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Original Article

Compliance with standard precautions during clinical training of nursing students in Saudi Arabia: A multi-university study

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Abstract

Introduction: Nursing students are susceptible to healthcare-associated infections because of their direct patient interactions during their clinical training. Hence, compliance with standard precautions (SPs) is paramount during their clinical exposure and training. This study investigated the compliance with SPs and its predictors among Saudi nursing students from six universities.

Methodology: This descriptive, cross-sectional study was conducted in six government universities in Saudi Arabia. A convenience sample of 829 Bachelor of Science in Nursing (BSN) students was surveyed using the Compliance with Standard Precautions Scale. Descriptive and inferential statistics were carried out to analyze the data.

Results: The overall compliance rate of the respondents was 60.1% with a mean score of 12.02 (SD = 4.50). The students reported highest compliance on covering the mouth and nose when wearing a mask, while the lowest compliance was on disposing sharps box before it is full. The university, academic year level, and attendance to infection prevention and control training or seminar in the last six months were identified as significant predictors of the students' compliance with SPs.

Conclusions: The findings provide valuable insights and guidance for improving the practice of SPs among future nurses, which could result in the reduction of infection exposure and its transmission rates among future nurses in clinical settings.

Key words: Baccalaureate nursing; compliance; infection prevention and control; nursing education; Saudi Arabia; standard precautions.

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Introduction

Healthcare-associated infections (HAIs) affect millions of patients around the globe [1]. HAIs pose a risk in developing complications leading to an extended hospital stay, high resistance to pathogenic organisms, high financial healthcare costs for patients and their families, and preventable deaths [2]. In the direction of reducing the HAIs risk, standard precautions (SPs) should be applied to all patients. The WHO reported that SPs is one of the procedures of healthcare professionals (HCPs) that apply the fundamental principle of infection prevention and control (IPC) [3]. However, HCPs compliance with these procedures has been reported to be low [4]. Several factors leading to non-compliance among HCPs were the lack of technical facilities, workload management priorities, lack of time, lack of knowledge and training, and negative influence of equipment on nursing skills [5].

Similarly, nursing students could also be susceptible to HAIs [6]; hence, compliance with SPs is paramount during their clinical exposure and training [7]. Knowledge and social factors had a positive influence on the behaviors of individuals regarding compliance with infection control measures [8]. Some studies have also examined nursing students' compliance with SPs but very little has been written on nursing students' compliance with SPs especially those in the Arab Peninsula [9]. Studies that focus on establishing the factors that influence nursing students' compliance with SPs is also limited but is of considerable importance because nursing students play an essential role in preventing the transmission of

infection in healthcare settings and in mitigating the risks of hospital-acquired infections.

Background of the Study

HAIs are considered one of the most significant complications of modern hospital therapy that affects the quality of patient care [1]. HAIs are related directly to an extended hospital stay, higher resistance to pathogenic organisms, higher financial health care costs for patients and their families, and higher prevalence of preventable deaths [3]. Empirical data show that HAIs occur during healthcare delivery for other diseases and even after the discharge of patients [8]. This occurrence poses threats to the health and safety of patients, family members, HCPs, and healthcare organizations. Millions of patients develop HAIs around the world, and 1.4 million cases have been attributed to hospital infection [10]. In Saudi Arabia, 851 HCAIs were reported among 5,523 hospitalized patients and stayed for 53,025 days, with an average of nine days' hospitalization [11]. Given these facts, healthcare organizations have the responsibility to protect its healthcare staff from occupational hazards and potential injuries. Hence, IPC procedures must be practiced strictly and considered at all times in rendering quality patient care.

The Centers for Disease Control offered a sequence of measures to prevent and reduce the risk of HCPs coming into contact with the infection. SP is one of the procedures utilizing the fundamental standards of infection control (e.g., hand washing, use of appropriate protective equipment barriers, and safe handling of sharps) and protects patients and HCPs from the occurrence of hospital infections [3]. A considerable decline of HAIs through effective IPC interventions has also been observed [1]. Since 2011, many hospitals have obtained a Joint Commission International accreditation, which is considered the gold standard certification in global healthcare [12]. However, despite SPs being carried out for more than a decade in healthcare settings, which has resulted in a considerable decline of HAIs, low compliance rates with SPs among HCPs remains a challenge [5]. For example, a study conducted among 540 HCPs working in 11 units in five hospitals in the United States of America reported an observed adherence of 62.0% [13]. Another study conducted among HCPs in northwest Ethiopia reported a meager percentage (12.0%) of HCPs who always comply with SPs [14].

