



# Compliance with standard precautions among baccalaureate nursing students in a Saudi university: A self-report study

Paolo C. Colet<sup>a</sup>, Jonas Preposi Cruz<sup>a,\*</sup>,  
Khalaf Aied Alotaibi<sup>a</sup>, Maverick Kaypee A. Colet<sup>b</sup>,  
Sheikh Mohammed Shariful Islam<sup>c,d,e,f</sup>

<sup>a</sup> Nursing Department, College of Applied Medical Sciences, Shaqra University, Saudi Arabia

<sup>b</sup> College of Physical and Respiratory Therapy, Lorma Colleges, Philippines

<sup>c</sup> Non-Communicable Diseases Initiative, International Center for Diarrhoeal Diseases Research, Bangladesh (icddr,b), Bangladesh

<sup>d</sup> Diabetes Research, University of Munich, Germany

<sup>e</sup> NCD, Bangladesh University of Health Science Postdoc Research, Bangladesh

<sup>f</sup> The George Institute for Global Health, University of Sydney, Australia

Received 23 March 2016; received in revised form 23 May 2016; accepted 24 June 2016

## KEYWORDS

Baccalaureate nursing;  
Compliance with  
Standard Precautions  
Scale;  
Nursing students;  
Saudi Arabia;  
Standard precaution

**Summary** Meticulous observance of standard infection control precautions by health care providers is strongly recommended for every patient encounter. Assessment of nursing students' compliance should be carried out regularly in order to ensure adherence to protocols. Thus, this study was conducted to assess self-reported compliance with standard precautions among baccalaureates in nursing students in a Saudi university. A convenience sample of 236 nursing students was surveyed in this cross-sectional, self-reported study, using the Compliance with Standard Precaution Scale Arabic version (CSPS-A). Independent *t*-test and one-way analyses of variance (ANOVA) were performed to examine the differences on compliance. A multiple regression analysis was performed to identify the factors affecting compliance. The overall compliance rate was 61.0%. The students reported highest compliance in disposing used sharp instruments and other sharp objects into sharps-only boxes, while the lowest compliance rate in using water only for hand washing. Significant differences in compliance were observed when respondents were grouped according to their demographic characteristics. Cultivating a supportive culture of

\* Corresponding author at: Nursing Department, College of Applied Medical Sciences, Shaqra University, PO Box 1678, Dawadmi, 11911, Saudi Arabia. Tel.: +966 506521179.

E-mail addresses: [cruzjprn@gmail.com](mailto:cruzjprn@gmail.com), [cruzjpc@su.edu.sa](mailto:cruzjpc@su.edu.sa) (J.P. Cruz).

<http://dx.doi.org/10.1016/j.jiph.2016.06.005>

1876-0341/© 2016 King Saud Bin Abdulaziz University for Health Sciences. Published by Elsevier Limited. All rights reserved.

adherence to infection control precautions among nursing students is of paramount importance. The clinical environment should be supportive of a culture where strict compliance with the control and prevention of infection is of prime importance.  
© 2016 King Saud Bin Abdulaziz University for Health Sciences. Published by Elsevier Limited. All rights reserved.

## Introduction

Healthcare professionals continue to deal with the challenges of increasing incidence and emergence of infectious diseases around the globe. Health care-associated infections (HAIs) affect hundreds of millions of patients each year, with 7 in developed and 10 in developing countries acquire at least one HAI in every 100 hospitalized patients at any given time [1]. In the United States of America, the estimated incidence rate was 4.5% in 2002, corresponding to 9.3 infections per 1000 patient-days. In Saudi Arabia, a similar situation is observed with HAIs, with an incidence rate of between 2 and 13.7 per 1000 patient days in the period 2010–2012, and a case fatality rate of 2.3–14.4% [2–4]. Despite the advancement in infection prevention and control in health care facilities, poor adherence to practices continues to be linked with HAIs [5]. Healthcare workers, most specifically nurses, have the greatest risk of causing cross-infection among patients and fellow healthcare workers, because of their high visibility and their direct interaction with patients while performing their nursing activities [6–8]. This may be occurring if infection control procedures are ineffectively implemented.

Many initiatives, including standard precautions, have been set up to implement evidence-based interventions with the aim of reducing HAIs [9]. Meticulous observance of standard infection control precautions by health care providers is strongly recommended for every patient encounter [10]. However, adherence to standard precautions was practiced inconsistently in various studies [11–13]. Specifically, compliance was reportedly lower among younger and less clinically experienced healthcare professionals [14,15]. In a previous study conducted among medical students in Saudi Arabia using a questionnaire developed by the researchers, the overall knowledge scores for standard precautions were low with mean score of  $19.3 \pm 9.1$  out of 41 points (where 24 out of 41 points considered as knowledgeable), especially in the domains of hand hygiene, management of sharp objects, and personal protective equipment [16]. Another study conducted among Taiwanese nursing

students reported that practice of proper infection prevention and control was quite inadequate [10]. Moreover, various studies have also revealed the significant deficit in knowledge of, and compliance with, the components of infection control among nursing students [10,17–21].

