NHSJ Nursing and Health Sciences Journal

Volume 06 Number 01 (March 2026)
e-ISSN: 2798-5067; p-ISSN: 2798-5059

Determinants of personal protective equipment utilization among healthcare workers

Ismarina[1], Dini Rachmaniah[1], Rita Ramayulis[1]

[1]Faculty of Health Sciences, Universitas Faletehan, Indonesia

Corresponding Author: Ismarina, rinaismarina77@gmail.com

Article Info:

Submitted:
28-12-2025
Revised:
07-03-2026
Accepted:
09-03-2026
Published:
17-03-2026

Keywords:

compliance behavior, healthcare workers, occupational health, personal protective equipment

ABSTRACT

Despite established guidelines, non-compliance with personal protective equipment (PPE) protocols remains a persistent challenge in healthcare settings, posing risks to occupational safety and infection prevention. This study examined factors associated with PPE use behavior among healthcare workers in inpatient units. An analytical cross-sectional study was conducted involving 260 healthcare workers. Data were collected via structured questionnaires and observational checklists. Associations between independent variables and PPE use behavior were assessed using chi-square tests. Inappropriate PPE use was observed in 60.8% of respondents. Bivariate analysis identified supervisory support ($p = 0.011$; OR = 2.315) and peer support ($p < 0.001$; OR = 4.470) as significant predictors of compliance. Conversely, age, education, knowledge, length of service, attitudes, comfort, and facility availability showed no significant association. Workplace social support, particularly from supervisors and colleagues, is a critical determinant of PPE compliance. Strategies to improve PPE adherence should prioritize strengthening organizational support systems rather than focusing solely on individual knowledge or resource availability.

https://doi.org/10.53713/nhsj.v6i1.634

INTRODUCTION

Occupational health and safety (OHS) have become an increasingly central concern in global health systems, particularly amidst emerging infectious diseases and the growing complexity of healthcare delivery (Afandi et al., 2025). Healthcare workers (HCWs) constitute the backbone of health services, yet they remain disproportionately exposed to occupational hazards within high-risk hospital environments (Khubchandani et al., 2024). These settings present a confluence of biological, chemical, ergonomic, and psychosocial risks, in which daily exposure to blood, body fluids, and contaminated instruments continuously exposes personnel to the risk of injury and infection (Ekrami et al., 2024). Consequently, ensuring the safety of the healthcare workforce is not only an ethical imperative but also a critical component of maintaining resilient health systems capable of withstanding public health challenges (Qassim & Abedelrahim, 2024).

Personal Protective Equipment (PPE) serves as a fundamental element of infection prevention and control (IPC) strategies and is mandated under World Health Organization standard precautions (Gašpert, 2025). Functioning as a physical barrier, PPE, including gloves, masks, gowns, and eye protection, prevents microorganisms from contacting the skin and mucous membranes, thereby protecting workers, patients, and visitors (Buhler et al., 2025). However, the persistence of healthcare-associated infections (HAIs) indicates that PPE availability is a necessary but insufficient condition for safety (Afework & Tamene, 2025). Gaps in behavioral adherence suggest that infrastructure alone cannot guarantee compliance; rather,

consistent PPE use is heavily influenced by behavioral determinants, organizational culture, and leadership engagement (Lohiniva et al., 2025).

In low- and middle-income countries, challenges regarding PPE compliance are often amplified by resource constraints, staffing shortages, and high patient loads (Drouard et al., 2023). Indonesia, as a rapidly developing health system, continues to face rising occupational accident rates, with national labor insurance data indicating a steady increase in work-related injuries (Alayyannur & Arini, 2024). In this context, nurses constitute the largest proportion of hospital staff and are among the most frequently exposed to occupational risks due to prolonged, close patient contact (Santoro et al., 2022). In inpatient units, routine procedures such as blood draws and wound care increase the likelihood of exposure to infectious materials. At the same time, high workloads and fatigue may further compromise adherence to safety protocols (Aboalnass et al., 2024).