Previous literature has identified the factors associated with non-compliance to SPs including lack of facilities, time constraints, high employee workload, lack of technical knowledge and education, and lack of specialized equipment in the practice of SPs [5,7]. A recent study in Jordan argued that HPCs' knowledge of IPC measures should be advocated in the clinical settings to improve SPs compliance rate [15].

Nurses are the frontline HCPs who deliver 24 hours direct patient care. Nursing students, the future of the nursing profession, are also often exposed to healthcare facilities through their clinical training. Thus, compliance with SPs must be investigated thoroughly. Previous studies have gained considerable interest both in nursing education and practice on SPs [16,17]. Regardless of healthcare setting or classroom teaching, SPs measure must be applied because they are considered essential for quality care. Nursing students who have reached the end of their formal nursing education program are actively involved in the actual clinical practice setting, which exposes them to the threats of HAIs. They come into contact with patients' blood and other body fluids, which may expose them to infections [18]. This fact is noteworthy because previous studies have shown that nursing students still comply in part with SPs [16,19].

In a qualitative descriptive study conducted among nursing students in South Korea, nursing students were found to be aware of the significance of SPs as being taught in the classroom. However, failure in compliance with established measures in clinical areas can still be observed [7]. Previous studies have obtained substantive findings on the compliance with SPs among baccalaureate nursing students [19,20]. A study among nursing students in the central region of Saudi Arabia reported a compliance rate of 61.0%. The same study reported significant differences in compliance rates, where female students, bridging program students, and third and fourth-year students had significantly higher compliance rate than their counterparts [9]. Nevertheless, limited information is currently available regarding the relationship of nursing students' compliance with SPs in clinical areas [21]. Therefore, instituting a baseline understanding of nursing students' compliance with SPs in clinical areas is essential.

This study assessed the self-reported compliance with SPs and its predictors among nursing students under clinical training in Saudi Arabia.

Methodology

This descriptive, cross-sectional study was part of a larger study conducted in six government universities in Saudi Arabia. University A is located in the Northern region of the country, whereas Universities B and C are in the Central region. Universities D, E, and F are situated in the Western region of the country. The BSN

program of the six universities is a four-year program with an additional one-year intensive clinical internship program after graduation. Students who met the following inclusion criteria were included: (1) Saudi national, (2) enrolled in the regular BSN program in any of the participating universities, (3) registered in the third, and fourth years, and the internship program, and (4) full-time nursing student. Students in the first and second-year levels were excluded because they lacked adequate clinical exposure in training hospitals. Students under the supervision of any of the researchers were also excluded to prevent potential coercion and undue influence. A total population sampling was used in the study. Based on the inclusion criteria, a total of 1,191 students from the six universities were qualified to participate. Using the SurveyMonkey sample size calculator (https://www.surveymonkey.com/mp/sample-size-calculator/), the required sample size was 291 (confidence level = 95%; margin of error = 5%). However, the researchers decided to invite all the students who met the inclusion criteria to ensure adequate sample size. From the 1,191 students, 1,072 students consented to participate and only 829 had completed the questionnaire (response rate = 77.3%). Recruitment of participants was conducted in two ways. First, third and fourth-year students were recruited by the researchers during their break time. Second, the researchers coordinated with the nursing office of each training hospital and acquired the schedules of the nursing interns. The researchers visited the nursing interns during their break time to invite them to participate in the study.

