RESEARCH
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KNOWLEDGE, ATTITUDES, AND PRACTICES REGARDING THE PREVENTION OF INFECTIONS AMONG NURSING STUDENTS IN THE INTERNSHIP YEAR AT UNIVERSITY OF TABUK

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Abstract
Background
The consequences of nursing students' disregard for infection control protocols affect patients as well as the students themselves. The true level of infection control compliance and understanding among nursing students is not well understood. This study's primary goal was to characterize nursing students' knowledge, attitudes, and practices around infection prevention and control measures in an environment with limited resources. Method: In 2024, a cross-sectional study was conducted by using a self-administered quiz about infection prevention and control guidelines for 160 University of Tabuk internship year students enrolling in a standard undergraduate nursing program. Cronbach's range of 0.65 to 0.94 indicates the validity and reliability of the study questionnaire (content validity index: 0.81). Findings: Of the 160 students in the final cohort, 58.8% were male, and 75.6% of participants were 21 years of age or older. When compared to students who reported having problems with inadequate information, the majority of students (86.9%) had better mean scores (M = 14.7, SD = 2.4) with good knowledge. (M = 7.2, SD = 1.7, P =.001*). Students who reported having problems with bad practice had a lower mean score (M = 36.7, SD = 8.2, P =.001*) than those who scored well, which accounted for the largest percentage of students (60.6%). most participating students (64.4%) had a positive attitude (M = 26.9, SD = 5.5, P =.001*). In light of the study's findings, it is advised that more rigorous kinds of evaluations that concentrate on infection prevention and control be used throughout clinical training, in addition to interactive courses on infection control that encourage critical thinking to be established at the undergraduate level.
Keywords: Standard precautions, Nursing students, Knowledge, Attitudes, Practice, Infection control.

INTRODUCTION

Nosocomial infections, also referred to as healthcare-associated infections (HAIs), are illnesses that people get when they visit or stay in healthcare facilities.(1) Healthcare-associated infections (HAIs) also comprise occupational infections among healthcare workers (HCWs) and students, as well as illnesses that develop after hospital discharge.(2)Strategies for reducing the risk of infection transmission in healthcare settings are provided by infection prevention and control (IPC) organizations, and they should be applied across sectors.(3). Effective IPC procedures across sectors are required because of the high incidence of HAIs, which are particularly prevalent in Africa and Asia(4–8), and because they rank among the top ten dangers to world health(9).

One of the factors contributing to the rise in HAIs and antimicrobial resistance (AMR) in hospitals is the absence of IPC measures.(10) Infections, particularly those that are resistant to drugs, raise morbidity and mortality rates worldwide.(11)Drug-resistant illnesses can also have a detrimental effect on the nation's economy and raise medical expenses.(11) As a result, reducing the harmful socioeconomic and psychological effects of HAIs requires a strong emphasis on prevention and the use of realistic, evidence-based strategies.(4, 1, 12)

During their clinical placement, nursing and healthcare students are more susceptible to infections from blood-borne pathogens and sharp instrument injuries (13). Lack of protective materials for students, inadequate training in high-risk medical operations, and limited practical experience in basic precautions could all contribute to the high risk for students (14). If nursing students disregard recommended infection control procedures, they could become a source of cross-infection (15).

Standard precautions, or SPs, have been created to protect medical staff from disease and halt the spread of infection (16). The core practices of infection control, which include handwashing, donning personal protective equipment (PPE) such gloves, masks, gowns, and eyewear, and handling sharps securely, are carried out by SPs to avoid contact with potentially infected materials (17). The Centers for Disease Control and Prevention [CDC] (2020)(18) state that SPs are the minimal infection prevention practices that should be adopted for all patient care, regardless of the patient's proven or suspected infection status, in every setting where healthcare is offered.