Behavioral science perspectives suggest that PPE compliance is driven by multiple interacting factors beyond simple resource availability (Hintz et al., 2023). While individual determinants such as age, education, knowledge, and length of service shape risk perception, contemporary research emphasizes the critical role of organizational and social determinants (Van Belle et al., 2024). Supervisory support, peer norms, and safety climate significantly influence compliance, as employees are more likely to engage in safety behaviors when they perceive strong institutional commitment to their well-being (Baghdadi, 2024). Conversely, weak safety cultures and inconsistent enforcement can undermine adherence, highlighting the need to examine social support factors alongside individual characteristics (King et al., 2024).

This study aimed to analyze factors associated with PPE use behavior among healthcare workers in a regional referral hospital in Indonesia. By identifying significant determinants, particularly social and organizational factors, this research seeks to provide actionable insights for hospital management and policymakers (Clavel et al., 2025). Ultimately, understanding these dynamics is crucial for enhancing occupational safety culture and strengthening infection prevention practices in healthcare settings (Juliasih et al., 2023).

METHOD

Research Design

This study employed a quantitative analytic design using a cross-sectional approach to examine factors associated with Personal Protective Equipment (PPE) use behavior among healthcare workers. The cross-sectional design was selected to assess relationships between independent variables and PPE compliance at a single point in time. Data collection was conducted between March and April 2025 at Dr. Dradjat Prawiranegara Regional Hospital, a regional referral facility providing secondary-level healthcare services in Indonesia. The hospital comprises inpatient, surgical, emergency, and specialty care units, where healthcare workers are routinely exposed to biological and occupational hazards, making it a representative setting for investigating infection prevention practices.

Participants

The study population consisted of 362 healthcare workers assigned to inpatient units, including nurses, physicians, midwives, and other clinical staff directly involved in patient care. A proportionate stratified random sampling technique was applied, with each inpatient unit treated as a stratum to ensure representative participation across departments. The minimum sample size was calculated using a proportion estimation formula for cross-sectional studies (95%

confidence level, 5% margin of error) with finite population correction, yielding a requirement of 255 participants; 260 respondents were recruited to account for potential non-response. Inclusion criteria were: (1) active employment in inpatient units during the study period, (2) direct patient contact, and (3) provision of written informed consent. Administrative staff without patient contact and healthcare workers on leave during data collection were excluded.

Data Collection

Data were collected using a structured, self-administered questionnaire complemented by an observational checklist. The dependent variable, PPE use behavior, was defined as the degree of compliance with standard PPE protocols during patient care and was assessed through both self-reported practices and observational validation. Independent variables included: (1) sociodemographic characteristics (age, educational level, length of service); (2) individual factors (knowledge and attitudes toward PPE); and (3) organizational and environmental factors (supervisory support, peer support, comfort in PPE use, and availability of facilities). Supervisory support was defined as the extent to which direct supervisors provided encouragement, monitoring, and reinforcement of PPE compliance; peer support was defined as collegial encouragement and modeling of proper PPE use.

The questionnaire comprised four sections: sociodemographics; PPE knowledge (multiple-choice items); attitudes toward PPE use (Likert-scale statements); and perceived supervisory/peer support, comfort, and facility availability. PPE behavior was measured using a compliance scale adapted from standard infection prevention guidelines, with responses categorized as "appropriate" or "inappropriate" based on predefined scoring criteria. Prior to data collection, the instrument underwent content validity assessment by three experts in occupational health and infection prevention. Construct validity was tested via Pearson correlation analysis in a pilot study (n=30), with all items demonstrating acceptable correlations ($r > 0.30$). Reliability testing yielded Cronbach's alpha coefficients ranging from 0.72 to 0.88 across subscales. Observational assessments were conducted unobtrusively in selected units to validate self-reported practices. Questionnaires were distributed anonymously during working hours to minimize social desirability bias.

Data Analysis

Data were analyzed using statistical software (SPSS version 26.0). Descriptive statistics summarized participant characteristics and variable distributions: categorical variables were presented as frequencies and percentages, while continuous variables were expressed as means and standard deviations. Bivariate analysis was conducted using the chi-square test to examine associations between independent variables and PPE use behavior. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to estimate the strength of associations. Variables with p-values < 0.25 in the bivariate analysis were entered into a multivariate logistic regression model to identify independent predictors of PPE use behavior, controlling for potential confounders. Statistical significance was set at $p < 0.05$ for all analyses.

