 (2.6)	11.1 (3.8)	9.0 (1.7)	9.4 (2.2)
Min-Max	7-16	6-16	4-18	7-13	7-18

Table 3.

Underlying chronic health conditions and health problems in the past three months of selected departments of healthcare workers.

Health condition n (% reported)	Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)	p-value
Underlying disease						0.400
Yes	98 (33.8)	85 (39.4)	23 (44.2)	21 (40.4)	66 (41.3)	
No	192 (66.2)	131 (60.6)	29 (55.8)	31 (59.6)	94 (58.7)	
Asthma						0.941
Yes	10 (3.4)	5 (2.3)	1 (1.9)	2 (3.8)	4 (2.5)	
No	280 (96.6)	212 (97.7)	51 (98.1)	50 (96.2)	156 (97.5)	
Allergy						0.569
Yes	46 (15.9)	39 (18.0)	12 (23.1)	9 (17.3)	34 (21.3)	
No	244 (84.1)	178 (82.0)	40 (76.9)	43 (82.7)	126 (78.7)	
Diabetes mellitus						0.461
Yes	7 (2.4)	5 (2.3)	3 (5.8)	1 (1.9)	7 (4.4)	
No	283 (97.6)	212 (97.7)	49 (94.2)	51 (98.1)	153 (95.6)	
High blood pressure						0.158
Yes	12 (4.1)	14 (6.5)	2 (3.8)	5 (9.6)	15 (9.4)	
No	278 (95.9)	203 (93.5)	50 (96.2)	47 (90.4)	145 (90.6)	
Heart disease						0.740
Yes	3 (1.0)	2 (0.9)	1 (1.9)	1 (1.9)	2 (1.3)	
No	287 (99.0)	215 (99.1)	51 (98.1)	51 (98.1)	158 (98.7)	
Cancer						0.252
Yes	3 (1.0)	1 (0.5)	–	2 (3.8)	1 (0.6)	
No	287 (99.0)	216 (99.5)	52 (100.0)	50 (96.2)	159 (99.4)	
Thalassemia						0.175
Yes	12 (4.1)	4 (1.8)	2 (3.8)	3 (5.8)	2 (1.3)	
No	278 (95.9)	213 (98.2)	50 (96.2)	49 (94.2)	158 (98.7)	
Skin						
Itchy						0.358
Yes	152 (52.4)	107 (49.3)	31 (59.6)	21 (40.4)	81 (51.3)	
No	138 (47.6)	110 (50.7)	21 (40.4)	31 (59.6)	77 (48.7)	
Rash						0.076
Yes	93 (32.2)	54 (25.2)	23 (44.2)	14 (26.9)	45 (28.3)	
No	196 (67.8)	160 (74.8)	29 (55.8)	38 (73.1)	114 (71.7)	
Nettle rash						0.320
Yes	55 (19.2)	30 (14.0)	12 (23.1)	6 (11.8)	27 (17.0)	
No	231 (80.8)	184 (86.0)	40 (76.9)	45 (88.2)	132 (83.0)	
Dry/wound						0.013*
Yes	81 (28.1)	38 (17.7)	17 (32.7)	7 (13.7)	36 (22.9)	
No	207 (71.9)	177 (82.3)	35 (67.3)	44 (86.3)	121 (77.1)	