Ensuring strict compliance with standard precautions by all healthcare workers, including nursing students, is with utmost importance in preventing occurrences of HAIs, and upholding patients' safety in hospitals [22,23]. However, despite the abundance of studies conducted on this topic in other parts of the world [24–26], such studies are quite limited in Saudi Arabia. A comprehensive assessment on compliance with standard precautions among Saudi nursing students is warranted. Thus, this study was conducted to assess the self-reported compliance with standard precautions among baccalaureate nursing students in a Saudi university. It also examined factors that likely influenced their level of compliance.

## Methods

### Design

A descriptive, cross-sectional, self-report design was used in this study in assessing the self-reported compliance with standard precautions among baccalaureate nursing students in a Saudi university. The design facilitated the data collection from a sample of Saudi nursing students in a single contact period using a self-administered questionnaire.

### Setting and participants

The study was conducted in the nursing department of the College of Applied Medical Sciences of a university situated in Riyadh province, Saudi Arabia. A convenience sample of 236 Bachelor of Science in Nursing (BSN) students participated in this study during the second semester of the academic year 2015–2016. A priori power analysis was conducted using the software, GPower version 3.1 [27]. Because no previous study explored

the compliance with standard precautions and factors affecting it among Saudi nursing students, the study adopted a medium effect size (0.15) for multiple regression analysis. A sample size of 107 was required to generate a power of 0.95; thus, the actual sample size was more than adequate for this study. The inclusion criteria were as follows: (1) enrolled in regular or bridge programs (diploma to BSN program) of the BSN, (2) registered in the 2nd–4th year of the program, and (3) enrolled in courses with clinical placement.

## Instrument

A two-part self-administered questionnaire was utilized to collect for this study. Part 1 was the respondent's demographic sheet, which was tailored to collect data on the age, gender, marital status, stream of study, year in the program, clinical exposure and attendance to infection control seminars.

Part 2 was the 20-item Compliance with Standard Precautions Scale (CSPS) by Lam [23]. This was used to assess the extent of compliance with standard precautions among nursing students. The questions in the CSPS asked about compliance with the use of personal protective equipment (PPE), disposal of sharp objects and other biological wastes, decontamination of spills and used articles, and prevention of cross-infection. The response set was a 4-point Likert scale, which consisted of responses such as "never", "seldom", "sometimes" and "always". As recommended by the developer of the scale, a score of 1 was interpreted as an "always" response, while 0 was for the other responses. A total range score of 0–20 is expected, with higher scores signifying better compliance with standard precautions. In addition, compliance rates can also be calculated (average compliance with the 20 items in percentage). Items 2, 4, 6 and 15 were negatively stated, thus, scores were reversed before computations [28,29]. The CSPS was culturally adapted to Arabic language and psychometrically tested in a sample of Saudi nursing students in a previous study by Cruz et al. [23]. The CSPS Arabic version (CSPS-A) was used in this study. The findings of the psychometric evaluation of the CSPS-A exhibited good internal and stability reliability (Cronbach's  $\alpha$ , 0.89; Intraclass correlation coefficient, 0.88; Item-total correlation, 0.325–0.728) as well as acceptable content and construct validity [23]. The original version of the tool had good reliability with a Cronbach's alpha of 0.73 and intraclass correlation coefficient (ICC) of 0.79 and 0.74 for the 2-week and 3-month test–retest, respectively. It also demonstrated

satisfactory concurrent and construct validity as reported in previous studies [28,29].

## Ethical consideration

Before beginning this study, permission to use the CSPS-A was obtained (CA400N06-201603) from the copyright holder. Approval from the research committee and the dean of the College of Applied Medical Sciences of the university were secured. Coordination with the college for women was done through the head of the nursing department. The respondents were informed that participation was voluntary and that they can refuse participation without any consequences in their part. Confidentiality of the respondents was assured by instructing them not to write their names or anything that would identify them in any part of the questionnaire. Informed consent was obtained from each respondent before they were included in the study. No reward for participation was offered to the respondents.

## Data collection

Collection of data was performed in the first hour of either the morning or afternoon classes of the respondents from December 2015 to January 2016. The first and second authors undertook the collection of data from the male respondents, while a trained female research assistant undertook the collection of data from the female respondents. The students were given the necessary information and instructions on how to complete the survey form by the first and second authors for the male students and by the female research assistant for the female students. A similar script of the information and instructions was prepared and read to the students before they were handed the questionnaires. They were given 10–15 min to answer the questionnaire, and then return them to the researchers. Filled in questionnaires from the female respondents were collected from the research assistant at the end of each week.