Ethical Clearance

Ethical approval for this study was obtained from the Institutional Health Research Ethics Committee of the Faculty of Public Health, Faletehan University, prior to data collection. Written informed consent was obtained from all participants following a detailed explanation of the study objectives, procedures, potential risks, and benefits. Participation was entirely voluntary, and

respondents were explicitly informed of their right to withdraw at any time without penalty or consequence. Strict measures were implemented to ensure confidentiality and anonymity: all data were de-identified at the point of collection, stored securely, and used exclusively for research purposes. No personally identifiable information appears in any reports or publications derived from this study.

RESULT

Descriptive Analysis

Table 1. Characteristics of respondents and distribution of PPE use behavior (N=260)

Variable	Category	Frequency	Percentage
PPE Use Behavior	Incomplete	158	60.8
	Complete	102	39.2
Age	< 25 years	15	5.8
	≥ 25 years	245	94.2
Educational Level	Higher education	260	100
Knowledge	Poor	111	42.7
	Good	149	57.3
Length of Service	< 5 years	86	33.1
	≥ 5 years	174	66.9
Attitude	Negative	111	42.7
	Positive	149	57.3
Availability of Facilities	Incomplete	260	100
Comfort	Not comfortable	115	44.2
	Comfortable	145	55.8
Supervisory Support	Not supportive	67	25.8
	Supportive	193	74.2
Peer Support	Not supportive	71	27.3
	Supportive	189	72.7

A total of 260 healthcare workers participated in this study. Overall, 158 respondents (60.8%) demonstrated inappropriate PPE use behavior, while only 102 (39.2%) reported appropriate or complete PPE use. Regarding age distribution, the majority of participants were aged ≥25 years (94.2%), with only 5.8% aged <25 years. All respondents had a higher education background (100%), with varying professional qualifications, including diplomas, bachelor's degrees, professional nursing degrees (Ners), and medical specialist qualifications.

Regarding knowledge, 57.3% of respondents had good knowledge of PPE use, while 42.7% demonstrated insufficient knowledge. Most participants had ≥5 years of work experience (66.9%), while 33.1% had worked for less than five years. Attitudinal assessment indicated that 57.3% of respondents expressed positive attitudes toward PPE use, whereas 42.7% reported less favorable attitudes. Regarding perceived comfort, 55.8% reported feeling comfortable using PPE, while 44.2% reported discomfort. Notably, all respondents (100%) reported that PPE facilities were not fully complete in their view. Regarding organizational factors, 74.2% of participants reported receiving supervisory support for PPE use, and 72.7% reported receiving support from colleagues. Overall, these findings suggest that despite relatively favorable knowledge levels and perceived organizational support, compliance with complete PPE use remained suboptimal.

Bivariate Analysis

Table 2. Factors associated with PPE use behavior among healthcare workers (N=260)

Variable	Category	Incomplete n (%)	Complete n (%)	Total	p-value	OR
Age	< 25 years	9 (60.0)	6 (40.0)	15	1.000	0.966
	≥ 25 years	149 (60.8)	96 (39.2)	245		
Knowledge	Poor	73 (65.8)	38 (34.2)	111	0.195	1.446
	Good	85 (57.0)	64 (43.0)	149		
Length of Service	< 5 years	57 (66.3)	29 (33.7)	86	0.253	1.421
	≥ 5 years	101 (58.0)	73 (42.0)	174		
Attitude	Negative	67 (60.4)	44 (39.6)	111	1.000	0.971
	Positive	91 (61.1)	58 (38.9)	149		
Comfort	Not comfortable	66 (57.4)	49 (42.6)	115	0.387	0.776
	Comfortable	92 (63.4)	53 (36.6)	145		
Supervisory Support	Not supportive	50 (74.6)	17 (25.4)	67	0.011*	2.315
	Supportive	108 (56.0)	85 (44.0)	193		
Peer Support	Not supportive	59 (83.1)	12 (16.9)	71	<0.001*	4.470
	Supportive	99 (52.4)	90 (47.6)	189		