Instrument

Compliance with Standard Precautions Scale was used in this study (CSPS) [20]. The scale assesses the extent to which nursing students comply with SPs. The scale has 20 items, which are responded using a four-point Likert scale (0 = never, 1 = seldom, 2 = sometimes and 3 = always). Items 2, 4, 6, and 15 were negatively stated. Thus, scores need to be reversed before computations. A score of 1 was given to an "always" response, while 0 for the other responses, giving a total possible range score of 0 to 20. Higher scores signify better compliance with SPs. Compliance rates (CR) were also calculated (average compliance with the 20 items in percentage) [22,23]. Healthcare workers are expected to comply with IPC guidelines fully; hence, a compliance rate near 100% is desired [22]. For this study, the Arabic version of the CSPS (CSPS-A) by Cruz et al. was used [24]. The CSPS-A exhibited good internal and stability reliability (Cronbach's α, 0.89; Intraclass correlation coefficient, 0.88; Item-total correlation, 0.325 to 0.728) as well as acceptable content and construct validity [24].

A demographic information sheet elicited data on the respondent's age, gender, year of study (third year, fourth year, or nursing interns), and attendance to IPC seminar or training in the last six months.

Ethical Consideration

This study was part of a study protocol reviewed and approved by the Institutional Review Board of King Saud University, College of Medicine (Project no.: E-17-2559). Administrative approval was also sought from each participating university. Adequate information on the study, including its significance, voluntary participation, benefits and risks of participation, and the expected involvement of the respondents, were discussed thoroughly with the respondents. The confidentiality of the respondents was also protected throughout the study period. Informed consent was obtained from the respondents before they were asked to answer the questionnaire.

Data Collection

Data collection was conducted from October 2017 to January 2018. For third and fourth year nursing students, the researchers coordinated with their instructors to take at least 15 minutes to 20 minutes at the end of their lectures. After the instructors left the classroom, the researchers provided adequate information on the study and provided sufficient time for questions. The researchers distributed the informed consent, and those who signed the informed consent were given the questionnaire. Ample time was also provided for the respondents to answer the questionnaire. For nursing interns, the researchers visited them during their breaks in the hospital to distribute the questionnaire. The nursing interns were given adequate time to complete the questionnaire and were asked to submit the questionnaire to the researchers after they completed it.

Statistical Analysis

All statistical analyses were performed using SPSS version 22.0. The characteristics of the respondents were expressed through frequency count, percentages, mean and standard deviation. Frequency count and percentage were also conducted to identify the compliance rate of the respondents. Mean, and standard deviation were calculated to describe further the compliance with SPs. One-way analysis of variance

with *post-hoc* Tukey HSD test, *t*-test for two independent samples, and Pearson's product moment correlations were computed to examine the association between the respondents' demographic characteristics and compliance with SPs. A standard multiple linear regression analysis was also performed to identify the significant demographic predictors of the students' compliance.

Results

Table 1 presents the demographic characteristics of the respondents. The mean age of the respondents was 22.26 (SD = 2.69). Majority of the respondents were females (69.5%) and had not attended IPC training or seminar in the last six months (67.9%). The largest percentage of the respondents was studying in University A (30.6%), whereas the lowest percentage of students was from University E (7.6%). Approximately 36.4%, 34.0%, and 29.6% of the respondents were in their junior, senior, and internship years of the BSN program, respectively.

Compliance with Standard Precautions

The overall compliance rate of the respondents was 60.1% with a mean score of 12.02 (SD = 4.50). The students reported the highest compliance on item 14 "My mouth and nose are covered when I wear a mask" (CR = 81.8%), while the lowest compliance was on item 6 "Disposing sharps box before it is full" (CR = 7.0% as shown in Table 2).

Association between the Students' Demographic Characteristics and Compliance with Standard Precautions

Table 3 shows that the compliance with SP was differed significantly between universities ($F = 44.30$, $p < 0.001$). Students from University B reported significantly lower compliance as compared with students from other five universities. Students from University C reported higher compliance with SP than students from University A, University B, and University E. Female nursing students (CR = 62.8%) reported significantly higher compliance rate than male nursing students (CR = 53.9%, $t = 4.89$, $p < 0.001$). Moreover, differences on compliance were identified between the years of study ($F = 19.80$, $p < 0.001$). Students in their internship year (CR = 52.7%) exhibited poorer compliance with SP as compared with junior (CR = 63.8%, $p < 0.001$) and senior (CR = 62.5%, $p < 0.001$) students.

