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A Descriptive Study to Assess the Knowledge of Nursing Students in Preventing Health Care Associated Infections in Intensive Care Units

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ABSTRACT

Background: Healthcare-associated infections (HCAIs) are infections acquired by patients during the course of receiving medical care. These infections typically manifest 48 hours or more after hospital admission or within 30 days following healthcare intervention. Intensive Care Units (ICUs) are particularly vulnerable due to the presence of critically ill patients and the frequent use of invasive diagnostic and medical procedures. **Aim of the Study:** This study aimed to assess the knowledge of nursing students regarding the prevention of HCAIs in ICUs. **Methodology:** A non-experimental descriptive research design was adopted, utilizing a structured knowledge questionnaire to evaluate students' understanding of HCAI prevention. A total of 94 BSc Nursing students were selected through a non-probability convenient sampling method. Data were analyzed quantitatively using Microsoft Excel. **Results:** The majority of participants were aged 20–22 years (64.89%), with females comprising 52 (55.32%) of the sample. Most students were from the third year 48 (51.06%), while the remaining were in their fifth semester 46 (48.94%). Knowledge levels varied among the students: 12 (12.76%) demonstrated excellent knowledge, 35 (37.23%) had good knowledge, 29 (30.85%) showed fair knowledge and 18 (19.15%) had poor knowledge. A statistically significant association ($p = 0.001$) was found between knowledge levels and both age and prior training. **Conclusion:** While nursing students' exhibits adequate understanding of HCAI prevention, there is a need for enhanced educational initiatives and practical training to improve their competency and ensure better infection control practices in ICUs.

Keywords: Healthcare-associated infections, Central Line-Associated Bloodstream Infections, Surgical Site Infections, Catheter-Associated Urinary Tract Infections, Ventilator-Associated Pneumonia, Nursing Students, ICUs.

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Introduction

The infections that occur to the patients while receiving care are known as healthcare-associated infections. Healthcare-Associated Infections (HCAIs), earlier it was known by the name of nosocomial infections and linked with admissions to acute-care hospitals; now it includes infections developed in various healthcare settings such as long-term care, family medicine clinics, home care, and ambulatory care. HCAIs are infections that first appear 48 hours or more after hospitalization or within 30 days after having received health care[1]. Globally, healthcare-associated infections (HCAIs) are a substantial challenge in contemporary healthcare systems, particularly within intensive care units (ICUs). These infections are contributing to increased morbidity and mortality rates, prolonged hospitalization periods, and increased healthcare expenditures. ICUs are particularly susceptible to the spread of infections due to critically ill patient and the frequent invasive medical and diagnostic procedures. The prevention of

HCAIs in ICUs high-risk environments is of paramount importance, as it directly influences patient outcomes and the overall quality of healthcare delivery.

According to the US Center for Disease Control and Prevention, approximately 1.7 million hospitalized patients annually acquire HCAIs while treating for other health conditions and that more than 98,000 of these patients (one in 17) die due to HCAIs[2]. A study examining health-care-associated bloodstream (BSIs) and urinary tract infections (UTIs) in 89 intensive care units of 26 tertiary care hospitals in India reported that in adult and pediatric ICUs, the pooled rates of BSI ranged between 5·3–7·3/1000 patient days, while CLABSI rates ranged between 8·3–12·1/1000 central line days. The pooled UTI and CAUTI rates in these ICUs ranged between 1·7–2·8 per 1000 patient days and 8·3–12·1 per 1000 catheter days, respectively[3].

Healthcare-associated infections (HCAIs) are a significant challenge in modern healthcare settings and are leading cause of increased morbidity, mortality, and healthcare costs globally[4, 5]. Intensive Care Units (ICUs) are particularly susceptible to HCAIs due to the high prevalence of invasive procedures, the critical condition of patients, and the dynamic, complex environment of care [2, 6].

A study by Gammon J, Hunt J, Duffy L, et al (2024) [7] reported the hand hygiene practices of 825 nursing students in a clinical suite. The finding shows that the educational intervention significantly influenced the nursing student's clinical skills learning. A high success rate was found, with 99.4% (779 students) passed the assessment at the first attempt. The educational intervention also led to improved compliance to recommended hand hygiene technique and practice. However, research by Davis et al. (2013) [8] and Nicol et al. (2014) [9] indicates that despite the availability of evidence-based guidelines, knowledge and practice gaps continue to exist among nursing students. This discrepancy between theoretical understanding and practical application suggests a need to reexamine the nursing curricula, potentially incorporating more practical, hands-on training experiences. The existing literature suggests that healthcare-associated infections (HCAIs) represent a significant threat to patient safety, particularly in Intensive care settings.