Prior to beginning their first hospital rotation, healthcare students must get the necessary knowledge and proficiency in standard precautions (13). Pre-graduation instruction is essential for encouraging adherence to SPs procedures. Furthermore, a crucial setting for the development of SP knowledge is undergraduate clinical training (19). In order to prevent and manage healthcare-associated infections (HCAIs),

the CDC prioritizes knowledge assessment and adherence to infection control recommendations in addition to staff education and training (16). According to the CDC (2020) (18), all health care workers ought to get training on the fundamental ideas and procedures for stopping the transmission of illnesses. Numerous research have shown that greater compliance with SPs procedures was significantly predicted by having a high degree of SPs knowledge (20, 19). In order to improve educational tactics and, in turn, increase compliance with infection control measures, it is imperative that healthcare students' understanding of infection control be evaluated (21). While maintaining good standards of SPs practice requires knowledge and comprehension of SPs, there are other crucial elements that must also be taken into account and investigated (20).

Few research have focused on nursing students, despite the fact that numerous studies have looked at healthcare personnel' awareness of and adherence to conventional precautions (22, 23, 24). Because they are exposed to hospital practice during their training, students studying health sciences, including internship nursing students, are more likely to get health-associated infections (HAIs). (25) This study evaluated the infection prevention practices, attitudes, and knowledge of University of Tabuk nursing students completing their internship year.

1. Significance of the study:

Healthcare-associated infections (HAIs), or illnesses contracted while receiving medical care, are a major public health concern. This research has the potential to decrease healthcare-associated infections (HAIs), save healthcare costs, and enhance public health outcomes by addressing gaps in nursing students' knowledge, attitudes, and practices related to infection prevention. 851 healthcare-associated infections (HCAIs) were recorded in 5,523 hospitalized patients in Saudi Arabia during a period of 53,025 days, resulting in an average hospital stay of nine days (26).

The findings of the research that are now accessible show that healthcare- associated infections (HAIs) annually harm hundreds of millions of patients worldwide(27) and that despite the underreporting of occupational illnesses, Low- and middle-income countries (LMICs), account for over 90% of all HAIs cases worldwide (28,29,30,31). Each year, healthcare organizations see over 3000,000 healthcare workers suffer from occupational diseases, as reported by the World Health Organization, this alarming statistic highlights the pressing issue of workplace safety in the healthcare field [WHO].

1-2 Aim of the study:

The objective of this research will be to conduct a comprehensive assessment of the level of knowledge, attitudes, and the practices associated with infection control measures among nursing students. Specifically, the focus was on those in their final year of practical training at the University of Tabuk. The study sought to identify gaps in knowledge, evaluate the efficacy of attitudes in promoting best practices, and observes the actual application of these practices in a clinical setting, which is crucial for the development of effective infection prevention strategies within healthcare education and in order to improve students' awareness and raise the level of preventive behaviors such as vaccination.

1-3 Research Question:

What are the levels of knowledge, attitudes, and practices (KAP) regarding infection prevention among nursing students in the intern ship year at the University of Tabuk?

2- Subjective and Method:

2-1 Research design:

Descriptive-across section study was conducted among nursing students at university of tabuk. Convenience sampling technique was used to recruit the student participants in this study.

2-2 Setting of the study:

The study was conducted in the Nursing Department at the University of Tabuk

2-3 Study subjects:

In this study, the target population included a convenience sample composed of all Internship students (160 students) who received training in different hospitals.

Sample Size Estimation

Based on the literature of Cohen's Tables (28), regarding nursing students' adherence to infection control precautions (27) were used to estimate an effect size of 0.15. Consequently, 160 subjects were assessed to be the sample size required to perform the regression analysis with six predictors at ά=0.05 and power=0.80. But in order to account for incomplete questionnaires and attrition, a bigger sample size was taken into consideration.

2-4 Tools of Data Collection:

A semi-structured questionnaire was used to gather information about knowledge, attitudes, and practices related to infection control. The questionnaire was taken from previously published studies (29, 30, 31), and it was further modified to meet the goals of the study and the local context. There were four sections on the data gathering tool. Among them were:

• The questions in Section A asked about the age, gender, years of experience, and educational attainment of the student nurses who participated.

