

Infection Control Practices of Saudi Baccalaureate Nursing Students During Clinical Training

Murad A Mubarak^{1*}, Ahmad E Aboshaiqah², Regie B Tumala³, Taghreed A Hafiz¹, Ibrahim M Shamali³ and Mohammed Ali A Marie¹

¹Clinical Laboratory Sciences Department, College of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia

²Nursing Administration and Education Department, College of Nursing, King Saud University, Riyadh, Saudi Arabia

³Medical–Surgical Nursing Department, College of Nursing, King Saud University, Riyadh, Saudi Arabia

***Corresponding Author:** Murad A Mubarak, Clinical Laboratory Sciences Department, College of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia.

Received: October 25, 2017; **Published:** November 11, 2017

Abstract

Background: Stringent adherence to standard precautions (SPs) by nursing students (NSs) is of paramount importance in every patient contact during clinical placements. Thus, this study aimed to evaluate the rate and predictors of SPs compliance among NSs in Saudi Arabia.

Methodology: A convenience sample of 493 NSs was surveyed in this cross-sectional, self-reported study using a valid and reliable Compliance with Standard Precaution Scale - Arabic version (CSPS-A).

Results: The overall compliance rate was 56.8%. NSs reported highest compliance in putting used sharp articles into sharps boxes, while the lowest compliance was in disposing sharps box only when full. Significant differences in compliance were observed when participants were grouped according to their demographic characteristics in terms of sex, stream of study and academic level. Sex and stream of study were found as predictors of SPs compliance. Remarkably, months in clinical placement negatively affected SPs compliance of NSs.

Conclusion: The findings of this study offered valuable information for clinical instructors and staff nurses regarding SPs compliance of Saudi NSs. To ensure safety of healthcare workers (HCWs) and patients, SPs training and supportive culture are warranted to reinforce and enhance SPs compliance of Saudi NSs during clinical placements.

Keywords: Saudi Nursing Students; Standard Precautions Compliance; Standard Precautions Predictors; Clinical Placement; Saudi Arabia

Introduction

Nearly four decades ago, HCWs became concerned with occupational exposure to blood and other body fluids when exercising their profession [1]. Healthcare associated infections (HAIs) such as human immunodeficiency virus (HIV) discovered in the 1980s, and the occurrences of a high rate of hepatitis B and C viruses are a serious public health concern of HCWs as well as their patients [2,3]. In Saudi Arabia, Middle East respiratory syndrome corona virus (MERS-CoV), a predominant HAI, has been reported to reach 1,541 confirmed cases as of May 5, 2017, which caused major impact worldwide with high case fatality rate since its hospital outbreaks in 2012 [4]. Exposure to HAIs is a serious global problem that threatens the safety of both patients and HCWs, including nurses [5,6]. Similarly in a potential omnipresent contagious risk, NSs during clinical training maybe exposed to harmful pathogens when obligated to provide care to patients admitted with unknown infectious diseases [3,7]. Full SPs compliance among HCWs as well as NSs is mandatory as it optimizes safety climate in healthcare settings when patients' viral and/or bacterial status is unknown [8].

Citation: Murad A Mubarak, *et al.* "Infection Control Practices of Saudi Baccalaureate Nursing Students During Clinical Training". *EC Microbiology* 13.2 (2017): 55-64.

Standard precautions are the most recent infection control guidelines intended to decrease risk of cross-transmission of blood-borne pathogens and other disease-causing microorganisms in healthcare settings [9,10]. Components of SPs include: 1) hand hygiene, 2) use of personal protective equipment (e.g. gloves, gowns, facemasks - e.g. N95 against MERS-CoV infection), depending on the anticipated exposure, 3) respiratory hygiene and cough etiquette, 4) safe injection practices, and 5) safe handling of potentially contaminated equipment or surfaces in the patient environment [9,11,12]. Although SPs are designed to limit HAIs, adherence to full complement of observed behaviors by HCWs of all types was suboptimal globally [13]. Moreover, in a study about universal precautions (UPs) - replaced with SPs in 1996 [12], NSs revealed lack of knowledge and poor self-reported practice with UPs [14]. Similarly, in several related studies worldwide, NSs varied in SPs compliance by year of study [7], reported witnessing many instances of failure to comply with established infection control measures [3], and identified to have low knowledge scores and wrong practices with SPs [15]. Given this premise, the current study aimed to assess the self-reported adherence to standard precautions of Saudi NSs during their clinical training in various teaching hospitals in the kingdom.

