Knowledge, environmental factors, and compliance about needle stick injuries among nursing students.

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Abstract: Nursing students are particularly susceptible to occupational needle stick injuries due to limited clinical experience. These injuries may lead to serious and potentially fatal infections with blood-borne pathogens such as hepatitis B virus, hepatitis C virus, or human immunodeficiency virus. So, the purpose of this study was to determine the relationships between knowledge, environmental factors, and the compliance with standard and transmission-based precautions for the prevention of transmission of infectious diseases. A four part, 89 item questionnaires was administered to all students enrolled in first and last clinical courses at baccalaureate nursing. Useable data was collected from 60 nursing students enrolled in first clinical courses and 10 from the last clinical courses. All 70 respondents were females, between the ages of 19 and 25. A total of 200 incidents of needle stick injuries were reported among the 70 student nurses during the time period of their clinical courses. Mean scores of total knowledge percent score for both students from first and last clinical courses did not differ (38.5), but scores for both groups were lower than might be expected for mastery level achievement. Students of the last clinical course have statistically significant higher median compliance percent scores compared to those of the first clinical course (65.2% and 60.6% respectively) and *P*= 0.03. In addition, There is statistically significant correlation between environment and total knowledge percent scores among the student in the first clinical course of as r= - 0.40 and *P* =0.002. Finally, there is statistically significant, good and negative correlation between compliance and environment percent scores among the student in the last clinical course of the 8th level as r= - 0.69 and *P* =0.03. The findings suggest enhanced awareness of occupational safety with handling needle stick injuries in nursing students must be emphasized and integrated into their educational curriculum.
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Key wards: Knowledge, environmental factors, compliance, needle stick injuries and nursing students.

1. Introduction

Needle stick injuries (NSIs) present the single greatest risk to medical personnel, primarily due to accidental exposure to infected blood and body fluids [(1)]. The US Centers for Disease Control and Prevention (CDC) estimates that about 600,000–1,000,000 needle stick injuries occur annually [(2)]. It is further estimated that about half of these needle stick injuries were unreported [(3)]. These injuries may lead to serious and potentially fatal infections with blood-borne pathogens such as hepatitis B virus (HBV), hepatitis C virus (HCV), or human immunodeficiency virus (HIV) [(4,5)].

Nursing students are particularly susceptible to occupational needle stick injuries due to limited clinical experience. Almost 90 % of all the needle stick injuries occurred in nurses of third world countries where there is lack of knowledge, resources and training [(1, 5)]. 2 million Needle stick injuries are reported in health care providers every year. But these are only the reported cases and about 40-70% cases of needle stick injuries are unreported in developing countries [(2,6)]. An European survey of Needle stick injury found that nurses (91%) are the main group among health care providers who are more exposed to needle stick injuries as compared to doctors and phlebotomist[(7)].

It is further estimated that about half to 2/3 of these NSIs were unreported [(8)]. These injuries may lead to serious and potentially fatal infections with blood-borne pathogens. Due to insufficient training, limited practical experience and use of needles for frequent injections, nursing students are particularly susceptible to occupational NSIs, which may result in serious health problems in their vocational work[(9)].

Preclinical nursing students often are prepared for the clinical area with the use of simulations in a learning or skills laboratory before caring for patients. In these settings students practice procedures, learning to apply the principles of asepsis or other common techniques outside of the clinical area. Since nurses are responsible for venipuncture, intravenous fluid administration, intramuscular injections, and other procedures which require the use of needles, these techniques are often performed first in a laboratory setting[(4,9)].

Lack of clinical experience and insufficient attention to personal safety put nursing students at high risk for occupational exposure to blood-borne pathogens through needlestick injuries (NSIs) and sharps injuries (SIs). Nursing is a practical profession, and thus nursing education comprises both classroom teaching and clinical practice. Unlike staff nurses, nursing students "work" in clinical settings only during their clinical placement. But even though nursing students have less experience in clinical settings, they, like staff nurses, are required to perform various types of nursing procedures, such as administration of subcutaneous, intramuscular, and intravenous injection; and handle different types of instruments,

such as syringes with needles and pill cutters[5,10].

