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Predicting Medical Students' Safety Practices in Clinical Environment via Protection Motivation Theory

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ABSTRACT

Aims Occupational hazards in healthcare settings threaten the safety of medical students, whose protective behaviors during clinical training are vital for their well-being and patient care. This study applied protection motivation theory to identify key determinants of protective behaviors among medical students.

Instrument & Methods This descriptive-analytical study was conducted in 2025 among 420 medical students at Shahid Beheshti University of Medical Sciences, Tehran, Iran, selected through multistage cluster sampling. Data were collected using demographic and protection motivation theory-based questionnaires. Pearson correlation and linear regression analyses were performed using SPSS 18.

Findings Participants had a mean age of 22.45±3.90 years; 61% were female. Perceived susceptibility (p=0.003), intention (p<0.001), and behavior (p=0.002) significantly predicted protection motivation. Self-efficacy (p=0.001), intention (p=0.001), and protection motivation (p=0.002) significantly predicted protective behaviors.

Conclusion Self-efficacy, intention, and protection motivation are the strongest determinants of students' safety behaviors.

Keywords Health Behaviors; Occupational Injuries; Self-Efficacy; Social Vulnerability

CITATION LINKS

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Introduction

Occupational hazards remain a persistent challenge in occupational health and safety, particularly in healthcare, where nearly 44.5% of healthcare workers experience needlestick injuries annually [1]. These hazards pose ongoing challenges, with potential consequences ranging from injuries and illnesses to long-term disability and workforce depletion [2, 3]. Such risks are especially critical in healthcare, where exposure to physical, chemical, biological, ergonomic, and psychosocial hazards is a daily reality for workers [4, 5]. Ensuring safety in these environments is therefore essential for both individual well-being and the sustainability of healthcare systems.

Global statistics emphasize the substantial economic and human burden of occupational hazards. Work-related accidents and diseases are estimated to cost approximately 4% of the global GDP annually [3, 6]. According to the International Labor Organization (ILO), about 330 million occupational accidents occur worldwide each year, with nearly 160 million workers suffering from work-related illnesses, resulting in approximately 2 million deaths [7]. The World Health Organization (WHO) also reports that workplace accidents lead to the loss of nearly 170 million workdays annually, with at least four workers injured every second [8].

These figures highlight the critical need for targeted preventive and protective strategies, particularly in healthcare settings, where workers—including medical students, nurses, and clinical staff—are exposed to a wide spectrum of physical, chemical, biological, ergonomic, and psychosocial hazards [9, 10]. Protecting this workforce requires not only awareness of risks but also the adoption of effective safety practices, making the study of factors that influence protective behaviors highly relevant.

Unsafe behaviors account for the majority of occupational incidents, underscoring the importance of targeting human factors rather than environmental conditions alone [8].

Consequently, analyzing the individual factors affecting healthcare workers is critical for understanding and preventing occupational accidents [11]. However, simply increasing knowledge about occupational hazards is insufficient to guarantee safe practices, as behavior is shaped by multiple psychological and motivational determinants [12, 13]. Therefore, selecting an appropriate model is a crucial step in implementing behavior change processes [14].

The protection motivation theory (PMT) offers a robust framework for this purpose. It explains how individuals assess threats (perceived susceptibility and severity) and evaluate coping options (self-efficacy, response efficacy, and response cost), thereby forming intentions that guide behavior [15–19]. PMT has been effectively applied to predict protective behaviors across domains, such as cancer prevention, HIV risk reduction, and workplace safety [20-22].

Medical students, as future healthcare providers, represent a unique high-risk group. Their limited clinical experience, combined with frequent exposure to invasive procedures and insufficient training in occupational safety, makes them especially vulnerable [23]. For instance, occupational injury rates among Australian nursing students were reported at 13.9%, with needles and standard syringes accounting for 37% of injuries [24]. Similarly, a systematic review highlights a high incidence of occupational contact dermatitis in certain groups of healthcare workers [25].

Another systematic review reports the high prevalence of needlestick injuries among healthcare personnel [1, 25, 26].

In Iran, a study declares that 71.1% of medical, dental, nursing, and midwifery students have experienced needlestick injuries—considerably higher than rates reported in other countries [26].