## Data treatment

Data analyses were performed using statistical software, SPSS version 22.0. The characteristics of the respondents were expressed by frequency count percentages. Artificial dichotomies were developed for responses in each item in the CSPS-A (1 = always and 0 = sometimes, seldom, and never). Compliance rates were calculated from the average compliance with the 20 items of the CSPS-A in percentages. Independent *t*-test and one-way

analyses of variance (ANOVA) were performed to examine the differences on compliance. When the ANOVA test revealed significant difference, Tukey HSD test was performed. A multiple regression analysis was performed to identify the factors affecting compliance. Categorical predictor variables with more than two levels were coded before they were entered in the regression analysis. A correlation analysis was done to measure the strength of relationship between a significant predictor of the compliance with standard precautions. All analyses were set at 0.05 level of significance.

## Results

Among the 250 nursing students recruited in this study, only 236 were returned, thus leading to a response rate of 94%. The majority were females (61.0%), single (79.7%), enrolled in the regular BSN program (65.3%), registered in the final year of the program (53.4%), and had attended training or seminars regarding infection control in the last 12 months (88.1%). The mean age of the respondents was  $25.79 \pm 5.55$  years (see Table 1).

**Table 1** Demographic characteristics among Saudi nursing students ( $N=236$ ).

Demographic characteristics	<i>n</i>	%
<i>Age</i>		
Mean (SD)	29.79 (5.55)	
<i>Gender</i>		
Male	92	39.0
Female	144	61.0
<i>Marital status</i>		
Single	188	79.7
Married	48	20.3
<i>Stream of study</i>		
BSN regular program	154	65.3
BSN bridge program	85	34.7
<i>Year in the program</i>		
Second year	30	12.7
Third year	80	33.9
Fourth year	126	53.4
<i>Clinical exposure</i>		
>1 year	66	26.0
1–2 years	48	20.3
3–4 years	122	51.7
<i>Attended seminars in infection control</i>		
Yes	208	88.1
No	28	11.9

## Compliance with standard precautions

Table 2 reflects the compliance with standard precautions among Saudi nursing students. The overall compliance rate was 61.0%. As indicated, the students reported highest compliance in disposing of used sharp articles and instruments into sharps-only boxes, with a compliance rate of 84.3%, followed by decontaminating hands immediately after removal of gloves (compliance rate, 78.0%), washing hands between patient contacts (compliance rate, 75.8%), changing gloves between each patient contact (compliance rate, 74.2%), and wearing a surgical mask alone or in combination with goggles, face shield, and apron whenever there was a possibility of a splash or splatter (compliance rate, 72.9%). On the other hand, three of the items in the scale received a compliance rate of below 50.0%. The lowest compliance rate was reported in the item on using water only for hand washing (compliance rate, 26.7%), followed by placing waste contaminated with blood, body fluids, secretion and excretion in red plastic bags, irrespective of the patient's infective status (compliance rate, 48.3%), and not recapping used needles after administering an injection (compliance rate, 49.2%).

The comparisons relating to compliance with standard precautions between demographic characteristics are reflected in Table 3. As shown, female students exhibited higher rates of compliance compared with male nursing students ( $t = -2.59, p < 0.05$ ). Students in the bridge program reported better compliance than the students in the regular program ( $t = -3.66, p < 0.001$ ). In terms of academic level, the one-way ANOVA revealed a statistical difference in compliance with standard precautions ( $F = 10.95, p < 0.001$ ). The Tukey HSD test indicated that students in the second year reported lower compliance with standard precautions than those in the third year ( $p < 0.01$ ) and fourth year ( $p < 0.001$ ). On the other hand, a statistical difference was also revealed on compliance with standard precautions in terms of clinical exposure ( $F = 14.12, p < 0.001$ ). The *post hoc* test showed that students with less than 1 year of clinical exposure manifested poorer compliance with standard precautions than those with 1–2 years ( $p < 0.01$ ), and 3–4 years ( $p < 0.001$ ) of clinical exposure.

