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ASSESS THE KNOWLEDGE OF NURSING STUDENTS REGARDING HAND HYGIENE IN A PRIVATE NURSING COLLEGES

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Abstract

Background: Hand hygiene is the most effective and simple measure for preventing healthcare-associated infections (HAIs) in clinical settings. Nursing students, as future healthcare providers, are regularly exposed to clinical environments where proper hand hygiene knowledge is essential to prevent cross-contamination and ensure patient safety.

Objective: To assess the knowledge of nursing students regarding hand hygiene in a private nursing college (Mustafa Kamal Institute of Nursing and Medical Sciences, Vehari).

Methodology: A descriptive cross-sectional study was conducted among 104 nursing students using a structured self-administered questionnaire based on WHO hand hygiene guidelines. Data was collected through a non-probability convenience sampling technique. The questionnaire included demographic variables and hand hygiene knowledge items.

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Data was analyzed using SPSS version 26, applying descriptive statistics such as frequency, percentage, mean, and standard deviation.

Results: The findings revealed that the majority of students demonstrated moderate knowledge of hand hygiene principles. Most students were aware of the basic importance of hand hygiene in infection prevention. However, gaps were identified in specific areas, including the correct duration of alcohol-based hand rub use, all five moments of hand hygiene, and specific handwashing techniques.

Conclusion: Nursing students possess a moderate level of hand hygiene knowledge, with notable gaps in specific technical aspects. Strengthening hand hygiene education through practical training, simulation-based sessions, and regular workshops is recommended to improve compliance and patient safety outcomes.

CHAPTER 01

INTRODUCTION

1.1. Background:

Hand hygiene, one of the most effective and simple ways to prevent the spread of infection in health-care environments, is one of the most straightforward combinations of ultimate prevention measures. HABIs are still a high-priority problem worldwide that causes higher morbidity and mortality rates and costs in healthcare. Healthcare workers and students properly use hand hygiene to help limit spreading pathogens to patients, others, and the hospital setting. So, ensuring adherence to the recommended hand hygiene practices and the acquisition of knowledge is critical for patient safety and infection prevention programs (Singh & Barnard, 2023).

Hand hygiene is known as the 'bedrock' of IPC in health care. One of the most frequent modes of hospital-acquired microorganism transmission is through the contaminated hands of health workers in the hospital and clinical settings. Proper hand hygiene (hand washing using soap and water or alcohol based hand rub) significantly helps prevent the spread of infection and prevent infection of

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patients and healthcare providers. It is therefore critical that healthcare workers and those in healthcare-related education are aware of the importance of hand hygiene in order to ensure safe practices when delivering care and minimize healthcare-related infections (Pittet et al., 2021).

When students are in their clinical education, they will be experiencing the environment in which they will work with the nursing profession and perform clinical tasks with a nursing rationale, such as medication administration, procedures, and daily patient care. These activities put them at risk of being exposed to infectious agents. Students can avoid cross-infection and adhere to aseptic skills during patient care when they have adequate knowledge of hand hygiene procedures. Research has demonstrated that adequate teaching and consistent reminders of infection control procedures are needed to increase students' knowledge about and adherence to hand washing guidelines (Allegranzi et al., 2022).

By monitoring their knowledge throughout the course, educators are able to determine how well teaching strategies are working. Educational institutions are extremely important in shaping safe clinical behaviours among nursing students. Education should be an integral part of implementing hand hygiene programs to contribute to the awareness and skills students have regarding hand hygiene. Training programs comprising practical hand hygiene, lectures, and demonstrations are important aspects of the implementation of hand hygiene programs to contribute towards students' awareness and skills about hand hygiene. Adequate training and supervision for nursing students during internship rotations increases the chances of developing good attitudes and good practices, and identifies their areas of strength and weakness (World Health Organization, 2022).