Health condition n (% reported)	Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)	p-value
Water blister/ itchy						0.720
Yes	27 (9.4)	19 (8.8)	4 (7.7)	2 (3.9)	17 (10.7)	
No	260 (90.6)	196 (91.2)	48 (92.3)	49 (96.1)	142 (89.3)	
Respiratory tract						
Nasal congestion, runny nose						0.342
Yes	172 (59.7)	117 (55.2)	27 (51.9)	35 (68.6)	97 (60.6)	
No	116 (40.3)	95 (44.8)	25 (48.1)	16 (31.4)	63 (39.4)	
Cough/ cough with phlegm						0.257
Yes	156 (54.2)	118 (55.1)	27 (51.9)	36 (70.6)	91 (57.2)	
No	132 (45.8)	96 (44.9)	25 (48.1)	15 (29.4)	68 (42.8)	
Chest tightness						0.142
Yes	49 (17.1)	44 (20.7)	7 (13.5)	14 (27.5)	39 (24.7)	
No	238 (82.9)	169 (79.3)	45 (86.5)	37 (72.5)	119 (75.3)	
Chest pain						0.004 *
Yes	41 (14.2)	32 (14.9)	7 (13.5)	18 (34.6)	32 (20.1)	
No	247 (85.8)	183 (85.1)	45 (86.5)	34 (65.4)	127 (79.9)	
Wheezing						0.159
Yes	21 (7.3)	19 (8.9)	5 (9.8)	8 (15.7)	21 (13.2)	
No	267 (92.7)	194 (91.1)	46 (90.2)	43 (84.3)	138 (86.8)	
Eye						
Eye pain						0.001 *
Yes	89 (31.1)	81 (38.2)	18 (34.6)	23 (45.1)	81 (50.9)	
No	197 (68.9)	131 (61.8)	34 (65.4)	28 (54.9)	78 (49.1)	
Blurred vision						0.005 *
Yes	106 (36.9)	88 (41.1)	18 (34.6)	28 (56.0)	83 (52.2)	
No	181 (63.1)	126 (58.9)	34 (65.4)	22 (44.0)	76 (47.8)	
Eye irritation/ red eyes/ watery eyes						0.005 *
Yes	74 (26.0)	66 (31.0)	16 (30.8)	16 (31.4)	69 (43.7)	
No	211 (74.0)	147 (69.0)	36 (69.2)	35 (68.6)	89 (56.3)	
Ear						
Hearing loss						0.012 *
Yes	49 (17.1)	39 (18.3)	10 (19.2)	19 (38.8)	33 (20.8)	
No	238 (82.9)	174 (81.7)	42 (80.8)	30 (61.2)	126 (79.2)	
Nonspecific Symptom						
Headache						0.386
Yes	170 (58.6)	117 (54.2)	28 (53.8)	33 (66.0)	83 (52.2)	
No	120 (41.4)	99 (45.8)	24 (46.2)	17 (34.0)	76 (47.8)	
Dizziness						0.968

Health condition n (% reported)	Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)	p-value
Yes	151 (52.4)	109 (52.4)	29 (55.8)	29 (55.8)	83 (52.2)	
No	137 (47.6)	103 (47.6)	23 (44.2)	23 (44.2)	76 (47.8)	
Arms and legs fatigue						<0.001 *
Yes	21 (7.3)	26 (12.1)	5 (9.6)	16 (30.8)	20 (12.7)	
No	266 (92.7)	188 (87.9)	47 (90.4)	36 (69.2)	138 (87.3)	
Mild fever						0.003 *
Yes	52 (18.1)	36 (16.7)	8 (15.4)	18 (34.6)	45 (28.3)	
No	235 (81.9)	179 (83.3)	44 (84.6)	34 (65.4)	114 (71.7)	
Loss of appetite/ Weight loss						0.491
Yes	20 (7.0)	16 (7.5)	4 (7.7)	7 (14.0)	15 (9.5)	
No	267 (93.0)	196 (92.5)	48 (92.3)	43 (86.0)	143 (90.5)	
Flatulence						0.918
Yes	133 (46.3)	92 (43.0)	22 (42.3)	23 (44.2)	67 (42.4)	
No	154 (53.7)	122 (57.0)	30 (57.7)	29 (55.8)	91 (57.6)	
Often urinate						<0.001 *
Yes	49 (17.1)	42 (19.7)	8 (15.4)	16 (32.0)	55 (34.8)	
No	238 (82.9)	171 (80.3)	44 (84.6)	34 (68.0)	103 (65.2)	
Jaundice						0.650
Yes	6 (2.1)	7 (3.3)	1 (1.9)	—	6 (3.8)	
No	281 (97.9)	206 (96.7)	51 (98.1)	52 (100.0)	153 (96.2)	
Depression						0.099
Yes	27 (9.5)	35 (16.4)	8 (15.4)	7 (13.7)	28 (17.7)	
No	258 (90.5)	179 (83.6)	44 (84.6)	44 (86.3)	130 (82.3)	

(*) Significant differences at $p < 0.05$ Chi-square

(†) Fisher's exact test.

Table 4.

Accidents of selected departments of healthcare workers in the past three months.