These observations highlight a critical need to investigate the psychological and motivational determinants of protective behaviors in medical students. Specifically, examining constructs such as self-efficacy, intention, and protection motivation within the PMT framework can provide insights into why students adopt—or fail to adopt—safety practices in clinical settings.

Accordingly, the present study aimed to identify predictors of protective behaviors among medical students facing occupational hazards, using PMT as the guiding framework to inform the design of targeted educational interventions that strengthen students' self-efficacy and motivation, ultimately promoting safer clinical practices and improving healthcare quality.

Instrument and Methods

Design and participants

This descriptive-analytical study was conducted in 2025 among students at Shahid Beheshti University of Medical Sciences, Tehran, Iran. Using a 95% confidence level, an expected proportion of 0.5, and a margin of error of 0.05, the initial sample size was calculated as 400 participants. To account for a potential 5% nonresponse rate, the final sample size was increased to 420 students.

To ensure representation across the university's 13 faculties, 35 students were allocated to each faculty. Within each faculty, students from different departments were included, and participants were selected via systematic random sampling by choosing every 10th student from departmental lists. Participants were eligible if they had successfully completed at least one academic term and one clinical course in a hospital setting.

Instrument

A demographic information questionnaire collected data on participants' age, gender, field of study, educational level, marital status, and employment status.

Protective behaviors were assessed using the Protection Motivation Theory (PMT)-Based Questionnaire, adapted for the Iranian context [27]. This comprehensive instrument measures key constructs of the theory, including perceived susceptibility, perceived severity, self-efficacy, response efficacy, response cost, protection motivation, intention, and action.

Perceived susceptibility evaluates the extent to which individuals perceive themselves as vulnerable to occupational illnesses. It consists of five items, namely "Anyone may contract illnesses resulting from working in a hospital." Responses are recorded on a 5-point Likert scale from strongly disagree (1) to strongly agree (5), yielding scores ranging from 5 to 25.Perceived severity assesses participants' understanding of the seriousness of health risks and potential consequences. It includes six items, such as "Contracting an illness would impact my ability to perform tasks and lead to disability." Responses use the same 5-point Likert scale, with a scoring range of 6 to 30. Response cost examines perceived barriers to performing protective behaviors. Five items are included, for instance: "Using personal protective equipment at work or in public places to prevent illness is time-consuming for me". Scores range from 5 to 25 on a 5-point Likert scale. Response cost examines perceived barriers to performing protective behaviors. Five items are included, for instance: "Using personal protective equipment at work or in public places to prevent illness is time-consuming for me." Scores range from 5 to 25 on a 5-point Likert scale. Response efficacy measures the perceived effectiveness of protective behaviors in mitigating health risks. Five items assess this construct, e.g., "Following protective recommendations and adhering to prevention principles can save my family money." Responses are recorded on a 5-point Likert scale, ranging from 5 to 25. Self-efficacy evaluates confidence in one's ability to adopt and maintain protective behaviors. Five items are included, such as "I am confident that I can prevent illness." Scoring is conducted on the same 5-point Likert scale, ranging from 5 to 25. Protection motivation comprises four items assessing determination to adopt protective measures, e.g., "I intend to wash my hands with soap and water after every healthcare service." Responses are rated on a 5-point Likert scale from strongly disagree (1) to strongly agree (5), with scores ranging from 4 to 20. Action assesses actual protective behaviors through five items, such as "Do you use personal protective equipment in the workplace?" Responses range from never (1) to always (5), with total scores ranging from 5 to 25. The instrument's quantitative content validity was evaluated using the content validity ratio (CVR) to assess item necessity and the content validity index (CVI) to examine relevance, clarity, and simplicity. Feedback from ten experts across health promotion, instrument design, nursing, and medical education guided necessary qualitative and quantitative revisions. Additionally, the impact score (IS) was calculated to confirm the final approval of all questionnaire items.

To assess internal consistency, Cronbach's alpha coefficients were calculated. A pilot test with 30 participants, who were not part of the main study, was conducted. Cronbach's alpha values for the constructs were as follows: self-efficacy, 0.97; response efficacy, 0.89; perceived susceptibility, 0.93; perceived severity, 0.96; perceived costs, 0.93; intention, 0.92; protection motivation, 0.96; and action, 0.89, indicating excellent internal reliability and confirming the instrument's validity and reliability for assessing the intended constructs.