Despite the existence of clear guidelines and infection control policies, several studies have documented a lack of knowledge and non-compliance with hand hygiene among health care workers and students. Heavily occupied staff, inadequate hand hygiene facilities, inadequate training, and misunderstandings regarding the spread of infection may impact adherence with recommended practices. These barriers could be pinpointed through evaluating nursing students' knowledge about hand hygiene and can help inform the development of interventions. Targeted education

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interventions can be developed by evaluating nursing students' hand hygiene knowledge, thereby highlighting these challenges. (Centers for Disease Control and Prevention, 2023).

Hand hygiene education programmes should be particularly emphasized in the private nursing colleges, as students may be from different educational backgrounds, and their clinical experience would differ. To ensure students understand and practice standard precautions when working in health care settings, a well-designed clinical curriculum, monitoring, and knowledge accounts can be used. Educating them on hand hygiene will not only have a positive impact on patient safety but also help them to be responsible healthcare providers who would be able to contribute to infection prevention and control measures successfully in healthcare institutions (Kumar & Sharma, 2024).

Hand hygiene is known to be the most effective and cost-effective measure to reduce the transmission of infections in the health care environment. Healthcare-associated infections are still a huge problem globally and cause millions of infections in patients annually, which lengthen hospital stays, incur more treatment expenses, and result in death rates. Hand hygiene among healthcare providers prevents microorganisms from being spread from contaminated surfaces or patients to other people. Therefore, promoting hand hygiene knowledge amongst healthcare students is a key factor in enhancing the prevention of infection and patients' safety in healthcare institutions (Sax et al., 2021). During their clinical placements, nursing students have a crucial role in caring for the patients, and are often exposed to patients, hospital machines and equipment, as well as the hospital environment. If they don't know and understand the basics of hand hygiene, they could be indirectly spreading disease-causing microorganisms. Researchers found that pupils who were more aware of protective measures around infectious diseases were more likely to follow good hand hygiene protocols and that this generally led to a decrease in the likelihood of cross-infection occurring in healthcare (Golin et al., 2021)

Education for hand hygiene is an important aspect of the nursing curriculum as it empowers students with safe clinical practices from early in their nursing studies. Within the nursing institutions, there is often a theoretical approach to the teaching of infection control; this should

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also be reinforced by practice so that the students fully understand and apply the recommended infection control measures regarding hand hygiene. Workshops, simulations, and demonstrations of good practice have been shown to have an important positive effect on the knowledge and attitudes of students around hand hygiene (Haque et al., 2022).

Observance of the "Five Moments for Hand Hygiene" recommendation in the international guidelines for controlling infection is another important issue related to hand hygiene. These moments are: Prior to hand touching the patient, prior to performing aseptic procedures, after contact with body fluids, after patient contact, and after touching the patient's environment. Nursing students need to be aware of these moments in order to prevent infections from being passed between patients and between patients and nurses in health facilities. Yet, it has been revealed that not every student knows all five moments, indicating there is a need for better training and education (Kampf & Kramer, 2022).

Healthcare education programs emphasize that knowledge alone may not be sufficient to ensure proper hand hygiene practices. Other factors, including behavioral, institutional culture, and availability of hand hygiene resources, impact compliance. When nursing students observe good examples around their clinical instructors and the senior nurses, then proper infection control behavior is adopted by the nursing students. Hence, knowing the level of Knowledge about Hand Hygiene among nursing students is essential to create awareness about the knowledge gaps and improve the strategies of Infection Prevention in Nursing Education (Lotfinejad et al., 2023).

Appropriate knowledge about hand hygiene should be especially emphasized in private nursing colleges because students undertake clinical rotations in various hospitals, which have varying levels of infection whenever they move from one hospital to another. Frequent assessment of their skills and processes can assist teachers in seeing gaps in training courses and deliver instructional activities to address these gaps. There is a notable lack of knowledge regarding hand hygiene among nursing students, which will impact their ability to care for patients safely, as well as teaching competent

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health care providers to ensure the maintenance of high standards in infection control in health care practice in the future (Alzyood et al., 2024).

