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Factors associated with nursing students' compliance with standard precautions: a self-reported survey

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Abstract

Adhering to standard precautions is a key factor in reducing the risk of infection among nurses and nursing students. This study identified nursing students' compliance with standard precautions and the factors associated with their compliance. This descriptive survey included 176 nursing students from a regional nursing college. Compliance with standard precautions was assessed using a 20-item questionnaire. Data were analysed using t-tests, a one-way analysis of variance, and a multiple regression analysis. Participants' overall compliance rate was 50.5%. Concerning general characteristics, significant differences were found regarding needle-stick or sharps injuries, practicum department (surgical and paediatric), and type of contact (faeces). Needle-stick or sharps injury experience (β = -0.225) and surgery practicum department (β = 0.182; Adj R^2 = 0.063; p = 0.001) had a significant effect on compliance level. Standard precautions should be emphasized in the nursing curricula, along with systematic continuing education. Educational programs for needle-stick or sharps injury prevention should also be included in standard precautions curricula.

Keywords: infection control, universal precautions, nursing students, compliance, South Korea

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Introduction

Healthcare associated infections (HAIs) are strongly related to morbidity, mortality, and healthcare costs.[1] According to the World Health Organization, hundreds of millions of patients each year are affected by HAIs worldwide. Ten percent of hospitalised patients in developing countries and 7% in developed countries are reported to have had at least one HAI.[2] In the United States, HAIs affect approximately 1 million patients every year and lead to 75,000 deaths.[3] In South Korea, HAIs occur in approximately 5–10% of hospitalised patients, with the most frequent being urinary tract infections, bloodstream infections, and pneumonia in intensive care.[4]

Considering the negative effect that HAIs have on patients and the increased medical costs, preventing HAIs is necessary. In previous studies, standard precautions (SPs) have been the foundation for the prevention of cross-contamination at clinical sites and are the most recent guideline for infection control.[5,6] This is because healthcare workers are at a high risk of exposure to HAIs[7] and nurses' compliance with SPs ranged from 9.1 to 73%, and is effected by age, sex, knowledge level, receptivity, and safety climate.[8] Once nursing students graduate, they will be required to prevent HAIs by strictly following SPs.[9-11] Nursing students have less clinical experience compared to nurses; however, they perform the same nursing behaviours and their risk of exposure to blood, bodily fluids, and needle-stick and sharps injuries are just as high as those of nurses .[6,12,13]

SP training in nursing education is being performed internationally, which is critical because systematic nursing education can promote infection control.[8,14] However, previous studies[15] have shown that nursing students struggle to understand the principles of infection control management. This signifies that insufficient time is being devoted to infection prevention and management in nursing school curricula and/or in clinical settings. In addition, recent research on infection control training among nursing students revealed that students had low knowledge and performance levels.[16] One Korean study further reported that nursing students' understanding of infection prevention is low, and they were unfamiliar with the practice of infection prevention.[17]

Although awareness of infection control has increased in South Korea because of the Middle East respiratory syndrome coronavirus, which resulted in 24 deaths in 2015,[18] and there have been formal efforts to prevent HAIs,[19] there is relatively limited research analysing the effect on nursing students' compliance rate using tested tools such as the Compliance with Standard Precautions scale.[11] Therefore, our study identified the adherence rate of nursing students to SPs and factors that affect adherence as basic data for infection control training in nursing education.

Materials and methods

Design

This descriptive study was conducted with nursing students from one regional university from December 15 to 23, 2017 to identify students' compliance with SPs for infection control, differences in compliance according to general characteristics, and factors that affect compliance.

Study setting and sample

Questionnaires were distributed to 3rd- and 4th-year nursing students with clinical experience who understood the purpose and agreed to participate in the 2017–18 academic year.

Sample size estimate

We used G*Power 3.1.9.2, setting in an effect size of 0.15, an α probability of 0.05, a power of 0.95, and six predictors for regression analysis, which resulted in a required sample size of 146. Considering a dropout rate of 20%, questionnaires were distributed to 180 candidates. After excluding questionnaires with incomplete responses, data of 176 students were included.

Ethical consideration

For the protection of the participants, the objectives, methods, assurance of participants' rights, and questionnaires were reviewed and approved by the Institutional Review Board at Keimyung University (40525-201711-HR-67-02). Participants were informed of the study objectives and contents, and those who voluntarily agreed to participate provided written consent.

Instruments

We asked participants to self-report their sex, age, nursing year, practical training department, experience with needle-stick or sharps injuries during practical training, experience with contact with patients' blood or bodily fluids during practical training, previous contractions of infectious disease, and HAI-management education.

Compliance with SPs was measured with a scale developed by Lam[20] to measure nurses' and nursing students' levels of compliance with SPs. It includes use of protective devices (6 items), disposal of sharps (3 items), disposal of waste (3 items), decontamination of spills and used articles (1 items), and prevention of cross infection from person to person (7 items). In this study, we measured SPs with a version of the tool that Lim[21] translated, back-translated, and validity-tested for Korean use. The questionnaire comprised 20 items and was answered using a 4-point Likert scale: "never", "seldom", "sometimes", and "always". We received approval from the original creator and Lim. Following the recommendations of the tool developer, compliance rate was measured by scoring "always" as 1 and all other responses as 0. Items 2, 4, 6, and 15 were reverse-coded. The total score ranged from 0 to 20, with higher scores indicating a higher SP compliance rate. The reliability and validity were tested at the time of the original tool's development,[11] at which point the Cronbach's α was 0.73. The Cronbach's α of Lim's Korean version was α = 0.82, and that in the present study was α = 0.79.

