

Research Progress on Occupational Exposure Risk Perception among Nursing Staff

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Abstract: Nursing staff face multiple occupational exposure risks in clinical practice, which not only affect their physical and mental health but may also negatively impact healthcare quality and patient safety. In recent years, scholars worldwide have extensively studied occupational exposure risks among nursing personnel. This review summarizes research progress on risk perception regarding occupational exposure among nursing staff, including types of occupational exposure, theoretical foundations of risk perception, research tools, and influencing factors. By analyzing existing studies, it aims to provide scientific evidence for the prevention and management of occupational exposure risks among nursing personnel.

Keywords: Nursing staff; Occupational exposure; Risk perception; Literature review

1 Introduction

As a critical force within the healthcare system, nursing staff are exposed to prolonged periods in high-risk, high-workload environments, facing multiple occupational exposure threats (Medeni, Alagüney, & Medeni, 2024). Occupational exposure refers to situations where workers, during professional activities, come into contact with blood containing bloodborne pathogens or other potentially infectious substances through the eyes, mouth, nose, other mucous membranes, broken skin, or non-gastrointestinal routes (Ministry of Health of the People's Republic of China, 2009). Research indicates occupational exposure impacts nursing staff in multiple dimensions: it threatens their physical health while potentially triggering psychological issues like anxiety and depression, and may even affect their professional identity and job retention intentions (Dumas et al., 2020; Abu-Alhaija et al., 2023). Studies indicate that workplace violence severely impacts staff mental and physical health, leading to symptoms such as occupational burnout, de-

pression, fear, and post-traumatic stress disorder (Antão et al., 2020; Al-Qadi, 2021). During public health emergencies, the occupational exposure risks faced by nursing staff significantly escalate, subjecting their health and safety to unprecedented challenges (Ding, 2024).

Nursing staff are confronted with severe occupational exposure risks that adversely affect their physical and mental health, professional identity and job retention, especially during public health emergencies. Against this backdrop, scientifically assessing and improving nursing staff's perception of occupational exposure risks has become a critical issue for optimizing occupational protection strategies and ensuring the stability of the medical workforce. Risk perception refers to an individual's subjective cognition and evaluation of potential hazards, which directly influences protective behaviors and decision-making (Shao, 2024). Nurses' level of occupational exposure perception is closely linked to their protective compliance, emergency response capabilities, and mental health status. However, existing research indicates variations

in risk perception among nursing staff, potentially influenced by individual characteristics, organizational environments, and cultural contexts (Kunzler et al., 2020; Mendez-Maturrano et al., 2023). Differences in resource allocation across healthcare institutions may also contribute to group-level biases in risk perception (Zhang et al., 2021). While scholars worldwide have extensively studied the epidemiological characteristics, protective technologies, and management policies related to occupational exposure in nursing, research on the formation mechanisms, dynamic changes, and intervention pathways of risk perception remains fragmented. Comprehensive cross-cultural and multi-setting analyses are notably lacking.

This study systematically reviews domestic and international literature on nursing staff's occupational exposure risk perception, clarifying its theoretical basis, influencing factors, assessment tools, and research progress. The findings aim to provide theoretical support for formulating targeted risk perception improvement strategies and optimizing occupational safety policies, and offer references for protecting nursing staff in future public health emergencies.

2 Literature review

Nurses face classified occupational exposure risks across biological, physical, chemical, and psychosocial domains, each with distinct hazards and significant implications for their health and professional well-being. Biological occupational exposure involves contact with patients' blood or bodily fluids, exposing nurses to infectious agents including bacteria, viruses, and fungi (Rasmussen et al., 2023). Bloodborne exposure mainly occurs via needlestick injuries among junior nurses, with hepatitis B virus as the predominant pathogen (Wang et al., 2024). Physical occupational exposure includes musculoskeletal injuries and physical irritants such as noise and needlestick injuries (Du et al., 2021; Amare et al., 2021). The annual prevalence of musculoskeletal injuries among Chinese nursing staff was 79.87%, and low back pain showed the highest prevalence, ranging from 49.0% to 84.0% (Zheng et al., 2021; Soyler & Ozer, 2018). Chemical occupational exposure derives from toxic or irritating chemical agents such as drugs, solutions, gases, vapors, aerosols, and particulates

(Walton & Rogers, 2017). Prolonged exposure to chemotherapy drugs increases the risk of cancer, reproductive hazards, skin irritation, and respiratory diseases (Campbell et al., 2024). Psychosocial occupational exposure primarily includes workplace violence and occupational stress (Rai et al., 2021). Risk perception refers to the subjective cognitive process through which individuals interpret potential hazards based on knowledge, experience, emotions, and sociocultural context, which varies across individuals even under the same threat (Xu & Xie, 1995). In nursing, risk perception is the subjective assessment of workplace hazards by nursing staff, formed by their professional knowledge, clinical experience, emotional state, and sociocultural background (Zhang, 2016).