Accident n (% reported)	Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)	p-value
Sharp injury						<0.001 [*]
Yes	63 (22.1)	36 (16.7)	13 (25.5)	30 (57.7)	44 (27.5)	
No	222 (77.9)	179 (83.3)	38 (74.5)	22 (42.3)	116 (72.5)	
Needle stick						<0.001 [*]
Yes	31 (10.8)	10 (4.6)	14 (27.5)	5 (9.6)	19 (12.0)	
No	256 (89.2)	206 (95.4)	37 (72.5)	47 (90.4)	139 (88.0)	
Electrical shock						0.061
Yes	10 (3.5)	6 (2.8)	4 (7.8)	1 (1.9)	13 (8.1)	
No	277 (96.5)	210 (97.2)	47 (92.2)	51 (98.1)	147 (91.9)	
Fall from height						0.030 [†]
Yes	7 (2.5)	7 (3.2)	2 (4.0)	1 (1.9)	14 (8.9)	
No	277 (97.5)	209 (96.8)	48 (96.0)	51 (98.1)	144 (91.1)	
Falling from slippery floor						<0.001 [*]
Yes	32 (11.1)	14 (6.5)	10 (20.0)	16 (30.8)	28 (17.5)	
No	255 (88.9)	202 (93.5)	40 (80.0)	36 (69.2)	132 (82.5)	
Contact with chemical or body fluid						0.026 [†]
Yes	31 (11.0)	11 (5.1)	6 (12.0)	2 (3.8)	7 (4.5)	
No	252 (89.0)	205 (94.9)	44 (88.0)	50 (96.2)	150 (95.5)	

^(*)Significant differences at p < 0.05 Chi-square^(†)Fisher's exact test.

Table 5.

Hazard in the workplace of selected departments of healthcare workers in the past three months.

Hazard in the workplace n (% reported)	Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)	p-value
Chemical hazard						
Formaldehyde						<0.001 *
Yes	34 (12.0)	16 (7.4)	27 (55.1)	–	11 (7.1)	
No	250 (88.0)	199 (92.6)	22 (44.9)	52 (100.0)	145 (92.9)	
Ethylene oxide						<0.001 †
Yes	18 (6.3)	10 (4.6)	18 (35.3)	–	8 (5.1)	
No	267 (93.7)	206 (95.4)	33 (64.7)	52 (100.0)	148 (94.9)	
Chemotherapy						<0.001 *
Yes	140 (49.1)	10 (4.6)	6 (11.8)	–	6 (3.8)	
No	145 (50.9)	206 (95.4)	45 (88.2)	52 (100.0)	150 (96.2)	
Cleaning chemicals						<0.001 *
Yes	97 (33.9)	33 (15.3)	22 (43.1)	2 (4.0)	14 (9.0)	
No	189 (66.1)	183 (84.7)	29 (56.9)	48 (96.0)	141 (91.0)	
Glutaraldehyde						<0.001 *
Yes	32 (11.2)	10 (4.6)	24 (48.0)	–	10 (6.5)	
No	253 (88.8)	206 (95.4)	26 (52.0)	52 (100.0)	145 (93.5)	
Anesthetic gas						<0.001 †
Yes	8 (2.8)	8 (3.7)	40 (80.0)	–	4 (2.6)	
No	279 (97.2)	206 (96.3)	10 (20.0)	52 (100.0)	152 (97.4)	
Mercury						<0.001 †
Yes	33 (11.5)	6 (2.8)	10 (19.6)	–	6 (3.8)	
No	253 (88.5)	210 (97.2)	41 (80.4)	52 (100.0)	150 (96.2)	
Lead						0.003 †
Yes	18 (6.3)	11 (5.1)	10 (19.6)	–	11 (7.1)	
No	267 (93.7)	204 (94.9)	41 (80.4)	52 (100.0)	144 (92.9)	
Hand cleaner						<0.001 *
Yes	272 (94.8)	182 (84.3)	52 (100.0)	40 (80.0)	92 (59.4)	
No	15 (5.2)	34 (15.7)	–	10 (20.0)	63 (40.6)	
Gloves or dust form powdered medical gloves						<0.001 *
Yes	277 (96.5)	163 (76.2)	52 (100.0)	35 (68.6)	67 (43.8)	
No	10 (3.5)	51 (23.8)	–	16 (31.4)	86 (56.2)	
Physical hazard						
Loud noise						<0.001 *
Yes	180 (62.7)	137 (63.7)	36 (72.0)	43 (86.0)	84 (53.8)	
No	107 (37.3)	78 (36.3)	14 (28.0)	7 (14.0)	72 (46.2)	
Glare						0.059

