Hospital Nurses' Risk of Injury: A Mixed Methods Study in Indonesia

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Abstract: Various risks of injury become the background of incidents and health and safety problems for nurses globally, impacting a nurse's right to a safe work environment. No studies have examined the relationship between individual conditions and various aspects of the nurse's risk of injury. This study explored nurses' risk of injury in hospitals and the relationship between the individual characteristics of nurses with the surveillance, screening and injury prevention activities undertaken in hospitals.

This mixed methods study using an exploratory sequential design was conducted in Indonesia involving 176 registered nurses from 17 urban hospitals for the quantitative phase and 21 registered nurses from five hospitals for the qualitative phase. The quantitative data shows that more than half stated they were not good at occupational health and safety surveillance or screening or efforts to reduce occupational health and safety risks. The surveillance, screening, and injury prevention activities of the nurses in the hospitals were not found to be influenced by their age, working experience, marital status, gender, education level, and employment status. The qualitative data analysis revealed four main themes: (1) Causes of the nurses' risk of injury, (2) Preventing injuries, (3) Resilience, and (4) Acting to prevent risk of injury. The effective methods to prevent the risk of injury included optimizing nurses' roles, improving the work environment, and making organizational programs on health and safety. Nurses are exposed to multiple risks of injury, and their monitoring, screening, and injury prevention activities are influenced by factors other than the individual.

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Exposure to the risk of injury and the injuries experienced by nurses can impact their health and the quality of services provided by the nurses. The nurses' risk of injury includes a higher risk of experiencing occupational health hazards.[1] The complexity of the service situation and the changing situation due to the pandemic has also made clear the importance of paying attention to nurses who are frontline health workers facing various injuries and the risk of injury as a consequence of the risky work that they do. The COVID-19 pandemic in various countries has exposed nurses to various risks. Nurses in China have experienced feelings of fatigue, discomfort, and helplessness.[2]

Meanwhile, the preliminary interviews by a researcher in a government hospital in South Sumatra

showed that the health condition of 152 nurses included heart and blood vessel disease (19%), respiratory problems (12%), pregnancy (15%), breastfeeding (30%), diabetes mellitus (4%), hepatitis (4%), immune problems (3%), and other health risks (13%). Training and supervision by the hospital's occupational health and safety (OH&S) unit were routinely carried out, but nurses' injuries remain a finding. Besides, the existing data has not become a specific basis for preventing the nurses' risk of injury. A thorough exploration of all aspects related to the health and safety of nurses in Indonesia is needed to optimize efforts to prevent the risk of injury and fulfill the right to health and safety among nurses.

There have been many investigations into the risk of injury among nurses. However, relatively few studies have focused on the various types and causes of nurses' risk of injury in Indonesia. National studies and data availability as a reference and basis for analyzing and demonstrating the importance of prevention efforts are still minimal in this country. Moreover, we did not find any studies on the relationship between the individual characteristics of nurses and various aspects related to the nurse's risk of injury in Indonesia, especially within a mixed study.

This study was designed to comprehensively explore nurses' risk of injury and consider the relationship between the individual characteristics of nurses and various hospital settings in Indonesia. The findings were expected to form evidence to build specific preventive efforts and cover all aspects of injury and risk of injury that nurses in hospitals may experience. The various conditions accompanying the health and safety of nurses are an essential focus that must be explored, considering the limited results of studies on the risk of injury to nurses in Indonesia.

Literature Review

Hospitals should play a role and be responsible for fulfilling the rights of all health workers to occupational health and safety (OH&S).[3] Systems that build a safe work environment for nurses contribute directly to preventing risks and injury, improving the working conditions for nurses, and raising the quality of nursing services.[4] Strategies to improve the work environment of nurses will ultimately have an impact on the quality of care provided by the nurses in turn.[5]

Nursing safety based on the conceptual framework of this research focuses on a broad study of the safety function of nurses and an understanding of the risk of injury originating from hazards in the nursing area, including the identification, and preparation of hazard assessments, how to carry out hazard analysis in the workplace, work design, the management's risk awareness and control of nursing hazards, the control and correction of hazards, the use of personal protective equipment (PPE), and the areas to be evaluated. *The Conceptual Model: Predicting Future Incidents for High-Risk Work Teams*[6] and the Healthy Nurse concept[7] makes the nurses' risk injury management more comprehensive. Referring to the *Global Strategy on Human Resources for Health Workforce 2030,*[8] the need to optimize and ensure the health and safety development of health workers, including nurses in all settings, is an essential strategy that must be met. Nurse safety systems, an understanding of incidents, and the involvement of human factors are also complex aspects related to the risk of injury among nurses.