Materials and Methods

Design, sample and setting

The study employed cross-sectional, descriptive-correlational design. Out of the 654 participants recruited in the study, only 493 NSs participated (response rate, 75.4%). This study was conducted in the College of Nursing at King Saud University, both in Male and Female Campuses located in Riyadh Region, Kingdom of Saudi Arabia.

Instrument

The first part of the questionnaire asked the demographic characteristics of NSs which included their (1) age, (2) sex, (3) marital status, (4) stream of study, (5) academic level, (6) months in clinical placement, and (7) attended seminars/trainings in SPs.

The second part was the Compliance with Standard Precautions Scale - Arabic version (CSPS-A). The original version of the scale was developed by Lam [11], and was cross-culturally adapted to Arabic language by Cruz, *et al.* [9], with Cronbach's α values of 0.73 and 0.89, respectively. The 20-item scale evaluated the self-reported SPs compliance of NSs. The scale consisted of a 4-point adjectival response category such as "never", "seldom", "sometimes" and "always". Items 2, 4, 6 and 15 were negatively stated; thus, scores were reversed before the computations. Artificial dichotomies were developed in each item in the scale with a score of '1' interpreted as an "always" response, while '0' applied for the other responses. A total range score of 0 - 20 was expected, with higher scores signifying better SPs compliance. Finally, the average compliance rate for the 20 items was also calculated.

Data collection and Ethical considerations

To conduct the study, approval from the Intuitional Review Board (IRB) of the College of Medicine at King Saud University was obtained. Significant information about the study as well as the expected participation of NSs was properly explained before their voluntary participation. Those who agreed to participate were administered with the questionnaire and were given 5 - 10 minutes to complete it. Informed consent was obtained from the participants and data was gathered between January and February of Academic Year 2016 - 2017.

Statistical Analysis

Data was tallied and analyzed using IBM SPSS Statistics for Windows version 21. The demographic characteristics of NSs were presented in frequency count and percentages. Pearson correlation coefficient was tested to evaluate relationship of NSs' demographic characteristics and SPs compliance. Independent t-test and one-way analyses of variance (ANOVA) were performed to examine the differences on SPs compliance of NSs. 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 to examine significant predictors of SPs compliance.

Results

Demographic characteristics of NSs

Among the 654 NSs recruited to participate in this study, only 493 surveys were returned, which were utilized in the final analysis (see Table 1). NSs from 2 undergraduate baccalaureate programs participated in this study (BSN: n = 238, 48.3%; Bridging: n = 255, 51.7%), was similar to studies in Hong Kong, China [7] and Saudi Arabia [16]. Their ages ranged from 20 - 44 years, with a mean age of 26.5 years. Remarkably, the sex distribution of NSs (male/female = 1:1) was contrary to previous studies [7,16]. Notably, majority of NSs were single (n = 273, 55.4%). More than 50% (n = 293) reported to have had attended SPs seminars/training. NSs' academic levels were well distributed in Level 6 (n = 133, 27.0%), Level 7 (n = 138, 28.0%), and Level 8 (n = 182, 36.9%). Lastly, their exposure to clinical placements ranged from 3 - 24 months (Mean = 17.1 months).

Demographic characteristics	n	%
Sex		
Male	265	53.8
Female	228	46.2
Marital Status		
Single	273	55.4
Married	194	39.4
Divorced	26	5.2
Stream of study		
BSN Regular program	238	48.3
BSN Bridging program	255	51.7
Academic level		
Level 5	40	8.1
Level 6	133	27.0
Level 7	138	28.0
Level 8	182	36.9
Attended seminars/trainings in standard precaution		
Yes	293	59.4
No	200	40.6
Age		
Mean (SD) 26.5 (4.9)		
Months in clinical placement		
Mean (SD) 17.1 (6.2)		

Table 1: Demographic characteristics of Saudi NSs (N = 493).

