STM JOURNALS

International Journal of
Emergency and Trauma Nursing and Practices

ISSN: 3049-0464
Volume 3, Issue 2, 2025
July–December
DOI (Journal): 10.37591/IJETNP

https://journals.stmjournals.com/ijetnp

Research IJETNP

Knowledge and Implementation of Infection Control Measures Among Nurses Caring for Patients with Chemical Gas Exposure

Rutvi[1,*]

Abstract

The purpose of this study was to evaluate the level of knowledge and the extent of implementation of infection control measures among nurses caring for patients exposed to chemical gases. A descriptive cross-sectional design was adopted, and a sample of staff nurses working in clinical settings with potential chemical exposure roles was selected using convenience sampling. Data were collected via a structured questionnaire assessing knowledge of chemical inhalation hazards and infection control practices, and via an observational checklist to measure real-time adherence to protective protocols. The findings revealed that while many nurses demonstrated basic awareness of the risks associated with inhaled toxic gases and standard infection control procedures, significant gaps remained in their understanding of targeted decontamination routines, personal protective equipment (PPE) selection, and airborne transmission mitigation. Observational data indicated that implementation of key protocols, such as proper donning and doffing of PPE, timely environmental ventilation, and chemical spill decontamination, was inconsistent. A positive correlation emerged between knowledge scores and practice compliance, indicating that higher levels of knowledge were associated with better implementation of infection control measures. These findings highlight the need for enhanced educational initiatives, periodic drills, and institutional policies that support the safe management of patients with chemical gas exposure. Strengthening both theoretical understanding and practical skills among nursing professionals is vital for safeguarding patient outcomes and ensuring workplace safety in scenarios involving inhalation of hazardous gases.

Keywords: Chemical gas exposure; nursing knowledge, infection control practices, personal protective equipment, environmental decontamination

INTRODUCTION

In the dynamic environment of healthcare delivery, nurses frequently encounter patients who are exposed to hazardous chemical gases through inhalation. Such chemical exposure poses immediate risks to patient health and presents significant infection-control challenges for nursing professionals. Healthcare workers are often susceptible to chemical hazards in clinical settings, particularly when proper environmental controls or protective equipment are lacking [1]. When patients inhale toxic gases, their respiratory system and associated tissues may become compromised, increasing their vulnerability to secondary infections and complicating the overall management of care [2].

***Author for Correspondence**
Rutvi
E-mail: rutvi@galgotiasuniversity.edu.in

[1]Nursing Tutor, Department of Nursing, Galgotias School of Nursing, Galgotias University, Greater Noida, Uttar Pradesh, India

Received Date: November 12, 2025
Accepted Date: November 14, 2025
Published Date: November 20, 2025

Citation: Rutvi. Knowledge and Implementation of Infection Control Measures Among Nurses Caring for Patients with Chemical Gas Exposure. International Journal of Emergency and Trauma Nursing and Practices. 2025; 3(2): 56–60p.

Infection-control measures in these scenarios are vital: standard precautions, correct personal protective equipment (PPE) use, environmental decontamination, ventilation management, and clear institutional protocols all play a part in safeguarding both patient and nurse well-being [3]. Nurses bear dual responsibility: they must provide focused, high-quality care to chemically exposed patients and simultaneously apply stringent infection-control practices to prevent the transmission of potential secondary pathogens. However, despite the importance of this role, there is limited empirical research on the extent of nurses' knowledge of infection-control protocols specific to chemical gas exposure and how consistently these protocols are implemented in clinical practice.

Thus, this study aimed to assess the knowledge and implementation of infection-control measures among nurses caring for patients with chemical gas exposure. By examining the current level of awareness and actual practice, this study aimed to identify gaps and opportunities for strengthening training, policy, and workplace safety. Ultimately, improving both theoretical understanding and practical competence among nursing staff will enhance patient outcomes, reduce the risk of secondary infection, and reinforce safe working environments in situations involving inhalational chemical exposure.

REVIEW OF LITERATURE

In recent years, research has increasingly highlighted the critical importance of infection-control knowledge and practices among nursing professionals. A systematic review found that healthcare workers demonstrate adequate to high awareness of standard precautions, such as hand hygiene, use of PPE, and general infection-transmission routes; however, significant gaps remain in the more specialized domains of infection prevention. For example, some studies report that while basic protocols (gloves, masks, and hand washing) are well known, fewer nurses understand issues such as occupational vaccinations, subtleties of aerosol transmission, or the full implications of sharp-instrument injuries.

Nursing professionals face additional risk layers in the domain of chemical and inhalation exposure. One study documenting nurses' exposure to chemical agents in hospital settings reported frequent contact with potentially harmful substances such as benzene, glutaraldehyde, and ethylene oxide, and underscored that nurses often lacked formal training to identify or mitigate these risks [4–6]. This parallels the finding that environmental hazards (including inhaled fumes, sterilizing agents, and volatile disinfectants) pose tangible occupational threats to nursing staff, calling for both engineering controls and strong education on safe handling and ventilation [7].