1.2. Problem Statement

HAPIs or HAIs remain critical problems for health systems since they lead to more complications for a patient, longer stays in the hospital, and higher treatment expenses. One of the most important preventive measures against the spread of infections is proper hand hygiene. But studies have revealed the health care provider/health care student rate of following recommended hand hygiene practices to be low. There may be some misinformation about how to properly wash hands and about infection control guidelines, which can lead to the spread of microorganisms in the healthcare environment. Hence, it is important to evaluate the knowledge of hand hygiene among a group of nursing students who are involved in care-giving activities (Erasmus et al., 2020).

Nursing students are continually placed in clinical settings where they may come into contact with patients as well as participate in a range of nursing practices, which may inadvertently expose them to the transmission of infections at health care facilities. Assessing. In these activities, poor hand hygiene could result in cross-contamination and possible spread of infection. Some students in nursing education programs don't fully grasp the principles and practices of hand hygiene in clinical settings, despite covering infection prevention in their studies. While the topic of infection prevention is present in nursing curricula, some students still do not have an adequate understanding of hand hygiene principles and its significance in clinical practice. The disparity between theoretical learning and its application in practice exposes the need to assess nursing students' knowledge about hand hygiene (Kingston et al., 2021).

In certain educational environments, low access to training and educational activities, inadequate supervision of students, and inadequate reinforcement of the importance of hand hygiene may influence students' hand hygiene knowledge and adherence to hand hygiene guidelines. Given that not enough people are aware of the importance and need to understand the issue fully, the

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knowledge gaps can help educators detect the education gaps in training and enforce better teaching and learning on the issue of preventing infection (Neo et al., 2022).

Private nursing colleges are importantly involved in preparing basic students to perform their responsibility at future. The knowledge and attitudes towards the measures of infection control may vary from one student to another due to the differences in the teaching materials and facilities, clinical exposure, and institutional policies. Therefore, an assessment of hand hygiene knowledge amongst the nursing students in the private nursing colleges is required for determining their level of preparedness and their capacity that they are ready to follow the standard infection control measures when they enter the clinical setting (Haverstick et al., 2023).

In healthcare units, the spread of infectious diseases is still considered one of the serious public health problems around the world. Hand hygiene is regarded as the most successful measure for preventing the transmission of microorganisms during the care of patients. While several studies reported that undergraduate healthcare students are not very knowledgeable about correct hand hygiene practices or suggested guidelines regarding infection control. One of the critical areas is the deficiency level of nursing students' knowledge about hand hygiene practices in the clinical environment, as it can expose them to the risk of infection in clinical settings, hence the need to evaluate the level of their knowledge (Mathur, 2021).

Nursing students often have to perform clinical activities, including skin care, medicine administration, and patient evaluation, that involve following infection control measures. Any of these procedures without proper hand hygiene will allow microorganisms to easily be spread from patient to patient. Several studies have shown that many nursing students are not consistent with the guidelines recommended for hand hygiene, mostly because of the lack of knowledge and awareness of infection control processes (Mukherjee et al., 2022).

Effective infection control practices within nursing student circles are important for having safe healthcare practices in the future. It is the responsibility of the educational institutions to provide appropriate knowledge and training about hand hygiene. However, if there is inadequate delivery

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and application of the practical training or insufficient follow-up on guidelines, this may have a negative impact on students' application and understanding. Evaluating students' knowledge can be useful to understand if existing educational strategies are working to encourage good hand hygiene behaviors (Roshan et al., 2023).

Students may also get clinical exposure in different healthcare institutes in private nursing colleges, where they get to meet different patients and work with different healthcare professionals. Without sufficient information about hand hygiene, a nursing student may unknowingly spread infection in the health care environment. To this end, assessing their knowledge level is essential to determine their educational needs and enhance training programs on infection control in nursing (Alemayehu et al., 2024).

1.3. Significance:

Using hand hygiene as a tool to reduce hospital healthcare-associated infections (HAIs) is one of the simplest and most effective HA prevention measures. During the clinical portion of their degree, nursing students spend a significant amount of time working in hospitals and are in direct contact with patients, equipment, and body fluids. It is significant to gauge the knowledge of the respondents on correct hand washing techniques as it enables the determination of whether the future nurses have been well prepared in order to reduce the spread of infection in the process of providing care to patients. The knowledge level of these students can also be used as a guideline for further education and training opportunities that can be improved in private nursing colleges (Maraş et al., 2024).