The Canadian Center of Occupational Health and Safety[9] defines the risk of injury as anything that poses a potential threat to workers, both physically and psychologically. It can be concluded that the risk of injury in nursing is a potential and unpleasant result of their work, posing a threat of illness and disturbing safety, resulting in effects in the form of physical and psychological injury. Sources of danger or risk of injury include hazards, unsafe conditions, and risky behavior.[4] Infectious diseases, chemicals, and disaster conditions can potentially cause health and safety problems for health workers.[10] Danger anticipation relies on human intuition, training, common sense, observation, and constant awareness. Hazard identification efforts should focus on unsafe conditions, hazards, equipment

breakdowns, and deviations from individual practices. Hazards faced by nursing professionals include needle sticks, ergonomic hazards such as back injuries, slips and falls, laser hazards, physical hazards, chemical exposure, biological hazards, and psychosocial hazards, including workplace violence, as well as community safety and emergency management issues.[4,6] A survey found that 1,500 nurses were exposed to 11 hazardous materials, such as chemotherapy drugs, radiation, sterilization materials, household chemicals, anesthetic agents, and other therapeutic drugs, which can pose a risk of injury.[4]

International studies illustrate the incidence of nurses' risk of injury differently between countries. In Sweden, there is an increased risk of retirement among nurses with disabilities due to their exposure to adverse physical and psychosocial conditions. A heavy workload and low control over the risk of injury also significantly increase nurses' hazard ratios (HR).[11] A study in India reported that 5.4% of hospital nurses suffered from needlestick injuries, 7.4% had varicose veins, and 56.9% experienced occupational stress.[12] Meanwhile, studies in nine European countries found that a single patient's additional workload among professional nurses was associated with an increase of 7% in inpatient mortality after general surgical procedures. An increase in the workload of nurses due to a reduced number of staff due to nurses falling ill or being quarantined, long work shifts of more than 40 hours a week, and changes in circadian rhythm due to long night shifts have had an impact on the sleep quality and health of nurses.[10,13]

In the Indonesian context, based on the Central Government Board Indonesian National Nurse Association (DPP PPNI) data in Indonesia up to February 14, 2021, there were 5,207 confirmed nurses infected, 259 of whom had died from COVID-19. A study looking into nine hospitals in Surabaya, Indonesia, showed some discrepancies in the implementation of OH&S in different hospitals when providing facilities for COVID-19 in terms of equipment and treatment among the healthcare workers.[14] It was not identified whether individual factors significantly affected the transmission of COVID-19, especially among nurses. A four-year study in a tertiary teaching hospital in Central Java showed that needlestick and sharps injuries (NSSIs) were experienced by nurses (42.7%) at a rate of 15.2 per 1000 nurses, which is a higher incidence than that of doctors and medical students.[15] Nurses also experience stigma, which is significantly related to their anxiety.[16] The most frequent incidents experienced by health workers in Central Java, Indonesia, were exposed to blood and body fluids (68.9%), sharp objects (50.4%), and needles (47.7%).[17]

The large number, form, and type of injury incidence and exposure to the risk of injury experienced by nurses in hospitals in recent years can be linked to several causes. Factors that influence occupational diseases in the nursing service due to exposure to the risk of injury include lifestyle, physical, psychological, and psychosocial factors and factors due to the nurse's work.[18,19] Every workplace has hazards, even though there are personnel who carry out hazard risk assessments.[20] Organizations should develop a job hazard analysis for all tasks, processes, and phases of work.[6] Support from their organization accompanied by lifestyle interventions is more likely to become a complex solution that leads to changes in the work environment.[21] Management support from the nurse managers' role models suggests that they must practice self-care through involvement in sports, proper nutrition, and demonstrating a work-life balance.[22] There is an urgent need to plan to improve nurses' health regarding physical activity, nutrition, rest, safety, and quality of life, based on the high potential risk of injury in their workplace.[23] A similar study showed that as many as 70% of nurses prioritize patients' health, safety, and welfare before their health and safety. Personal support plays a vital role in realizing the health of individual nurses. Job factors psychometrically related to the nurses' health include self-efficacy and self-regulation when overcoming obstacles in the work environment and emotional coping.[24]

Study Aim

To explore the nurses' risk of injury and the relationship between the individual characteristics of the nurses (age, working experience, marital status, gender, education level, and employment status) with the surveillance, screening and injury prevention activities undertaken in the hospital setting in Indonesia.

Methods

Design: This study used a sequential mixed methods design which combined surveys and interviews to gain in-depth information about the nurses' risk of injury of sampled nurses through a qualitative phase which was further validated using a larger population in the quantitative phase. Through a sequential approach, the second phase was built on the initial database explored with a qualitative sample first. The quantitative phase could be adjusted to meet the exploration needs of the studied aspects. The point of data integration in exploratory sequential design is to use the information from the qualitative phase to proceed to the quantitative phase.[25,26] In this study, the themes found became the basis for the quantitative exploration, which was used to validate the research findings obtained in the previous phase to seek to generalize the results. This study is reported here following the STROBE and COREQ reporting guidelines.

Qualitative descriptions were obtained through in-depth individual interviews about the risk of injury faced by the nurses in their respective hospitals. A quantitative phase was conducted to describe the conditions of surveillance, screening, and risk prevention activities in Indonesia and their relationship with the individual characteristics of the nurses. The findings from the qualitative and quantitative phases describe the nurses' risk of injury, including the causes and prevention of the risk of injury and the relationship between their characteristics and the surveillance, screening, and injury prevention activities of the nurses in hospitals among the participant population.

