Journal of Multidisciplinary Healthcare

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Construction of a Two-Way and Progressive Occupational Protection Model for New Medical Staff: A Grounded Theory Study

Zhen Liu[1], Yanli Chen[2], Dongmei Xu[1], Mengfan Wu[1], Yaqin Xie[1], Ya Zhu[1], Shiqi Yang[1], Ziyi Liu[1]

[1]Department of Nursing, The First People's Hospital of Tianmen in Hubei Province, Tianmen, 431700, People's Republic of China; [2]Hubei Province Key Laboratory of Occupational Hazard Identification and Control, Wuhan University of Science and Technology, Wuhan, 430065, People's Republic of China

Correspondence: Yanli Chen, Hubei Province Key Laboratory of Occupational Hazard Identification and Control, Wuhan University of Science and Technology, No. 2, Huangjiahu West Road, Qingling Street, Hongshan District, Wuhan, 430065, People's Republic of China, Tel +8615972290899, Email tnsyyhlb5237409@163.com

Purpose: This study was aimed at developing a systematic and standardized occupational protection theory to guide new medical staff in protection against occupational exposure.

Subjects and Methods: Twenty-three new medical staff members of a comprehensive tertiary hospital in China were evaluated with semi-structured in-depth interviews. The participants were selected using the methods of convenience sampling, purposive sampling, and theoretical sampling Qualitative research was performed using the grounded theory method of Glaser and Strauss, and the data were coded openly, axially, and selectively. The study protocol and reporting were in accordance with the Standards for Qualitative Research (SRQR).

Results: Fifteen codes were extracted from the interview data, which were classified into six subcategories, namely, processing and reflection after occupational exposure, comprehensive identification of occupational exposure risk factors, progressive response, normalization of occupational protection, active expression of protection needs, two-way protection, and 1 core category—two-way-progressive occupational protection. With the information collected, a theoretical model of "two-way progressive occupational protection" was finally constructed.

Conclusion: The "two-way-progressive occupational protection" theory developed on the basis of the experiences of new medical staff can play a positive role in guiding new medical staff regarding occupational exposure, identifying relevant risk factors, and taking appropriate protective measures. It can also provide guidance for developing appropriate training modules for occupational protection.

Keywords: Occupational protection, occupational exposure, medical staff, grounded theory, qualitative research

Introduction

Occupational exposure refers to circumstances in which workers are exposed to risk factors that may damage their health or endanger their lives while engaging in their occupational activities.[1]

In the context of the medical profession, occupational exposure refers to situations in which medical personnel involved in nursing activities or diagnosis and treatment of conditions are exposed to toxic and harmful substances or infectious pathogens or are affected by psychological and social hazards, which may damage their health or endanger their lives.[2] Occupational exposure mainly occurs through biological, physical, chemical, or psychosocial hazards. Among them, biological hazards, also referred to as infectious or blood-borne hazards, are the most common.[3] Biological exposure occurs due to contact with patients' blood, body fluids, and secretions. The most common pathogens include hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), and syphilis, with the main route of exposure being needlestick injury.[4,5]

Due to the unique nature of their work environment, medical personnel are a high-risk group for occupational exposure. Studies have shown that the annual incidence of occupational exposure among medical personnel worldwide is as high as 50.3%, with doctors and nurses being more commonly affected, especially those with less experience.[6–8] Individual medical staff members may differ in their degree of exposure to occupational hazards and in the physical and mental effects of the exposure.

Received: 25 December 2024
Accepted: 12 May 2025
Published: 17 May 2025

Protection of medical staff against occupational hazards mainly refers to the scientific management methods that involve various measures such as providing medical staff with high-safety operating tools and protective equipment and encouraging medical staff to develop an awareness towards protective measures and actually implementing these measures to avoid physical and mental damage caused by occupational hazards.[9] With the continuous reforms in China's medical care, there has been considerable advancement in level of prevention and control of nosocomial infection at medical facilities; however, knowledge, attitudes, and behaviors of medical staff themselves towards occupational protection need to be further improved.[10]

Currently, domestic and foreign research on occupational exposure and protection is mainly dominated by quantitative research, and the main research hotspots have been topics such as needlestick injuries, blood-borne exposure, and occupational burnout.[5,11,12] The few qualitative studies undertaken hitherto have been focused on the experiences of medical staff with exposure to and protection against occupational hazards.[13,14]

Internationally recognized interventions based on The "Prevention-Monitoring-Support" model emphasize systematic risk management, while the "Pre-Exposure Prophylaxis (PrEP) + Post-Exposure Prophylaxis (PEP)" models specifically target bloodborne pathogen control.[15,16] Most of the domestic protective behavior prediction models are based on either the Theory of Planned Behavior (TPB) or Health Belief Model (HBM).[17] However, current models exhibit two major limitations: (1) overemphasis on single exposure types (eg, needlestick injuries) without comprehensive perspective; (2) disproportionate focus on behavioral interventions while neglecting psychosocial factors.

Under these circumstances, we sought to undertake a qualitative study based on the grounded theory method to explore the experiences of medical personnel with occupational exposure and appropriate protective strategies and thereby construct a theoretical model that can guide medical staff to improve their own knowledge, attitudes, and behaviors towards occupational protection.