Significance of the Study

Nursing professionals play a vital role in infection control within the ICU, responsible for implementing standard protocols and direct patient care practices that can significantly reduce the occurrence of infections such as ventilator-associated pneumonia (VAP), central line-associated bloodstream infections (CLABSI), and catheter-associated urinary tract infections (CAUTI)[10, 11]. The gaps in knowledge and practice are especially evident among nursing students, who have limited clinical experience and are still acquiring the competencies necessary to adapt standard infection control protocols to the intricacies of the ICU environment [8, 9].

Nursing students represent not only the future workforce but also the upcoming generation of healthcare professionals who will be responsible for ensuring patient safety. Consequently, their level of their knowledge about HCAIs and the efficacy of their training significantly influence the overall quality of care and patient outcomes[12, 13]. Evaluating their understanding of infection prevention measures is crucial for targeted educational interventions, identifying training deficiencies, and ultimately enhancing compliance to best practices within clinical environments [14, 15].

Sharma K, & Gupta R. (2018) [16], conducted a study on the impact of educational interventions on infection prevention practices among nursing students in ICUs. The findings indicated that focused educational initiatives significantly improved both the knowledge and compliance of nursing students concerning infection control protocols. It is recommended for the implementation of regular refresher training and the inclusion of hands-on training to ensure sustained knowledge retention and practical application. Kumar A. & Reddy B. (2017) [17] conducted a descriptive study assessing the knowledge, attitude, and practices of nursing students towards prevention of catheter-associated infections. This study revealed that although nursing students recognized the importance of standard precautions, their understanding was relatively low, and adherence levels were inconsistent, based on their clinical exposure. The study research highlighted the need for structured training programs that focus on evidence-based infection control practices tailored to the specific demands of ICU settings.

Joshi, M., & Singh, A. (2021)[18], conducted a cross-sectional study to Assess the infection control competencies of nursing students. The study showed that although nursing students possessed a moderate level of theoretical knowledge, their proficiency in implement infection control practices in high-risk areas such as intensive care units (ICUs) was notably limited. The authors recommended for the adoption of a competency-based training framework to improve infection control education and ensure the implementation of effective prevention strategies in critical care settings.

Considering the critical role of effective infection control plays in patient safety, it is imperative to assess the current state of knowledge among nursing students regarding HCAIs is essential. Several studies have shown that gaps in understanding and inconsistencies in practice can lead to higher infection rates, increased antimicrobial resistance, and prolonged hospital stays[10]. Furthermore, exploring the specific challenges that nursing student's face in ICU environments may provide valuable insights into designing the educational and practical training programs, ensuring that these programs initiatives adequately equip the nursing students for the demands of contemporary clinical care [8, 9].

Nursing students, as the upcoming healthcare providers, are crucial role in prevention of infection. It is imperative that their theoretical understanding, hands-on training, and competency training must emphasize infection control to equip them with necessary skills to minimize the risks associated with healthcare-associated infections (HCAIs). Overall, it is crucial to tackle the gaps in knowledge and practice among nursing students is essential for improving patient safety and healthcare outcomes in ICU settings. Hence, the present study aimed to assess the nursing students' knowledge of health care-associated infections (HCAIs) within ICUs settings.

The objectives of the study are to-

1. Assess the demographic profile of the nursing students
2. Assess the level of knowledge among nursing students regarding prevention of health care-associated infections in ICUs.
3. Find the association between the level of knowledge regarding prevention of health care-associated infections in ICUs and selected demographic variables of nursing students.

Materials and Methodology

Research design: A non-experimental, descriptive research design was chosen to assess the knowledge of nursing students regarding Prevention HCAIs in ICUs.

Sample selection: A total of 94 nursing students enrolled in the BSc nursing programme, fulfilled the inclusion criteria and currently studying in the 3rd year and 5th semester of third year at the college of nursing, SGPGIMS were the study participants. The sample was determined as per the sample size calculation.

Setting: Setting refers to the place where the study is conducted the study was conducted in the College of Nursing, SGPGIMS Lucknow, Uttar Pradesh, India.

Sample: The samples were selected from the College of Nursing, Sanjay Gandhi Postgraduate Institute Lucknow, Uttar Pradesh.

Sampling technique: The sample was selected by using the convenient sampling method in this study.