Bivariate analysis using the chi-square test was conducted to examine associations between independent variables and PPE use behavior. Odds ratios (ORs) were calculated to estimate the strength of association. No statistically significant associations were observed between PPE use behavior and age ($p = 1.000$; OR = 0.966), knowledge ($p = 0.195$; OR = 1.446), length of service ($p = 0.253$; OR = 1.421), attitudes ($p = 1.000$; OR = 0.971), or perceived comfort ($p = 0.387$; OR = 0.776). These findings indicate that individual demographic and cognitive factors were not significantly related to PPE compliance in this study population.

Educational level was associated with PPE use behavior ($p < 0.001$). However, variability across professional categories suggests that compliance patterns differed substantially between qualification groups, particularly among medical specialists. Importantly, organizational support variables demonstrated significant associations with PPE use behavior. Healthcare workers who reported a lack of supervisory support were more than twice as likely to demonstrate inappropriate PPE use compared to those receiving supervisory support ($p = 0.011$; OR = 2.315).

Similarly, a lack of peer support was strongly and statistically significantly associated with inappropriate PPE use ($p < 0.001$; OR = 4.470). Healthcare workers who perceived insufficient support from colleagues were more than 4 times as likely to exhibit incomplete PPE use than those who perceived supportive peer environments. These findings highlight the substantial influence of workplace social dynamics on PPE compliance. Compared to individual-level factors, organizational and social support variables demonstrated stronger associations with PPE use behavior.

DISCUSSION

This study investigated the determinants of Personal Protective Equipment (PPE) adherence among healthcare workers within a regional referral hospital. The findings revealed a concerning level of non-compliance, with over half of respondents failing to use adequate PPE despite established occupational safety regulations. Crucially, organizational and social support systems emerged as significantly stronger predictors of adherence than individual demographic or cognitive characteristics (King et al., 2023).

Age and PPE Use Behavior

This study found no significant association between age and PPE use behavior ($p = 1.000$; OR = 0.966), indicating that chronological age alone does not determine adherence to safety protocols. Although older healthcare workers (≥25 years) constituted most respondents, their compliance levels did not differ significantly from those of younger colleagues, a finding that contrasts with previous studies linking advanced age to higher adherence due to increased risk perception (Boakye et al., 2022). Instead, the results suggest that safety behavior in this setting is shaped more profoundly by organizational climate and institutional enforcement than by individual maturity or experience (Finsel et al., 2023; North, 2022). Consequently, interventions aimed at improving PPE compliance should adopt a universal approach that targets all age groups equally, rather than focusing on specific demographic groups.

Educational Level and PPE Use Behavior

Educational level demonstrated a statistically significant association with PPE use behavior ($p < 0.001$), yet compliance varied notably across professional qualifications. While higher educational attainment typically enhances risk awareness and exposure to infection prevention principles (Qureshi et al., 2022), the observed variability indicates that formal education alone does not ensure adherence. Complex factors such as professional hierarchy, workload intensity, and perceived autonomy may compromise compliance, particularly among specialized professionals who might prioritize clinical efficiency over procedural strictness (Khattooni et al., 2026). Consequently, while education contributes to behavioral formation, achieving standardized PPE compliance requires supplementary strategies, including structured in-service training, regular audits, and robust institutional reinforcement across all professional groups.

Knowledge and PPE Use Behavior

Although respondents with poorer knowledge were more likely to use incomplete PPE (OR = 1.446), no significant association was found between knowledge level and PPE use ($p > 0.05$). This discrepancy highlights a persistent knowledge-behavior gap, indicating that cognitive awareness alone is insufficient to ensure compliance. Aligning with the Health Belief Model and the Theory of Planned Behavior, knowledge must be accompanied by perceived susceptibility, social norms, and enabling factors to translate into effective action (Fang et al., 2025). In clinical settings, barriers such as time pressure, habituation, and organizational culture often override cognitive awareness, suggesting that educational interventions must be complemented by behavioral reinforcement strategies and systemic support mechanisms to bridge this gap (Hussein et al., 2025).