Material and Methods

Research Design

In this study, we adopted the grounded theory method, specifically the classic grounded theory of Glaser and Strauss. Grounded theory is one of the commonly used qualitative research methods. We used the grounded theory to explore the experiences of new medical staff regarding exposure to occupational hazards and thereby construct a theoretical background that can guide new medical staff to take corresponding protective measures against such occupational hazards.

Research Subjects

Since the ultimate goal of this study is to explore the experiences of new medical staff regarding exposure to and protection from occupational hazards, we sought to conduct the study on new medical staff who have been engaged in clinical work for ≤2 years. This study employed a three-phase integrated sampling strategy: To rapidly establish baseline data convenience sampling was done initially, recruiting 3 newly employed medical staff meeting the core criteria and having the typical exposure experiences recommended by hospital infection control administrators. Subsequently, based on analysis of initial case characteristics, purposive sampling was applied to supplement 10 representative samples across different departments and exposure factors. Finally, theoretical sampling was dynamically adjusted by analyzing data gaps after each interview, until theoretical saturation was achieved. The data collected from the subjects were recorded as codes in order to construct a theory, and theoretical sampling was continued until no new codes appeared. The sampling method of grounded theory is mainly based on theoretical saturation, and therefore, the sampling in this study was continued until theoretical saturation. Finally, 23 subjects were recruited in this study. In order to protect the identity information of the interviewees, each interviewee and the corresponding interview materials were assigned digital codes.

Data Collection

The research team developed the interview guide through three key steps: (1) conducting literature reviews by screening Chinese and English databases to extract relevant questions for the initial draft; (2) organizing expert panel discussions

with three specialists (in infection control, nursing management, and clinical nursing) to revise the guide; and (3) conducting pilot interviews with three participants to finalize the interview guide.

The outline of the questions used for the interview is as follows: (1) Have you ever experienced occupational exposure? If so, what was the specific situation? How did you deal with it? (2) What occupational exposure risk factors do you think exist in your work? (3) What occupational protection measures do you generally take to avoid occupational exposure? (4) What other occupational protection needs do you have? (5) What do you think is the significance of occupational protection?

This study adopted a rigorous interview protocol. Prior to commencing each interview, written informed consent was obtained from all participants with signed consent forms. The formal interview was conducted by a research member, while another research member recorded the interview and prepared the paper records. The average duration of the interview was 30 minutes, with a three-phase time control system (5 minutes for trust-building, followed by 20 minutes for core discussion and 5 minutes for summary). Once the researcher asked the questions, he/she guided the participant to delve deeper into the topic by asking leading questions such as "What was the specific situation?" "Is there anything else to add?" and "Do you have any better suggestions for this?" The participants would sometimes repeat part of their statements or pause in between their answers. All interviews were conducted in a quiet demonstration room and recorded using Patriot digital voice recorders. A three-tier confidentiality protocol with encrypted storage, text de-identification, and 3-year destruction was strictly enforced for interview content.

Data Analysis

After each interview, the collected data was transcribed using the Feishu cloud platform, and the data were constantly compared and analyzed in combination with the field notes. The NVIVO11-Plus software was used to analyze the data step-by-step using the three-level coding method. First, open coding was performed, during which the researcher carefully analyzed the data with a neutral attitude to identify and define the concept categories. Second, axial coding was performed, where the researcher identified the associations between the responses and grouped them into each concept category. Finally, selective coding was performed to determine the core categories in the identified concept categories and use these to construct theories. Coding in this study was completed by two members of the research team —a Senior Nurse practitioner and a Nurse Practitioner. Both coders are master's degree holders in nursing. The text data were independently coded by two researchers; any disagreement between them was resolved through mutual discussion. Once coding was completed, a consistency test was performed, and the Kappa coefficient was determined to be above 0.8. Word frequency analysis was also completed using the software. In addition, we constructed a code word frequency chart on the WordArt website.

Ethical Considerations

This study protocol was approved by the ethics review committee of Tianmen First People's Hospital (ethical approval number: Scientific Research Review No. 20210312). Before the start of the study, all subjects were explained about the purpose of the investigation and provided informed consent for participation in the study, which included permission to publish anonymized responses and direct quotes. The confidentiality principle was strictly observed for all procedures.

Quality Control

The researchers were trained in advance regarding data collection such that homogeneity of the data was achieved. Each interview was conducted by two researchers, one was responsible for asking question, while the other recorded the interview and took on-site notes. During data collation, the audio data were first transcribed into text with the help of software; then, the data were manually transcribed in combination with the on-site notes and the audio data reverified. For data analysis, two researchers independently coded and analyzed the data with a neutral attitude, and the consistency of the coding was verified after completion.

Results

Basic Characteristics of the Research Subjects

Subjects who participated in this study were aged between 21 and 28 years (average age: 24 years). The participants belonged to 20 different departments, including the hospital infection department, emergency department, and laboratory department. The basic characteristics of the research subjects are detailed in Table 1.