• Section B, which tested nursing students' understanding of infection management through the use of eighteen questionnaires with numerical values to indicate each answer (1= Yes (right answer), 0 = No (incorrect answer). The students' nurses' total knowledge score ranged from 0 (no correct answer) to 18 (all correct answers). A cut-off score of less than or equal to 9 denoted inadequate knowledge, while more than or equal to 9 indicated strong knowledge.

• Section C asked participants about their attitudes toward infection control; the attitude question has a 10-point rating system with a minimum of 10 and a maximum of 50.

The attitude score, which consists of five points Likert Scale: 1 to 5 represents strongly disagree to strongly agree on a specific point scale. Positive attitudes were defined as having a mean score >33 (strongly agree or agree), whilst negative attitudes were defined as having a score between 10 and 33 (strongly disagree, disagree, or neutral).

• Section D, which asked about the practices of student nurses in preventing infections: The practice question is number fourteen, with a possible maximum score of 70 and a minimum score of 14.

The exercise will be graded out of five, with a range of one to five representing never to always. Good practice was defined as having a mean score >42 (answering constantly, most of the

time, or occasionally), whereas poor practice was defined as having a score ≤42 (answering never or +rarely).

• Then, we conducted a pilot study on 10% of students to give the questionnaire more robustness. The results of the pilot study were excluded from the final analysis of the study and applied to enhance the coherence and rationale of the data collection instrument.

• Every scale showed a respectable Cronbach's Alpha, demonstrating that they are legitimate and trustworthy scales. The results demonstrated that the hemodialysis nurses' Cronbach's Alpha for infection prevention practice was.933, their attitudes toward infection control were.922, and their knowledge about the infection control questionnaire was.873.

Ethical consideration: The University's ethics committee granted ethical permission. A cover letter outlining the purpose of the study and participants' rights is attached to the research instruments. Completing the survey signifies consent to take part in the research. Confidentiality and anonymity were guaranteed both during and after the study. The participants were told that their participation in the study is optional and that they are free to leave at any time without facing any repercussions. The researcher did not require any name or other identifying information from them.

The University of Tabuk's head of the nursing faculty granted the researcher permission to carry out the investigation. In which the participants were asked about the prospect of participating in the study through college groups on Facebook, Twitter, and WhatsApp, and the researchers explained the goal of the study.

• After uploading the self-questionnaire to Google Drive, the researcher sent it to the students electronically over WhatsApp. The researcher urged them to complete the questionnaire completely and honestly.

• The researcher made it clear that students' involvement in the study would not have an impact on their evaluation results. Subsequently, the researcher obtained the student nurses' questionnaire. Each participant took about 20 to 30 minutes to complete the questionnaire on the data collecting instrument. A five-point Likert scale was employed to evaluate the students' IPC-related knowledge, attitudes, and practices.

Data processing and analysis:

After personally verifying that the obtained data is complete, it will be entered into EPI-data manager version 4.2.1 and subjected to statistical analysis using SPSS version 23. The normally distributed data were described using descriptive statistics such as proportion, percentage, ratios, frequency distribution, mean, and standard deviation; the skewed data were described using the median and interquartile range.

Results: -

A hundred and sixty nursing students accepted the invitation to take part, making the response percentage one hundred percent. After reliability analysis, the results below provide information on all the data gathered from the updated questionnaire.

Sample Characteristics:

Of the participants in the sample as a whole, 75.6% were older than 21, and 58.8% of the participants were men. The hepatitis B virus vaccine was administered to the majority of participating students (76.9%). Of the students who took part, less than half (40.0%) did not attend any courses on infection prevention and control. Furthermore, 46.9% of the students who took part in the study stated they did not receive any special training.Table (1).

Infection Control Knowledge:

The students' total knowledge scores ranged from 4 to 18, with 13.7 (SD = 3.4) serving as the mean. Only 22 students (13.8%) out of 160 who accepted the invitation to participate received the maximum score of 18. Conversely, just one student (0.6%) received a score of 4, the lowest possible. At the 25th, 50th, and 75th percentiles, the overall students' knowledge score quartiles were 12, 14, and 16, respectively. Student knowledge was categorized as "poor" (13.1%) and "good" (86.9%) based on the overall knowledge scale. The first question, "The virus can cause infection," was answered correctly by the vast majority of students (84.4%). However, 33.8 percent of respondents gave the wrong response to the second question (Market availability of infection vaccine) (Table 2).