When performing these nursing tasks, the only difference between staff nurses and nursing students is in the level of proficiency in the acquisition and development of the necessary skills. According to Benner, staff nurses should be at least at a competent, proficient or even expert level, depending on years of experience. To achieve the competent level, the nurse should be "on the job in the same or similar situation two or three years" [11].

However, nursing students start at the novice level and then move to the next level of advanced beginner. Novices and advanced beginners devote most of their efforts to remembering the rules that they have been taught; consequently, they might not be able to adequately manage their own safety when handling needles while giving injections to patients[11].

A review of the literature found that nursing students are at high risk for NSI and SIs. In France, nursing students even ranked first in the number of formally reported NSIs, surpassing staff nurses and other health care workers in one hospital. [5] In India and Singapore, nursing students ranked third after medical staff and staff nurses. Despite these known risks, however, only a few studies to date have examined the risk for NSIs and SIs in nursing students [12,13]. Most previous studies focused on final-year nursing students in their internship. Nursing students in their internship function almost like staff nurses, and thus would be expected to have similar rates of NSIs and SIs (range, 50.1%-100%) as staff nurses (range, 46%-82%)[14]. There is a lack of research on NSIs in different years of nursing study. So, the purpose of this study was to determine the relationships between knowledge, environmental factors, and the compliance with standard and transmission-based precautions for the prevention of transmission of infectious diseases.

2. Material and Methods

Research design:
The research utilize a correlational research design.

Setting:
The study will be carried out in the college of applied sciences, nursing department, Al Jouf University.

Subjects:
A convenient sample of 60 nursing students in the first clinical course (5th level) and 10 students in the last clinical course (8th level)

Tools:
A four part, 89 item questionnaire was administered to all students enrolled in first and last clinical courses at baccalaureate nursing to gather the necessary data. It divided into the following sections:

Section I: students knowledge (multiple choice questions 1-30)

Section II: The compliance actions

It consisted of a likert-type four point scale of 11 questions, items 31 through 41, designed to measure nursing students' actions concerning the practice of recommended precautions for the prevention of occupational exposure to blood borne pathogens

Section III: Observations of Environmental Risk Factors Section

The observations of environmental risk factors section consisted of a likert-type four point scale of 12 questions, items 42 through 53, designed to measure particular occupational circumstances noticed by students which are relevant to the practice of recommended precautions for the prevention of occupational exposure to bloodborne pathogens

Section IV: Demographic and Institutional Data Section

It is used to collect self-reported demographic and institutional data from nursing students in clinical nursing courses which was used to describe the subjects. Demographic data included information related to age, gender, work experience, type of nursing program, and current clinical course enrollment. Institutional data included information about initial instruction about the prevention of occupational exposure to bloodborne diseases.

Methods

1. The content validity of tool tested by 5 experts in the nursing and surgical field and the necessary modification done.
2. Consent from students to participate in the study obtained.
3. Anonymity& confidentiality assured.

4. A pilot study conducted on 5 students to test the tool for clarity and feasibility and accordingly the necessary modifications were done prior to data collection for the actual study.
5. The data collected and tabulated using appropriate statistical analysis.

3. Results

Table 1: Distribution of nursing students in relation to age, sex and Clinical Course Enrollment.

Table 2: The mean score of total knowledge percent scores among first and last clinical courses in 5th and 8th levels.

Table 3: Only 10 % of last clinical courses students had very good environment. While, 60 % of first clinical courses students had poor environment.

Table 4: Only 20% of last clinical course students had compliance percent scores less than 60% compared to 41.7% of first clinical course students. Moreover, half of last clinical course students had compliance percent scores of good and very good (≥ 65%) compared to less than one quarter (23.3%) of their counterpart. Students of the last clinical course have statistically significant higher median compliance percent scores compared to those of the first clinical course (65.2% and 60.6% respectively) and *P*= 0.03.