Table 1 Basic Characteristics of the Research Subjects

	Percentages	**Number**
Mean age (years)	24.421	
Gender		
Male	21.7	5
Female	78.3	18
Marital status		
Unmarried	82.6	19
Married	17.4	4
Educational level		
Junior college	26.1	6
Undergraduate	65.2	15
Master	8.7	2
Specialty		
Nurse	82.6	19
Technician	13	3
Doctor	4.3	1
Department		
Infectious disease department	8.7	2
Emergency department	8.7	2
Clinical laboratory	8.7	2
Department of hematology	8.7	2
Department of Gynecology	4.3	1
Department of Orthopedics	4.3	1
Nuclear medicine	4.3	1
Respiratory medicine	4.3	1
Dermatology	4.3	1
General surgery department	4.3	1
Nephrology department	4.3	1
Operating room	4.3	1
Disinfection supply center	4.3	1
Gastroenterology department	4.3	1
Oncology department	4.3	1
General neurology	4.3	1
CT Room	4.3	1
ICU	4.3	1
NICU	4.3	1
Total	100	23

Coding results

The study was conducted in strict adherence to Glaser and Strauss' classical grounded theory methodology, conducting systematic three-level coding analysis of 23 interview transcripts. After repeated analysis and open as well as manual coding, 15 codes were generated with the help of word frequency analysis (Figure 1). Using axial coding, six categories were generated from the 15 codes; these categories were processing and reflection after occupational exposure, comprehensive identification of occupational exposure risk factors, progressive response, normalization of occupational protection, active expression of protection needs, and two-way protection. Selective coding eventually revealed "two-way-progressive occupational protection" as the core category. The specific details of the three-level coding are provided in Table 2. Finally, a psychological model of the experiences of new medical staff regarding occupational exposure and occupational protection was constructed (Figure 2). The resulting model delineates the typical progression of occupational exposure and protection experiences among newly employed medical staff, evolving from passive response to proactive prevention under the "risk factor identification-needs expression-bidirectional protection" mechanism.

Treatment and Reflection After Occupational Exposure

Newly employed medical staff can be potentially exposed to different types of occupational hazards at work. In this study, about one-third of the new employees had experienced exposure to various hazards, mainly needlestick injuries. Newly employed medical staff are often more likely to be exposed to hazards because they are unfamiliar with the medical environment and they may not operate in a standardized manner. However, after occupational exposure occurs, they handle it in a timely, correct, and standardized manner according to the situation:

> P2: Once I accidentally stabbed my hand after removing a needle from a patient during the night shift. I rinsed it with water, and then I checked that the patient did not have any infectious diseases, so I did not report it.

> P15: When the 120 ambulance was on duty, a patient had respiratory and cardiac arrest, and the scene was chaotic when I gave him an injection. The needle stabbed my hand. There was only hand sanitizer and alcohol in the ambulance at the time. I squeezed the blood out, washed my hand with hand sanitizer, and rinsed it with alcohol. After returning to the hospital, I reported it and had a blood test.

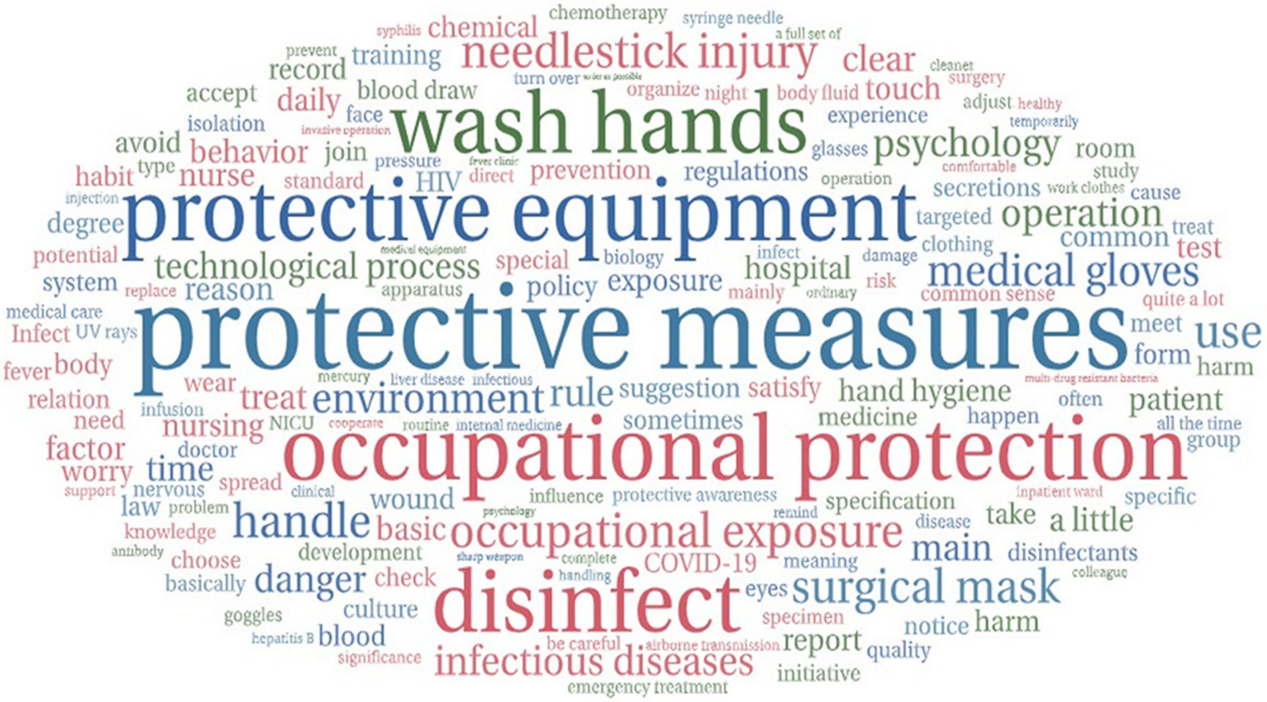

Figure 1 Code word frequency graph.