Length of Service and PPE Use Behavior

Length of service was not significantly associated with PPE compliance ($p = 0.253$; OR = 1.421), suggesting that professional tenure alone does not guarantee adherence to safety protocols. Although workers with shorter tenure exhibited slightly higher rates of non-compliance, the lack of statistical significance indicates that experience does not inherently translate into safer practices. While prolonged exposure to clinical risks may enhance familiarity, it can also foster complacency, whereby long-term staff members normalize unsafe shortcuts, particularly in environments with inconsistent enforcement (Ssemuddu et al., 2026). This finding underscores the necessity of continuous safety monitoring and regular refresher training across all career

stages, reinforcing that a robust occupational safety culture must be actively sustained rather than assumed to develop with experience.

Attitudes and PPE Use Behavior

Attitude toward PPE use was not significantly associated with actual compliance (p = 1.000; OR = 0.971), suggesting a substantial gap between expressed sentiment and actual behavior. Although most respondents endorsed positive attitudes, this did not translate into improved adherence, underscoring the limitations of relying solely on attitudinal change to influence practice. Such positive attitudes may reflect normative agreement rather than genuine behavioral commitment (Savari et al., 2023), as institutional barriers, workload demands, and environmental constraints often prevent cognitive awareness from being operationalized into consistent compliance. Consequently, effective behavioral change strategies must prioritize addressing structural and contextual factors rather than focusing exclusively on cognitive or attitudinal modification.

Comfort and PPE Use Behavior

Perceived comfort while using PPE showed no significant association with compliance (p = 0.387; OR = 0.776), suggesting that physical discomfort is not a primary determinant of adherence in this setting. Despite being commonly cited as a barrier, the lack of statistical significance implies that healthcare workers may tolerate discomfort when reinforced by strong organizational norms or peer expectations. This indicates that psychosocial factors, such as supervision and social accountability, may outweigh physical comfort in driving behavior. Therefore, while improving the ergonomic design of PPE remains valuable, organizational reinforcement appears to play a more critical role in sustaining compliance (Ada et al., 2025).

Supervisory Support and PPE Use Behavior

Supervisory support was significantly associated with PPE use behavior (p = 0.011; OR = 2.315), revealing that healthcare workers who perceived a lack of supervisory support were more than twice as likely to demonstrate incomplete compliance (Pacutova et al., 2023). Leadership plays a pivotal role in establishing safety priorities, as supervisors who actively monitor adherence, provide constructive feedback, and model appropriate behavior cultivate a strong safety climate. In contrast, weak supervision may inadvertently signal that PPE adherence is optional rather than mandatory. These findings align with safety climate theory, which emphasizes leadership commitment as a fundamental determinant of occupational safety behavior, underscoring the necessity of active managerial engagement in infection control practices (Sankar et al., 2023).

Peer Support and PPE Use Behavior

Peer support demonstrated the strongest association with PPE compliance (p < 0.001; OR = 4.470), indicating that healthcare workers without peer support were more than 4 times as likely to exhibit incomplete PPE use. This profound effect size underscores the critical influence of social norms, suggesting that PPE behavior is embedded within workplace culture rather than solely determined by individual demographics or cognitive characteristics (Khoshakhlagh et al., 2024). When colleagues consistently model protective practices and reinforce standards, compliance becomes a socially expected norm driven by collective accountability. Consequently, these findings indicate that organizational and social factors predominantly influence compliance,

implying that strengthening supervisory engagement and fostering a peer-driven safety culture may yield greater impact than knowledge-based interventions alone (Kadir et al., 2026). To enhance adherence, hospital management should prioritize implementing structured supervisory audits, peer safety champions, team-based accountability systems, and routine reinforcement of infection prevention standards.