SPs Compliance

The overall self-reported SPs compliance was 56.8%, as shown in table 2. As revealed, NSs reported highest compliance rates for more than 70% in five items, namely: putting used sharp articles into sharps boxes (compliance rate, 80.5%); wearing gloves when exposed to body fluids, blood products, and any excretion of patients (compliance rate, 74.7%); covering mouth and nose when wearing a mask (compliance rate, 73.8%); and washing hands (compliance rate, 72.2%) and changing gloves (compliance rate, 71.6%) between each patient contact. Adversely, six items were reputed by NSs with low compliance rates below 50%. Specifically, the lowest compliance rate was in item on disposing sharps box only when it is full (compliance rate, 26.0%), proceeded by taking a shower in case of extensive splashing even after putting on PPE (compliance rate, 40.4%), followed by using only water for hand washing (compliance rate, 42.0%), using alcohol hand rubs as an alternative if hands are not visibly soiled (compliance rate, 43.2%), wearing a surgical mask alone or in combination with goggles, face shield, and apron whenever there is a possibility of a splash or splatter (compliance rate, 44.0%), and finally, reusing mask or disposable PPE (compliance rate, 45.2%).

No.	Item	Average compliance rate
5	I put used sharp articles into sharps boxes.	80.5%
10	I wear gloves when I am exposed to body fluids, blood products, and any excretion of patients.	74.7%
14	My mouth and nose are covered when I wear a mask.	73.8%
1	I wash my hands between patient contacts.	72.2%
11	I change gloves between each patient contact.	71.6%
9	I cover my wound(s) or lesion(s) with waterproof dressing before patient contacts.	62.9%
12	I decontaminate my hands immediately after removal of gloves.	61.9%
19	I wear gloves to decontaminate used equipment with visible soils.	61.9%
16	I wear a gown or apron when exposed to blood, body fluids, or any patient excretions.	60.5%
20	I clean up spillage of blood or other body fluid immediately with disinfectants.	56.8%
4	^r I recap used needles after giving an injection.	56.0%
17	Waste contaminated with blood, body fluids, secretion, and excretion are placed in red plastic bags irrespective of patient's infective status.	54.8%
7	I remove personal protective equipment (PPE) in a designated area.	53.6%
18	I decontaminate surfaces and equipment after use.	53.6%
15	^r I reuse mask or disposable PPE.	45.2%
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.	44.0%
3	I use alcohol hand rubs as an alternative if my hands are not visibly soiled.	43.2%
2	^r I only use water for hand washing.	42.0%
8	I take a shower in case of extensive splashing even after I have put on PPE.	40.4%
6	^r The sharps box is only disposed when it is full.	26.0%
	Overall compliance rate	56.8%

Table 2: SPs compliance of Saudi NSs (N =493).

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

^r Reverse scored items.

Relationship and Comparisons of SPs Compliance

The multiple comparisons between demographic characteristics of NSs relating to their self-reported SPs compliance are shown in figures 1, 2 and 3. As revealed, female NSs had significantly higher compliance rate compared with male NSs ($t = -9.069$, $p < 0.001$). NSs in BSN bridging program had significantly better compliance than NSs in BSN regular program ($t = -2.202$, $p < 0.05$). When grouped according to their academic levels, a significant difference was reflected ($F = 6.331$, $p < 0.001$). With this result, the study employed multiple comparisons test using Fisher's least significant difference (LSD) method (see Table 3) to determine which of the groups differed. As depicted, NSs in Level 5 had significantly higher compliance rate than NSs in Level 7 ($F = 9.647$, $p < 0.05$). On the other hand, NSs in Level 6 had significantly higher compliance rate than NSs in Level 7 ($F = 12.142$, $p < 0.001$), and Level 8 ($F = 7.461$, $p < 0.05$). Surprisingly, a Pearson r correlation test indicated that NSs with more months of clinical placements had lower compliance than NSs with less months of clinical placements ($r = -0.142$, $p < 0.05$).