Hazard in the workplace n (% reported)	Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)	p-value
Yes	133 (46.5)	91 (42.9)	34 (65.4)	22 (44.9)	68 (43.6)	0.005 *
No	153 (53.5)	121 (57.1)	18 (34.6)	27 (55.1)	88 (56.4)	
Inadequate lighting						0.005 *
Yes	171 (59.6)	115 (53.7)	36 (69.2)	27 (54.0)	68 (43.6)	
No	116 (40.4)	99 (46.3)	16 (30.8)	23 (46.0)	88 (56.4)	<0.001 *
Heat exposure						
Yes	71 (24.5)	25 (11.6)	16 (30.8)	42 (82.4)	28 (17.9)	<0.001 *
No	219 (75.5)	191 (88.4)	36 (69.2)	9 (17.6)	128 (82.1)	
Cold exposure						<0.001 *
Yes	72 (24.8)	36 (16.7)	21 (40.4)	22 (43.1)	23 (14.7)	
No	218 (75.2)	180 (83.3)	31 (59.6)	29 (56.9)	133 (85.3)	<0.001 *
Radiation						
Yes	173 (60.1)	47 (21.9)	41 (80.4)	2 (4.1)	18 (11.6)	0.008 *
No	115 (39.9)	168 (78.1)	10 (19.6)	47 (95.9)	137 (88.4)	
Vibration						0.008 *
Yes	72 (25.0)	40 (18.5)	22 (42.3)	14 (28.0)	35 (22.4)	
No	216 (75.0)	176 (81.5)	30 (57.7)	36 (72.0)	121 (77.6)	<0.001 *
Biological hazard						
Contact with biological samples such as blood, phlegm and other secretion						<0.001 *
Yes	268 (92.7)	159 (73.3)	49 (94.2)	5 (10.0)	33 (21.2)	
No	21 (7.3)	58 (26.7)	3 (5.8)	45 (90.0)	123 (78.8)	<0.001 *
Contact with infected patient						
Yes	251 (87.5)	174 (80.2)	47 (90.4)	7 (14.0)	33 (21.3)	<0.001 *
No	36 (12.5)	43 (19.8)	5 (9.6)	43 (86.0)	122 (78.7)	
Source of disease vectors such as food waste or garbage						<0.001 *
Yes	190 (65.7)	128 (59.5)	36 (70.6)	35 (70.0)	59 (37.6)	
No	99 (34.3)	87 (40.5)	15 (29.4)	15 (30.0)	98 (62.4)	0.014 *
Areas containing disease vectors such as rats, cockroaches, flies						
Yes	225 (78.4)	150 (69.8)	38 (73.1)	45 (88.2)	108 (68.8)	<0.001 *
No	62 (21.6)	65 (30.20)	14 (26.9)	6 (11.8)	49 (31.2)	
Ergonomic hazard						<0.001 *
Moving heavy materials over 20 kg by lifting, pushing, pulling, dragging down						
Yes	203 (70.2)	109 (50.7)	38 (73.1)	30 (58.8)	82 (51.6)	<0.001 *
No	86 (29.8)	106 (49.3)	14 (26.9)	21 (41.2)	77 (48.4)	