https://doi.org/10.2147/JMDH.S514331

Table 2 Coding Content

Open coding	Axis Coding	Selective Coding
Standard processing	Treatment and reflection after occupational	Two-way-progressive occupational protection
Positive reflection		
Risk factors	Comprehensive identification of risk factors	
Predictive thinking		
Psychological change	Progressive coping	
Attitude change		
Foundation protection	Normalization of occupational protection	
Targeted protection		
Supplementary protection		
Protection training	Proactively express protection needs	
Protective equipment		
Protective medical devices		
Self-protection	Two-way protection	
Patient protection		

P5: After the operation, I needed to move the patient. The patient was slightly heavy, and I sprained my waist while assisting in lifting the patient. I rested for a day or two before I recovered.

P6: Once when I was helping an old man dress at work; he took the opportunity to touch my buttock. I did not react at the time, and then I directly reported the incident to the head nurse and called the security guard.

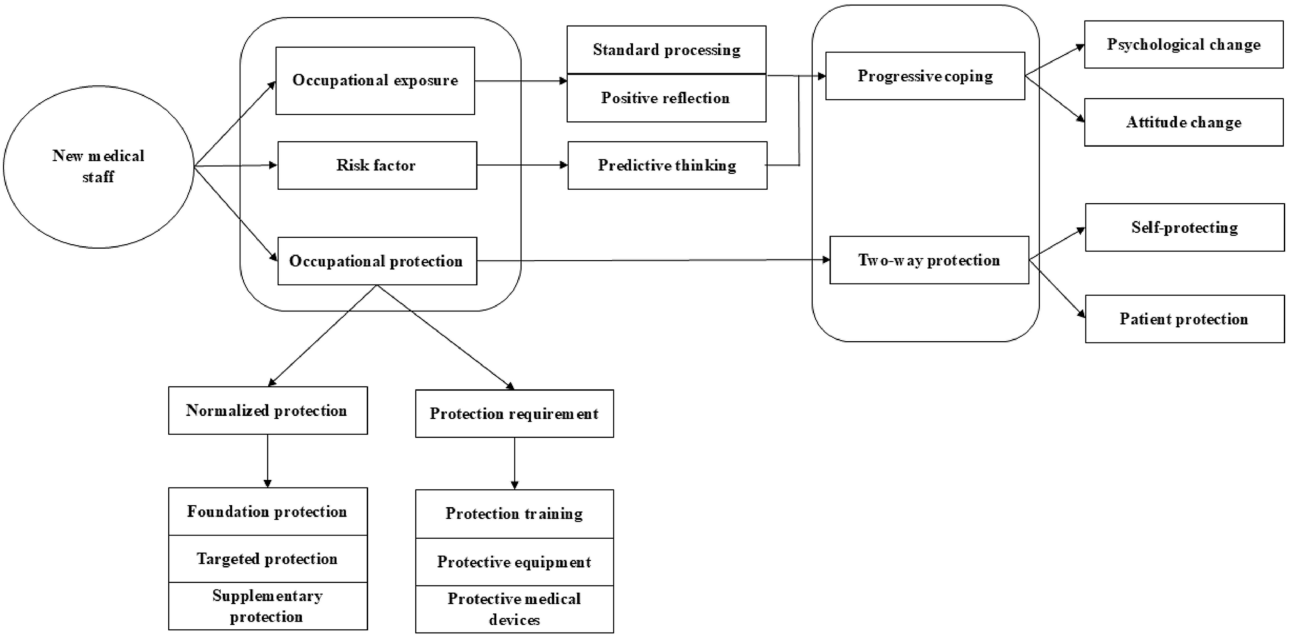

Figure 2 "Two-way-progressive occupational protection" model for newly employed medical staff.

P14: Occasionally, a mercury thermometer breaks. The department is equipped with a mercury spill treatment box. At that time, we immediately let the patient go out, opened the window for ventilation, and handled the spilled mercury according to the instructions.

At the same time, they will also actively reflect and further regulate their behavior:

P19: I am reflecting and will try not to make this happen again in the future.

P15: After that incident, I will leave the needle core there when I pull out the needle, and then pull it out and put it in after I get the sharps box, to ensure that there is no interference in the middle and it can be put in directly.

P2: I will be very careful every time I go to work in the future. I will not directly insert the pulled-out needle into the infusion tube. I will take it to the treatment room for treatment.

P5: Since that incident, although sometimes I am very busy on duty alone, I also pay special attention.

Comprehensively Identify Occupational Exposure Risk Factors

New medical staff learn to actively identify some risk factors at work, including biological, physical, chemical, and psychosocial, as described below:

P1: Some patients show some aggressive behavior, and there is a risk of being attacked by patients.