Academic Level	Mean Difference	Standard Error	p value	95% Confidence Interval	
				Lower Bound	Upper Bound
Level 5					
Level 6	-2.495	4.302	0.562	-10.949	5.959
Level 7	9.647	4.284	0.025*	1.229	18.065
Level 8	4.966	4.166	0.234	-3.221	13.152
Level 6					
Level 7	12.142	2.899	0.000***	6.446	17.838
Level 8	7.461	2.722	0.006*	2.113	12.809
Level 7					
Level 8	-4.681	2.693	0.083	-9.972	0.610

Table 3: Multiple comparisons of SPs compliance in terms of academic level of Saudi NSs (N = 493).

*Significant at 0.05 level

***Significant at 0.001 level

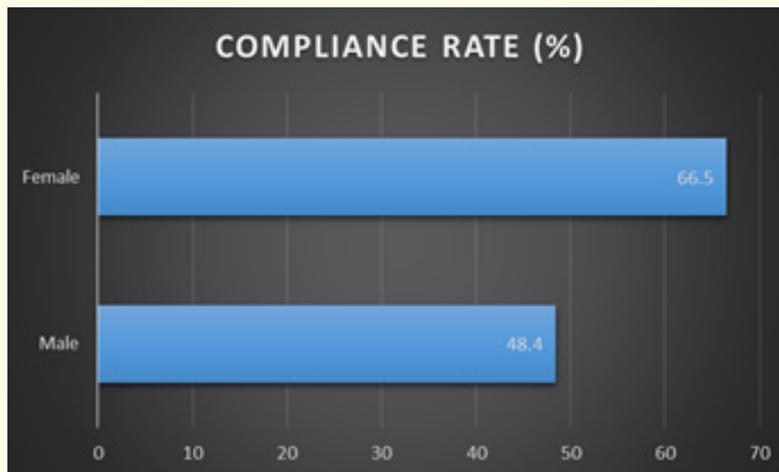


Figure 1: Comparison of standard precaution compliance by sex.

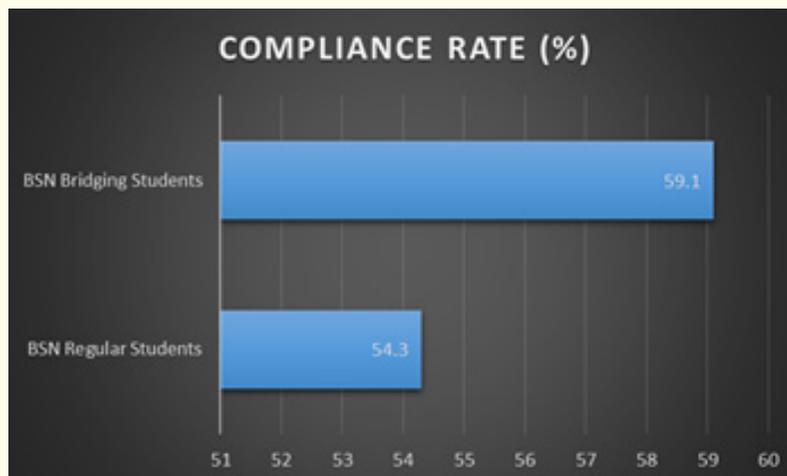


Figure 2: Comparison of standard precaution compliance by stream of study.



Figure 3: Comparison of standard precaution compliance by academic level.

Predictors of SPs Compliance

Two predictors for SPs compliance had been revealed through a multiple regression analysis, namely sex and stream of study (see Table 4). The demographic characteristics of NSs were analyzed to determine the factors that predicted their SPs compliance. The model was statistically substantial ($F(10, 482) = 11.305, p < 0.001$). It indicated a moderate level of prediction and implied that the independent variables explained approximately 19.0% of the variance in the SPs compliance ($R = 0.436; R^2 = 0.190; \text{adjusted } R^2 = 0.173$). In this study, sex and stream of study were found to be significant predictors for NSs' SPs compliance. The results implied that being female NSs increased the predicted compliance rate by 17.766 ($p < 0.001, 95\% \text{ CI } [13.318, 22.213]$), compared with male NSs. Similarly, being enrolled in BSN bridging program increased the prediction of SPs compliance by 8.157 ($p < 0.05, 95\% \text{ CI } [1.468, 14, 845]$), compared with NSs enrolled in BSN regular program.