3 Current research status of occupational exposure risk perception among nursing staff

3.1 Theoretical foundations of occupational exposure risk perception

The Health Belief Model (HBM) describes an individual's cognitive and behavioral decision-making patterns regarding personal health issues. It encompasses perceptions of illness, recognition of health threats, attitudes toward health concerns, and behavioral intentions (Hosseinpour et al., 2024). The HBM has demonstrated positive applications in predicting and modifying various long-term or short-term health risk behaviors (Zhang & Zhang, 2001) and is also suitable for research on occupational safety risk management among clinical nursing staff. This model emphasizes individuals' perceptions of disease threats (such as susceptibility and severity) and their assessment of the benefits/barriers to behavioral change (Chen & Zhao, 2014). Research confirms that nursing staff exhibit higher protective compliance when they perceive the severity of needle stick injury consequences more strongly (Antão et al., 2020).

Protection Motivation Theory (PMT) aims to explain individuals' behavioral decision-making processes when facing threats. This theory posits that individuals determine whether to adopt protective behaviors through threat appraisal and coping appraisal (Peng & Zhang, 2023). PMT emphasizes that the protective motivation individuals exhibit to avoid hazardous be-

haviors is the key factor driving them to take self-protective actions (Cummings, Rosenthal, & Kong, 2021). Applying this theory, when nursing staffs face occupational exposure risks, they evaluate the severity of the risk and their own susceptibility while considering their coping capabilities and costs, thereby deciding whether to adopt effective protective measures. This model has been applied to studies on operating room nurses' willingness to protect against surgical smoke (Tao et al., 2024).

The Theory of Planned Behavior (TPB) posits that behavior stems from rational decision-making, emphasizing the combined influence of attitudes, subjective norms, and perceived behavioral control. TPB focuses on examining the predictive role of attitudes, subjective norms, and perceived behavioral control in risk responses (Bosnjak, Ajzen, & Schmidt, 2020). The TPB model has been extensively applied in healthcare settings, effectively predicting and explaining the relationship between attitudes and health behaviors (Kebede et al., 2023). Research indicates that departmental safety culture (subjective norm) significantly influences nursing staffs' willingness to use protective equipment (Zhao et al., 2022).

Social Cognitive Theory (SCT) proposes a triadic interaction model among individuals, behaviors, and environments, analyzing the dynamic influence mechanisms among these three components. This theory posits that human behavior is regulated not only by external environments but also by internal cognitive processes (Jiao, 2024). In health contexts, SCT asserts that profound understanding of health knowledge is a prerequisite for behavioral change, with self-efficacy serving as a core element that critically influences individual health behaviors (Bandura, 2004). Within nursing practice, nursing staffs cognitively process and evaluate occupational risk factors to develop risk perceptions. These perceptions subsequently shape their behavioral decisions—such as whether to adopt protective measures or how to optimize workflows.

3.2 Research tools for nurses' risk perception

3.2.1 Perceived risk scale

The perceived risk assessment tool developed by Lifshitz's research team is a comprehensive measurement scale designed based on psychometric principles (Lifshitz, Nimrod, & Bachner, 2016). This measure-

ment tool covers eight risk items, including core risk domains such as public safety threats, physical health damage, personal violence risks, and property loss. During administration, participants are asked to predict the probability of each risk event occurring within the next 12 months using a percentage scale (0% indicating completely impossible, 100% indicating extremely likely). The sum of individual scores reflects the intensity of an individual's risk perception, with total scores positively correlated with risk sensitivity. The scale exhibits excellent psychometric properties (Cronbach's α coefficient of 0.920) and has broad applicability across populations.

3.2.2 Nursing staff risk perception questionnaire

This measurement tool was developed by Zhang's research team based on risk perception theory. It comprises 6 assessment dimensions with a total of 28 evaluation items (Zhang, 2016). Using a five-point Likert scale, each option corresponds to scores ranging from 1 to 5 (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = almost always). The total scale score positively correlates with the intensity of risk awareness among nursing staff. Reliability testing yielded an internal consistency coefficient of 0.947.