## Factors influencing compliance with standard precautions

A multiple regression analysis was performed to identify the factors that influence compliance with



**Table 2** Compliance rate on standard precautions among Saudi nursing students ( $N = 236$ ).

No.	Item	Average compliance rate
5	I put used sharp articles into sharps boxes	84.3%
12	I decontaminate my hands immediately after removal of gloves	78.0%
1	I wash my hands between patient contacts	75.8%
11	I change gloves between each patient contact	74.2%
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	72.9%
10	I wear gloves when I am exposed to body fluids, blood products, and any excretion of patients	69.5%
8	I take a shower in case of extensive splashing even after I have put on PPE	65.3%
19	I wear gloves to decontaminate used equipment with visible soils	64.8%
14	My mouth and nose are covered when I wear a mask	63.1%
20	I clean up spillage of blood or other body fluid immediately with disinfectants	62.3%
9	I cover my wound(s) or lesion(s) with waterproof dressing before patient contacts	61.4%
7	I remove PPE in a designated area	59.7%
6	The sharps box is only disposed when it is full <sup>a</sup>	54.2%
3	I use alcohol hand rubs as an alternative if my hands are not visibly soiled	53.4%
15	I reuse surgical mask or disposable PPE <sup>a</sup>	52.5%
18	I decontaminate surfaces and equipment after use	52.5%
16	I wear a gown or apron when exposed to blood, body fluids, or any patient excretions	51.3%
4	I recap used needles after giving an injection <sup>a</sup>	49.2%
17	Waste contaminated with blood, body fluids, secretion, and excretion are placed in red plastic bags irrespective of patient's infective status	48.3%
2	I only use water for hand washing <sup>a</sup>	26.7%
	Overall Compliance Rate	61.0%

Note. Scale items were arranged from the highest to lowest compliance rate.

<sup>a</sup> Reverse scored items.

standard precautions among Saudi nursing students. The respondents' characteristics were analyzed to determine the factors that predicted their compliance with standard precautions. The model was statistically significant ( $F(9, 226) = 4.84, p < 0.001$ ). It accounted for approximately 11.8% of the variance in compliance with standard precautions,  $R^2 = 0.152$ ; adjusted  $R^2 = 0.118$ . As shown in Table 4, only clinical exposure was found to be a significant factor that influenced the students' compliance after controlling for all the other predictor variables as constants. Having 1–2 years and 3–4 years of clinical experience increases the predicted compliance rate by 8.865 ( $p < 0.05$ , 95% CI [1.88, 15.85]) and 9.491 ( $p < 0.05$ , 95% CI [1.61, 17.37]), respectively, compared with having less than 1 year of clinical exposure. This implies that as the students' exposure to the clinical environment increases, so also their compliance with standard precautions. Using the Spearman's rank correlation, the strength of relationship between clinical exposure and compliance with standard precautions was weak (Spearman's  $\rho = 0.31, p < 0.001$ ).

## Discussions

The overall compliance rate of the respondents (61.0%) in this study was lower than the compliance rate among nursing staffs in Brazil (69.4%) [30], but higher than those reported in Hong Kong among nursing students (53.5%) [28] and nursing staffs (57.4%) [30] using the same tool.

This study found mixed result with high and low compliance rates in some aspects of standard precautions, primarily in disposal of sharp objects, prevention of cross-infection, and utilization of protective devices. Specifically, participants reported a high (84.3%) compliance rate in the disposing of used sharp articles into sharps-only boxes, and a low compliance rate (49.2%) in not recapping used needles after administering an injection. The results of our study are similar to the findings documented in a previous study where 86.5% of Turkish nursing and midwifery students, dispose of their used needles in sharps-only boxes, while 89.4% also reported recapping of used needles before disposal [31]. The findings are also

**Table 3** Comparisons of compliance with standard precautions between demographic characteristics among Saudi nursing students ( $N = 236$ ).

Demographic characteristics	Average compliance rate	Statistical test	$p$
<i>Gender</i>			
Male	57.2%	$t = -2.59$	0.011*
Female	63.4%		
<i>Marital status</i>			
Single	59.9%	$t = -1.91$	0.057
Married	65.1%		
<i>Stream of study</i>			
BSN regular program	58.1%	$t = -3.66$	0.000***
BSN bridge program	66.3%		
<i>Year in the program</i>			
Second year	48.5%	$F = 10.95$	0.000***
Third year	61.1%		
Fourth year	63.9%		
<i>Clinical exposure</i>			
>1 year	52.2%	$F = 14.12$	0.000***
1–2 years	62.8%		
3–4 years	65.0%		
<i>Attended seminars in infection control</i>			
Yes	61.8%	$t = 1.61$	0.117
No	54.6%		

\* Significant at 0.05 level.

\*\*\* Significant at 0.001 level.