Predictor variables	β	SE-b	Beta	t	p value	95% Confidence Interval	
						Lower Bound	Upper Bound
Age	-0.097	0.424	-0.020	-0.229	0.819	-0.931	0.737
Sex	17.766	2.263	0.366	7.849	0.000***	13.318	22.213
Marital status (reference group: Single)							
Married	3.019	2.955	0.061	1.022	0.307	-2.787	8.825
Divorced	-9.815	5.025	-0.091	-1.953	0.051	-19.689	0.058
Stream of study	8.157	3.404	0.168	2.396	0.017*	1.468	14.845
Academic level (reference group: Level 5)							
Level 6	-5.324	6.339	-0.098	-0.840	0.401	-17.779	7.132
Level 7	-9.852	10.715	-0.183	-0.919	0.358	-30.906	11.201
Level 8	-6.411	15.487	-0.128	-0.414	0.679	-36.841	24.019
Months in clinical placement							
	-0.232	0.826	-0.060	-0.281	0.779	-1.856	1.391
Attended seminars/trainings in standard precautions							
	-1.836	2.168	-0.037	-0.847	0.397	-6.096	2.424

Table 4: Predictors of SPs compliance of Saudi NSs (N = 493).

Note: SPs compliance was the dependent variable. β is the unstandardized coefficients; SE-b is the standard error.

*Significant at 0.05 level

***Significant at 0.001 level

$R^2 = 0.190; \text{Adjusted } R^2 = 0.173$

Discussion

The study explored the Saudi NSS' self-reported SPs compliance as a method to prevent occupational exposure to HAIs during clinical placements. Using a similar scale, the results of this study revealed that the overall compliance was lower than the compliance of NSs in another university in the northern region of Saudi Arabia [16], but higher than NSs in Hong Kong [11].

The study reflected highest compliance rate in the item on putting sharp articles into sharp boxes which is highly congruent with the findings presented in previous studies [15,16]. This result might explain that sharps container in the hospital settings are designed to be clearly visible and readily available to HCWs. In addition, NSs in this study reported high compliance rate in covering their mouth and nose when wearing a mask. In this case, exact fitting of N95 masks is emphasized in the hospital settings to prevent MERS-CoV infection. This result is contrary among NSs in another study in Saudi Arabia [16]. However, NSs in this study were also highly compliant in washing hands and changing gloves between patient contacts, and in wearing gloves when exposed to body fluids, blood products and any excretions of patients. These findings are similar to previous studies with high compliance rates in these SPs items [15,17-19]. As reflected in the study, this may be explained by high attendance of NSs in trainings or seminars related to SPs, comparable with previous studies that reported training programs or seminars on prevention and control of infection was found as predictor of hand hygiene practice among NSs [9]. In another study, its findings revealed that nurses with training on SPs had greater compliance than those without SPs training [20]. Correspondingly, these educational and training strategies in SPs and use of PPE have been reported to enhance the quality of patient care, and safety of HCWs and patients in particular [21]. Moreover, these strategies or programs have been concluded in another study to be offered as continuous professional development across baccalaureate years of NSs [14]. On the other hand, the lowest compliance rate was reported on disposing the sharps box only when full. Although, NSs in this study reflected highest compliance rate on putting used sharp articles immediately and directly into sharps boxes as discussed elsewhere, there is a need to promote awareness that sharps container can be disposed when able to determine the container's fill status and distinguish any warning labels. This is to prevent overfilling of sharps container that significantly cause sharps injury in healthcare settings [22].