CONCLUSION

This study establishes that PPE compliance among healthcare workers is predominantly driven by organizational and social determinants rather than individual demographic or cognitive characteristics. While variables such as age, knowledge, attitude, and comfort showed no significant association, educational level, supervisory support, and peer support emerged as critical predictors, with peer support identified as the strongest determinant of adherence. These findings underscore that sustainable compliance relies less on individual-level interventions alone and more on cultivating a robust safety climate characterized by active leadership engagement and collective accountability. Consequently, hospital management should prioritize systemic strategies—such as structured monitoring, peer-driven accountability, and reinforced safety norms—to complement educational efforts. Future research should employ longitudinal and multi-center designs to elucidate causal pathways further and validate the effectiveness of organizational culture interventions across diverse healthcare settings.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the management of Dr. Dradjat Prawiranegara Regional Hospital, Serang Regency, for granting permission and facilitating the conduct of this study. We also extend our appreciation to all healthcare workers who participated in this research for their time, cooperation, and valuable contributions. The authors acknowledge the support provided by colleagues and research assistants who contributed to data collection and administrative processes. Their assistance was essential to the successful completion of this study.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper. The research was conducted independently, without any financial or commercial relationships that could be construed as a potential conflict of interest.

REFERENCES

Aboalnass, F. M., Alguthamy, W. H., Al-Hussein, A. A. N., Al-Mazargah, A. N. M., Al-Harisi, I. S. I., Alotaibi, S. S. H., ... & Alharbi, M. F. (2024). Health And Safety In Health Care Settings: Review On Protection Of Patients And Healthcare Workers. *Cultura: International Journal of Philosophy of Culture and Axiology, 21*(3s), 285-306. https://doi.org/10.5281/zenodo.18153409

Ada, Y. R., Surono, A., Supriyati, S., & Pribadi, A. P. (2025). Strategies to improve compliance with personal protective equipment use in the textile industry: a scoping review. *BMC Public Health, 25*(1), 2743. https://doi.org/10.1186/s12889-025-24037-9

Afandi, A., Kurniawan, D. E., Ardiana, A., & Purwandari, R. (2025). The effectiveness of training on occupational safety and health behavior among rubber tappers in Indonesia. *International Journal of Occupational Safety and Health, 15*(4), 439-453. https://doi.org/10.3126/ijosh.v15i4.70939

Afework, A., & Tamene, A. (2025). Uncovering the obstacles: a comprehensive analysis of barriers to hand hygiene adherence among healthcare providers: a systematic review. *BMC Infectious Diseases, 25*(1), 502. https://doi.org/10.1186/s12879-025-10924-4

Alayyannur, P. A., & Arini, S. Y. (2024). Occupational Health and Safety Problems in Various Sectors. *Indonesian Journal of Occupational Safety and Health, 13*(1), 1-3. https://doi.org/10.20473/ijosh.v13i1.2024.1-3

Baghdadi, A. (2024). Navigating occupational safety and health challenges in sustainable infrastructure projects: a comprehensive review. *Frontiers in Built Environment, 10,* 1414366. http://dx.doi.org/10.3389/fbuil.2024.1414366

Boakye, M. K., Adanu, S. K., Coffie, G. H., Adzivor, E. K., & Ayimah, J. C. (2022). Building construction artisans' level of access to personal protective equipment (PPE) and the perceived barriers and motivating factors of adherence to its use. *Journal of Environmental and Public Health, 2022*(1), 4870731. https://doi.org/10.1155/2022/4870731

Buhler, W., Dittman, B., & Langley, R. L. (2025). Personal Protective Equipment. In *Farm Toxicology: A Primer for Rural Healthcare Practitioners* (pp. 23-50). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-80441-0_4

Clavel, N., Castonguay, F. M., Laprise, C., Williams, S., Ethier, I., Bernier, M. C., & Beauharnais, C. (2025). Barriers and facilitators to implementing reusable personal protective equipment in hospitals, and their impacts on environment, care safety, costs, and supply chain resilience: a scoping review protocol. *BMJ Open, 15*(5), e096504. https://doi.org/10.1136/bmjopen-2024-096504