Predictors of the Nursing Students' Compliance with Standard Precautions

The demographic characteristics of the respondents were entered into a regression analysis to predict compliance with SP. The regression model was statistically significant ($F(10, 818) = 26.88$, $p < 0.001$), accounting for approximately 23.8% variance in students' compliance ($R^2 = 0.247$; Adjusted $R^2 = 0.238$).

Table 1. Demographic characteristics of the respondents (n = 829).

Variable	Mean	SD
Age[a]	22.26	2.69
	n	**%**
University		
University A	254	30.6
University B	144	17.4
University C	120	14.5
University D	94	11.3
University E	63	7.6
University F	154	18.6
Gender		
Female	576	69.5
Male	253	30.5
Academic level		
Junior year	302	36.4
Senior year	282	34.0
Internship year	245	29.6
Attendance to infection control and prevention training/seminar in the last 6 months		
No	563	67.9
Yes	266	32.1

[a]Range = 19-40 years.

Table 2. Compliance with standard precautions among the respondents (n = 829).

No.	Item statement	Mean compliance rate (%)
14	My mouth and nose are covered when I wear a mask	81.8
5	I put used sharp articles into sharps boxes	79.1
11	I change gloves between each patient contact	78.9
10	I wear gloves when I am exposed to body fluids, blood products, and any excretion of patients	77.9
20	I clean up spillage of blood or other body fluid immediately with disinfectants	77.6
1	I wash my hands between patient contacts	73.2
12	I decontaminate my hands immediately after removal of gloves	72.7
19	I wear gloves to decontaminate used equipment with visible soils	72.5
16	I wear a gown or apron when exposed to blood, body fluids, or any patient excretions	70.3
7	I remove PPE in a designated area	61.0
17	Waste contaminated with blood, body fluids, secretion, and excretion are placed in red plastic bags irrespective of patient's infective status	60.2
18	I decontaminate surfaces and equipment after use	60.1
13	I wear a surgical mask alone or in combination with goggles, face shield, and apron whenever there is a possibility of a splash or splatter	57.4
9	I cover my wound(s) or lesion(s) with waterproof dressing before patient contacts	55.4
15	I reuse surgical mask or disposable PPE[a]	53.3
8	I take a shower in case of extensive splashing even after I have put on PPE	49.7
3	I use alcohol hand rubs as an alternative if my hands are not visibly soiled	43.7
4	I recap used needles after giving an injection[a]	38.1
2	I only use water for hand washing[a]	33.9
6	The sharps box is only disposed when it is full[a]	7.0
	Overall compliance rate	60.1

Scale items were arranged from the highest to lowest compliance rate; [a]Reverse scored items.

Table 3. Associations between nursing students' demographics and compliance with standard precautions (n = 829).

Variables	Compliance rate (%)	Statistical test	*p*
Age		$r = -0.03$	0.366
University[a]			
University A	61.8	$F = 44.30$	< 0.001***
University B	39.4		
University C	70.0		
University D	68.5		
University E	54.0		
University F	66.3		
Gender			
Female	62.8	$t = 4.89$	< 0.001***
Male	53.9		
Academic level[b]			
Junior year	63.8	$F = 19.80$	< 0.001***
Senior year	62.5		
Internship year	52.7		
Attendance to infection control and prevention training/seminar in the last 6 months			
No	59.2	$t = -1.73$	0.085
Yes	62.0		

***Significant at 0.001 level.

Table 4 reveals the university, academic year level, and attendance to IPC training or seminar in the last six months, which were identified as significant predictors of the students' compliance with SPs after controlling other variables as constant. Specifically, students from University B reported lower compliance than students from University A (ß = 23.12, $p < .001$, 95% CI = 18.74, 27.50), University C (ß = 27.06, $p < 0.001$, 95% CI = 21.81, 32.31), University D (ß = 24.76, $p < 0.001$, 95% CI = 19.09, 30.43), University E (ß = 13.20, $p < 0.001$, 95% CI = 7.18, 19.22), and University F(ß = 24.58, $p < 0.001$, 95% CI = 19.67, 29.48). Moreover, students in their internship year reported poorer compliance than junior (ß = 9.03, $p < 0.001$, 95% CI = 5.24, 12.82) and senior students (ß = 7.78, $p < 0.001$, 95% CI = 4.18, 11.39). Finally, students who attended IPC training or seminar in the last six months exhibited better compliance with SPs as compared with the students who do not have similar experience (ß = 4.09, $p = 0.003$, 95% CI = 1.72, 8.08).