Sample and Setting: A purposive sample of 21 nurses was recruited from five government and private hospitals in urban areas in South Sumatra, Indonesia, with efforts to maximize the variation in demographics (e.g., age, gender, government/private hospitals, and work setting) and risk of injury experiences. Recruitment ended when saturation was achieved using snowball sampling. Saturation is the justification for the sample size in qualitative health research.[27] The inclusion criteria were: registered nurses willing to share their experiences through in-depth interviews; at least six months of work experience in emergency, perioperative, intensive care, special intervention units (chemotherapy, cardiac catheterization, hemodialysis) or pediatric, medical, surgical, and maternity units; and a minimum education level of a diploma III in nursing.

Furthermore, as many as 176 nurses from 17 government and private hospitals from three provinces in Indonesia, namely South Sumatra, Bangka Belitung, and West Borneo, were given explanations and were willing to become survey participants. During the study period, all nurses who met the inclusion criteria from the three provinces were invited to participate in the quantitative phase of this study. The sample size was analyzed based on the survey sample size. It was calculated using online software[28] (http://riskcalc.org:3838/samplesize/), which indicated that to perform the survey analysis, 118 subjects were needed[34] to provide a significance level of 0.05 (SD 1.167; *d* 0.211).

Ethical Considerations: This study was approved by the Institutional Ethical Review Board of the Faculty of Nursing Universitas Indonesia (Approval No. Ket-207/UN2.F12.D1.2.1/PPM.00.02/2021). Informed consent was obtained from all interview and survey participants. The participants for the qualitative phase were given a complete explanation orally and in writing about the study purpose, procedures, outcomes, and the opportunity to cancel their participation without penalty. Their research rights were protected throughout, including the protection of their personal information, and the data would be analyzed anonymously

and would only be used for this study. The researcher provided a written explanation at the start of the online survey, and it was assumed that those who completed this gave their study consent.

Data Collection: The study took place from June 2021–July 2022. In-depth interviews were conducted using interview guidelines, comprised of five open questions over 45 – 60 minutes for each participant and using a recording device with participant consent. An online survey was conducted using the questionnaire for over 15–30 minutes.

Interviews: The interviews took place in a closed and quiet room which was mutually agreed upon between the researcher and the participant, taking into account the environmental conditions and comfort of the participants. Each interview was voice recorded, and additional field notes captured the participants' non-verbal reactions. The researcher stopped the interview if the participant seemed uncomfortable. The participant was allowed to confirm the source of their discomfort, including if they wanted to stop the interview and continue at another time. One experienced and validated researcher conducted the interviews face-to-face with the participants based on the interview guidelines.

The guidelines consisted of five questions (see **Table 1**), open or semi-structured, to get an overview of the nurses' experiences with various forms and risks of injury at work, including the barriers and expectations of preventing the risk of injury. In consultation with qualitative study experts, the researcher developed the interview questions. The clarity of the questions was ensured by conducting face validity tests using a pilot sample of five nurses working in a perioperative unit. The interviews were conducted until no new information was provided.

Table 1. Interview guidelines

1. What are the sources of risk that can cause injury to nurses?
2. Please describe the experience of injuries that you experienced in the hospital.
3. What are the efforts to prevent the risk of injury by personal nurses, nursing units and hospital institutions where you work?
4. What are your sources of support in efforts to maintain health and safety and protect against the risk of injury?
5. What is your view on efforts to protect nurses from the risk of injury in hospital services?
6. What are your hopes for the health care system in hospitals so that they can protect nurses from the risk of injury?

Survey: All participants who met the eligibility criteria were included in the dataset created and were given an online survey link by the researcher. The survey was conducted using an online form, and all variables were entered into an Excel spreadsheet that was automatically designed to be easy to use for the analysis phase. The questionnaire included the personal characteristics of the nurses (age, working experience, marital status, gender, education level, and employment status). The questionnaire was developed to refer to previous studies by Rogers and Livsey on the nurses' risk of injury, including biological/infectious agents and chemical, mechanical, physical and psychosocial environments according to the literature review focusing on workplace hazards.[10] The questionnaire was combined with another by Walton and Rogers looking into occupational health surveillance, screening, and prevention activities in occupational nursing health practices. The questionnaire had a mean of 2.3 and a standard deviation of 0.91, measured on a 4-point scale.

Data Analysis

Qualitative Data: The researcher listened to all recordings to ensure that all the interviews could be heard and understood. Qualitative data analysis was

carried out by thematic analysis of the keywords, categories, and themes. The data was confirmed using the transcripts made by the researcher. The research team audited and validated the coding process used to analyze the qualitative data regarding exploring the nurses' risk of injury. The triangulation of the results was carried out to fulfill the validity of the study findings by comparing the varied data from the participants. Peer debriefing was carried out between the researcher and the research supervisor to reduce bias and ensure the confirmability of findings. For trustworthiness, the researcher checked, discussed, and repeatedly presented the transcription and interpretation of the data. Further discussion of the qualitative findings became the basis for mutual agreement regarding the themes and categories identified.

Quantitative Data: Analysis was carried out by calculating the variables using SPSS v.21. Basic descriptive statistics were used to identify the individual characteristics of the nurses, the sources of exposure to the risk of injury, surveillance, screening, and the efforts to reduce the OH&S risks in Indonesia and its relationship with the individual nurse characteristics. The findings were then compared to the previous findings from the interviews. Further quantitative data analysis was conducted using a 2-tailed t-test, while the Chi-Square method was used to find the relationship between the variables, referencing a significance level of 0.05.