**Table 4** Factors that influence compliance with standard precautions among Saudi nursing students ( $N = 236$ ).

Predictor variable	$\beta$	SE-b	Beta	$t$	$p$	95% CI
Age	-0.511	0.517	-0.168	-0.987	0.325	-1.530 to 0.509
<i>Gender (reference group: female)</i>						
Male	0.234	2.969	0.007	0.079	0.937	-5.616 to 6.084
<i>Marital status (reference group: married)</i>						
Single	0.538	3.510	0.013	0.153	0.878	-6.378 to 7.454
<i>Stream of study (reference group Bridge program)</i>						
Regular program	-10.485	6.023	-0.297	-1.741	0.083	-22.353 to 1.383
<i>Year in the program (reference group: fourth year)</i>						
Second year	-6.035	4.483	-0.119	-1.346	0.180	-14.868 to 2.798
Third year	3.167	2.945	0.089	1.075	0.283	-2.637 to 8.971
<i>Clinical exposure (reference group: &lt;1 year)</i>						
1–2 years	8.865	3.543	0.212	2.502	0.013*	1.883 to 15.847
3–4 years	9.491	3.999	0.282	2.374	0.018*	1.612 to 17.371
<i>Attended seminars in infection control (reference group: not attended)</i>						
Attended	2.686	3.409	0.052	0.788	0.432	-4.032 to 9.405

Note. Compliance with standard precautions was the dependent variable.  $\beta$  is the unstandardized coefficients; SE-b is the standard error.

\* Significant at 0.05 level.

 $R^2 = 0.152$ ; adjusted  $R^2 = 0.118$ .

comparable to the study in Hong Kong, where nursing students' compliance in disposing of used needles or scalpels in a sharps-only box were as high as 95.3%, and as low a compliance of 49.3% on not recapping needles after administering injections [17]. For some reason, although nursing students seem to be aware of the importance of immediate disposal of used needles in sharps-only boxes, they still practice recapping needles which is a major risk for needle-stick injury [31]. Ideally, needles should not be recapped unless such an act is required by a specific procedure, has no feasible alternative or if sharps disposal container is not available right away [32,33]. However, recapping should only be performed using a mechanical device or the one-handed technique [32,34]. Similarly, previous studies have also reported this wrongful practice by nursing students and nurses [35–37]. This practice of recapping needles reported by the students in this study may be attributed to the locations of the sharp-only boxes in the hospital where these students attend their clinical duties. The sharp-only boxes in the said hospital were located only in the nursing stations, which are not readily accessible if the student is in the patient's room or if they are away from them. Because of this, most of the students may have recapped the needles they used before disposing it in the sharp-only boxes in the nursing stations; thus explaining the high compliance in disposing of used needles or scalpels in a sharps-only box and low compliance in not recapping needles.

Also, in this study, the respondents reported a high compliance rate in decontamination of hands immediately after removal of gloves (78.0%), washing hands between patient contacts (75.8%), and changing gloves between each patient contact (74.2%). The findings of high compliance rates with these components of standard precautions are similar to those studies conducted among nursing students' compliance with standard precautions; in Hong Kong [17], in Jordan [37] and in Turkey [38]. This may be a result of the respondents' high attendance at training or seminars regarding infection control, as reflected in the findings. An earlier study identified attendance at training programs, or seminars on prevention and control of infection as a predictor of hand hygiene practice among nursing students, which may explain this result [8]. Moreover, also to be noted, was the high compliance reported in wearing a surgical mask alone or in combination with goggles, face shield, and apron whenever there was a possibility of a splash or splatter (72.9%). This may be attributed to the training hospital attended by the students, where protective devices, such as masks and goggles, are

readily available in every department. This can be supported by a previous study that reported low compliance in using protective equipment, such as goggles, masks, or gowns, against blood or fluid splatter, because of the absence of such devices in clinical areas [38]. Hence, it can be reasoned out that compliance with the use of protective devices can be attributed to the availability of these supplies in clinical areas.

Notably, the participants obtained the lowest compliance rate in the item on using water only for hand washing (26.7%). This implies that 73.3% of the students in this study seldom, sometimes or always used water only in performing hand washing. This further implies that the students in this study seldom use antiseptic solutions during the act of hand washing. A similar low compliance rate (32.7%) in this particular item of the scale was also reported previously among nurses [30]. The low compliance reflected in this study may have cultural and religious implications. In Islam, performing regular prayer five times a day is one of the most important basic tenets. Muslims are required to conduct methodical ablutions before performing a prayer. Every Muslim is urged to wash their hands frequently and after doing some specific activities. Ablutions must be conducted in running water and involve washing the hands, face, forearms, ears, nose, mouth and feet, three times each [39]. However, performing the ritual of hand washing before prayer is often done without antiseptic solutions. This practice might have been adapted by the students in their performance of hand washing in the clinical settings, which might explain the low compliance rate. On the other hand, a low compliance rate was also reported in placing waste contaminated with blood, body fluids, secretion, and excretion, in red plastic bags, irrespective of the patient's infective status. In like manner, a study conducted among nursing staff in India, reveals unsatisfactory knowledge and practice concerning healthcare waste management [40]. In another qualitative study on causes of improper waste disposal, participants reported a lack of awareness on waste disposal, and inadequate training on control and disposal of healthcare waste [41]. Ideally, healthcare waste disposal should never be mixed; instead, these should be categorized and disposed of appropriately in color-coded plastic bags [32]. In this case, participants fail to follow the proper protocol for healthcare waste disposal.