3.2.3 Nursing occupational risk assessment questionnaire

Developed by Li's research team based on the healthcare industry's occupational hazard classification system (Li, Song, & Wang, 2008), this measurement tool comprises five assessment modules: accidental hazards, physical hazards, chemical hazards, organizational hazards, and biological hazards, totaling 29 items. Scored on a 1-25 scale, the results positively correlated with clinical nurses' risk perception of occupational hazards. Psychometric validation demonstrated an internal consistency reliability coefficient exceeding 0.80, with mean content validity indices of 0.946 across all items, indicating robust measurement reliability and validity. The total score directly reflects nursing practitioners' cognitive level and prioritization of occupational risk factors.

The primary limitation of current measurement tools is that they assess risk perception through static, self-reported probability estimates or frequency ratings without capturing the dynamic, contextual, and multidimensional nature of risk evaluation in real-

world clinical environments.

3.3 Influencing factors of nurses' occupational exposure risk perception

3.3.1 Individual factors

Research indicates that factors such as gender, age, educational background, and professional title significantly influence nursing staff's perception of occupational exposure risks. Findings reveal that women exhibit higher risk perception levels than men, potentially due to greater attention to personal physical risks (Yang, et al., 2019). Younger age groups exhibit higher risk perception than older age groups, potentially due to accumulated clinical experience with age reducing risk sensitivity (Zhao et al., 2023). However, this observation contradicts findings by He (He et al., 2021), who reported age increasing risk perception levels. Such discrepancies may stem from differences in study periods, regions, and populations. A strong correlation exists between nursing staff risk perception and educational attainment, with higher education levels correlating with heightened risk perception. This stems from higher-educated nurses undertaking more clinically demanding roles and demonstrating greater professional prominence, thereby accumulating richer work experience and heightened awareness of occupational risks (Liu, Sun, & Hao, 2024). Nurses' risk perception is closely related to their professional title. Higher titles correlate with higher total risk perception scores and scores across all dimensions. This may be because nurses with lower titles, newly entering the workforce, primarily focus on learning hospital regulations, core work systems, and basic skills. In contrast, nurses with senior titles typically handle teaching, nursing team leadership, and management duties, possessing extensive clinical experience and having encountered more emergency situations or occupational risk management cases (Liu, Sun, & Hao, 2024).

3.3.2 Organizational factors

Research indicates that nursing staff's work environment, perceived organizational support, and leadership behaviors significantly influence their perception of occupational exposure risks. Studies demonstrate a strong correlation between various elements of the nursing work environment and risk perception (Shao,

2024). The sense of organizational support can indirectly enhance risk awareness by increasing responsibility. Leadership behaviors exhibited by head nurses directly influence nursing staff's vigilance toward adverse events by shaping the department's safety culture (Li, Du, & Wang, 2023). Specifically, leadership behaviors subtly alter nurses' work attitudes and safety behaviors, thereby regulating their risk perception levels.

3.3.3 Psychosocial factors

Research indicates that factors such as psychological resilience, emotional state, and social support significantly influence nurses' perception of occupational exposure risks. Studies reveal a correlation between psychological resilience and risk perception: nurses with higher psychological resilience demonstrate stronger adaptive capabilities, enabling them to better cope with diverse pressures and setbacks (Martin et al., 2023). Emotional state exerts a critical influence on individuals' risk assessment mechanisms. Empirical evidence indicates that positive emotions enhance cognitive flexibility while reducing risk sensitivity. Conversely, negative emotions trigger a risk amplification effect, manifesting as overestimation of potential hazards and heightened vigilance, thereby elevating perceived risk levels (Shao, 2024). This discrepancy primarily stems from emotional states modulating information processing; negative emotions cause individuals to focus more on threatening information and overestimate its severity. Research indicates that social support is a critical factor influencing nursing staff's risk perception. A strong sense of social support can stimulate individuals' work enthusiasm and sense of responsibility, fostering professional value and alignment, reducing occupational burnout, and enhancing their ability to perceive risks (Ke et al., 2024).

4 Strategies to improve nurses' occupational risk perception and reduce occupational exposure

4.1 Strengthen training and management to improve nurses' risk awareness.

Occupational exposure safety begins with cultivating risk perception and prevention awareness among nursing staff. Strengthening this capability re-

quires targeted safety education that enhances nurses' ability to identify and respond to occupational hazards (Zhang, 2016). Hospital management plays a key role by implementing measures such as expert lectures, case-based warning education, and emergency drills. These strategies not only improve risk awareness and behavioral standardization but also embed preventive protocols into daily practice (Aluko et al., 2016; Dasbilek, Yesiltepe, & Ercel, 2025). Through continuous training and reinforcement, nursing staff develop a sustained capacity to detect, assess, and avoid occupational exposure risks, contributing to both individual safety and overall healthcare quality. Ultimately, effective occupational exposure protection depends on coordinated efforts across hospital administration, nursing personnel, and broader societal systems (Liang et al., 2018; Alkhawaldeh et al., 2025). Hence, future research should use longitudinal and interventional designs to assess the enduring effects of training on risk perception and protective behavior, and to explore contextual barriers and facilitators influencing the implementation of occupational safety strategies in varied healthcare environments.