Study Results

Qualitative Findings

Table 2 shows the general characteristics of the 21 participants involved in the interviews. The thematic analysis found 31 subcategories, 17 categories and four themes. The themes found regarding the experience of the nurses related to the risk of injury were about the nurses' risk of injury, the need for the prevention of injury, the nurses' resilience, and the efforts undertaken to prevent the risk of injury. Based on the analysis, the following themes were found:

Table 2. Demographic characteristics of participants (n = 21)

Participant	Age	Gender	Marital Status	Education	Unit	Working Experience
1	35	Female	Married	Bachelor	Cardiac catheterization	15
2	29	Female	Unmarried	Diploma III	Hemodialysis	10
3	35	Female	Married	Diploma III	Medical	15
4	37	Male	Married	Diploma III	Surgical	15
5	37	Female	Married	Bachelor	Perioperative	15
6	23	Male	Unmarried	Diploma III	Hemodialysis	3
7	37	Female	Married	Bachelor	Emergency	17
8	42	Female	Married	Bachelor	Chemotherapy	16
9	40	Female	Unmarried	Diploma III	Cardiac catheterization	19
10	28	Female	Married	Diploma III	Perioperative	7
11	35	Female	Married	Bachelor	Perioperative	15
12	37	Female	Married	Diploma III	Intensive care	17
13	41	Female	Married	Bachelor	Surgical	20
14	38	Female	Married	Bachelor	Surgical	17
15	36	Female	Married	Bachelor	Maternity	15
16	28	Female	Unmarried	Diploma III	Chemotherapy	5
17	45	Male	Married	Diploma III	Emergency	20
18	35	Male	Married	Bachelor	Medical	16
19	38	Female	Married	Diploma III	Intensive care	17
20	35	Female	Married	Diploma III	Pediatric	16
21	37	Female	Married	Bachelor	Maternity	18

Theme 1: Causes of the nurses' risk of injury

This theme included the physical and psychological-social injuries experienced in the work environment.

Category 1: *An occupational injury can include the risk of physical injury.*

Participants experienced muscle soreness, spasms, back pain, and stomachache due to long working hours and moving patients. Other participants experienced physical abuse, needlestick injuries, surgical instruments injury, exposure to the patient's blood and infection, slips, pain in the post-surgical area, electric shocks, and skin problems due to PPE. As stated by the following participants:

> *"It is sore in this part [touching a part of the body] or here in the back... A muscle spasm in this part, and suddenly I get a stomachache the next morning"* (P5)

> *"....in the operating room... usually using a scalpel to make an incision... incised..."* (P11)

> *"....I had ganglion surgery on my hand... it hurts when I lift the patient or do CPR... it feels more intense because of the pressure..."* (P7)

Category 2: *An occupational injury can also include the risk of psychological-social injury.*

The participants also experienced discomfort, felt burnt out, stressed, fearful and anxious, and inferiority and were subjected to verbal abuse and socially pressured.

> *"feeling uncomfortable when taking off the gloves, we often thought that we have been exposed to patients' body fluids"* (P4)

> *"feeling worried about the risk of exposure to HIV or hepatitis. And once I experienced a needlestick injury, I began wondering whether I have been infected"* (P10)

Theme 2: Preventing injuries

The data analysis identified the need to prevent injury according to seven categories: PPE, workload management, nutrient-rich food provision, compliance with the procedures, medical examinations, competency and safety improvement, and equipment maintenance.

Category 1: *An occupational injury can be prevented through personal protective equipment.*

Most participants clearly stated the need for complete and standardized PPE use as an essential protective measure to avoid the risk of injury.

> *"One of our standard procedures is the use of PPE."* (P5)

> *"All of the interventions in the emergency unit must be done while wearing PPE, face masks, medical gloves, and a pair of fully-covered shoes."* (P7)

Category 2: *An occupational injury can also be prevented through workload management.*

The workload setting through the distribution of patients and the additional distribution of interventions that require special competence will prevent the nurses from a higher risk of injury, for example, in units with a radiation risk when carrying out procedures.

> *"One patient can be given interventions by one nurse. Another patient will be handled by a different nurse."* (P13)

> *"workload distribution in the cath lab depending on their competencies. Taking a turn for each intervention in the cath lab. This is one of the efforts to reduce radiation-related workload."* (P9)

Category 3: *Providing nutrient-rich foods can also prevent occupational injury.*

The participant statements illustrate that adequate and various types of high-quality and healthy nutrients are needed for the nurses on duty and those with more exposure to the risk of injury.

> *"Exposure to x-ray radiation is countered by consuming high-quality nutrients."* (P8)

"...extra nutrient-rich foods for fitness like milk and fruit, so, not only rice and meat." (P3)

"We provide substitutions, such as milk and bread, for on-duty staff." (P4)

Category 4: ***An occupational injury can be prevented by following standard operating procedures (SOPs).***

Another participant realized that the consequences of the many risks of working as a nurse in a hospital needed to be accompanied by the nurse's adherence to various safety protocols and procedures to avoid injury.