Interestingly, this study revealed that female respondents are more compliant with standard precautions than their male counterparts. The higher compliance among females may be linked to their inclination to act or implement socially acceptable

conduct [41]. In the Saudi context, a female's individuality depends greatly on her deeds, with much emphasis on maintaining their reputation, and that may also apply in the proper practice of infection control measures. By contrast, a male, in Saudi culture, does not think much of his actions, the reason being that a man remains a man in whatever he does [42]. Further in-depth research is required to reveal the reasons behind the results obtained.

The regression result suggested that clinical exposure was a significant factor that influences students' compliance with standard precautions. This finding indicates that higher years of clinical experience were associated with more rigorous compliance with standard precautions. Specifically, students who had more than 1 year of clinical experience were more likely to be more compliant with standard precautions. However, the strength of relationship between clinical exposure and compliance with standard precautions was weak. Despite this weak association, the finding is congruent with the theory "From Novice to Expert" by Patricia Benner [43]. According to this theory, in the acquisition and development of a skill, a nurse passes through five levels of proficiency: novice, advanced beginner, competent, proficient, and expert. Through actual practical experience, preconceived notions as well as theories get confirmed, refined, or disconfirmed in real circumstances [43]. Experience has been described as the most essential factor affecting the development of skills. Direct experience is an invaluable tool in psychomotor skill development and enhancement of decision-making [44]. As nursing students' studies progress, they gradually get more practice in the nursing procedures that necessitate them to use standard precautions, and their skill competency improves [45]. In addition, students who had longer clinical exposure are more familiar with the hospital's guidelines and protocols regarding infection control and prevention, thus increasing their practice in observance of standard precautions. Clinical experience is dependent on academic year and type of nursing program involved in this study. Those students who are in their later years of the program, and who are in the bridge nursing program, have higher clinical exposures, which is associated with higher standards of compliance with precautions. A previous study documented similar findings, where students in their first year exhibited lesser compliance with standard precautions than those in the higher levels [38]. This could be associated with the fact that students in the higher levels of the program have more experience in the clinical setting. This might contribute

towards refining their performance in the adoption of standard precautions.

While this study yielded significant findings regarding compliance with standard precautions among Saudi nursing students, some limitations are acknowledged. The use of self-reports may have introduced some degree of social desirability, hence, judicious interpretation is recommended. Likewise, the use of convenience sampling technique limits the generalizability of the findings. The study was conducted in a single university only, therefore, future studies should include wider settings. The variance explained by compliance by the predictor variable is low, which may not be significant practically. However, the fact that actual practical experiences are essential in skill acquisition and development in nursing, future studies should be conducted to better understand this relationship.

## Conclusions

In conclusion, this study provided understanding about Saudi nursing students' self-reported compliance with standard precautions. Cultivating a culture of safety among nursing students is of paramount importance. Proper assessment of the students' compliance should be undertaken on a regular basis to ensure their satisfactory practice. As revealed from the results, more clinical experience may yield a better compliance with standard precautions. Thus, the clinical environment should be supportive of a culture where strict compliance with infection control and prevention is of great importance. Moreover, topics regarding standard precautions should also be incorporated in the clinical teaching plans throughout the nursing program and the intended learning outcomes should be properly communicated to the students. Nursing instructors should also design clinical placement plan that provides opportunities for each student to experience nursing skills and procedures that necessitates strict compliance with standard precautions.

## Funding

None required.

## Competing interests

None required.



## Ethical approval

Before beginning this study, permission to use the CSPS-A was obtained (CA400N06-201603) from the copyright holder. Approval from the research committee and the dean of the College of Applied Medical Sciences of the university were secured. Coordination with the college for women was done through the head of the nursing department. The respondents were informed that participation was voluntary and that they can refuse participation without any consequences in their part. Confidentiality of the respondents was assured by instructing them not to write their names or anything that would identify them in any part of the questionnaire. Informed consent was obtained from each respondent before they were included in the study. No reward for participation was offered to the respondents.