Hand hygiene is known to be one of the most effective ways in preventing the spread of healthcare-associated infections (HAIs) in healthcare environments. Clinical practice is commonly a component of nursing education, giving students opportunities to engage with patients, medical equipment, and the clinical setting. It is essential to measure their awareness of appropriate hand

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hygiene procedures because knowing if they are prepared to carry out infection control measures to keep patients safe from possible infection (Alzyood et al., 2021).

The level of understanding of the nursing students in relation to hand hygiene is important because, if they lack knowledge or do not follow the hand hygiene guidelines properly, it can lead to a risk of cross-infection in hospitals. If nursing students don't know the correct indication for when and how to use hand hygiene, they can inadvertently spread microbes that are infectious. Knowledge gaps can guide educators to carry out targeted training programs for the enhancement of nursing students' knowledge of infection prevention behaviors (Lotfinejad et al., 2021).

The study also has significance for enhancing the safety of patients and the standards of health services. Effective hand hygiene among healthcare staff (including students) is a key tool in the prevention and transmission of pathogens and hospital-acquired infections. If nursing students acquire good knowledge and a positive attitude about hand hygiene during training, they will more likely maintain hand hygiene in their professional way (WHO, 2022)

Moreover, findings from this study could help nursing educators and administrators in private nursing colleges in assessing their effectiveness in students' education on infection control measures. Understand deficiencies in knowledge, which could be addressed in curriculum revision, by adding practical demonstrations, and by improving clinical supervision to better ensure student knowledge and adherence to CDC-recommended hand hygiene practices (CDC, 2023).

1.4. Objectives

1.4.1: To assess the knowledge of nursing students regarding hand hygiene in a private nursing college.

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MATERIALS AND METHODS

3.1 Study Design:

Cross-sectional studies measure the knowledge of hand hygiene among nursing students in private nursing colleges at one point in time via a structured questionnaire/survey. The aim of these studies would be to assess the knowledge, understanding, and acceptable practices when it comes to hand hygiene among students.

3.2. Study Variables:

3.2.1 Independent Variable:

Demographic data of nursing students (age, gender, year of study, previous training in controlling infection, clinical experiences).

3.2.2 Dependent Variables:

The participants' scores on knowledge of hand hygiene.

3.3 Operational Definitions:

Direct measurement of the level of knowledge about hand hygiene among nursing students using a self-administered structured hand hygiene questionnaire according to the WHO hand hygiene guidelines that include correct hand washing technique, five moments of hand hygiene, using alcohol based hand rub, and the principles of infection prevention

3.3.1 Knowledge:

The knowledge of nursing students on hand hygiene will be determined by a structured questionnaire in this research. A score of 0 is the lowest score, while 20 is the highest score. Criteria for scoring are as follows:

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Good Knowledge: 10–20 (score ≥50%)

Poor Knowledge: Less than 10 (score <50%)

3.4. Study Setting:

This study will be carried out in the Mustafa Kamal Institute of Nursing and Medical Sciences, Vehari. It will consist of BS Nursing students, especially those at clinical years where they are exposed to the hospital ward and handling with patients. Questionnaires will be given to collect data in classrooms and in clinical settings to portray practical knowledge of hand hygiene in the clinical environment.

3.5 Study Population:

Of students who have completed clinical rotations, all undergraduate nursing students (3rd /4th /6th /8th semester) of the College of Nursing, Mustafa Kamal Institute of Nursing & Medical Sciences, Vehari (KIMS) are eligible for this certificate program.

3.6 Sampling Technique:

The convenience sampling technique will be used as a non-probability sampling method, and samples will be selected that have the characteristics listed in the inclusion criteria and are available at the time of the sampling. This approach is chosen because it is able to be implemented in the school context.