P4: When facing patients with severe vomiting of blood, patients with endotracheal intubation, patients with multidrug-resistant bacteria infection, and when doing blood gas analysis for patients, exposure may occur.

P15: When we are doing gastric lavage for patients who attempt suicide by taking pesticides, there will be a smell of pesticides in the air. I will cover myself tightly and do a good job of air disinfection and ventilation.

P16: When the instruments after surgery are delivered to our supply room, some are not handled properly. There may be needles or blades stuck in the package. If you are not careful when opening the package, you may prick your hand.

P20: When testing body fluid specimens, I don't know whether the specimen is infectious or not, because they are all mixed together and cannot be separated.

Predictive thinking plays a vital role in identifying risk factors, enhancing the awareness of staff towards the prevention of exposure to risk factors at work, pre-evaluate these risk factors, and take necessary preventive steps:

P5: After experiencing a sudden expansion of the gastric fluid negative pressure box, I will subconsciously clamp it and stay away from it when I change it for the patient.

P7: We perform a lot of surgeries, and we must be alert during the procedure. For example, when doctors are handling blood vessels, they must pay attention to the possibility of splashing and need to avoid it in time.

P8: When operating on patients, we must first evaluate whether the patient's body fluids are likely to splash. If so, we must wear a protective face shield to enhance protection.

Progressive Response

New medical staff have a process of coping with occupational exposure. At the beginning, they may feel fear, tension, and anxiety, and may panic when facing unfamiliar environments and difficult tasks at work:

P5: There was a particularly scary incident. A patient came from the emergency room because he was in pain. The emergency department treated him in advance and gave him an injection. After a blood test, it was suspected that he had AIDS. I thought to myself that it was a good thing that I didn't give him an injection that day, but I still feel scared when I think about it.

P9: Sometimes I feel that needlestick injuries may occur when caring for HIV patients. Even if I am nervous at ordinary times, I will still feel a little nervous despite knowing nothing is wrong.

P15: I was quite anxious at the time, because there is an initial screening for blood donation, and I went to donate blood at that time.

P22: I was in the ambulance, and the patient was in a serious condition and needed an intravenous access. It was urgent. I couldn't find the sharps box, so I just stuck the needle next to the seat.

With more experience, they gradually adapted to their environment, and their attitude towards occupational exposure changed over time. In order to reduce the occurrence of occupational exposure, they learnt to be careful, cautious, and calm in their work:

P10: Now I think we can't be afraid of occupational exposure, because it is inevitable and sometimes it is an accident, but we must know what measures to take to protect ourselves and what to do if occupational exposure occurs.

P13: It's better to be slow. Anyway, you can't be impatient, because it's easy to make mistakes when you are impatient.

P15: At the beginning, I was quite flustered. Sometimes I didn't know what to do after a patient came. Now I have my own set of standards in my mind.

P18: When doing blood sample testing, sometimes the sample may accidentally spill. Now I will remain calm and deal with it immediately.

Normalization of Occupational Protection

As new medical staff become more familiar with their work, their awareness regarding protective measures gradually increases. In addition to the daily basic protective measures, they also adopt some targeted protective measures for specific circumstances. Sometimes they may even take some additional protective measures, such as wearing wristbands, waist belts, varicose vein socks, and other personal protective equipment. These are becoming the norm:

P17: We still need to standardize our daily operations, because standardized operations can largely avoid occupational exposure.

P19: We have to wear work clothes, gloves, masks, and goggles when we go to work. These are for basic protection.

P20: When we perform chest puncture or bone marrow puncture on patients, we strictly follow the operating procedures and aseptic principles.

P1: If the patient is infected with multidrug-resistant bacteria, we isolate the patient in a single room, and the patient's belongings are handled by a dedicated person. We wear gloves, masks, and isolation gowns before nursing activities and turn on the air disinfector for disinfection.

P12: When patients come to our gastroenterology department, they undergo blood tests. If the patient is found to have hepatitis B, AIDS, or syphilis, our medical staff will notify each other and pay attention when caring for such patients.

P23: When doing CT scans for patients, we will do a good job of radiation protection. If there are patients with multidrug-resistant bacteria who come for examination, we will also take corresponding protective measures, and then use disposable items for patients, such as disposable bed sheets.

P17: I will consciously separate work items from my personal items. For example, the nurse uniform I wear has two pockets, and I will distinguish between the left and right. I put the paper, pen and PDA used at work in one pocket, and other personal items in the other pocket.

P10: Earlier, when I was at work, my wrist suddenly lost strength, so I went for physical therapy and bought a wrist guard to wear.

Actively Express Occupational Protection Needs

The main protection needs of new medical staff include the need for training in occupational protection, the need to prepare protective equipment, and the need to configure protective medical equipment:

P3: I hope these protection trainings can be given in different forms, so that I can remember them more easily.

P6: I have seen some advanced equipment on the Internet, such as advanced blood collection needles, with which we will not easily prick ourselves. I hope our hospital can also be equipped with such equipment.

P11: Protective equipment should be selected according to the department. If there is no protective equipment and if the situation is urgent, just go and deal with it directly.

P16: Prevention and control supplies must be prepared, and facilities such as eyewash must be kept in good condition.

Two-Way Protection

The ultimate objective of occupational protection is two-way protection. Occupational protection for medical staff not only protects the staff themselves, but also patients to some extent.