Infection Control practice:

The students' total practice scores ranged from 14 to 70, with 46.8 (SD = 11.5) serving as the mean. Just six students (3.8%) out of the 160 who accepted the invitation to participate achieved the maximum score of 70. Conversely, just three students (1.9%) received the lowest possible score of 14. For the 25th, 50th, and 75th percentiles, the quartiles for the overall students' knowledge score were 40, 47, and 54, respectively. The entire practice scale categories categorized student practice as "good" (60.6) and "poor" (39.4%). The fourth, ninth, and thirteenth questions (do you wash your hands after handling contaminated objects in the past 14 days, do you feel that too much worry or anxiety has been made about infection) were satisfactorily answered by the vast majority of students (77.5%). However, the tenth question, "Do you avoid using the elevator in the past 14 days?" had a bad response from 35.6% of respondents (Table 3).

Infection Control attitude:

The students' overall attitude ratings varied from 11 to 50, with a mean of 35.4 (SD = 8.3). Just 8 students (5.0%) out of the 160 who accepted the invitation to participate achieved the maximum score of 50. Conversely, just three students (1.9%) received the lowest possible score of 14. For the 25th, 50th, and 75th percentiles, the quartiles for the overall attitude score of the students were 30, 36, and 41, correspondingly. Students' attitudes were categorized as "unfavorable" (35.6%) and "favorable" (64.4) based on the total attitude scale categories. With regard to the ninth item (Infection patients should be maintained in isolation), the great majority of students (62.5%) expressed a positive attitude. However, (50.0%) felt negatively about the second item, "You think you will probably get illness.(Table 4)."

The majority of students (86.1%) had a good level of knowledge, according to the knowledge scale category, with a higher mean score (M = 14.7, SD = 2.4) than those who reported having problems with low knowledge (M = 7.2, SD = 1.7, P =.001*). Students who reported having problems with bad practice had a lower mean score (M = 36.7, SD = 8.2, P =.001*) than those who scored well, which accounted for the largest percentage of students (60.6%). With a higher mean score (M = 40.0, SD = 5.3) than students who reported having problems with bad practice, the majority of participating

students (64.4%) had a positive attitude (M = 26.9, SD = 5.5, P =.001*) (Table 5).

Table (6): announced that Mean ± SD of practice and attitude scores toward infection control were lowest (39.9 ± 6.1 & 30.0 ± 4.7, respectively) in poor knowledge group compared with highest (47.9 ± 11.8 & 36.1 ± 8.4) in good knowledge group (P = .003* & .001*). The results revealed that knowledge about infection control was associated with increased risk of practice checklist to prevent infection and attitude checklist toward infection control (OR: 6.3, 95% CI: 2.2 - 18.2 & OR: 7.6, 95% CI: 2.6 - 22.3). Also, this table demonstrated that knowledge about infection control had positive correlation and relationship (Coef = .293, R = .814 &Coef = .329, R = .771) with practice and attitude toward infection control.

Table (1): Demographic characteristics of the sample, n = 160Frequencies (Number & percentage).

Characteristic		Frequency (N)	Percentage (%)
Gender	Male	94	58.8
	Female	66	41.3
Age group	20 years and below	39	24.4
	21 years and above	121	75.6
Vaccinated against Hepatitis B	Yes	123	76.9
	No	37	23.1
Do you have any previous course on preventing infection and preventing its spread?	Yes	96	60.0
	No	64	40.0
Have you undergone any specific infection control training?	Yes	85	53.1
	No	75	46.9

Table (2): Percent distribution of correct and incorrect responses of the students for each knowledge question (N = 160):