3.7 Sample Size:

Sample size will be determined based on Slovin's formula for a finite population.

$$n = N / (1 + N(e^2))$$

Where:

N = the total population of BSN students

e = the margin of error (0.05 for a confidence level of 95%)

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Assuming the total population (N) = 140 nursing students from the 3rd,4th,6th & 8th semesters, the sample size will be computed as follows:

$n = 140 / (1 + 140(0.05^2))$

$n = 140 / (1 + 140(0.0025))$

$n = 140 / (1 + 0.35)$

$n = 140 / 1.35$

$n \approx 104$

The sample size will be around 104 students of the 3rd, 4th, 6th & 8th Sems from a nursing college.

3.8 Study Duration:

The research will take four months from the approval of the synopsis to date.

Writing of the tool development and validation: 1 month

Data collection: 1 month

Data analysis and report writing: 2 months

3.8.1 Inclusion Criteria:

Participants will be eligible for inclusion in the study if they meet the following criteria:

- Students enrolled in the BSN Generic programs at KIMS.
- Students who have successfully completed their clinical rotation, ensuring exposure to a clinical setting.
- Students aged between 19 and 27 years at the time of data collection.
- Students who are present during data collection.

3.8.2 Exclusion Criteria:

Participants will be excluded from the study if they meet any of the following conditions:

- Students enrolled in programs other than the BSN Generic program at KIMS.

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- Students who have not yet completed any clinical rotation.
- Students who are below 19 years or above 27 years of age.
- Students who decline to provide informed consent or withdraw their participation at any stage of study.

3.9 Research Tools:

An appropriate tool for assessing hand hygiene knowledge among the students of nursing in KIMS College of Health Sciences comprised a validated self-administered structured questionnaire asking multiple-choice and true/false questions (TCQ) to assess the awareness/mistakes in hand hygiene practices among the nursing students at KIMS College, Veihari. In addition, an observation checklist can be used to observe students' hand washing in the clinical context, which includes: hands washed correctly, using alcohol-based rub, and ensuring the WHO's 5 moments of hand hygiene.

3.10 Data Collection Procedure:

1. Approval from the institutional ethical review board will be obtained
2. Participants will be informed about the study objectives and procedures.
3. Written informed consent will be obtained.
4. Questionnaires will be distributed in class sessions and collected on the same day.
5. Anonymity will be maintained by not collecting identifiable information.
6. Completed questionnaires will be checked for completeness before data entry.

3.11 Data Analysis Plan:

- Data will be entered and analyzed using SPSS version 26.
- Descriptive statistics: frequency, percentage, mean, and standard deviation.

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3.12 Ethical Considerations:

- Ethical approval will be obtained from the Institutional Review Board of [Mustafa Kamal Institute of Nursing and Medical Sciences, Vehari].
- The following ethical principles will be ensured:
- Written informed consent will be obtained from all participants.
- Participation will be voluntary.
- Confidentiality and anonymity will be maintained.
- Participants will be informed they can withdraw at any time without penalty.
- Information about hand hygiene and post-exposure prophylaxis will be provided to all students.

3.12 Validity and Reliability:

A structured questionnaire using the WHO hand hygiene guidelines was used to determine nursing students' knowledge about hand hygiene. Content Validity was established through the review of the questionnaire by the subject matter experts. The content of the items was judged for clarity, clarity of relevance, and appropriateness of the study goals. It was pre-tested with a smaller set of students before data collection to ensure that it did not include any questions that were unclear to students. The internal consistency of the instrument was checked for reliability, and the reliability was found satisfactory (Cronbach's alpha value ≥ 0.70).

CHAPTER 04

RESULTS AND DISCUSSION

This descriptive cross-sectional study was carried out on 104 nursing students of Mustafa Kamal Institute of Nursing and Medical Sciences (KIMS), Vehari, Pakistan. A convenience sampling technique was used to select the participants, who came from the 3rd, 4th, 6th, and 8th semesters. An instrument of a self-administered structured questionnaire, which is based upon the hand

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hygiene guidelines of the WHO, was used to evaluate the level of knowledge about hand hygiene among the undergraduate nursing students. The data was analysed with SPSS version 26. Data is displayed using tables, percentages, and frequencies.