P3: Occupational protection can not only protect yourself, but also patients. It is a two-way protection.

P14: It is mainly the patients who suffer. That is, the patients' problems are the top priority. Just do your own protection.

P16: "First, protect yourself, and then you can provide better services to patients."

Discussion

Our investigation has provided some insights into the experiences of new medical staff regarding exposure to occupational hazards and protective measures.

In this study, we adopted the classic grounded theory,[18] which emphasizes the theory of discovery. It is not only applicable to understanding the fundamental rationale behind nursing phenomena and practice, but can also help elucidate the psychological model of people's cognition and coping methods. This method can help comprehensively explore the experience of new medical staff in coping with occupational exposure and help implement various measures for protection against occupational hazards. Based on the codes identified from the interview data, several key categories were recognized.

Standardize Diagnosis, Treatment, and Nursing Operations and Implement Standard Preventive Strategies

Standardizing medical and nursing operation processes and implementing standard preventive strategies are not only the first line of action for occupational protection, but also the key to reducing occupational exposure of medical staff.[19] Often, medical staff may function in a non-standard manner,[20] which greatly increases the risk of occupational exposure. We noted that one-third of the medical staff interviewed in this study had experienced needlestick injuries. Analysis of the interview data revealed that such instances were related to non-standard operative steps and poor awareness regarding occupational protection. Therefore, it is necessary to strengthen the awareness regarding standard protective measures among new medical staff and ensure their proper implementation.

The French group of Michinov et al[21] developed the Standard Precautions Questionnaire (SPQ); this questionnaire includes 7 dimensions and 21 items, including attitude, willingness to comply, and social influence. SPQ has been proven to have good reliability and validity[22] and can be used to analyze the implementation of standard preventive measures by medical staff.

Comprehensively Understand the Types of Occupational Exposure and Take Classified Protection Measures

We also noted that in addition to common needlestick injuries, some interviewees reported weight-bearing injuries that were caused by carrying patients or heavy objects, as well as negative psychological states such as tension and anxiety due to factors such as excessive work pressure. In the medical environment, medical staff are often required to physically support patients and may tend to support most of the patient's weight with an improper posture, putting excessive weight on the lower back, thereby potentially causing back pain, lumbar sprain, or lumbar disc herniation.[23] When faced with such circumstances, medical staff should follow the principles of mechanics and use force reasonably; careful

manipulation can reduce the occurrence of such occupational issues to some extent.[24] Further, the effect of psychosocial occupational hazards on medical staff is often overlooked.[25] Some participants of our study reported that the lack of familiarity with the medical environment when they first entered the workplace made them prone to negative psychological states such as tension and anxiety. Furthermore, some interviewees also said that they had encountered sexual harassment at work.

The positive aspect of this issue is that all those who had encountered such situations had sought support from friends and colleagues around them as soon as possible. Melnyk et al[26] have reported that electronic mental health interventions, including online cognitive behavioral therapy sessions and cognitive behavioral therapy using the "Foundation" mobile application, can effectively improve negative psychological symptoms such as anxiety and depression among medical staff. These electronic mental health interventions can also be used to improve the negative psychological effects of occupational exposure in medical staff.

Pre-Identify Potential Risk Factors for Occupational Exposure and Conduct Targeted Intervention

Ousman A et al[27] used a logistic regression model to show that occupational exposure is more likely among medical staff who are work in certain departments such as emergency departments, operating rooms, and ICUs. We also noted that new medical staff in the emergency department are more likely to be exposed to occupational hazards. Therefore, new medical staff in these departments require special attention. Studies abroad[5] have shown that occupational exposure is most likely to occur during needle removal; delivery of medical equipment; handling of medical waste; face-to-face communication with patients; and contact with patients' blood, body fluids, and secretions. These findings are consistent with the responses given by the participants of our study. Therefore, medical staff should adopt a precautionary mindset, pre-identify the risk factors for occupational exposure, and conduct targeted intervention.

Regular Occupational Protection, Ultimately Achieving Two-Way Protection

Regular occupational protective measures require not only the strengthening of personal awareness of medical staff regarding occupational protection, but also the implementation of specific protective measures by medical institutions to ensure the occupational protection of medical staff. First, it is necessary to strengthen the training of new medical staff regarding occupational protection. The subjects in this study expressed the hope that the content of the training would be more comprehensive, covering all domains of occupational exposure as much as possible. They also expressed the need for more flexibility in the training methods and a combined approach that included both theoretical as well as practical aspects via both online and offline modes of instruction.

Personal protective equipment is a key factor in ensuring the safety of medical staff. The shortage of personal protective equipment increases the risk of infection among the staff. Therefore, medical institutions should ensure that medical staff have access to appropriate and adequate protective equipment. In addition, medical staff can be supplied with protective medical devices such as devices for the prevention of "sharp injury" and safe blood collection needles.[28,29] The subjects in this study also hoped that hospitals can effectively implement these protection measures.