Table 5:Compliance is negatively related to the environment and positively related to total knowledge, but these relations are not statistically significant. There is statistically significant, mild and negative correlation between environment and total knowledge percent scores among the student in the first clinical course of the 5th level as r= - 0.40 and *P*=0.002

Table 6: Knowledge is positively related to compliance and negatively related to environment, but these relations are not statistically significant. There is statistically significant, good and negative correlation between compliance and environment percent scores among the student in the last clinical course of the 8th level as r= - 0.69 and *P*=0.03

Table 1: Distribution of nursing students in relation to age, sex and Clinical Course Enrollment:

Item	No	%
Age		
19-22 years	22	31.4
23-25 years	48	68.6
Total	70	100.0
Sex		
Female	70	100.0
Male	0	0.0
Clinical Course Enrollment:		
First course	60	100.0
Intermediate course	0	0.0
Last course	10	100.0

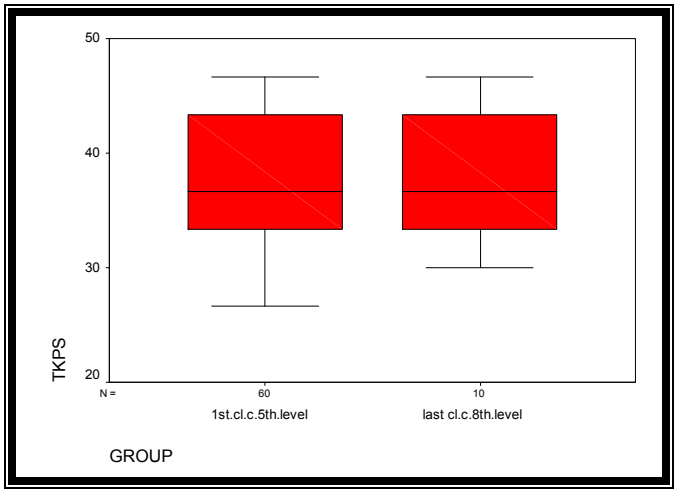

Figure 1: Complex box plot for the values of total knowledge percent scores among first and last clinical course in 5th and 8th levels.

Table 2: Comparison of student distribution according to their knowledge regarding occupational exposure to blood borne pathogens

Knowledge	First	last	Test
Fail	60(100.0)	10(100.0)	
Min. – max. Mean ± SD Median (IQR)	26.7-46.7 38.5±6.6 36.7(10)	30-46.7 38.3±5.7 36.7(10.8)	Z=0.188 P=0.9

Z: Mann-Whitney Test; *P*: For significance

Table 3: Comparison of student distribution according to their environment regarding occupational exposure to blood borne pathogens

Environment	First clinical course students	last clinical courses students	Test
Poor (<60%)	36(60.0)	3(30.0)	
fair (60% -)	8(13.3)	3(30.0)	
Good (65% -)	15(25.0)	3(30.0)	
V. good (75% -)	1(1.7)	1(10.0)	
Min. – max.	38.9-75	52.8-75	
Mean ± SD	58.2±8.9	63.1±6.7	Z=1.523 P=0.1
Median (IQR)	58.3(13.2)	62.5(9.7)	

Z: Mann-Whitney Test; *P*: For significance

Table 4: Comparison of student distribution according to their compliance regarding occupational exposure to blood borne pathogens

Compliance:	First	last	Test
Fail (<60%)	25(41.7)	2(20.0)	
Pass (60% -)	21(35.0)	3(30.0)	
Good (65% -)	12(20.0)	3(30.0)	
V. good (75% -)	2(3.3)	2(20.0)	
Min. – max.	42.4-75.8	51.5-75.8	
Mean ± SD	59.6±7.8	65.5±7.7	Z=2.152* P=0.03
Median (IQR)	60.6(6.1)	65.2(11.4)	