## References

- [1] WHO. Health care-associated infections FACT SHEET. World Health Organization; 2015. p. 4. Retrieved from [http://www.who.int/gpsc/country\\_work/gpsc\\_ccisc\\_fact\\_sheet\\_en.pdf](http://www.who.int/gpsc/country_work/gpsc_ccisc_fact_sheet_en.pdf).
- [2] Sabra SM, Abdel-Fattah MM. Epidemiological and microbiological profile of nosocomial infection in Taif hospitals, KSA (2010–2011). *World J Med Sci* 2012;7:1–9.
- [3] Halwani M, Tashkani N, Basuny A. 905 Healthcare associated Infections in ten Saudi intensive care units: the result of a one year incidence study. Jeddah, Saudi Arabia: Directorate of Health Affairs. Infection Control and Central Sterilization; 2010. Retrieved from <https://shea.confex.com/shea/2010/webprogram/Paper1533.html>.
- [4] Al-Tawfiq JA, Tambyah PA. Healthcare associated infections (HAI) perspectives. *J Infect Public Health* 2014;7:339–44.
- [5] Duce G, Fabry J, Nicolle L. Prevention of hospital acquired infections: a practical guide. 2nd ed; 2002.
- [6] Cruz JP, Cruz CP, Al-Otaibi ASD. Gender differences in hand hygiene among Saudi nursing students. *Int J Infect Control* 2015;11, <http://dx.doi.org/10.3396/ijic.v11i4.14123>.
- [7] Mani A, Shubangi AM, Saini R. Hand hygiene among health care workers. *Indian J Dent Res* 2010;21:115.
- [8] Cruz JP, Bashrawi MA. Predictors of hand hygiene practice among Saudi nursing students: a cross-sectional self-reported study. *J Infect Public Health* 2015, <http://dx.doi.org/10.1016/j.jiph.2015.11.010>.
- [9] Siegel JD, Rhinehart E, Jackson M, Chiarello L. 2007 guideline for isolation precautions: preventing transmission of infectious agents in health care settings. *Am J Infect Control* 2007;35:S65–164.
- [10] Wu CJ, Gardner GE, Chang AM. Taiwanese nursing students' knowledge, application and confidence with standard and additional precautions in infection control. *J Clin Nurs* 2009;18:1105–12.
- [11] Cheung K, Chan CK, Chang MY, Chu PH, Fung WF, Kwan KC, et al. Predictors for compliance of standard precautions among nursing students. *Am J Infect Control* 2015;43:729–34.
- [12] Kermode M, Jolley D, Langkham B, Thomas MS, Holmes W, Gifford SM. Compliance with Universal/Standard Precautions among health care workers in rural north India. *Am J Infect Control* 2005;33:27–33.
- [13] Luo Y, He GP, Zhou JW, Luo Y. Factors impacting compliance with standard precautions in nursing, China. *Int J Infect Dis* 2010;14(12):e1106–14.
- [14] Musharrafieh UM, Bizri ARN, Nassar NT, Rahi AC, Shoukair AM, Doudakian RM, et al. Health care workers' exposure to blood-borne pathogens in Lebanon. *Occup Med (Lond)* 2008;58:94–8.
- [15] Patterson JMM, Novak CB, Mackinnon SE, Ellis RA. Needlestick injuries among medical students. *Am J Infect Control* 2003;31:226–30.
- [16] Amin TT, Al Noaim KI, Saad MAB, Al Malhm TA, Al Mulhim AA, Al Awas MA. Standard precautions and infection control, medical students' knowledge and behavior at a Saudi university: the need for change. *Global J Health Sci* 2013;5:114, <http://dx.doi.org/10.5539/gjhs.v5n4p114>.
- [17] Lam SC, Fung ESS, Hon LKY, Ip MPY, Chan JHT. Nursing students' compliance with universal precautions in Hong Kong. *J Clin Nurs* 2010;19:3247–50.
- [18] Kim KM, Oh H. Clinical experiences as related to standard precautions compliance among nursing students: a focus group interview based on the theory of planned behavior. *Asian Nurs Res* 2015;9:109–14.
- [19] Mitchell BG, Say R, Wells A, Wilson F, Cloete L, Matheson L. Australian graduating nurses' knowledge, intentions and beliefs on infection prevention and control: a cross-sectional study. *BMC Nurs* 2014;13:43.
- [20] Livshitz-Riven I, Nativ R, Borer A, Kanat-Maymon Y, Anson O. Nursing students' intentions to comply with standard precautions: an exploratory prospective cohort study. *Am J Infect Control* 2014;42:744–9.
- [21] Gould D, Drey N. Student nurses' experiences of infection prevention and control during clinical placements. *Am J Infect Control* 2013;41:760–3.
- [22] Collins AS. Preventing health care-associated infections. In: Hughes RG, editor. Patient safety and quality: an evidence-based handbook for nurses. Rockville, MD: Agency for Healthcare Research and Quality (US); 2008. Chapter 41. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK2683/?report=classic>.
- [23] Cruz JP, Colet PC, Al-otaibi JH, Soriano SS, Cacho GM, Cruz CP. Validity and reliability assessment of the Compliance with Standard Precautions Scale Arabic version in Saudi nursing students. *J Infect Public Health* 2016, <http://dx.doi.org/10.1016/j.jiph.2016.01.010>.
- [24] de Carvalho Nagliate P, Nogueira PC, de Godoy S, Mendes IAC. Measures of knowledge about standard precautions: a literature review in nursing. *Nurse Educ Pract* 2013;13:244–9.
- [25] Kim KM, Choi JS. An integrative review of infection control research in Korean nursing journals. *Asian Nurs Res* 2014;8:128–34.
- [26] Hessels AJ, Larson EL. Relationship between patient safety climate and standard precaution adherence: a systematic review of the literature. *J Hosp Infect* 2015, <http://dx.doi.org/10.1016/j.jhin.2015.08.023>.
- [27] Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G\* Power 3.1: tests for correlation and regression analyses. *Behav Res Methods* 2009;41:1149–60.
- [28] Lam SC. Validation and cross-cultural pilot testing of compliance with standard precautions scale: self-administered instrument for clinical nurses. *Infect Control Hosp Epidemiol* 2014;35:547–55.