Finally, it is necessary to strengthen the evaluation and supervision of the actual implementation of occupational protection behavior among medical staff and adopt an effective supervision and management mechanism that encourages reporting and strengthens the occupational safety culture.[30] Moreover, attention should be paid to the mental health of new medical staff. Studies have found that high work pressure and exposure to biohazards can increase the risk of occupational burnout among medical personnel and reduce the degree of job satisfaction.[31] Some studies have suggested that a long-term psychological support service system for medical staff should be established[32] to address negative psychological states among medical staff. In addition, medical personnel should standardize their own diagnostic, therapeutic, and nursing operations and take personal supplementary protective measures that allow for basic as well as graded protection as deemed necessary by their actual situation. At the same time, they should also strengthen health education for patients. While protecting themselves, medical personnel should also protect patients and achieve two-way protection.

This study has certain limitations. First, we must acknowledge the possibility of recall bias in the interviewees' description of their experiences with occupational exposure. Second, this study was only conducted at a single tertiary hospital and may not be truly representative of the entire Chinese population. Therefore, large-scale investigations are warranted to account for regional, economic, and cultural differences across the country.

Conclusion

The "two-way-progressive" occupational protection theory model represents a new concept regarding the protection of new medical staff against exposure to occupational hazards. The model identified six major coping strategies regarding occupational exposure and protection: standardized treatment and reflection of occupational exposure, comprehensive identification of risk factors for occupational exposure, progressive response, normalized occupational protection, active expression of occupational protection needs, and two-way protection. This model can play a positive guiding role in the management of occupational exposure, identification of occupational exposure risk factors, and the adoption of occupational protection measures for new medical staff. It can also help guide clinical training in occupational protection.

Funding

This work was supported by Joint Fund of Hubei Province Key Laboratory of Occupational Hazard Identification and Control (JF2023-G20).

Disclosure

The authors report no conflicts of interest in this work.

References

1. Peters S, Pronk A, Vermeulen R. S-264 Taking a working life exposome approach: why do we need it and which challenges are we facing? *Occup Environ Med*. 2021;78(Suppl 1):A156–A156.
2. Auerbach JD, Malone S, Forsyth AD. Occupational post-exposure prophylaxis among healthcare workers: a scoping review of factors affecting optimal utilization. *J Int AIDS Soc*. 2024;27(8):e26341. doi:10.1002/jia2.26341
3. Minard G, Touche S, Delavelle AC, Bonnet M, Huguenin A, N'Guyen Y. Case Report: could Artemisinin-Based Combination Therapy Prevent Occupational Malaria following Blood Exposure? *Am J Trop Med Hyg*. 2021;104(1):240–242. doi:10.4269/ajtmh.20-0717
4. Sunday EO, Okafor CA, Florentina EA, et al. Evaluation of the Factors Influencing Needle stick Injury And Bloodborne Pathogens among Healthcare Workers in Benue State University Teaching Hospital Makurdi, North-Central Nigeria. *Sumerianz J Med Healthcare*. 2024;7(1):9–18.
5. Mengistu DA, Tolera ST, Demmu YM. Worldwide Prevalence of Occupational Exposure to Needle Stick Injury among Healthcare Workers: a Systematic Review and Meta-Analysis. *Can J Infect Dis Med Microbiol*. 2021;2021:9019534. doi:10.1155/2021/9019534
6. Bouya S, Balouchi A, Rafiemanesh H, et al. Global Prevalence and Device Related Causes of Needle Stick Injuries among Health Care Workers: a Systematic Review and Meta-Analysis. *Ann Glob Health*. 2020;86(1):35. doi:10.5334/aogh.2698
7. Larese Filon F, Pesce M, Paulo MS, et al. Incidence of occupational contact dermatitis in healthcare workers: a systematic review. *J Eur Acad Dermatol Venereol*. 2021;35(6):1285–1289. doi:10.1111/jdv.17096
8. Shi Y, Xue H, Ma Y, et al. Prevalence of occupational exposure and its influence on job satisfaction among Chinese healthcare workers: a large-sample, cross-sectional study. *BMJ Open*. 2020;10(4):e031953. doi:10.1136/bmjopen-2019-031953
9. Liu X, Li Y, Li X, Yu K, Saravanan V, Saravanan V. Study on cognition and behavior of self-occupational protection of nurses in the hospital. *Aggr Violent Behav*. 2020;101535. doi:10.1016/j.avb.2020.101535
10. Zhao C, Yu M, Wang A, Xu X, Zheng X. Construction of an evaluation system for medical staff's occupational protection ability based on knowledge, attitude, and practice theory, and a cross-sectional survey of current conditions. *BMC Nurs*. 2023;22(1):78. doi:10.1186/s12912-023-01242-8
11. Zhang X, Zhou Y, Fan C, et al. Visualization and bibliometric analysis of occupational exposure among nurses in Asia. *Heliyon*. 2023;9(11):e21289. doi:10.1016/j.heliyon.2023.e21289
12. Liu Y, Li Y, Yuan S, Ma W, Chen S, Wang LY. Risk Factors for Occupational Blood Exposure, Compliance with Policies of Infection Prevention and Control, and Costs Associated with Post Exposure Management Among Nursing Staff. *Infect Drug Resist*. 2024;17:1215–1228. doi:10.2147/IDR.S451615
13. Salvarani V, Rampoldi G, Ardenghi S, et al. Protecting emergency room nurses from burnout: the role of dispositional mindfulness, emotion regulation and empathy. *J Nurs Manag*. 2019;27(4):765–774. doi:10.1111/jonm.12771
14. Wang Q, He P, Tian Y, et al. Experiences of healthcare workers following occupational exposure to COVID-19 at the early stages of the pandemic: a phenomenological qualitative study. *Nurs Open*. 2023;10(6):3696–3706. doi:10.1002/nop2.1623
15. K Roush. News Brief: CDC issues new guidelines for STI postexposure prophylaxis. *Am J Nurs*. 2024;124(9):13. doi:10.1097/01.NAJ.0001050780.82610.28
16. Chapin-Bardales J, Algarin AB, Baruch-Dominguez R, Smith LR, Hernandez-Avila M, Sanchez T. Awareness, willingness to use pre-exposure prophylaxis, and use of post-exposure prophylaxis for HIV prevention among men who have sex with men in Mexico. *Int J STD AIDS*. 2024;35(9):675–688. doi:10.1177/09564624241248254