"Any sharp objects are put away in a separate sharp-object container after use according to the SOPs." (P8)

"We must work safely according to the patient safety standards and standards of workplace safety for nurses with adherence to the protocols and operating procedures." (P11)

Category 5: ***An occupational injury can be prevented through medical check-ups (MCU).***

Through the participants, the statements made became the basis of the importance of hospital management policies regarding routine MCU implementation. This should also be accompanied by the development of screening based on the type of risk regarding the individual nurse's specific work, for example, whether there is a radiation risk, to prevent the nurses' risk of injury.

"The nurses have their absorbed dose of radiation measured every three months or each month." (P1)

"MCU becomes the regular procedure as part of the hospital management policies for each staff member." (P7)

"It includes a complete blood count, regular HBsAg and HIV tests, and we receive electrocardiography and radiography (Rontgen)." (P4)

Category 6: ***An occupational injury can be prevented through competency enhancement and safety improvement.***

Seven participants stated that repeated training to improve their competence, especially in OH&S, patient and nurse safety, IPC, and PPE, including risk-specific standards and procedures, needs to be provided on an ongoing basis and evaluated for their application as an injury prevention strategy.

"...assigned to a training .... up to monitoring of the implementation and the same for the patient and nurse safety." (P6)

"...frequently participating in training on OH&S, PPE education and briefing, how to hand over and receive sharp objects to and from an operator in an intervention." (P10)

"... the majority of the training are related to IPC for both operating room and other standards." (P5)

Category 7: ***An occupational injury can be prevented through equipment safety and maintenance.***

The availability of various safety and maintenance equipment tools to support the efforts to identify nursing risks are part of a necessary effort to prevent injury.

"Maintenance of the equipment errr... starts from a routine check of the radiation exposure at least once a month." (P1)

"Before an intervention, all of the equipment is checked, such as the machine, monitor, and medical devices. Also when an intervention starts." (P11)

Theme 3: Resilience

The categories that constitute this theme are family support, personal management, both spiritual and psychological and the conditions of the nurses' interpersonal relationships in an optimal work environment.

Category 1: *Family support*

Three participants expressed that meaningful family members' physical, spiritual, and psychological presence was felt to provide them with the strength and confidence to face various job risks.

> *"...but thinking oh God, maybe I believe that I am strong, I tell my mother every day, I pray that you are healthy, mom"* (P17)

Category 2: *Personal management, spiritual and psychological*

The five participants also reported this as one way to gain resilience when dealing with various risks, specifically faith and being calm in all preparations, accompanied by improving the spiritual aspects.

> *"... honestly, it's lighter, isn't it? In the past, every time we wanted to go to work, it was really hard, especially when we wanted to do night work, because every time a COVID-19 patient came, we used hazmat and had to take a shower..."* (P19)

Category 3: *The conditions of interpersonal relationships in an optimal work environment*

The participants tended to work together, given the scope of the work, while considering the risks they faced. They were willing to help each other and provide solutions and support to optimize the safety of the work environment.

> *"... ask the operating room nurse to move the patient to a bed ..."* (P14)

> *"... If I'm sick, there are friends who want to help, so let's rest first or find a replacement friend "* (P20)

Theme 4: Acting to prevent risk of injury

The categories that constitute this theme are the nurses' experience and required OH&S management, the infection prevention and control unit, the nurse manager, their colleagues, a secure infrastructure, and financing for injury prevention.

Category 1: *The OH&S management supported the prevention of injuries*

Several participants were aware of the optimal management of OH&S to support the prevention of the nurses' risk of injury.

> *"...the OH&S is also part of the Hospital Maintenance Department* (IPSRS)*, so they do the regular check."* (P9)

> *"/The staff examines and immediately completes a report... and the report is forwarded to the top management and returned to the hospital OH&S management* (K3RS) *in less than 2 hours."* (P12)

Category 2: *The Infection Prevention and Control (IPC) team supported the prevention of occupational injuries*

Six participants stated that the existence of the IPC team was significant and necessary in terms of anticipating and overcoming the nurses' risk of injury due to interventions that potentially transmit infection.

> *"The IPC team also frequently controls our interventions."* (P7)

> *"We have to get PPI approval ... must at least report... if we have been exposed to patients with suspected HIV-AIDS, COVID-19, or HBsAg + ..."* (P18)

Category 3: *The nurse manager (head of ward/ team leader) also supported the prevention of occupational injuries*

The participants also reported on the role of the nurse manager, who gave them lots of reminders about the importance of paying attention to the risk of injury, the standard tools and procedures to use, as well as evaluating and understanding the sources of injury and standard prevention found in almost all daily activities of the nurses on the ward.

> *"... The head of each ward gives a briefing so we can gain more understanding."* (P4)

> *"The role is more of a reminder, like reminding us to wear medical gloves, that's it ..."* (P6)

Category 4: *The colleagues support the prevention of occupational injuries*

Peer support is illustrated through the participant statements reminding each other how to prevent injuries among their team members.

> *"We remind each other. All the team members remind each other."* (P2)

> *"A solid team at work, including reminding each other to prevent injuries."* (P10)

Category 5: *Prevention of occupational injuries is supported financially*

The role of the hospital in providing financial support such as risk allowances and when handling injury reports is essential when looking to mitigate nursing injuries, for example:

> *"The hospital provides allowances for us as nurses."* (P3)

> *"Injuries are covered by the hospital as long as we fill out the report form and follow the reporting procedure."* (P13)

Quantitative Findings

Table 3 shows the details of the 176 participants who completed the survey. They had an average age of 35.2 years and working experience of 11.3 years. The majority were married (85,7%), women (75%), had a diploma III in nursing education (61.4%) and were permanent employees (61.4%).