Z: Mann-Whitney Test; *P*: For significance

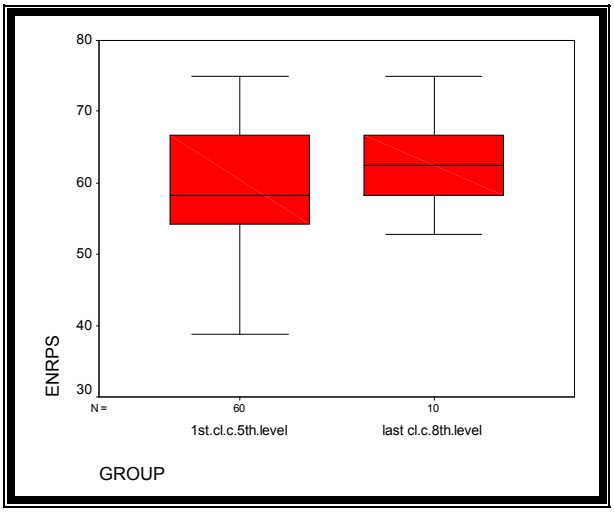

Figure 2: Complex box plot for the values of total environment percent scores among first and last clinical course in 5th and 8th levels.

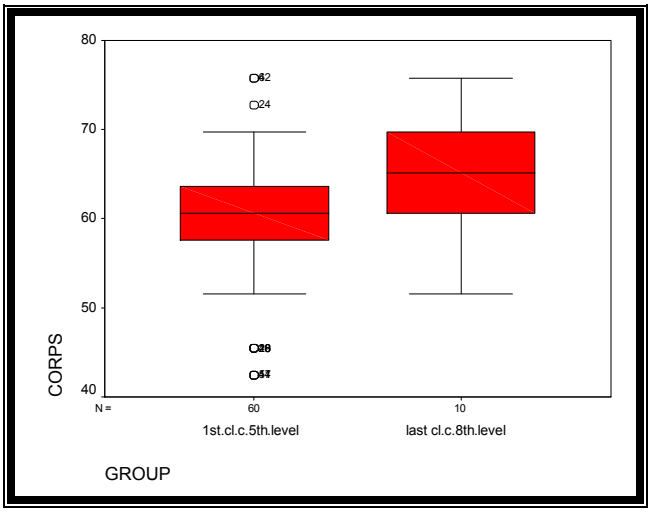

Figure 3: Complex box plot for the values of total compliance percent scores among first and last clinical course in 5th and 8th levels.

Table 5: Spearman's correlation between compliance, environment and knowledge among first clinical course in 5th levels.

	Compliance	Environment
Environment	**r= -0.14** ***P*= 0.3**	
Knowledge	**r= 0.03** ***P*= 0.8**	**r= -0.40*** **P= 0.002**

Table 6: Spearman's correlation between compliance, environment and knowledge among last clinical course in 8th levels.

	Compliance	Environment
Environment	**r= -0.69* P= 0.03**	
Knowledge	**r= 0.24 *P*= 0.5**	**r= -0.37 *P*= 0.3**

4. Discussion

Needle sticks and sharps injuries represent a major occupational hazard in the healthcare industry, with nurses incurring a large proportion of the total burden. Student nurses are also at significant risk from occupationally acquired infections, as many of their NSIs involve devices that have been used on a patient prior to the NSIs [(12)]. Nursing students are exposed to these risks on a daily basis, when administering drugs in the healthcare setting and also when practicing in the clinical skills laboratory [(13)]. Although nurses are a high-risk subgroup for NSIs, nursing students may be at similar or greater risk due to their limited clinical experience [(15)].

Nursing students, in clinical practice in hospitals, are particularly vulnerable to accidental exposures to blood-borne pathogens [(16)]. Their manual skills are underdeveloped, and their clinical experience is limited, but they are eager to learn new procedures. Overall, NSI reporting rates increased significantly between the first year and the third[(15)].

In Turkey, practical nursing experience begins in the first year and culminates in the fourth year with a 4- months nursing practicum at teaching hospitals and other affiliated healthcare services. Throughout this time, students are gradually exposed to more and more needles and sharps activities as their competency improves and their clinical skills develop [(14)].

The results of the present study revealed low mean score of total knowledge percent scores among first and last clinical courses in 5th and 8th levels. Accidental exposure to blood borne diseases through needle stick injuries (NSI) is very common among health care workers. They are more prone to hospital acquired transmission of blood pathogens via contaminated needles [(14)]. Almost 90 % of all the needle stick injuries occurred in nurses of third world countries where there is lack of knowledge, resources and training [(15)]. 2 million Needle stick injuries are reported in health care providers every year. But these are only the reported cases and about 40-70% cases of needle stick injuries are unreported in developing countries [(16)].