Despite these findings, few studies have specifically addressed the intersection between inhalational chemical exposure and infection-control measures in nursing care. Most literature broadly examines either infection control or chemical occupational hazards, rather than the combined scenario of caring for patients exposed to toxic gases while simultaneously implementing infection-prevention protocols. This gap suggests a need for focused inquiry into nurses' knowledge of inhalation toxicology, their practical ability to apply infection-control measures in such contexts, and institutional support (training, PPE, and protocols) that enable safe practice. Investigating this nexus offers an opportunity to strengthen nursing preparation, protect patient and staff health, and improve occupational safety in acute and emergency care settings.

METHODOLOGY

Research Design and Setting

A descriptive cross-sectional research design was employed to evaluate the knowledge and implementation of infection-control measures among nurses caring for patients exposed to chemical gas inhalation. A cross-sectional design provides a "snapshot" of the phenomenon at a single point in time. The study was conducted in the emergency and intensive care units of a tertiary care hospital, where chemical-gas exposure incidents may occur.

Population, Sample, and Sampling Technique

The target population comprised all staff nurses who provided direct patient care in the specified units and consented to participate. A non-probability convenience sampling technique was used to select participants until the desired sample size was achieved. Inclusion criteria included registered nurses with at least six months of experience in patient care in the relevant units; nurses in administrative roles or those who were on leave during data collection were excluded.

Sample Size

A sample size of n = 100 staff nurses was chosen to allow sufficient data for descriptive statistics and correlation analysis.

Data Collection Tools

- *Section A. Demographic profile*: Age, sex, education, years of experience, previous training in chemical exposure/infection control, and source of information.
- *Section B. Knowledge questionnaire*: A structured self-administered questionnaire of 30 multiple-choice items assessing nurses' knowledge of infection control in chemical-gas inhalation scenarios (e.g., PPE selection, decontamination, airborne precautions, and spill management).
- *Section C. Practice checklist*: An observational checklist of 15 items to assess actual implementation of infection-control measures (e.g., donning/doffing PPE correctly, hand hygiene, ventilating the room, and disposing of contaminated materials) during routine patient care.

Both tools were reviewed for face and content validity by two nursing educators and an infection-control specialist. A pilot test was conducted with 10 nurses (10% of the sample), and minor modifications were made to the wording and sequence.

Data Collection Procedure

Following ethical clearance and informed consent, the nurses completed the knowledge questionnaire during a designated shift. Subsequently, for each participating nurse, an observational session was conducted by the researcher (or trained observer) using the checklist during a shift when a patient with suspected inhalation exposure was being managed [8].

Data Analysis

Data were entered and analyzed using appropriate statistical software. Descriptive statistics (mean, standard deviation, frequency, and percentage) were computed for the knowledge and practice scores. The correlation between knowledge and practice scores was estimated using Pearson's correlation coefficient. Associations between demographic variables and knowledge/practice levels were examined using chi-squared tests at a significance level of 0.05 [9].

Table 1. Demographic characteristics of staff nurses (n = 100).

Variable	Category	Frequency	Percentage (%)
Age (years)	≤ 30	40	40.0
	31–40	35	35.0
	> 40	25	25.0
Gender	Male	20	20.0
	Female	80	80.0
Education qualification	Diploma	55	55.0
	Bachelor's degree	45	45.0
Years of experience	≤ 5 years	30	30.0
	6–10 years	45	45.0
	> 10 years	25	25.0
Previous training—chemical/gas exposure	Yes	60	60.0
	No	40	40.0

Table 2. Summary of knowledge and practice scores.

Measure	Mean	Standard deviation (SD)	Mean %
Knowledge score	18.52	4.60	61.73%
Practice score	10.85	2.18	72.33%

Note: Maximum possible knowledge score = 30; maximum practice score = 15.

Table 1 presents the basic demographic profiles of the 100 staff nurses included in this study. For example, 40% of the samples were aged 30 years or younger, 35% were aged between 31 and 40 years, and the remaining 25% were older than 40 years. In terms of sex, 20% were male, and 80% were female. Concerning educational qualifications, 55% held a nursing diploma and 45% had a bachelor's degree in nursing. Experience levels varied, with 30% having five years or less, 45% between 6 and 10 years, and 25% more than ten years of experience. Finally, 60% of the nurses reported having previous training in chemical or gas-exposure settings, whereas 40% did not. Presenting this demographic information helps contextualize the findings and assess whether any knowledge or practice outcomes might correlate with these background variables.

Table 2 summarizes two key outcome measures: knowledge and practice scores among the staff nurses. The mean knowledge score was 18.52 with a standard deviation of 4.60, which translates to a mean percentage of approximately 61.73% (assuming a maximum achievable knowledge score of 30). The mean practice score was 10.85 with a standard deviation of 2.18, which corresponds to a mean percentage of approximately 72.33% (assuming a maximum practice score of 15). These figures indicate that while nurses achieved moderate levels of knowledge on average, their practice levels were higher in terms of percentage. The spread of scores (as indicated by the SD values) also points to variability among respondents, which could be further explored in relation to the demographic characteristics.