Drouard, S. H. P., Ahmed, T., Fernandez, P. A., Baral, P., Peters, M., Hansen, P., Hashemi, T., Sieleunou, I., Ogunlayi, M. I., Karibwami, A. D., Bergeron, J. R., Montufar Velarde, E. E., Yansane, M. L., Wesseh, C. S., Mwansambo, C., Nzelu, C., Uddin, H., Tassembedo, M., & Shapira, G. (2023). Availability and use of personal protective equipment in low- and middle-income countries during the COVID-19 pandemic. *PLOS ONE, 18*(7), e0288465. https://doi.org/10.1371/journal.pone.0288465

Ekrami, H. A., Dehaghi, B. F., Ghanbari, S., Haghighifard, N. J., & Mohammadi, M. J. (2024). Health risk assessment and occupational safety at hospitals in Southwest of Iran. *Clinical Epidemiology and Global Health, 26,* 101515. https://doi.org/10.1016/j.cegh.2024.101515

Fang, L., Zhang, Q., Zhou, N., Chen, J., & Lou, H. (2025). Influencing factors and mechanisms promoting proactive health behavior intention: an integration of the health belief model and the theory of planned behavior. *Frontiers in Public Health, 13,* 1629046. https://doi.org/10.3389/fpubh.2025.1629046

Finsel, J. S., Wöhrmann, A. M., & Deller, J. (2023). A conceptual cross-disciplinary model of organizational practices for older workers: Multilevel antecedents and outcomes. *The International Journal of Human Resource Management, 34*(22), 4344-4396. https://doi.org/10.1080/09585192.2023.2199939

Gašpert, T. (2025). Personal Protective Equipment (PPE). In *Principles of Nursing Infection Prevention Control: Introduction and global context of Infection Prevention and Control* (Volume 1) (pp. 109-118). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-84469-0_9

Hintz, E. A., Betts, T., & Buzzanell, P. M. (2023). Caring for Patients without Personal Protective Equipment (PPE): Material Conditions as Multidimensional Cascading Triggers for Resilience Processes. *Health Communication, 38*(2), 371–380. https://doi.org/10.1080/10410236.2021.1953727

Hussein, A., Opoku-Mensah, F. A., Amoafo, I. Q., & Saifu, K. (2025). Fundamentals of occupational health and safety practices outside the workplace among health professionals in Ghana: an assessment of determinants of crash helmet use in the Tamale Teaching Hospital. *BMC Public Health.* https://doi.org/10.1186/s12889-025-25442-w

Juliasih, N. N., Dhamanti, I., Semita, I. N., Wartiningsih, M., Mahmudah, M., & Yakub, F. (2023). Patient Safety Culture, Infection Prevention, and Patient Safety in the Operating Room: Health Workers' Perspective. *Risk Management and Healthcare Policy, 16,* 1731–1738. https://doi.org/10.2147/RMHP.S425760

Kadir, A., Dhesi, S. K., Amalinda, V. D., Yuantoko, T. D., Satrya, B. A., & Fitriadi, F. (2026). Occupational Health and Safety in Educational Settings: Barriers, Strategies, and Compliance Using a Mixed-Methods Approach. *Safety, 12*(1), 11. https://doi.org/10.3390/safety12010011

Khatooni, M., Momeni, M., Alizadeh, A., & Khalilzade, M. M. (2026). Professional Autonomy and Perceived Organizational Support as Predictors of Adherence to Ethical Codes Among Emergency Nurses. *Journal of Emergency Nursing.* https://doi.org/10.1016/j.jen.2025.12.002

Khoshakhlagh, A. H., Malakoutikhah, M., Park, J., Kodnoueieh, M. D., Boroujeni, Z. R., Bahrami, M., & Ramezani, F. (2024). Assessing personal protective equipment usage and its correlation with knowledge, attitudes, performance, and safety culture among workers in small and medium-sized enterprises. *BMC Public Health, 24*(1), 1987. https://doi.org/10.1186/s12889-024-19517-3

Khubchandani, J., Batra, K., Yockey, R. A., Webb, F. J., & Banerjee, S. (2024). Health care workers' risk behaviors and health status: Hidden realities or new paradigms? *Journal Of Medicine, Surgery, and Public Health, 2,* 10. https://doi.org/10.1016/j.glmedi.2024.100097