The clinical responsibilities of student nurses in the main routine patient care involve, measuring patients basic vital signs (body temperature, pulse, blood pressure and respiration). Nursing students are also expected to administer injections and manage patients with HBV and HCV under adequate supervision. The process of clinical internship can be very stressful to student nurses especially in the areas of personal inadequacy and the fear of making mistakes[(17,18)]. Therefore, aside from the lack of knowledge of the reporting mechanisms, underreporting may be linked to the fear of being considered to have poor clinical skills[(19,20)].

The results of the present study revealed that 60 % of first clinical courses students had poor environment. Nurses' working conditions are inextricably linked to the quality of care that is provided to patients and patients' safety[(21)]. These same working conditions are associated with health and safety outcomes for nurses and other health care providers, and as such, research focused on the health and safety of nurses is critically important[(22)]. Health care workers comprise more than 10% of those employed in the United States (14 million) and their numbers are projected to increase in the future, accounting for 20% of all new jobs. Among this population, 80% are females, and there are a greater percentage of African Americans and Asians in health care work compared to other industry sectors[(23,24)].

The results of the present study revealed that students of the last clinical course have statistically significant higher median compliance percent scores compared to those of the first clinical course (65.2% and 60.6% respectively) and *P*= 0.03. The difficulty of achieving full compliance, even with varied and multidisciplinary approaches, has been well documented [(25)]. However, the nursing profession must strive to improve the current compliance situation.

The results of the present study revealed that knowledge is positively related to compliance and negatively related to environment, but these relations are not statistically significant. There is statistically significant, good and negative correlation between compliance and environment percent scores among the student in the last clinical course of the 8th level as r= - 0.69 and *P*=0.03

Though the serious consequences of noncompliance with standard precautions have been widely disseminated, noncompliance itself remains a problem. A study conducted by Ramsey *et al.* [25] utilized drawn random samples of registered nurses and licensed practical nurses in 1991 and 1993 to determine if compliance rates had increased as a result of the 1992 enactment of mandatory OSHA regulations. Using a 36 item Risk Assessment Scale with three subscales to measure perceived risk and a 16 item questionnaire to measure attitudinal, behavioral, practice setting, and role modeling factors, the investigators found that the 1993 survey showed improved compliance, particularly with known HIV/hepatitis B virus status, yet optimum rates had not been attained. Generalizability was limited by very low response rates, 30% in 1991 and 24% in 1993[26].

Issues surrounding compliance with barrier precautions and safer needle technology have not yet been fully explored. Furthermore, the effect of education and training on future compliance by nurses has not been clearly identified. Since compliance with standard precautions and transmission-based precautions are essential to preventing transmission of bloodborne disease, further exploration of compliance factors is needed[20,22].

The student nurses are performing these clinical responsibilities as an educational pathway for the acquisition of the knowledge and technical competence rather than sharing the registered nurses' clinical workload in a less intensive manner [26]. Compliance with universal precautions by student nurses is far less than acceptable; in particular, behavior associated with the disposal of used needles [27,28].

Recommendations

The findings of this study suggest that nurse educators reconsider current

Curriculum design, course content, and teaching strategies concerning nursing student compliance with standard and transmission-based precautions for the prevention of transmission of infectious diseases. Nursing students in both baccalaureate and associate degree programs possessed inadequate knowledge of items related to needlestick injuries. Reexamination of the curriculum devoted to transmission of infectious disease, as well as nursing interventions for the prevention of transmission of disease by bloodborne pathogens, should be seriously considered.

The importance of the content should be emphasized through the increased use of demonstration, modeling of behaviors, and guided practice. More interaction and small group work and less lecture and video presentations should be considered, if nursing students are to appreciate and integrate into their practice recommended precautions for the prevention of needlestick injuries. Students should have adequate practice of the techniques supported by positive reinforcement of successful application in competency and clinical laboratories.

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