Procedure

Prior to data collection, the study's objectives were clearly explained, and participants were assured that their responses would be kept confidential. Written informed consent was obtained from all participants. The questionnaires were administered face-to-face and were anonymous to ensure confidentiality. All procedures were conducted in accordance with the ethical standards of the institutional committee on human experimentation and the Declaration of Helsinki (1975, revised in 2000). Questionnaires were administered face-to-face. Following ethical approval and receipt of the study's ethics code, researchers visited the university faculties to recruit participants in accordance with the predefined inclusion criteria.

Data analysis

Data were analyzed using SPSS 18. The normality of the data was evaluated using the Kolmogorov-Smirnov test. Analytical statistics examined relationships among constructs using Pearson's correlation coefficients and identified predictors of protective behavior and motivation through linear regression. No missing data were reported for any study parameters; therefore, no imputation procedures were required.

Findings

A total of 420 medical students with a mean age of 22.45±3.90 years participated, of whom 61% were female and 39% were male.

All students who were approached agreed to participate, resulting in a 100% response rate (Table 1).

The highest mean score for PMT constructs was observed for perceived severity (23.76±3.70), followed by perceived susceptibility (22.11±2.40). Other constructs demonstrated the following mean scores: response efficacy (21.35±2.50), behavior (21.14±2.80), intention (19.32±3.40), self-efficacy

(17.43±3.20), protection motivation (16.74±2.60), and perceived cost (15.07±4.10). No missing data were observed for any of the parameters included in the descriptive analysis, and all participants provided complete responses for every item. There was a significant positive relationship between intention and protection motivation (Table 2).

Self-efficacy, intention, and protection motivation were significant predictors of protective behavior in the context of occupational hazards (Table 3).

Perceived susceptibility, intention, and behavior were significant predictors of protection motivation among students exposed to occupational hazards (Table 4).

Table 1. Participants' demographic information (n=420)

Parameter		Frequency (%)
Gender	Female	256 (61)
	Male	164 (39)
Marital status	Single	390 (92.9)
	Married	30 (7.1)
Study field	Nursing	192 (45.7)
	Medical doctor	63 (15)
	Paramedicine	104 (24.8)
	Other	61 (14.5)
Educational level	Bachelor's degree	348 (82.9)
	Master's degree	22 (5.2)
	Ph.D.	19 (4.5)
	Doctor of medicine	31 (7.4)
Work experience in hospitals and healthcare centers	Yes	151 (36)
	No	269 (64)

Table 2. Correlations of protection motivation theory (PMT) constructs

PMT Constructs	8	7	6	5	4	3	2	1
1. Perceived susceptibility	r=0.056 p=0.254	r=0.175 p<0.001	r=-0.03 p=0.535	r=0.034 p=0.469	r=0.268 p<0.001	r=0.053 p=0.281	r=0.355 p<0.001	1
2. Perceived severity	r=0.137 p=0.005	r=0.148 p=0.002	r=0.038 p=0.443	r=0.086 p=0.077	r=0.373 p<0.001	r=-0.076 p=0.12	1	
3. Perceived cost	r=0.098 p=0.046	r=0.152 p=0.002	r=0.2 p<0.001	r=0.219 p<0.001	r=0.104 p=0.034	1		
4. Response efficacy	r=0.232 p<0.001	r=0.241 p<0.001	r=0.168 p=0.001	r=0.279 p<0.001	1			
5. Self-efficacy	r=0.296 p<0.001	r=0.195 p<0.001	r=0.114 p=0.019	1				
6. Intention	r=0.337 p<0.001	r=0.411 p<0.001	1					
7. Protection motivation	r=0.317 p<0.001	1						
8. Behavior	1							

Table 3. Predictors of behavior based on the protection motivation theory (PMT) constructs

Parameter	B	Standard error	Beta	t	p-Value
Constant	9.022	1.572	-	5.74	0.0001
Perceived susceptibility	-0.016	0.056	-0.013	-0.278	0.781
Perceived severity	0.045	0.037	0.061	1.225	0.221
Perceived cost	-0.015	0.031	-0.023	-0.49	0.624
Response efficacy	0.089	0.057	0.079	1.565	0.118
Self-efficacy	0.183	0.041	0.21	4.495	0.001
Intention	0.193	0.04	0.237	4.836	0.001
Protection motivation	0.167	0.053	0.156	3.132	0.002