DEMOGRAPHICS

The total number of questionnaires distributed was 104, and 100% of the questionnaires were returned. Most of the respondents were females, as in most of the nursing programs in Pakistan, a large percentage of students are females.

Table 1: Demographic Characteristics of Study Participants

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	22	21.15
	Female	82	78.85
Age (Years)	19–21	48	46.15
	22–24	42	40.38
	25–27	14	13.46
Year of Study	1st Year (3rd Sem)	30	28.85
	2nd Year (4th Sem)	28	26.92
	3rd Year (6th Sem)	25	24.04
	4th Year (8th Sem)	21	20.19
Residence	Urban	58	55.77

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	Rural	46	44.23
Previous HH Training	Yes	67	64.42
	No	37	35.58
Clinical Rotation	Completed	104	100

As is evident from Table 1, females (78.85%) were overrepresented as compared to males (21.15%) in the study, and this phenomenon is common in the enrollment of females in nursing education programs in Pakistan. The majority of students (46.15%) were in the age group of 19-21 years, while 64.42% of the students had prior training in hand hygiene. All the participants were already trained in at least one clinical rotation, which was the inclusion criterion of the study.

KNOWLEDGE REGARDING HAND HYGIENE

This study aimed mainly to evaluate the knowledge of nursing students on hand hygiene. The WHO hand hygiene guidelines were used to frame a true/false and a yes/no-based questionnaire comprising 20 questions. The scores were from 0–20. Students who obtained 10 or more (50%) were considered to have Good Knowledge, and those students with less than 10 (less than 50%) were considered to have Poor Knowledge.

Table 2: Overall Knowledge Level of Participants Regarding Hand Hygiene

Knowledge Level	Score Range	Frequency (n)	Percentage (%)
Good Knowledge	10–20 (≥50%)	81	77.88
Poor Knowledge	<10 (<50%)	23	22.12
Total		104	100

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As indicated in Table 2, a vast majority of participants (77.88%) had good knowledge about hand hygiene. 22.12% of the students were considered to have poor knowledge. The overall knowledge level of the students of Nursing in KIMS College is satisfactory, but some deficiencies are found in some areas.

ITEM-WISE KNOWLEDGE ANALYSIS

The results of an item-by-item analysis of the knowledge questionnaire showed that there were differences in the percentage of correct answers given for the various hand hygiene topics.

Table 3: Item-Wise Knowledge Responses of Participants

No.	Knowledge Item	Correct Response (%)
1	Hand hygiene is the most effective way to prevent HAIs	96.15
2	Alcohol-based hand rub is more effective than soap for routine HH	71.15
3	Hand hygiene before touching a patient	94.23
4	Hand hygiene after touching a patient	95.19
5	Hand hygiene before an aseptic procedure	88.46
6	Hand hygiene after exposure to body fluids	92.31
7	Hand hygiene after touching patient surroundings	82.69
8	WHO recommends Five Moments for Hand Hygiene	86.54

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9	Gloves can replace the need for hand hygiene (False)	74.04
10	Duration for alcohol-based hand rub is 20–30 seconds	68.27
11	Handwashing with soap/water lasts 40–60 seconds	65.38
12	Artificial nails/nail polish affect hand hygiene effectiveness	72.12
13	Hand hygiene reduces microorganism transmission	97.11
14	Soap and water for visibly soiled hands	89.42
15	Students should practice HH even when wearing gloves	91.35
16	Regular HH training improves compliance	93.27
17	Poor hand hygiene is a major cause of HAIs	95.19
18	Hand hygiene before and after every patient contact	90.38
19	Back of the hands and between fingers are included in the technique	84.62
20	Nursing students must follow HH protocols in clinical settings	98.08

As shown in Table 3, students' performance was best when they were asked general conceptual questions. Almost all participants (98.08%) agreed that nursing students are responsible for adhering to adhere to hand hygiene procedure at all times. Likewise, 97.11% were able to correctly answer that hand hygiene helps to reduce the spread of microorganisms. However, there was a significant number of items with technical responses that were much lower. Only 65.38% of the respondents were aware that handwashing should be performed for 40-60 seconds, and 68.27% of respondents

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knew that alcohol-based hand rub should be applied for 40-60 seconds. The findings reflect the technical aspects of hand hygiene knowledge gaps, while maintaining high awareness of overall importance.