Table 3. Demographic characteristics of the survey participants (n = 176)

Variable	Frequency	Percent	Mean	Standard Deviation	Range (Min-Max)
Gender					
Female	132	75			
Male	44	25			
Nursing education level					
Diploma III	108	61.4			
Bachelor	66	37.5			
Master degree/Nurse specialist	2	1.1			
Employment type					
Permanent	108	61.4			
Temporary	68	38.6			
Age (years)			35.22	7.61	22-56
Working experience (years)			11.34	7.77	1-34

The results show that the nurses' surveillance, screening, and injury prevention activities in the hospitals were not influenced by the individual variables of the nurses studied (age, working experience, marital status, gender, education level, and employment status). The results of the descriptive analysis are shown in **Table 4.** The analysis shows that the majority of sources of exposure to the risk of injury were due to biological agents in the form of blood-borne pathogens, including hepatitis and HIV (73%), tuberculosis (53%) and COVID-19 (49%). More than half of the risk exposures due to chemical agents were caused by antiseptics, antibiotics, and disinfectants (59%). Risk exposure from environmental/mechanical sources was in the form of needles/needlesticks (59%) and the activities of lifting, bending, and twisting objects (54%). Exposure to the risk of injury due to physical sources included radiation (47%), and sources of psychosocial exposure due to the stress following overwork and long working hours (40%) and stress due to shift work. More than half stated that they were

not good at the OH&S surveillance aspects (58%), OH&S screening (52.8%), and efforts to reduce the OH&S risks (54%). There was no statistical correlation between the variables tested. The quantitative analysis strengthens the findings that emerged from the results of the interviews in the qualitative phase.

Table 4. Exposure of nurses' risk injury, screening, surveillance, and efforts to reduce health and safety risks (n = 176)

Items	Frequency	Percent
Exposure to nurses' risk injury		
Biological agents	128	73
Blood-borne pathogens (hepatitis B, C, HIV)	28	16
Pertussis, measles, mumps, rubella	47	27
Common cold, influenza, bacterial infection	23	13
Tuberculosis	94	53
Cytomegalovirus, Herpes simplex virus	23	13
COVID-19	86	49
Chemical agents		
Antimicrobial drugs/antibiotics	57	32
Antineoplastic drugs/cancer drugs (*chemotherapy*)	29	16
Antiseptic, disinfectant	103	59
Chlorine	63	36
Volatile and irritating organic compounds	45	26
Environment/Mechanical agents		
Activities lifting, bending, and rotating objects	95	54
Lighting, poor ventilation, and slippery floors	54	31
Inadequate work environment and limited facilities	33	19
Needle/needle stick injury	103	59
Slipped, tripped, and fell	50	28
Violence/physical abuse from patients, family, health workers	28	16
Physical agents		
Radiation	83	47
Electrical or fire	36	20
Extreme hot or cold temperature	58	33
Psychosocial agents		
Verbal abuse	42	24
Stress over working hours/long working hours	70	40
Stress changes in schedule/work shift changes	47	27
Stress of being overworked or feeling unprepared	43	24
Stress due to changes in responsibilities/work units	29	16
Stress from lack of managerial support	38	22
Stress from lack of peer support	16	9
Screening health and safety risks for nurses		
Good	93	52,8
Not good	83	47,2
Surveillance health and safety risks for nurses		
Good	102	58
Not good	74	42
Efforts to reduce health and safety risks for nurses		
Good	102	58
Not good	74	42

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Discussion

This study explored nurses' risk of injury in 17 private and public hospitals in an urban area in Indonesia. This phenomenon was investigated comprehensively using both quantitative and qualitative approaches. The qualitative findings were derived from in-depth interviews and field notes, and the quantitative findings were attained by examining the relationships between the nurses' characteristics and the OH&S surveillance, OH&S, and the efforts to reduce OH&S safety risks. The mixed-methods design exposed several fascinating and valuable findings about the nurses' risk of injury.

Our qualitative findings emphasize the importance of resilience and acting for injury prevention as nurses' need for injury risk prevention for hospital nurses. Meanwhile, quantitatively, describing sources of risk of injury, surveillance, screening, and prevention of risk of injury, which is not yet optimal, becomes an accurate picture of nursing safety. The absence of correlation can be explained in several ways. These possible interpretations are related to factors outside the individual that may influence aspects related to hospital nurses' risk of injury.

In our study, the proportion of exposure to various injury risks varied and even tended to be more than in earlier studies that determined the number of injury events reported during the last year. For example, needlestick injuries (5.4%), varicose veins (19.5%), hospital-acquired infections (7.4%), occasionally stressful situations (56.9%), and the nurses being frequently stressed while working in the hospital (35.9%).[12] However, in other studies, it has been found that the loss of working hours and the risk of exposure to blood-borne diseases are the basis for the importance of changing the method of carrying out work to prevent the risk of injury to nurses. Through changes to the technique of breaking the testing ampoules, there is a role played in reducing the risk of nurses getting needlestick injuries.[29] This confirms that the focus of attention is not only on the number of incidents and exposure but also on what is essential in finding ways to prevent the incidents effectively. This is supported by the quantitative findings from this study, in which nurses described the many risks of injury they faced as nurses on duty in various types of wards and how to prevent the hospital nurses' risk of injury obtained from the themes by qualitative exploration.