Knowledge about infection control	Incorrect		Correct	
	N	Percent	N	Percent
1. The virus can cause infection	25	15.6%	135	84.4%
2. Infection vaccine is available in markets	54	33.8%	106	66.3%
3. The first-line of treatment is antibiotics.	45	28.1%	115	71.9%
4. Using face masks and washing hands with soap and water can help prevent the spread of sickness.	28	17.5%	132	82.5%
5. The danger of infection is increased for healthcare personnel	39	24.4%	121	75.6%
6. An infection could be lethal	33	20.6%	127	79.4%
7. The primary clinical signs of infection are fever, cough, sore throats, dyspnea, myalgia, and exhaustion.	32	20.0%	128	80.0%
8. People who are infected frequently experience runny nose, stuffy nose, and sneezing.	44	27.5%	116	72.5%
9. The majority of individuals can recover from the infection with early symptomatic and supportive treatment.	35	21.9%	125	78.1%
10. Patients who are elderly or who have underlying chronic conditions are more likely to die from a serious infection	39	24.4%	121	75.6%
11. The infection would come from eating or coming into contact with wild animals.	45	28.1%	115	71.9%
12. When there is no fever, an infected person cannot spread the virus to others.	49	30.6%	111	69.4%
13. Infection is spread through direct touch and respiratory droplets from an infected individual.	33	20.6%	127	79.4%
14. To stop the illness, regular residents can put on general medical masks.	45	28.1%	115	71.9%
15. There is no need for children and young people to take precautions against the infection.	52	32.5%	108	67.5%
16. People should stay away from crowded areas like train stations and refrain from using public transportation in order to prevent the illness.	37	23.1%	123	76.9%
17. The best approaches to stop the virus from spreading are to treat and isolate those who are afflicted.	27	16.9%	133	83.1%
18. Those who come into contact with an infected person should be isolated in a suitable location right away	30	18.8%	130	81.3%

- Frequencies (Number & percentage).

Table (3): Percent distribution of good and poor responses of the students for each practice question (N = 160):

Practice to prevent infection checklist	Poor		Good	
	N	Percent	N	Percent
1. Have you visited any busy locations?	55	34.4%	105	65.6%
2. Did you leave your house wearing a mask?	41	25.6%	119	74.4%
3. Do you always take off safety gear carefully?	42	26.3%	118	73.8%
4. In the previous 14 days, have you covered your mouth while you coughed or sneezed?	36	22.5%	124	77.5%
5. Have you avoided taking public transit in the last 14 days?	38	23.8%	122	76.3%
6. In the last 14 days, have you washed your hands with soap and water?	44	27.5%	116	72.5%
7. In the last 14 days, have you cleaned your hands right away after sneezing, coughing, or touching your nose?	41	25.6%	119	74.4%
8. Regardless of whether you have experienced symptoms in the last 14 days, do you use a mask?	43	26.9%	117	73.1%
9. In the previous 14 days, have you washed your hands after handling contaminated items?	36	22.5%	124	77.5%
10. Over the last 14 days, have you avoided utilizing the elevator?	57	35.6%	103	64.4%
11. During the previous 14 days, did you ever eat in a row?	37	23.1%	123	76.9%
12. In the last 14 days, have you avoided meeting with more than ten people?	45	28.1%	115	71.9%
13. Do you think that there has been much concern or fear around infection?	36	22.5%	124	77.5%
14. Do you stay at home instead of going to the family quarantine in order to prevent infection?	49	30.6%	111	69.4%

- Frequencies (Number & percentage).

Table (4): Percent distribution of good and poor responses of the students for each attitude question (N = 160):

Attitude toward infection control	Poor		Good	
	N	Percent	N	Percent
1. Do you think that infection will eventually be effectively under control?	77	48.1%	83	51.9%
2. You believe that the illness is likely to strike you.	80	50.0%	80	50.0%
3. You are concerned that a member of your family might become ill.	74	46.3%	86	53.8%
4. You agree to accept isolation in medical institutions if you become infected.	69	43.1%	91	56.9%
5. Frequent hand washing with soap can help prevent the spread of infection.	66	41.3%	94	58.8%
6. Participation in active infection control initiatives at hospitals helps lower the prevalence of infection.	71	44.4%	89	55.6%
7. If there was a vaccine for an infection, I would get it.	67	41.9%	93	58.1%
8. Individuals with infections ought to be segregated	60	37.5%	100	62.5%
9. Patients ought to reveal their exposure	64	40.0%	96	60.0%
10. Medical personnel are prepared to take part in community anti-epidemic initiatives	71	44.4%	89	55.6%

- Frequencies (Number & percentage).