Please cite this article in press as: Colet PC, et al. Compliance with standard precautions among baccalaureate nursing students in a Saudi university: A self-report study. *J Infect Public Health* (2016), <http://dx.doi.org/10.1016/j.jiph.2016.06.005>

- [29] Lam SC. Universal to standard precautions in disease prevention: preliminary development of compliance scale for clinical nursing. *Int J Nurs Stud* 2011;48:1533–9.
- [30] Pereira FMV, Lam SC, Chan JHM, Malaguti-Toffano SE, Gir E. Difference in compliance with standard precautions by nursing staff in Brazil versus Hong Kong. *Am J Infect Control* 2015;43:769–72.
- [31] Karadağ M. Occupational exposure to blood and body fluids among a group of Turkish nursing and midwifery students during clinical practise training: frequency of needlestick and sharps injuries. *Jpn J Nurs Sci* 2010;7:129–35.
- [32] 56 Fed. Reg. 64004 [1991]. Occupational Safety and Health Administration: final rule on occupational exposure to bloodborne pathogens.
- [33] US Food and Drug Administration. What to do if you can't find a sharps disposal container. Available at: <http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/HomeHealthandConsumer/ConsumerProducts/Sharps/ucm263259.htm>.
- [34] Ross S, Furrows S. *Rapid: rapid infection control nursing*. Somerset, NJ, USA: John Wiley & Sons, Incorporated; 2013. Retrieved from <http://www.ebrary.com>.
- [35] AL-Rawajfah OM, Hweidi IM, Alkhalaileh M, Khader YS, Alshboul SA. Compliance of Jordanian registered nurses with infection control guidelines: a national population-based study. *Am J Infect Control* 2013;41:1065–8.
- [36] Ward DJ. Infection control in clinical placements: experiences of nursing and midwifery students. *J Adv Nurs* 2010;66:1533–42, <http://dx.doi.org/10.1111/j.1365-2648.2010.05332.x>.
- [37] Al-Rawajfah OM, Tubaihat A. Nursing students' knowledge and practices of standard precautions: a Jordanian web-based survey. *Nurse Educ Today* 2015;35:1175–80, <http://dx.doi.org/10.1016/j.nedt.2015.05.011>.
- [38] Mollaoglu M, Mollaoğlu M, Şanal L. Compliance with standard precautions of students in clinical practice. *J Family Med Community Health* 2015;2:1064.
- [39] 17, Religious and cultural aspects of hand hygiene. In: WHO guidelines on hand hygiene in health care: first global patient safety challenge clean care is safer care. Geneva: World Health Organization; 2009. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK143998/>.
- [40] Shivalli S, Sanklapur V. Healthcare waste management: qualitative and quantitative appraisal of nurses in a tertiary care hospital of India. *World J Med Sci* 2014, <http://dx.doi.org/10.1155/2014/935101>.
- [41] Oroei M, Momeni M, Palenik CJ, Danaei M, Askarian M. A qualitative study of the causes of improper segregation of infectious waste at Nemazee Hospital, Shiraz, Iran. *J Infect Public Health* 2014;7:192–8.
- [42] Alanazi FM. The Revised Self-Consciousness Scale: an assessment of factor structure, reliability, and gender differences in Saudi Arabia. *Social Behav Personal* 2001;29:763–76.
- [43] Benner P. *From novice to expert: excellence and power in clinical nursing practice*. Menlo Park, CA: Addison Wesley; 1984.
- [44] Khomeiran RT, Yekta ZP, Kiger AM, Ahmadi F. Professional competence: factors described by nurses as influencing their development. *Int Nurs Rev* 2006;53:66–72.
- [45] Cheung K, Ching SSY, Chang KKP, Ho SC. Prevalence of and risk factors for needlestick and sharps injuries among nursing students in Hong Kong. *Am J Infect Control* 2012;40:997–1001.

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

**ScienceDirect**