Remarkably, the results of this study found that female NSs were more compliant with SPs than male NSs, similar to a previous study [16]. Appropriate adherence to SPs of Saudi female nurses may be explained in the context of Saudi culture where their individuality depends on their deeds, with emphasis on maintaining their reputation than Saudi male NSs [16]. In addition, NSs in BSN bridging program had better compliance than those in BSN regular program. NSs in BSN bridging program had more clinical exposures and learned about SPs in their foundations of nursing practice and infection control courses earlier than NSs in BSN regular program [3,16]. Multiple comparisons had been conducted in this study that showed NSs in the lower levels (Level 5 and 6) had higher SPs compliance than those in higher levels (Level 7 and 8). Unexpectedly, contrary to a previous study [16], the findings also indicated that NSs with less months of clinical exposure reported higher SPs compliance. Although the trend must be reversed, it may be attributed to either unawareness of NSs in the higher levels of their noncompliance behaviors or the influence of staff nurses' noncompliance with SPs which implies negative or inappropriate clinical learning situations for NSs. This result is congruent to a previous qualitative study where nurses admitted of being in situations of noncompliance when they provided basic nursing care to patients [3,7].

While components of SPs must be strictly adhered by NSs for the safety of patients and their own safety, success in SPs compliance depends on many factors. In this study, sex and stream of study were found as predictors of adherence to SPs among NSs. It was revealed that male NSs reported lower SPs compliance than their female counterparts. This predictor is highly comparable with a previous study [23], which also reported that male HCWs were less compliant with UPs as cited by Cheung, et al [7]. Contrary to a previous study [16], stream of study was found to predict SPs compliance. The findings found that NSs in BSN bridging program were more compliant than NSs in BSN regular program. The Bachelor of Science in Nursing – Bridging program is a 2-year program in addition with half-year internship training in the kingdom. NSs in BSN bridging program had been practicing infection control guidelines in their respective hospitals than NSs in BSN regular program. Moreover, the Ministry of Health in Saudi Arabia strived to improve the nursing profession when faced with many challenges like but not limited to having majority of nurses are holding a diploma degree and the threat of emerging infectious

diseases such as MERS-CoV, has developed an upgraded bridging program to improve the quality of nursing education in the kingdom [24,25]. Congruently, this result may imply establishment of partnership between NSs in BSN bridging and regular programs during clinical placements to enhance SPs compliance.

Lastly, this study had posed some limitations on its reliance to self-reporting rather than observing NSs' SPs compliance by nurse practitioners in healthcare settings. Although many studies had utilized self-reports, some amount of public desirability and partiality of responses were other limitations. In addition, further research should be conducted to explore the decline of SPs compliance among NSs as they are promoted to higher levels. Conducting a qualitative study in this area might elucidate the factors influencing the decline with SPs compliance and institute accurate approaches to improve the SPs compliance among NSs across BSN years.

Conclusion

The findings of this study revealed that SPs compliance were not behaviors readily adopted by NSs even though they were knowledgeable with SPs' guidelines. Two predictors affected SPs compliance of NSs, namely sex and stream of study. Improvement for adherence to SPs among Saudi NSs needs to be addressed to create safety climate during clinical placements. Standard precautions training must be provided and reinforced to NSs before undergoing clinical placements in healthcare settings to ensure their safety, and particularly safety of patients. Reinforcement and support to NSs by clinical instructors and staff nurses are warranted to promote enhancement of SPs compliance among NSs during clinical placements.

Acknowledgement

Authors cordially express their sincere appreciation for the support provided by the Deanship of Scientific Research through the Research Center of the College of Nursing in King Saud University, Riyadh, Kingdom of Saudi Arabia.

Conflict of Interest

None to declare.