Table 4. Predictors of protection motivation based on protection motivation theory (PMT) constructs

Parameter	B	Standard error	Beta	t	p-Value
Constant	1.753	1.489	-	1.178	0.24
Perceived susceptibility	0.153	0.051	0.14	3.019	0.003
Perceived severity	0.024	0.034	0.034	0.706	0.48
Perceived cost	0.026	0.29	0.041	0.914	0.361
Response efficacy	0.078	0.052	0.075	1.519	0.129
Self-efficacy	0.062	0.038	0.076	1.639	0.102
Intention	0.255	0.035	0.334	7.211	0.0001
Behavior	0.139	0.044	0.149	3.132	0.002

Discussion

This study applied PMT to identify key determinants of protective behaviors among medical students. Healthcare systems, like other high-risk occupational settings, profoundly affect the well-being of their workforce. For medical students who combine academic study with direct patient care, safety concerns are especially pressing. International evidence shows that trainees are frequently exposed to hazards—ranging from slippery floors and poor

lighting to excessive noise [28] and needlestick injuries [29]—that jeopardize both their safety and learning. Such risks highlight students' vulnerability during clinical placements and emphasize the need to integrate preventive and protective behaviors into medical and nursing curricula. Promoting these behaviors not only safeguards students' health but also fosters resilient professionals capable of maintaining high standards in future practice.

The PMT is one of the most influential frameworks for understanding preventive and protective health behaviors [3]. It has been applied in diverse areas, including smoking cessation [4], cancer prevention [6], HIV risk reduction [7], physical activity [8], and healthy dietary practices [9]. Its strength lies in emphasizing cognitive processes—such as threat and coping appraisal—that drive individuals' motivation to adopt self-protective behaviors [10]. Drawing on this framework, the present study applied PMT to examine medical students' protective behaviors against occupational hazards, thereby extending its use to academic and clinical training contexts where young professionals encounter unique risks.

Among the PMT constructs, perceived severity had the highest mean score among medical students, reflecting their strong awareness of occupational hazards. This perception is likely shaped by both extensive media coverage and clinical training, which sensitize students to the inherent risks of their profession [30, 31]. Consistent with previous findings, medical students generally acknowledge occupational risks in clinical environments, and this awareness facilitates preventive behaviors [32]. Media reports highlighting the challenges faced by healthcare professionals may further strengthen professional identity and motivate students to adopt protective measures [30, 31]. These observations point to the need for targeted interventions by health authorities and educators that not only provide information about risks but also leverage risk perception as a driver for preventive behavior, ultimately fostering safer clinical environments.

There was a significant positive association between intention and protection motivation, suggesting that students who feel more vulnerable to occupational hazards are more likely to form stronger protective intentions and engage in preventive behaviors.

This finding is consistent with previous studies, which show that protection motivation directly influences the intention to adopt safety measures [33] and is linked to greater preventive action, as reported in research on rural women and skin cancer prevention [34]. Despite differences in context, the evidence collectively supports the premise that perceived vulnerability and protection motivation are central drivers of preventive behavior. These findings highlight that fostering protection motivation and risk perception is not merely an educational necessity but a strategic investment in shaping resilient future professionals. By embedding such approaches within medical curricula, institutions can cultivate a culture of safety that extends beyond individual students to the broader healthcare system, ultimately contributing to sustainable improvements in clinical practice and patient care.

Self-efficacy, intention, and protection motivation were key predictors of protective behaviors, consistent with findings from Okuhara *et al.* and Bashirian *et al.* [35, 36]. The strong positive correlation between self-efficacy and behavioral intention highlights the pivotal role of individuals' confidence in performing preventive actions: the more they trust their ability to carry out protective measures, the more likely they are to translate intentions into actual behavior. These insights underscore the value of interventions that build self-efficacy among medical students. Through practical training, constructive feedback, and reinforcement, educators can foster confidence, strengthen motivation, and increase adherence to protective practices. Embedding protection motivation concepts within curricula may further ensure that both intention formation and behavioral performance are systematically supported in clinical environments.