KNOWLEDGE BY YEAR OF STUDY

The knowledge scores showed a progressive increase in knowledge as students progressed through their academic program when compared to each other by year of study.

Table 4: Knowledge Level by Year of Study

Year of Study	n	Good Knowledge (%)	Poor Knowledge (%)
1st Year (3rd Semester)	30	60.00	40.00
2nd Year (4th Semester)	28	75.00	25.00
3rd Year (6th Semester)	25	84.00	16.00
4th Year (8th Semester)	21	95.24	4.76

The proportion of good knowledge for the students in the 4th year (8th semester) was the highest (95.24%), and the 1st year (3rd semester) had the lowest proportion (60.00%), as presented in Table 4. As is seen in this pattern, there is a positive association between academia and clinical exposure and hand hygiene knowledge, which aligns with the results of previous studies.

DISCUSSION

This study was conducted to evaluate the knowledge of undergraduate student nurses about hand hygiene in KIMS College, Vehari. The overall results show that most of the students (77.88%) have good knowledge about hand hygiene principles. This is in line with other research carried out in

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comparable environments. Parveen et al. (2024) found that over 90% of nursing students in Pakistan were aware of the importance of hand hygiene as an infection prevention strategy, and almost all had correct information on key principles. The general knowledge found in this study is high, especially in the importance of hand hygiene in preventing HAIs (96.15% correct) and the need to perform hand hygiene before touching patients (94–95% correct) and after touching patients, which shows the effectiveness of the nursing curriculum at KIMS in teaching the base concepts of infection prevention. This is in keeping with the results obtained from the study conducted in Afghanistan, where students of health sciences showed a high overall level of knowledge when there was an adequate integration of the curriculum and their practical experiences (Ejaz et al., 2025). The study did uncover some key technical areas where gaps in knowledge were identified. Just 65.38% of students used the correct duration for handwashing with soap and water (40-60 seconds), and only 68.27% of students used the correct duration for alcohol based hand rub (20-30 seconds). The findings are similar to those of Zhou et al. (2021), who determined that less than 50% of undergraduate student nurses in China were able to accurately describe technical aspects of hand hygiene (alcohol rub duration). Likewise, Paudel et al. (2023) found that 24% of nursing students in Nepal got the wrong answer when asked for the recommended duration for the use of alcohol-based hand rub, which is a widespread lack of knowledge in different settings. The increased knowledge level over the years of study from 60% in the 1st year to 95.24% in the 4th year justifies the importance of clinical experiences and academic knowledge in achieving competency in hand hygiene. This is consistent with the findings of Blomgren et al. (2024), who found that the WHO Hand Hygiene Knowledge Questionnaire scores were significantly higher for the senior nursing students compared to the first-semester students, indicating that hand hygiene knowledge was higher among students with more clinical experience. In line with this, Berhanu et al. (2023) also found that final-year nursing students had significantly higher scores in hand hygiene knowledge assessments than the first-year students in Ethiopia. It is likely important to consider the context of the finding that 64.42% of students had previously received formal hand hygiene training. The gaps

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in knowledge, however, especially in the technical domains, indicate that training programmes could focus more on theoretical awareness than on technique. However, numerous studies have shown that structured educational activities, such as simulation-based sessions, demonstrations, and workshops, lead to long-lasting improvements in knowledge and adherence (Gholizad Gougjehyaran et al., 2025; Purssell & Gould, 2022). The findings highlight the importance of further inclusion of competency-based, more practical hand hygiene training in the nursing program at KIMS. Overall, the knowledge pattern didn't seem to be significantly influenced by the urban-rural divide in residence (55.77% urban vs. 44.23% rural), although a detailed analysis of this variable was not part of the scope of this study. A future study could determine if the background of the residents influences the knowledge and practice of the nurses in hand hygiene who were students from various educational settings. The overall findings of this study are similar to those in multicentre studies. Mohammed et al. (2022) revealed that the correct answers to the hand hygiene knowledge questions were obtained by 68% of nursing students from several countries, being difficult to recognize the correct technique in various clinical situations. The results of the present study lies in the higher range of 77.88% of good knowledge, which may be due to the nursing curriculum targeted during the study and clinical exposure in KIMS. Both studies, however, point to a similar pattern, namely high levels of general awareness and areas of technical deficits.