Discussion

This study assessed the self-reported compliance with SPs and the factors influencing it among nursing students under clinical training.

The findings highlighted students' self-reported compliance with SPs. Results show the overall compliance rate of the students was moderate, which was similar to the results found in another study conducted among Saudi nursing students using a similar tool [24]. In this study, Saudi students have attained relatively higher scores on SPs compliance compared to Australian nursing students (59.8%) [25], but lower than students from Ghana (61.3%) [26], Italy (74.2%) [27], and Jordan (79.9%) [28]. This finding may be because each country has a different curricular content on infection control [29]. Different curriculum on SPs means different teaching approaches, views, and perceptions of students.

Findings showed nursing students have diverse results in high and low compliance rates SPs. For instance, they reported the highest compliance in covering the nose and mouth when wearing a mask. This finding is worth noting because nursing students are usually exposed to occupational biologic hazards [6]. Susceptibility to a dreaded infection during patient care is high if no protective measures were established. Therefore, wearing a mask is a preventive measure during patient care with unknown infection status. Findings also reported the lowest compliance in the disposal of sharps box before it is full. This result is lower than that in staff nurses in Brazil and Hong Kong [30].

Moreover, a previous study among Saudi nursing students also reported poor compliance (54.2%) in this area of SPs; however, the present finding showed even poorer compliance [9]. Poor compliance in this area of SPs among nursing students could be due to nursing students having different levels of clinical experience as compared with nurses. Students might have also viewed this aspect of SPs as being beyond their responsibilities as nursing students, and that they might have thought this practice was more of a responsibility of the staff nurses. However, this assumption should be verified through further investigation.

This study found the university was associated significantly with and a predictor of the compliance with SPs among nursing students. Nursing students in

Table 4. Factors influencing the compliance with standard precautions among nursing students (n = 829).

Predictor variables	B	SE-*b*	Beta	*t*	*p*	95% CI	
						Lower	Upper
Age	-0.21	0.30	-0.03	-0.69	0.492	-0.80	0.39
University (Reference group: University B)							
University A	23.12	2.23	0.47	10.36	< 0.001***	18.74	27.50
University C	27.06	2.67	0.42	10.12	< 0.001***	21.81	32.31
University D	24.76	2.89	0.35	8.57	< 0.001***	19.09	30.43
University E	13.20	3.07	0.16	4.31	< 0.001***	7.18	19.22
University F	24.58	2.50	0.43	9.84	< 0.001***	19.67	29.48
Gender	-3.39	1.89	-0.07	-1.80	0.073	-7.09	0.31
Academic level (Reference group: Internship year)							
Junior year	9.03	1.93	0.19	4.68	< 0.001***	5.24	12.82
Senior year	7.78	1.84	0.16	4.24	< 0.001***	4.18	11.39
Attendance to infection control and prevention training/seminar in the last 6 months	4.90	1.62	0.10	3.02	0.003**	1.72	8.08

Compliance with standard precautions was the dependent variable. B is the unstandardized coefficients; SE-b is the Standard error; **Significant at .01 level, ***Significant at .001 level; $R^2 = 0.247$; Adjusted $R^2 = 0.238$.

University C had better compliance compared with students in University A, University B, University D, University E, and University F. This finding indicates the different approaches of different universities on implementing infection control education and policies. Nevertheless, the majority of the universities from the study had suboptimal compliance with SPs. Nursing education in Saudi Arabia still faces the challenge of delivering public health education, such as inadequate curricular contents particularly in caring for patients with communicable diseases [31]. The country is still in the process of improving its undergraduate nursing education, which requires a robust curricular re-structuring to prepare future nurses to meet the global demands of health care needs [32]. Similar suboptimal results have also been observed in other countries regarding SPs course and concept teaching. For instance, lack of infection control courses was noted in Chinese nursing education [29]. Similarly, the absence of a national standard plan for SPs practice and poor practical short-term courses in undergraduate nursing curricula courses programs were observed in Italy [27]. Moreover, the absence of a special course on infection control issues in the nursing curricula was also reported in Jordanian universities [28].