Ethical consideration: Prior to data collection, permission was obtained from the Institutional ethical, followed by administrative permission to conduct this study. Informed consent was taken from the participants included in this study.

Data collection instrument: study was done after obtaining permission from the institutional ethical committee, using a self-structured questionnaire on the knowledge of preventing healthcare-associated infections in ICUs as a data collection instrument. This instrument was developed and self-structured questionnaire to ensure that it effectively meet the study objectives.

The tool used in this study:

Section A - Socio-demographic data: It consists of sample characteristics like age, gender, education, and previous experience of any training related to healthcare-associated infections.

Section B-This section consists of a 15-item questionnaire designed to assess knowledge on the prevention of healthcare-associated infections in ICUs. Each question is multiple-choice, with one correct answer for each. Participants were asked to complete the questionnaire, selecting the correct option for each question. Each correct answer is assigned a score of one point.

Scoring key:

- Excellent: 13-15 points
- Good: 10-12 points
- Fair: 7-9 points
- Poor: 0-6 points

Inclusion criteria:

- B.Sc. nursing students of SGPGIMS, Lucknow, who had enrolled in third-year training in an ICU during their clinical posting.
- Those who are willing to participate.

Exclusion criteria: Students who are on academic leave on the day of data collection.

Data analysis: Statistical analysis was undertaken with excel spread sheet for descriptive (percentage and frequency) and inferential (for association Chi Square) statistical calculation.

Analysis and Interpretations

1. Analysis of distribution of demographic data of nursing students regarding prevention of healthcare-associated infections in ICUs

Figure -1: Bar diagram showing age of nursing students (N=94).

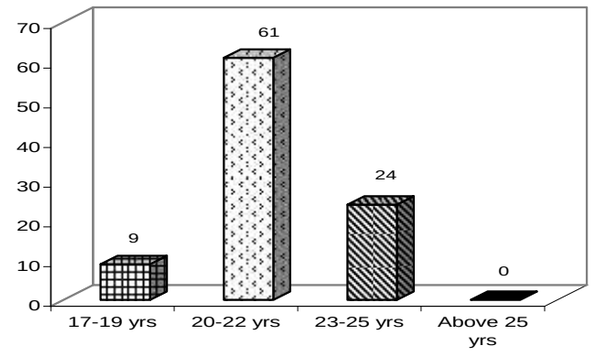

Figure- 2: Pie diagram showing Gender of nursing students.

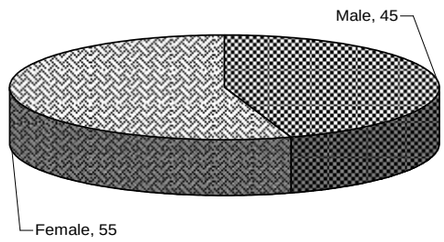

Figure-1 shows that majority of the student were found between the age group of 20 -22 year (64.89%), followed by 23-25 year (25.53%), least present in age group 17- 19 years (9.57 %) while the no students were present above the 25 years of age. In **Figure-2** Pie diagram represent that, more than half of samples were females 52 (55.32%) and rest of the students were male 42 (44.68%) in our study.

Figure-3: Column diagram showing year/semester in which the students are studying.

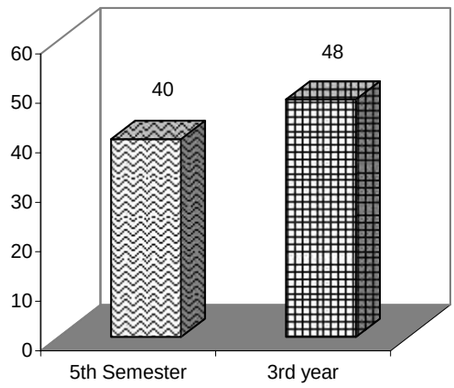

Figure-3: With due respect to year of study nearly half students were participated from 3rd year 48 (51.06%) and half students were from 5th semester 46 (48.94 %).

Figure-4: Pie diagram showing whether the students have received any previous training regarding HCAIs.

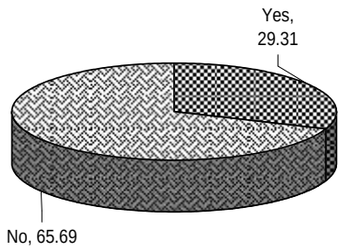

Figure 4: On the basis of received previous training 65 (69.15%) received previous training and rest of the students not received any previous training regarding health care associated infections.