Bibliography

1. Martins RJ, *et al.* "Adherence to standard precautions from the standpoint of the Health Belief Model: the practice of recapping needles". *Ciência and Saúde Coletiva* 20.1 (2015): 193-198.
2. Malaguti-Toffano SE, *et al.* "Adherence to standard precautions among nursing professionals exposed to biological material". *Revista Eletrônica de Enfermagem* 17.1 (2015): 131-135.
3. Kim KM and H Oh. "Clinical experiences as related to standard precautions compliance among nursing students: A focus group interview based on the theory of planned behavior". *Asian Nursing Research* 9.2 (2015): 109-114.
4. Saudi Ministry of Health Command and Control Center (Saudi MOH-CCC). Statistics: Middle East respiratory syndrome coronavirus (MERS-CoV) (2017).
5. Powers D, *et al.* "Factors influencing nurse compliance with standard precautions". *American Journal of Infection Control* 44.1 (2016): 4-7.
6. Hessels AJ and EL Larson. "Relationship between patient safety climate and standard precaution adherence: A systematic review of the literature". *Journal of Hospital Infection* 92.4 (2016): 349-362.
7. Cheung K, *et al.* "Predictors for compliance of standard precautions among nursing students". *American Journal of Infection Control* 43.7 (2015): 729-734.

8. Malavaud S. "Infection control in urology: standard and isolation precautions". *Progres En Urologie* 24.14 (2014): 934-938.
9. Cruz JP, *et al.* "Validity and reliability assessment of the Compliance with Standard Precautions Scale Arabic version in Saudi nursing students". *Journal of Infection and Public Health* 9.5 (2016): 645-653.
10. Giard M, *et al.* "Compliance with standard precautions: Results of a French national audit". *American Journal of Infection Control* 44.1 (2016): 8-13.
11. Lam SC. "Validation and cross-cultural pilot testing of compliance with standard precautions scale: Self-administered instrument for clinical nurses". *Infection Control and Hospital Epidemiology* 35.5 (2014): 547-555.
12. Centers for Disease Control and Prevention (CDC). Middle East Respiratory Syndrome (MERS) (2016).
13. Hessels AJ, *et al.* "Relationship between patient safety climate and adherence to standard precautions". *American Journal of Infection Control* 44.10 (2016): 1128-1132.
14. van der Berg LS and FM Daniels. "Do nursing students know and practice the universal precautions to prevent transmission of infectious agents?" *Curationis* 36.1 (2013): E1-E7.
15. Al-Rawajfah OM and A Tubaishat. "Nursing students' knowledge and practices of standard precautions: A Jordanian web-based survey". *Nurse Education Today* 35.12 (2016): 1175-1180.
16. Colet PC, *et al.* "Compliance with standard precautions among bacculaureate nursing students in a Saudi university: A self-report study". *Journal of Infection and Public Health* 10.4 (2016): 421-430.
17. Lam SC, *et al.* "Investigation on the compliance with standard precautions among nurses in Hong Kong hospitals". *International Journal of Infectious Diseases* 16.1 (2012): e386.
18. Mollaoglu M, *et al.* "Compliance with standard precautions of students in clinical practice". *Journal of Family Medicine and Community Health* 2.8 (2015): 1064.
19. Benboubker M, *et al.* "Knowledge, attitudes and practices towards standard precautions among caregivers at Hassan II University teaching Hospital in Fes, Morocco". *Eastern Mediterranean Health Journal* 23.1 (2017): 5-12.
20. Lou Y, *et al.* "Factors impacting compliance with standard precautions in nursing, China". *International Journal of Infectious Diseases* 14.12 (2010): e1106-e1114.
21. Olson CK, *et al.* "Preventing transmission of Zika virus in Labor and Delivery settings through implementation of standard precautions - United States, 2016". *Morbidity and Mortality Weekly Report* 65.11 (2016): 290-292.
22. Centers for Disease Control and Prevention (CDC). Sharps Injuries: Sharps Disposal (2010).
23. Kretzer EK and EL Larson. "Behavioral interventions to improve infection control practices". *American Journal of Infection Control* 26.3 (1998): 245-53.
24. Bashatah AS and HAE Alkorashy. "Challenges in Curriculum Designs: RN to BSN Bridging Program at King Saud University". Division of MBAA International (2011).

25. Jradi H., *et al.* "Public health nursing education in Saudi Arabia". *Journal of Infection and Public Health* 6.2 (2013): 63-68.

Volume 13 Issue 2 November 2017

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