Table (5): Comparison of frequency, percent and mean with SD among knowledge, practice and attitude scales categories, (n = 160):

Infection control checklist		N	Percent	Mean ± SD	P-Value
Knowledge	Poor	21	13.1	7.2 ± 1.7	.001*
	Good	139	86.9	14.7 ± 2.4	
Practice	Poor	63	39.4	36.7 ± 8.2	.001*
	Good	97	60.6	53.1 ± 8.1	
Attitude	unfavorable	57	35.6	26.9 ± 5.3	.001*
	favorable	103	64.4	40.0 ± 5.5	

- Frequencies (Number & percentage).
- Independent-Samples T Test for (Mean ± SD) * Statistically significant difference (P-Value < 0.05).

Table (6): Distribution of studied nurses according to association between knowledge about infection control and attitude toward infection control, n = 160

Variable	Knowledge checklist about infection control					
	Poor knowledge	Good knowledge	P-Value	Odds Ratio (95% CI)	(Correlation - value)	R - value
	Mean ± SD	Mean ± SD				
Practice checklist to prevent infection	39.9 ± 6.1	47.9 ± 11.8	.003*	6.3 (2.2 - 18.2)	.293	.814
Attitude checklist toward infection control	30.0 ± 4.7	36.1 ± 8.4	.001*	7.6 (2.6 - 22.3)	.329	.771

- Independent-Samples T Test for (Mean ± SD) * Statistically significant difference (P-Value < 0.05).
- Chi-Square Test for (odd's ratio).
- Pearson correlation and regression analysis.

Discussion

For healthcare professionals, infection control is an essential part of their work (32). As part of their daily responsibilities, nurses must follow IPC requirements to protect both their patients' and their own health (33). The scant evidence that is available indicates a significant frequency of illnesses linked to healthcare even in the face of these widely accepted guidelines among student nurses (34). Thus, this study's goal was to evaluate participants' knowledge, attitudes, and practices regarding standard and transmission-based precautions.

Merely 1/8 of the students in our study cohort possessed inadequate knowledge, putting their patients, families, and themselves at danger of acquiring and sharing infections. The overall mean score for correctly answered questions by nursing students was relatively high (86.9%) in comparison to other local and international studies. This is in contrast to the 65% reported in a separate study conducted in the Western Cape (35), 40% reported in Nigeria (36) and 59.8% reported in Australia (19).

From an international standpoint, the study's internship participants scored comparatively higher on the knowledge spectrum than students from Australia (19), Italy (21), Namibia (25), and Ghana (38). Our study's overall mean of correctly answered questions was 86.9%; in comparison, Australia's 19%, Italy's 21%, Namibia's 25%, Ghana's 38%, and Namibia's 59.8% were all higher. Overall, the SPs practices of the study sample were good and consistent with previous research on Jordanian registered nurses (RNs) (39, 40) and nursing students (24).

Most of the pupils in our study had received good knowledge grades. But this degree of understanding was turned into a positive outlook or effective behavior. The association between knowledge, attitude, and IPC guidelines practice was reaffirmed by the results, which indicated that attitude was favorably correlated with both knowledge and practice. This was consistent with research findings (41) that showed better practice has been linked to awareness of common precautions.

Conclusion:

The study's findings show that intern nursing students typically have strong knowledge levels. Moreover, as attitudes have been linked to knowledge and practice, nursing educators should take attitudes into account while planning their lessons. was **Infection Prevention & Control (IPC)** only taught as a minor portion of the courses at the various study levels in this environment. Therefore, it is advised that interactive **Infection Prevention & Control (IPC)** courses that encourage critical thinking be developed and put into use at different academic levels. This will support the application of knowledge to practice and help nursing students cultivate good attitudes early in their careers. Moreover, it is recommended to conduct more rigorous evaluations during clinical hours that concentrate on adherence to conventional and transmission-based precautions.

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