Hazard in the workplace n (% reported)	Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)	p-value
Using fingers, hands, arms, repeatedly and continuously						0.381
Yes	169 (58.3)	130 (60.7)	36 (69.2)	29 (56.9)	85 (54.1)	
No	121 (41.7)	84 (39.3)	16 (30.8)	22 (43.1)	72 (45.9)	
Using fingers or hand-held tools with vibration						0.006 [*]
Yes	40 (13.8)	30 (14.0)	16 (30.8)	3 (6.0)	28 (17.9)	
No	250 (86.2)	185 (86.0)	36 (69.2)	47 (94.0)	128 (82.1)	
Twisting body while sitting or standing working						<0.001 [*]
Yes	227 (78.8)	158 (73.5)	41 (78.8)	33 (66.0)	93 (58.5)	
No	61 (21.2)	57 (26.5)	11 (21.2)	17 (34.0)	66 (41.5)	
Sitting or standing on a vibrating machinery						0.036 [†]
Yes	14 (4.9)	17 (7.9)	6 (11.5)	1 (2.0)	18 (11.5)	
No	272 (95.1)	199 (92.1)	46 (88.5)	49 (98.0)	138 (88.5)	
Sitting on a chair most of the time						<0.001 [*]
Yes	115 (39.7)	133 (61.6)	24 (46.2)	22 (44.0)	108 (68.4)	
No	175 (60.3)	83 (38.4)	28 (53.8)	28 (56.0)	50 (31.6)	
Sitting on the ground most of the time						0.002 [*]
Yes	32 (11.1)	35 (16.3)	10 (19.2)	4 (8.0)	39 (24.8)	
No	255 (88.9)	180 (83.7)	42 (80.8)	46 (92.0)	118 (75.2)	
Squatting work most of the time						0.109
Yes	97 (33.6)	56 (25.9)	15 (28.8)	9 (18.0)	41 (25.9)	
No	192 (66.4)	160 (74.1)	37 (71.2)	41 (82.0)	177 (74.1)	
Standing most of the time						<0.001 [*]
Yes	256 (88.6)	159 (73.6)	49 (94.2)	43 (86.0)	88 (55.3)	
No	33 (11.4)	57 (26.4)	3 (5.8)	7 (14.0)	71 (44.7)	

(*) Significant differences at $p < 0.05$ Chi-square

(†) Fisher's exact test.

Table 6.

Compliance with safety rules and protocol, correct working posture and using PPE specific to type of work.

Health condition n (% reported)		Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)
Regular	Always	187 (65.8)	141 (67.5)	38 (77.6)	40 (80.0)	104 (68.9)
compliance with	Sometimes	87 (30.6)	61 (29.2)	11 (22.4)	10 (20.0)	43 (28.5)
safety rule and protocol	Never	10 (3.6)	7 (3.3)	–	–	4 (2.6)
Concerning about	Always	147 (50.7)	108 (51.7)	24 (47.1)	23 (46.0)	71 (45.2)
correct working	Sometimes	134 (46.2)	92 (44.0)	27 (52.9)	26 (52.0)	81 (51.6)
posture at work	Never	9 (3.1)	9 (4.3)	–	1 (2.0)	5 (3.2)
If your workplace provides personal protective equipment (PPE), how often do you use PPE?						
Working with loud noise						
Using ear plugs	Always	36 (29.0)	20 (21.1)	10 (35.8)	7 (17.1)	22 (28.9)
or muffs	Sometimes	29 (23.4)	35 (36.8)	9 (32.1)	14 (34.1)	28 (36.8)
	Never	59 (47.6)	40 (42.1)	9 (32.1)	20 (48.8)	26 (34.3)
Working with chemicals						
Using goggles	Always	32 (28.6)	20 (29.0)	18 (58.1)	4 (44.4)	14 (31.1)
	Sometimes	43 (38.4)	26 (37.7)	10 (32.3)	1 (11.2)	15 (33.3)
	Never	37 (33.0)	23 (33.3)	3 (9.6)	4 (44.4)	16 (35.6)
Using mask	Always	67 (48.9)	31 (37.8)	22 (59.5)	3 (33.3)	17 (32.1)
(with cartridge)	Sometimes	33 (24.1)	22 (26.8)	9 (24.3)	2 (22.3)	17 (32.1)
	Never	37 (27.0)	29 (35.4)	6 (16.2)	4 (44.4)	19 (35.8)
Using	Always	67 (48.2)	27 (33.3)	20 (60.6)	3 (37.5)	15 (30.0)
protective	Sometimes	34 (24.5)	24 (29.6)	5 (15.2)	–	17 (34.0)
clothing	Never	38 (27.3)	30 (37.1)	8 (24.2)	5 (62.5)	18 (36.0)
Using gloves	Always	183 (81.0)	80 (63.0)	36 (81.8)	15 (53.6)	30 (47.6)
	Sometimes	29 (12.8)	37 (29.1)	5 (11.4)	12 (42.9)	25 (39.7)
	Never	14 (6.2)	10 (7.9)	3 (6.8)	1 (3.5)	8 (12.7)
Face shield	Always	60 (42.0)	28 (31.5)	16 (50.0)	3 (30.0)	21 (42.0)
	Sometimes	33 (23.0)	32 (36.0)	10 (31.3)	2 (20.0)	12 (24.0)
	Never	50 (35.0)	29 (32.5)	6 (18.7)	5 (50.0)	17 (34.0)
Working related to biological samples, blood, body fluids						
Using	Always	94 (67.1)	64 (59.8)	25 (86.2)	2 (28.6)	10 (34.5)
surgical mask	Sometimes	40 (28.6)	31 (29.0)	4 (13.8)	1 (14.3)	14 (48.3)
	Never	6 (4.3)	12 (11.2)	–	4 (57.1)	5 (17.2)
Using N-95 mask	Always	89 (36.8)	46 (31.9)	33 (66.0)	5 (38.5)	12 (25.0)
	Sometimes	106 (43.8)	54 (37.5)	17 (34.0)	3 (23.1)	18 (37.5)
	Never	47 (19.4)	44 (30.6)	–	5 (38.4)	18 (37.5)
Using cloth or rubber gloves	Always	205 (75.4)	108 (66.7)	44 (89.8)	6 (35.3)	32 (53.3)
	Sometimes	56 (20.6)	41 (25.3)	4 (8.2)	8 (47.1)	20 (33.3)
	Never	11 (4.0)	13 (8.0)	1 (2.0)	3 (17.6)	8 (13.4)