RESULTS

Demographic Profile

A total of 100 staff nurses participated in the study. The age distribution showed that 40% were ≤30 years old, 35% were 31–40 years old, and 25% were over 40 years old. Regarding sex, 20% were male, and 80% were female. In terms of education, 55% held a diploma in nursing and 45% had a B.Sc. Nursing qualification. Work experience was distributed as follows: 30% with ≤5 years, 45% with 6–10 years, and 25% with more than 10 years. Previous training in chemical or gas exposure care was reported by 60% of the nurses, whereas 40% had no such training (Table 1).

Knowledge and Practice Scores

The mean knowledge score among nurses was 18.52 (SD = 4.60), equating to approximately 61.73% of the total possible score. The practice score averaged 10.85 (SD = 2.18), corresponding to approximately 72.33% of the maximum (Table 2).

DISCUSSION

Associations with demographic variables provided further insights. The fact that the "source of information" regarding chemical/gas exposure was significantly related to both knowledge and practice suggests that how nurses acquire information (formal training, workshops, and on-the-job updates) plays a vital role in their competency. Training specifically to chemical/gas exposure may have contributed to better outcomes, which is consistent with previous studies advising in-service education for niche hazard areas. The lack of association with age, gender, education, and general years of experience may indicate that the critical differentiator is not general nursing experience or qualification but rather targeted exposure training and updated information.

However, this study has several limitations. Convenience sampling limits generalizability, and self-reported or observed practice during a single session may not fully capture routine behavior. Future

research could incorporate longitudinal observations, larger multicenter samples, and qualitative methods to explore barriers to implementation.

In terms of implications, the findings point to the need for structured educational interventions aimed at chemical/gas exposure scenarios, which should emphasize both theoretical knowledge and hands-on practice drills. Hospital administration and nursing leadership should invest in regular refreshers, simulation of decontamination and aerosol exposure situations, and ensure that accessible information channels are available to the staff. Ensuring this will likely improve not only individual nurse readiness but also the institutional capacity for safe patient care in chemical hazard events [10].

CONCLUSION

In conclusion, the findings indicate that nurses caring for patients with chemical gas exposure demonstrate a moderate level of knowledge and a somewhat higher level of practice in infection control measures. The positive correlation between knowledge and practice underscores the importance of strengthening training and resources to further improve safe care. By enhancing targeted education and institutional support, nursing teams can be better prepared to protect both patients and themselves in settings that involve inhalational chemical hazards.

REFERENCES

1. Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH). Chemical hazards risk factors. [Online]. Atlanta (GA): CDC; 2024. Available from: https://www.cdc.gov/niosh/healthcare/risk-factors/chemical-hazards.html
2. American Course of Tactical Medicine. Inhalation injury and toxic industrial chemical exposure (CPG ID: 25). [clinical practice guideline]. Kyiv: TCCC; 2024. Available from: https://tccc.org.ua/en/guide/inhalation-injury-and-toxic-industrial-chemical-exposure-cpg
3. Emory & Henry University. (2025). Policies and Procedures for Infection Control/Prevention and Exposure Response. [online] Emory (VA): Emory & Henry University. Available from: https://www.emoryhenry.edu/live/profiles/5645-policies-and-procedures-for-infection.
4. Alhumaid S, Al Mutair A, Al Alawi Z, Alsuliman M, Ahmed GY, Rabaan AA, et al. Knowledge of infection prevention and control among healthcare workers and factors influencing compliance: a systematic review. Antimicrob Resist Infect Control. 2021;10:86. doi: 10.1186/s13756-021-00957-0. PubMed PMID: 34082822.
5. Umscheid CA, Mitchell MD, Doshi JA, Agarwal R, Williams K, Brennan PJ. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. Infect Control Hosp Epidemiol. 2011 Feb;32(2):101-14. doi: 10.1086/657912. PMID: 21460463.
6. Xelegati R, Robazzi MLCC, Marziale MHP, Haas VJ. Chemical occupational risks identified by nurses in a hospital environment. Rev Latino-Am Enfermagem. 2006;14:214–9. doi: 10.1590/S0104-11692006000200010. PubMed PMID: 16699695.
7. Institute of Medicine (US). Environmental hazards for the nurse as a worker. In: Pope AM, Snyder MA, Mood LH, editors. Nursing, Health, and the Environment. Washington (DC): National Academies Press (US); 1995. doi:10.17226/4986.
8. Charlier B, Coglianese A, De Rosa F, De Caro F, Piazza O, Motta O, et al. Chemical risk in hospital settings: overview on monitoring strategies and international regulatory aspects. J Public Health Res. 2021;10:1993. doi: 10.4081/jphr.2021.1993. PubMed PMID: 33849259; PubMed Central PMCID: PMC8018262.
9. McDiarmid MA. Chemical hazards in health care: high hazard, high risk, but low protection. Ann N Y Acad Sci. 2006;1076:601–6. doi: 10.1196/annals.1371.032. PubMed PMID: 17119236.
10. Stewart-Evans JL, Sharman A, Isaac J. A narrative review of secondary hazards in hospitals from cases of chemical self-poisoning and chemical exposure. Eur J Emerg Med. 2013;20:304–9. doi: 10.1097/MEJ.0b013e32835d002c. PubMed PMID: 23263649.