CHAPTER 05

CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

5.1 Conclusion

The current study was done to evaluate the knowledge of undergraduate nursing students about hand hygiene at Mustafa Kamal Institute of Nursing and Medical Sciences in Vehari, Pakistan. The descriptive cross-sectional study involved a total of 104 nursing students from the 3rd, 4th, 6th, and 8th semesters. Based on the results of this study, it is observed that the majority of the nursing students (77.88%) possessed good knowledge about the principles of hand hygiene. Students were

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very aware of the fundamental importance of hand hygiene in preventing HAI and clearly understood the need to do hand hygiene before contact with patients and after contact with patients. Most of the students had knowledge of the Five Moments for Hand Hygiene framework (86.54%), and almost all students (98.08%) recognized their own role in implementing hand hygiene in the clinical environment. However, there were key areas of technical knowledge gaps. Many students did not have a clear understanding of the recommended length of time for handwashing with soap and water (40-60 seconds) and the recommended length of time for alcohol-based hand rub (20-30 seconds) to apply. These gaps suggest that the nursing students have a good background on the conceptual level in hand hygiene; however, some aspects of the practical knowledge need reinforcement. The study also showed that there was a definite positive correlation between academic progress and knowledge of hand hygiene. 4th year students had significantly higher good knowledge (95.24%) than 1st year students (60.00%), which shows that clinical exposure and progressive nursing education play a significant role in the development of good knowledge on hand hygiene. Findings overall highlight the importance of focused education interventions that are delivered beyond the traditional classroom setting to encompass simulation and competency-based training in hand hygiene. To close the identified knowledge gaps and to enhance the infection prevention outcomes in clinical practice, the integration of WHO-recommended hand hygiene guidelines in clinical training programs will be crucial.

5.2 Recommendations

The following recommendations are made based upon the results of this study:

- The practical hand hygiene teaching sessions and the simulations should be part of the curriculum for nursing educators at KIMS to overcome the technical gaps in the knowledge of hand hygiene, especially about the time and technique of hand washing and the application of alcohol-based hand rub.

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- There should be frequent Workshops or Refresher Training programmes for all students of all academic years, especially for the first-year and second-year students who were found to have comparatively low knowledge.
- Hand washings should be adequately provided in the college and affiliated hospitals, especially in clinical areas, to include alcohol based hand wash, soap dispensers, and disposable towels.
- The clinical supervisor and faculty are positive role models for hand hygiene adherence – role modelling by senior staff has been found to have a significant impact on nursing student adherence to infection control measures.
- Knowledge or competency testing about hand hygiene should be conducted regularly as part of the education program to track student development and learning needs and to ensure that further educational support is provided where needed. WHO hand hygiene guidelines (correct technique and the five moments) should be well displayed in the college and clinical areas as visual reminders and informational posters.
- Future research should consider additional aspects of hand hygiene attitude, including hand hygiene practice, and additional dimensions of hand hygiene knowledge, such as the direct observation of hand hygiene practice, and explore the relationship between knowledge and real clinical compliance.

5.3 Limitations of Study

- This study was conducted in only one private nursing college (KIMS, Vehari) and therefore cannot be generalized to other nursing colleges in Pakistan.
- The study used a self-administered questionnaire, and this could have led to social desirability bias because students might have given answers that they thought they should, rather than what they know.

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- The cross-section design only captures students' knowledge at one moment in time and does not allow for causal inferences or tracking knowledge development over time.
- The study did not measure attitude, practice or actual clinical compliance – three other key factors of effective hand hygiene behavior.
- Access to skill laboratories and practical demonstration facilities may have taken the quality of the technical knowledge of students with special reference to resource-limited institutes like KIMS.

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