17. Wang Q, Chen J, Jiang N, et al. Parents' intention to vaccinate their preschool children against COVID-19: combining the health belief model and the theory of planned behavior. *Hum Vaccin Immunother*. 2023;19(2):2261171. doi:10.1080/21645515.2023.2261171
18. Connor J, Flenady T, Dwyer T, Massey D. Application of classic grounded theory in nursing studies: a qualitative systematic review protocol. *BMJ Open*. 2023;13(7):e068588. doi:10.1136/bmjopen-2022-068588
19. Zeb S, Ali TS. Factors associated with the compliance of standard precaution; review article. *J Pak Med Assoc*. 2021;71(2(B)):713–717. doi:10.47391/JPMA.416
20. Ding E, Li WH, Wang P, Jian XD. Somewhere in tertiary hospital clinical laboratory in pursuance of personnel sharp injury incidence status investigation and relative factor analysis. *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi*. 2016;34(7):502–505. doi:10.3760/cma.j.issn.1001-9391.2016.07.006
21. Michinov E, Buffet-Bataillon S, Chudy C, Constant A, Merle V, Astagneau P. Sociocognitive determinants of self-reported compliance with standard precautions: development and preliminary testing of a questionnaire with French health care workers. *Am J Infect Control*. 2016;44(1):14–19. doi:10.1016/j.ajic.2015.07.041
22. Luna T, Pereira-ávila FMV, Brandão P, et al. Psychometric properties of the Brazilian version of the Standard Precautions Questionnaire for health professionals in Brazil. *Rev Bras Enferm*. 2020;73(s6):e20190518. doi:10.1590/0034-7167-2019-0518
23. Hulshof CTJ, Pega F, Neupane S, et al. The prevalence of occupational exposure to ergonomic risk factors: a systematic review and meta-analysis from the WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury. *Environ Int*. 2021;146:106157. doi:10.1016/j.envint.2020.106157
24. Schröder C, Nienhaus A. Intervertebral Disc Disease of the Lumbar Spine in Health Personnel with Occupational Exposure to Patient Handling-A Systematic Literature Review and Meta-Analysis. *Int J Environ Res Public Health*. 2020;17(13):4832. doi:10.3390/ijerph17134832
25. Fathi Y, Barati M, Zandiyeh M, Bashirian S. Prediction of Preventive Behaviors of the Needlestick Injuries during Surgery among Operating Room Personnel: application of the Health Belief Model. *Int J Occup Environ Med*. 2017;8(4):232–240. doi:10.15171/ijoem.2017.1051
26. Melnyk BM, Kelly SA, Stephens J, et al. Interventions to Improve Mental Health, Well-Being, Physical Health, and Lifestyle Behaviors in Physicians and Nurses: a Systematic Review. *Am J Health Promot*. 2020;34(8):929–941. doi:10.1177/0890117120920451
27. Adal O, Abebe A, Feleke Y. Occupational Exposure to Blood and Body Fluids Among Nurses in the Emergency Department and Intensive Care Units of Public Hospitals in Addis Ababa City: cross-sectional Study. *Environ Health Insights*. 2023;17:11786302231157223. doi:10.1177/11786302231157223
28. Zhang L, Li Q, Guan L, et al. Prevalence and influence factors of occupational exposure to blood and body fluids in registered Chinese nurses: a national cross-sectional study. *BMC Nurs*. 2022;21(1):298. doi:10.1186/s12912-022-01090-y
29. Reddy VK, Lavoie MC, Verbeek JH, Pahwa M. Devices for preventing percutaneous exposure injuries caused by needles in healthcare personnel. *Cochrane Database Syst Rev*. 2017;11(11):Cd009740. doi:10.1002/14651858.CD009740.pub3
30. Cummings GG, Tate K, Lee S, et al. Leadership styles and outcome patterns for the nursing workforce and work environment: a systematic review. *Int J Nurs Stud*. 2018;85:19–60. doi:10.1016/j.ijnurstu.2018.04.016
31. Ungur AP, Bârsan M, Socaciu AI, et al. A Narrative Review of Burnout Syndrome in Medical Personnel. *Diagnostics*. 2024;14(17):1971. doi:10.3390/diagnostics14171971
32. Kunzler AM, Helmreich I, Chmitorz A, et al. Psychological interventions to foster resilience in healthcare professionals. *Cochrane Database Syst Rev*. 2020;7(7):Cd012527.