The leadership perspective regarding a safe culture and high-risk work environment emphasizes the importance of prioritizing and organizing according to the risks arising from work. The development of an adequate system also has accompanied[6] changes in the healthcare system in Canada and the United States to increase the fulfillment of nurses' health.[37]

In addition, the responsibility to provide direct nursing care, having a working experience of fewer than ten years and workplace conditions that do not have adequate safety standards were some of the risk factors for the verbal harassment of nurses. Meanwhile, the high workload of the nurses, the regulations regarding nursing care for adolescent and adult patients, the lack of reporting of violence at work, their age being less than 35 years, and inadequate workplace security are the risk factors for physical violence against nurses.[31] The prevention of radiation injuries can be reduced by increasing the understanding of radiation through training and the need for policies that provide adequate protection against radiation.[32] The findings from our in-depth interviews revealed that preventing the risk of injury is an important matter for nurses. Several efforts to prevent the risk of injury, including the risk of musculoskeletal injury, the risks due to chemical, biological, fluid and blood sources, needlestick injury, radiation exposure, as well as the sources of the risk of psychological injury, need to be implemented to provide for the safety and health of nurses.

Previous studies have shown that musculoskeletal injuries occur because safe patient handling and mobility are not implemented. This is because 46% of nurses do not receive the necessary information.[33] The use

of patient lift systems, patient handling training, multi-component intervention and cognitive behavioral therapy, and unstable shoes are implemented to prevent the risk of musculoskeletal injuries.[34] There are four main strategies to prevent needle stick injuries: education, training, using safe needles, and effective communication.[35] OH&S, which can be described through attitudes, norms and behavioral controls, influences the safety intention and indirectly affects the safety performance of needle stick injury prevention procedures.[36]

Nurse protection must be applied to prevent and control chemical exposure in the hospital. For example, it should include personal protective equipment supplied in the working environment.[37] This external support is in line with a policy reality that requires the Indonesian government to strengthen its national efforts in the health field and the associated workforce, as expected by the global policy.[38] Educational and training interventions, including interactive demonstrations, educational presentations, and web-based information systems, can improve efforts to prevent scalpel injuries and fluid exposure.[39]

Health institutions need four main domains so then nurses can carry out infection prevention and control in the health services, namely support from team leaders, infection education and training, education of the patients, their families and other health workers, and the monitoring of performance in infection prevention as the primary practice by nurses and health workers in the form of standard precautions, transmission-based precautions, the temporary use of invasive medical devices, and the occupational health of the nurses.[40] Infection prevention requires education and documentation to convey an adequate understanding to medical and non-medical personnel, patients, and their families. Implementing hand hygiene with the support of infrastructure, monitoring and evaluation systems is necessary.

The need for the prevention of injury risk, according to the qualitative findings coupled with the quantitative findings, is consistent with the literature, which can be associated with the various aspects of injury risk in nurses. Other incidents that occurred in the hospital settings, including those during the pandemic, underlie the importance of focusing on the effort to ensure nurses' health by reducing their risk of injury.[41] Further psychological intervention programs to support nurses, especially ones in resource-poor settings, can enhance their psychological resilience.[42]

Individual variables (age, working experience, marital status, gender, education level, and employment status) were not related to the surveillance, screening, and injury prevention activities of nurses in the hospitals. This finding differs from the results of another study conducted in Indonesia, where gender, level of education, salary, occupation, employment status and body mass index were significantly correlated with sharps injuries among the healthcare workforce.[43] Meanwhile, the responsibility to provide direct nursing care, work experience of fewer than ten years, and workplace conditions that did not have adequate safety standards were some of the risk factors for the verbal harassment of nurses. The high workload of the nurses, regulations regarding nursing care for adolescent and adult patients, a lack of reporting of violence in the workplace, being less than 35 years old, and inadequate workplace security were the risk factors for physical violence against nurses. Safe hospital policies, incident reporting systems, and security measures are necessary to prevent violence in the workplace. Education and training are also recommended for managing violence, aggression, and intimidation.[31] These quantitative findings also indicate that the aspects of prevention beyond the individual need to be optimized. This finding is in line with the recommendations from previous studies. Safe hospital policies, incident reporting systems, and security measures are necessary to prevent violence and accidents in the workplace. The roles of managers, nurse leaders, and other health teams are needed to formulate health policies that can reduce incidents of violence against nurses.[44]

Limitations

The limitations of this study are that the participants were limited to hospitals in three provinces that do not fully represent the various types of hospitals in Indonesia. This may affect the generalization of the study. However, the researcher argues that the mixed method nature of this study can better validate the phenomena relevant to the critical issues related to the work of nurses.

Barriers and communication inconveniences may have occurred during the interviews because the research implementation was during the COVID-19 pandemic, requiring the application of health protocols. Personal awareness, experience, and age are the factors that can influence the occurrence of memory bias when tracing the phenomenon under study, including the risk of bias when selecting participants, which is a point that needs attention.