Among the predictors examined, self-efficacy emerged as the strongest and most consistent determinant of protective behaviors. This suggests that students who both recognize their vulnerability to occupational hazards and feel confident in their ability to act are substantially more likely to translate intentions into preventive practices. These findings align with recent evidence underscoring the central role of self-efficacy in health-related behaviors. For example, Kusol & Kaewpawong report that higher perceived self-efficacy significantly increases nursing students' adoption of preventive measures during the COVID-19 pandemic [37]. Likewise, Dębska Janus *et al.* demonstrate that self-efficacy, together with optimism, can strongly influence health behaviors among Polish health sciences students [38]. Thus, strengthening self-efficacy is a cornerstone of effective interventions to promote protective behaviors in medical education.

Building on this evidence, enhancing self-efficacy through targeted educational and psychological strategies should be considered a priority. Practical training, guided simulations, constructive feedback, and reinforcement approaches can all foster students' confidence and increase their adherence to protective measures in both clinical and workplace environments. Ultimately, embedding self-efficacy as a core component of training curricula not only improves individual compliance but also helps cultivate a culture of safety that minimizes occupational risks over the long term.

Perceived vulnerability, intention, and behavior were key predictors of protection motivation among medical students. The greater the students' perceived susceptibility to occupational hazards, the stronger

their protection motivation, which subsequently drives preventive behaviors. Interestingly, Bashirian *et al.* report that self-efficacy, rather than perceived vulnerability, has the strongest association with protection motivation [36]. Such discrepancies may reflect differences in students' awareness of occupational risks, the quality of workplace training, or cultural and contextual factors, highlighting the multifactorial nature of protection motivation. Both cognitive factors (e.g., perceived vulnerability) and personal resources (e.g., self-efficacy) appear to jointly influence protective behaviors.

These observations emphasize the need for comprehensive educational interventions that enhance both awareness and confidence. By simultaneously addressing perceived risks and self-efficacy, training programs can effectively strengthen students' protection motivation and encourage adherence to preventive practices in clinical and workplace settings. In high-stress hospital environments, where occupational hazards are inherent, higher perceived severity is closely linked to vulnerability, shaping intentions and behaviors. This aligns with previous research demonstrating that heightened risk perception promotes adherence to safety measures, including protocols and personal protective equipment [39]. Overall, these results support the use of the PMT as a framework for designing interventions that enhance awareness, self-efficacy, and safe practices in clinical training.

Despite its strengths, several limitations should be considered. First, the study was conducted at a single university, which may restrict the generalizability of the findings to other medical schools with different educational environments or cultural contexts. Second, reliance on self-reported data may introduce recall and social desirability biases, as participants may overreport behaviors perceived as favorable. Finally, although key constructs of the PMT were assessed, other potential factors influencing protective behaviors—such as peer influence, institutional safety culture, and prior clinical experience—were not evaluated.

Several practical and educational strategies can be implemented to enhance protective behaviors among medical students. Structured educational sessions and interactive discussions can help students accurately perceive the severity and potential consequences of occupational hazards, thereby increasing their motivation to adopt protective measures. In parallel, practical simulations, guided exercises, and feedback mechanisms can strengthen students' confidence in their ability to perform protective behaviors effectively. Integrating reflective activities, scenario-based training, and reinforcement strategies can further help students translate their intentions into consistent protective practices in clinical settings. For future research, multi-center studies with larger and more diverse student populations are recommended to improve the generalizability of the findings. Additionally, longitudinal and mixed-method approaches could provide deeper insights into the dynamic relationships between perceived risk, self-efficacy, and protective behaviors over time.

These findings indicate a need for training institutions and teaching hospitals to strengthen institutional safety systems that support medical students' protective behaviors during clinical placements. Hospital safety officers, clinical supervisors, and training coordinators can play a critical role in enhancing students' self-efficacy and intention to adhere to protective practices by ensuring access to personal protective equipment, structured supervision, and clear safety protocols. The integration of PMT-based strategies, such as hands-on safety training, supervised performance of protective procedures, and feedback-driven skill reinforcement, can improve students' confidence and compliance with occupational safety measures. Implementing these approaches in clinical training environments may reduce occupational risks, such as sharp injuries, infection, and exposure to hazardous conditions.

Strengthening institutional responsibility for student safety during clinical training contributes to safer learning environments and supports broader occupational health and safety goals within healthcare settings.

Conclusion

Self-efficacy, intention, and protection motivation are strong predictors of protective behaviors among medical students facing occupational hazards.

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Conflicts of Interest: The authors reported conflicts of interest.

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