Table-1, reveals, among 94 students, the overall knowledge of nursing students regarding prevention of health-associated infections in ICUs, 12 students had excellent knowledge (12.76%), 35 students had good knowledge (37.23%), 29 students were having fair knowledge (30.85%) and rest of 18 students were having poor knowledge (19.15%).

Table- 1: Gradation of knowledge on the basis of pre-test (N= 94)

Knowledge level	Score		No.	%
Excellent	13-15	(87-100%)	12	12.76
Good	10-12	(67-86%)	35	37.23
Fair	7-9	(47-66%)	29	30.85
Poor	0-6	(0-46%)	18	19.15

Data presented in **Table -2** show that the association was found in the case of age and received previous training, where the value of age is 0.001 and received previous training is 0.001, i.e., statistically significant at 0.05 levels, and other demographic variables show that there is no significant relationship in the case of gender and year of study.

Table- 2: Association between knowledge and selected socio-demographic variables (N=94)

Demographic Data	Category	Subject Group	
Age (in years)	17-19	9	0.001 *
	20-22	61	
	23-25	24	
	> 25	0	
Gender	Male	42	0.071**
	Female	52	
Year/Semester in which you are studying	5th Semester	46	0.225**
	3rd year	48	
Received any previous training	Yes	65	0.001*
	No	29	

* Significant; ** Non-Significant

Discussion

1. ***Assess the demographic profile of nursing students*:** The majority of the students were found between the age group of 20-22 years (64.89%). More than half of the samples were female 52 (55.32%). The majority of the nursing students participated in 3rd year 48 (51.06%), and the remaining were from 5th semester 46 (48.94%).

2. **Assess the level of knowledge among nursing students regarding prevention of health care-associated infections in ICUs.**

- Among 94 students, 12 students had excellent knowledge (12.76%), 35 students had good knowledge (37.23%), 29 students had fair knowledge (30.85%) and the rest of 18 students had poor knowledge (19.15%).
- These findings are aligned with the research conducted by Rai S. et al (2019), Patel V. et al (2020), Joshi et al (2021) [19,20,18]. Rai S. et al. (2019)[19], examined knowledge and practices of nursing staff regarding infection control measures in a tertiary care hospital. The study highlighted that while most nursing staff had theoretical knowledge about infection control measures; there was a notable lacuna in practical, particularly in ICU settings. The research suggested that the imperative for ongoing/ continuous training and to reduce the gap between knowledge and practice, thereby enhancing patient safety and improving care standards. Patel, V., Thomas, J. (2020) [20] conducted a study on assessing the role of nursing students in preventing healthcare-associated infections. The findings suggested incorporating more hands-on infection control training within the nursing curriculum to better equip the nursing students for real-world clinical scenarios. Joshi and Singh (2021)[18], highlighted the importance of competency-based training to improve practical skills in infection control among nursing students.

3. **Find the association between the level of knowledge and selected demographic variables of nursing students:** Regarding association was found in the case of age and received previous training, where the value of age is 0.001 and received previous training is 0.001 i.e., statistically significant at 0.05 levels.

Recommendations: Based on the study findings, the following recommendations are proposed:

1. **Educational Recommendations**

- Implementation of specialized ICU infection prevention modules
- Integration of virtual reality and simulation-based training
- Regular competency assessments and feedback mechanisms

2. **Clinical Practice Recommendations**

- Structured mentorship programs for students in ICU settings
- Regular updates to infection prevention protocols
- Enhanced collaboration between academic institutions and clinical facilities

3. **Policy Recommendations**

- Development of standardized guidelines for student training in ICU settings
- Regular review and update of infection prevention policies
- Implementation of evidence-based protocols

Future Research Directions: This study highlights several areas for future research:

- Longitudinal studies tracking knowledge retention and application
- Impact of different teaching methodologies on infection prevention competency
- Cost-effectiveness analysis of enhanced infection prevention training programs
- Cross-cultural studies examining knowledge variations across different healthcare systems

Conclusion

The findings highlight the critical need for comprehensive infection prevention education targeted for nursing students, particularly in ICU settings. Although students exhibit satisfactory basic knowledge levels on healthcare-associated infections (HCAIs), , there is a significant gap in understanding complex infection prevention protocols such as ventilator-associated pneumonia (VAP), central line-associated bloodstream infections (CLABSI), and catheter-associated urinary tract infections (CAUTI), that need to be addressed. Finally, the study emphasizes the necessity for enhanced educational strategies to equip nursing students with the knowledge and skills required to effectively prevent healthcare-associated infections in ICUs, ultimately leading to improved patient care and safety.

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