Health condition n (% reported)		Inpatient (N = 290)	Outpatient (N = 217)	Surgery & anesthesia (N = 52)	Nutrition service (N = 52)	Hospital supporting service (N = 160)
Working with radioactive materials						
Wearing lead coveralls for radioactive protection	Always	17 (34.7)	12 (23.5)	23 (76.7)	1 (20.0)	5 (20.8)
	Sometimes	15 (30.6)	18 (35.3)	7 (23.3)	–	10 (41.7)
	Never	17 (34.7)	21 (41.2)	–	4 (80.0)	9 (37.5)
Using film badge for radioactive exposure protection	Always	18 (26.1)	15 (28.3)	21 (56.8)	3 (42.9)	5 (20.0)
	Sometimes	20 (29.0)	14 (26.4)	10 (27.0)	–	5 (20.0)
	Never	31 (44.9)	24 (45.3)	6 (16.2)	4 (57.1)	15 (60.0)
Cleaning work						
Wearing cover all for cleaning	Always	53 (54.1)	23 (38.3)	20 (64.5)	28 (82.4)	9 (26.5)
	Sometimes	32 (32.7)	23 (38.3)	10 (32.3)	4 (11.8)	13 (38.2)
	Never	13 (13.2)	14 (23.4)	1 (3.2)	2 (5.8)	12 (35.3)
Wearing boots	Always	54 (42.5)	21 (26.3)	18 (48.6)	24 (61.5)	13 (23.2)
	Sometimes	35 (27.6)	24 (30.0)	13 (35.1)	10 (25.6)	21 (37.5)
	Never	38 (29.9)	35 (43.7)	6 (16.3)	5 (12.9)	22 (39.3)
Wearing cloth or rubber gloves	Always	107 (66.0)	64 (58.7)	36 (85.7)	27 (65.9)	25 (41.7)
	Sometimes	42 (25.9)	32 (29.4)	4 (9.5)	11 (26.8)	26 (43.3)
	Never	13 (8.1)	13 (11.9)	2 (4.8)	3 (7.3)	9 (15.0)
Wearing dust mask/surgical mask	Always	112 (68.7)	65 (57.0)	34 (79.1)	28 (73.7)	29 (41.4)
	Sometimes	40 (24.5)	38 (33.3)	7 (16.3)	6 (15.8)	32 (45.7)
	Never	11 (6.8)	11 (9.7)	2 (4.6)	4 (10.5)	9 (12.9)
Using ladder	Always	45 (35.4)	23 (29.1)	16 (50.0)	12 (42.9)	17 (26.6)
	Sometimes	55 (43.3)	34 (43.0)	10 (31.3)	10 (35.7)	35 (54.7)
	Never	27 (21.3)	22 (27.9)	6 (18.7)	6 (21.4)	12 (18.7)