4.2 Create a safe working environment to enhance nurses' risk awareness

A safe work environment enhances nursing staff's risk perception and motivates protective behaviors. Research based on the Culture-Work-Health model shows that a positive hospital safety culture improves professional commitment, quality of life, job satisfaction, and safety performance while reducing nursing errors (Liang et al., 2023). Hospital administrators must assume primary responsibility for occupational exposure prevention by establishing comprehensive management and quality control systems. Interdisciplinary collaboration among nursing, medicine, ergonomics, and chemistry professionals through workshops and roundtable discussions supports the development of targeted protection plans to address hazards including sharps injuries, musculoskeletal strain, and chemotherapy drug exposure (Yu, 2020; Polovich, 2016). Department managers should implement staffing strategies that reduce risk, including scientific scheduling, limited consecutive work hours, shift rotation, and workload-based dynamic adjustments (Williams et al., 2022). Strengthening the occupational health workforce is also essential. Estab-

lishing an occupational health liaison nurse role responsible for education, supervision, feedback, and follow-up bridges the gap between theory and practice, providing sustained professional support for nursing staff (Foster et al., 2024). Future research should empirically test the effectiveness of interdisciplinary and managerial interventions, including liaison nurse roles and dynamic staffing, on risk perception, protective behaviors, and occupational health outcomes across diverse healthcare settings using rigorous experimental or quasi-experimental designs.

4.3 Strengthen mental health support to improve nurses' risk awareness

Multiple studies indicate that nursing staff's psychological state significantly influences their risk perception (Li & Lyu, 2020; Fukasawa et al., 2020). To address their occupational exposure risk perception, establishing a multidimensional mental health intervention system is imperative, focusing on three dimensions: organizational support, individual adaptation, and institutional safeguards. At the organizational level, establish a tiered and categorized mental health management system. Implement dynamic risk assessments and tiered early warning mechanisms, prioritizing targeted interventions for high-exposure departments, new hires, and individuals with traumatic experiences. Develop modular psychological intervention programs integrating evidence-based therapies such as Mindfulness-Based Stress Reduction (MBSR) (Feng et al., 2024), Cognitive Behavioral Therapy (CBT) (Wang, 2023), and Acceptance and Commitment Therapy (ACT) (Lu, 2023). At the individual level, psychological resilience cultivation should be strengthened through training in emotion management, stress management and psychological resilience, and self-compassion to enhance emotional labor management capabilities (Jiang et al., 2024; Zhang et al., 2023). At the institutional level, mental health services should be integrated into healthcare quality evaluation systems (Bautista et al., 2024). We recommend establishing clear resource allocation standards, forming interdisciplinary mental health teams, and building a multi-tiered support network including peer support and counseling hotlines (Yang & Li, 2025). Mental health education should be a mandatory continuing education module, and scenario simulation training developed to improve psychologi-

cal resilience (Raeburn, et al., 2026). Policies should also clarify occupational injury recognition for work-related psychological trauma and establish corresponding compensation mechanisms (Tei-Tominaga & Nakanishi, 2018).

5 Conclusion

Based on the literature review, this study systematically examined the concept, theoretical foundations, assessment tools, and influencing factors of occupational exposure risk perception among nursing staff. The findings reveal that nurses face multifaceted occupational hazards spanning biological, physical, chemical, and psychosocial domains. Their risk perception is shaped by a complex interplay of individual characteristics, organizational factors, and psychosocial elements. While theoretical models such as the Health Belief Model, Protection Motivation Theory, Theory of Planned Behavior, and Social Cognitive Theory provide valuable frameworks for understanding these processes, the measurement tools developed based on these theories remain limited by their static, self-report nature. As a result, they fail to capture the dynamic and contextual dimensions of risk evaluation as it occurs in real-world clinical settings. These findings underscore the need for multidimensional intervention strategies encompassing targeted training programs, safe work environment creation, and mental health support systems to enhance nurses' risk awareness and reduce occupational exposure.

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