Conclusions and Implications for Nursing Practice

This study emphasizes two perspectives when looking at the hospital nurses' risk of injury. We found that most nurses are exposed to various risks of injury accompanied by a poor assessment of monitoring, screening, and the prevention of injury. Individual characteristics were found to be unrelated to surveillance, screening, and injury risk prevention activities. Factors other than individual characteristics need to be considered in the various injury risks of hospital nurses.

This finding is the basis for the urgency to fulfill the rights of nurses in Indonesia to avoid the risk of work-related injuries. Therefore, it is necessary to develop an effort to prevent the hospital nurses' risk of injury with an orientation toward strengthening the role of the individual as a whole. Such efforts can be undertaken by involving support from nurses' environments and organizational programs. Testing the effectiveness of nursing injury risk prevention methods is challenging for further research. However, evidence needs to be obtained to argue for and underlie the development of specific policies and the application of appropriate injury risk prevention efforts for nurses. An injury risk mitigation model can be developed by considering the findings of this study. Long-term studies are needed to find specific incidents of hospital nurses' injuries, their causes, and strategies to overcome them.

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ความเสี่ยงต่อการบาดเจ็บของพยาบาลในโรงพยาบาล: การศึกษาแบบผสานวิธีในอินโดนีเซีย

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บทคัดย่อ: ความเสี่ยงต่าง ๆ ต่อการบาดเจ็บกลายเป็นที่มาของเหตุการณ์ที่ไม่พึงประสงค์และปัญหาด้านสุขภาพและความปลอดภัยของพยาบาลทั่วโลก ซึ่งส่งผลกระทบต่อสิทธิของพยาบาลที่จะทำงานในสภาพแวดล้อมการทำงานที่ปลอดภัย จากการทบทวน ยังไม่พบการวิจัยใดที่ศึกษาความสัมพันธ์ระหว่างปัจจัยส่วนบุคคลกับความเสี่ยงต่อการบาดเจ็บของพยาบาลในแง่มุมต่าง ๆ การศึกษานี้สำรวจความเสี่ยงต่อการบาดเจ็บของพยาบาลในโรงพยาบาลและศึกษาความสัมพันธ์ระหว่างปัจจัยส่วนบุคคลของพยาบาลกับกิจกรรมการเฝ้าระวัง การคัดกรอง และการป้องกันการบาดเจ็บในโรงพยาบาล

การศึกษาแบบผสานวิธีครั้งนี้ เป็นการวิจัยแบบขั้นตอนเชิงสำรวจที่ดำเนินการในประเทศอินโดนีเซีย โดยมีพยาบาลวิชาชีพจำนวน 176 คนจากโรงพยาบาลในเขตเมืองจำนวน 17 แห่งสำหรับการศึกษาในระยะเชิงปริมาณ และพยาบาลวิชาชีพ 21 คนจากโรงพยาบาล 5 แห่งสำหรับการศึกษาในระยะเชิงคุณภาพ ข้อมูลเชิงปริมาณแสดงให้เห็นว่ากลุ่มตัวอย่างมากกว่าครึ่งหนึ่งระบุว่า การเฝ้าระวังหรือการคัดกรองด้านอาชีวอนามัยและความปลอดภัย หรือความพยายามในการลดความเสี่ยงด้านอาชีวอนามัยและความปลอดภัยนั้นยังไม่ดีพอ และกิจกรรมในการเฝ้าระวัง การคัดกรอง และการป้องกันการบาดเจ็บของพยาบาลในโรงพยาบาลนั้น ไม่พบว่ามีความสัมพันธ์กับอายุ ประสบการณ์ทำงาน สถานภาพการสมรส เพศ ระดับการศึกษา และสถานภาพการมีงานทำ ส่วนการวิเคราะห์ข้อมูลเชิงคุณภาพชี้ให้เห็นประเด็นหลัก 4 ประการ ได้แก่ (1) สาเหตุของความเสี่ยงต่อการบาดเจ็บของพยาบาล (2) การป้องกันการบาดเจ็บ (3) ความสามารถในการฟื้นตัว และ (4) การปฏิบัติเพื่อป้องกันความเสี่ยงต่อการบาดเจ็บ วิธีการที่มีประสิทธิผลในการป้องกันความเสี่ยงต่อการบาดเจ็บ ได้แก่ การปรับเพิ่มบทบาทของพยาบาลให้เหมาะสม การปรับปรุงสภาพแวดล้อมในการทำงาน และการจัดทำโครงการขององค์กรด้านสุขภาพและความปลอดภัย พยาบาลมีความเสี่ยงต่อการบาดเจ็บหลายอย่าง และกิจกรรมการติดตาม การคัดกรอง และการป้องกันการบาดเจ็บได้รับอิทธิพลจากปัจจัยอื่นที่ไม่ใช่ปัจจัยส่วนบุคคล

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คำสำคัญ: โรงพยาบาล การป้องกันการบาดเจ็บ แบบผสานวิธี พยาบาล การฟื้นตัว ความเสี่ยงต่อการบาดเจ็บ ความเสี่ยงด้านความปลอดภัย การคัดกรอง การเฝ้าระวัง ปริมาณงาน

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