This study revealed female students were more compliant to SPs as compared with males. A similar study among health-related students in Saudi Arabia found that females scored higher means of SP knowledge and compliance as compared with males [33]. Other previous findings suggested the use of PPE had an adverse effect on male nurses' status [34]. In previous surveys, male nurses tended to avoid nursing procedures in the ward that included the use of PPE [35]. However, a study conducted among nurses in Cyprus negated these findings and instead showed female respondents described the use of PPEs in SPs as uncomfortable. Female nurses argued that time constraints hinder the implementation of SPs [5]. Hence, future empirical studies focusing on studying the gender differences in compliance with SPs is justified.

This study found that nursing students' academic level is associated significantly with and a predictor of the compliance with SPs. Nursing interns reflected significantly lower compliance with SPs as compared with junior and senior students. This finding indicates compliance with SPs among nursing students tend to decline as they advance in the nursing program. This finding can be attributed to the fact that the Fundamentals of Nursing course, which contains the concept of IPC, is imparted during the earlier years of the program [32]. This earlier year focused on the fundamentals of nursing theory and concepts in the classroom setting and is strengthened by practical courses by demonstrating nursing procedures. This finding coincides with the claim that comprehensive learning outcome in SPs begins during the second and third years of the BSN program in Jordan and Hong Kong [28,36]. Students at this stage are expected to develop good quality skills in SPs by being engaged in classroom and clinical settings. University clinical instructors also guide students while interns are assisted by nursing staff during their internship [37]. However, because of the heavy workload, organizational working condition climate, and autonomy, nursing staff often neglect to supervise nursing interns, giving rise to the possibility of non-compliance [38]. Nursing staff serves as models and superiors of the interns, and they tend to see and acquire the wrong practices of nursing staff [39]. Students may be puzzled between the ideal standards and real-life clinical situations. This gap often leaves them in confusion or uncertainty, which may affect their non-compliance. Hence, continuous reinforcement of SPs behaviors encountered frequently in the clinical setting should be practiced at all times.

The present study reported that attendance to IPC training or seminar was a predictor of the students' compliance with SPs. This result is consistent with previous literature, thereby suggesting that individuals with proper training in infection control are more compliant [22]. Other empirical data indicate compliance rate of students significantly increased after education seminar-workshop [40,41]. Hence, this study underscores the importance of integrating seminars/training on IPC for nursing students in the nursing curricula.

Some limitations should be acknowledged and considered when utilizing the findings of this study. First, the self-report nature may have introduced some degree of bias, such as social desirability bias and recall bias. Second, the study only used an SPs compliance survey and over, or under-reporting of one or more components of the SPs is highly possible. Studies observing the practices of SPs directly are also recommended for comparisons. Finally, the study used a cross-sectional design, which can limit the cause and effect inferences.

Conclusion

This study highlighted the compliance with SPs practices among Saudi nursing students. Nursing students exhibited an overall moderate level of compliance. The type of university, academic year, and

seminar or training attended were predictors of the students' SP compliance. The findings also provide valuable insights and guidance for improving the practice of SPs among future nurses, which could result in the reduction of infection exposure and its transmission rates among future nurses in clinical settings.

Nursing students also have essential roles to play in preventing the transmission of infection in healthcare settings and in mitigating the risk of hospital-acquired infections. This study highlighted the SPs compliance and its predictors among nursing students. Several recommendations can be drawn from the study findings. Healthcare facilities and academic institutions could establish evidence-based SPs policies for successful SPs compliance. Lower SPs can be improved by disseminating protocols to eliminate barriers in the implementation of infection control practice. A comprehensive supporting program is also recommended for the effective and efficient implementation of SPs. The program must be anchored on materials focusing on the SPs constructs presented in a manner that will be understood at all academic levels regardless of the factors influencing them. The active role modeling of clinical instructors of SPs should be emphasized to ensure learning takes place at all levels of the nursing program. Finally, the findings of the study may inform the creation of educational material for the undergraduate nursing curriculum to continually improve the knowledge and skills of nursing students regarding IPC practices and to bridge the gap between theory and practice.

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