King, E. C., Zagrodney, K. A., McKay, S. M., Holness, D. L., & Nichol, K. A. (2023). Determinants of nurse's and personal support worker's adherence to facial protective equipment in a community setting during the COVID-19 pandemic in Ontario, Canada: A pilot study. *American Journal of Infection Control, 51*(5), 490-497. https://doi.org/10.1016/j.ajic.2022.07.021

King, E. C., Van Belle, T. A., Zagrodney, K. A., McKay, S. M., Giosa, J., Holubiec, I., Holness, D. L., & Nichol, K. A. (2024). Factors influencing self-reported facial-protective equipment adherence among home care nurses and personal support workers: A multisite cross-sectional study. *American Journal of Infection Control, 52*(10), 1105-1113. https://doi.org/10.1016/j.ajic.2024.06.005

Lohiniva, A. L., Lehtinen, J. M., Arifulla, D., Ollgren, J., Nuorti, P., & Lyytikäinen, O. (2025). Factors influencing healthcare workers' compliance with personal protective equipment guidelines in long-term care during the COVID-19 pandemic—A theory-based mixed-methods study. *PLOS ONE, 20*(4), e0321851. https://doi.org/10.1371/journal.pone.0321851

North, M. S. (2022). Chinese versus United States workplace ageism as GATE-ism: Generation, age, tenure, experience. *Frontiers in Psychology, 13,* 817160. http://dx.doi.org/10.3389/fpsyg.2022.817160

Pacutova, V., Geckova, A. M., de Winter, A. F., & Reijneveld, S. A. (2023). Opportunities to strengthen resilience of health care workers regarding patient safety. *BMC Health Services Research, 23*(1), 1127. https://doi.org/10.1186/s12913-023-10054-0

Qassim, A. A., & Abedelrahim, S. S. (2024). Healthcare Resilience in Saudi Arabia: The Interplay of Occupational Safety, Staff Engagement, and Resilience. *International Journal of Environmental Research and Public Health, 21*(11), 1428. https://doi.org/10.3390/ijerph21111428

Qureshi, M. O., Chughtai, A. A., & Seale, H. (2022). Recommendations related to occupational infection prevention and control training to protect healthcare workers from infectious diseases: a scoping review of infection prevention and control guidelines. *BMC Health Services Research, 22*(1), 272. https://doi.org/10.1186/s12913-022-07673-4

Sankar, S. S., Anandh, K. S., Rajendran, S., Ibrahim, C. K., & Szóstak, M. (2023). Examining the Relative Importance and Association between Safety Leadership Styles and Factors Affecting Organizational Safety Climate. *Buildings, 13*(8), 2062. https://doi.org/10.3390/buildings13082062

Santoro, P. E., Borrelli, I., Gualano, M. R., Proietti, I., Skroza, N., Rossi, M. F., Amantea, C., Daniele, A., Ricciardi, W., Potenza, C., & Moscato, U. (2022). The Dermatological Effects and Occupational Impacts of Personal Protective Equipment on a Large Sample of Healthcare Workers During the COVID-19 Pandemic. *Frontiers in Public Health, 9,* 815415. https://doi.org/10.3389/fpubh.2021.815415

Savari, M., Damaneh, H. E., Damaneh, H. E., & Cotton, M. (2023). Integrating the norm activation model and theory of planned behaviour to investigate farmer pro-environmental behavioural intention. *Scientific Reports, 13*(1), 5584. https://doi.org/10.1038/s41598-023-32831-x

Ssemuddu, J. B., Kajjoba, D., Olupot, P. W., Kirabira, J. B., & Okure, M. (2026). Structural equation modeling of safety integration and production pressure effects on safety performance in cement manufacturing. *Scientific Reports.* https://doi.org/10.1038/s41598-026-36696-8

Van Belle, T. A., King, E. C., Roy, M., Michener, M., Hung, V., Zagrodney, K. A., McKay, S. M., Holness, D. L., & Nichol, K. A. (2024). Factors influencing nursing professionals' adherence to facial protective equipment usage: A comprehensive review. *American Journal of Infection Control, 52*(8), 964-973. https://doi.org/10.1016/j.ajic.2024.04.006