Data collection

Three research assistants explained the purpose and aims of this research, obtained written consent, and distributed the questionnaires to the participants. After completion, the questionnaires were returned to them.

Data analysis

The collected data were analysed using IBM SPSS Statistics 21.0 (IBM Corporation, Armonk, NY). Participants' general characteristics and SP compliance rate for infection management were presented as means and standard deviations. The differences in nursing students' compliance with SPs according to their general characteristics were analysed with t-tests or a one-way analysis of variance. A multiple regression analysis was performed to identify the factors influencing nursing students' compliance with SPs.

Results

Participants' characteristics

The participants' characteristics are shown in Table I.

Participants' self-reported compliance with SPs

The mean compliance rate with SPs among nursing students was 50.5%. The compliance rates per item are shown in Table II.

Participants' compliance with SPs per their characteristic

Regarding participants' compliance with SPs, there were no differences in sex, age, nursing year, experience with body fluids during practical training, contracting an infectious disease, or infection management education experience. However, those with practical experience in surgical and paediatric departments showed significantly higher compliance rates compared to their counterparts. Further, those with needle-stick or sharps injury experience showed a higher compliance rate, while those who had experience with contact with faeces, among the subdivisions of contact with blood or bodily fluids, showed higher compliance rates than did those without said experience (Table III).

Factors influencing participants' compliance with SP

To identify the factors influencing compliance with SPs among nursing students, a stepwise multiple regression analysis was performed with type of contact (faeces), needle-stick or sharps injury experience, and practical training department (surgical and paediatrics), which showed significant differences regarding compliance with SPs, as independent variables. The results showed that the factors influencing compliance with SPs were needle-stick or sharps injury experience and practical training experience in the surgery department (Table IV).

Discussion

This study was conducted with third and fourth-year nursing students with clinical practicum experience from one school to identify their compliance rate with

SPs for infection control and the influencing factors that affect their compliance. The results showed that half the students reported that they practiced SPs, which is lower than the compliance rates observed in studies of Brazilian (69.4%) or Hong Kong (57.4%) nurses[22] and Hong Kong nursing students (53.5%),[11] who were analysed with the same tool used in the present study.

Specific differences in students' compliance rate were revealed for certain SPs such as the use of protective devices, disposal of sharps, decontaminant of spills, and used articles. First, "use of protective devices" was generally low in comparison to research conducted with Saudi nursing students.[10] Specifically, the compliance rate with "I wear a surgical mask alone or in combination with goggles, a face shield, and an apron

Table I. Participants' characteristics (N = 176)

Characteristic		n	%
Sex	Male	19	10.8
	Female	154	89.2
Age (years)	20–21	61	35.8
	22–23	93	53.4
	≥24	19	10.8
Year of study	3	99	56.9
	4	74	43.1
Practicum department	Internal medicine	166	96.0
	Surgery	147	85.0
	Obstetrics	73	42.2
	Paediatrics	153	88.4
	Intensive care unit	116	67.1
	Other	25	14.5
Needlestick or sharps injury	Yes	33	19.3
	No	140	80.7
Contact with blood or bodily fluids	Yes	39	23.3
	No	140	76.7
Contact type	Blood	22	12.7
	Tear	9	5.2
	Urine	25	14.5
	Faeces	3	1.7
	Saliva	15	8.7
	Sweat	16	9.2
	Other	1	0.6
Infectious disease experience	Yes	9	5.1
	No	164	94.9
Standard precaution training	Yes	89	51.1
	No	84	48.9

Table II. Participants' self-reported compliance with standard precautions (N = 176)

Ranking	Item	Compliance rate n (%)
1	Q 5. I put used sharp articles into sharps boxes.	158 (91.3%)
2	Q 20. I clean up spillage of blood or other bodily fluids with disinfectants immediately.	137 (79.2%)
3	Q 14. When I wear a mask, my mouth and nose are covered.	135 (78.0%)
4	Q 12. I decontaminate my hands immediately after removal of gloves.	134 (77.5%)
5	Q 1. I wash my hands between contact with patients.	127 (73.4%)
6	Q 19. I wear gloves to decontaminate used equipment with visible soils.	115 (66.5%)
7	Q 17. Waste contaminated with blood, bodily fluids, secretion, and excretion is placed in red plastic bags irrespective of patients' infection status.	114 (65.9%)
8	Q 11. I change gloves between contact with patients.	111 (64.2%)
9	Q 10. I wear gloves when I am exposed to bodily fluids, blood products, and any excretion of patients.	102 (59.0%)
10	Q 3. I use alcoholic hand rubs as an alternative if my hands are not visibly soiled.	97 (56.1%)
11	Q 8 I take a shower in case of extensive splashing even after I have put on personal protective equipment.	92 (53.2%)
12	Q 7. I remove personal protective equipment in a designated area.	87 (50.3%)
13	Q 13. I wear a surgical mask alone or in combination with goggles, a face shield, and an apron whenever there is a possibility of a splash or splatter.	72 (41.6%)
14	Q 16. I wear a gown or apron when exposed to blood, bodily fluids, or any patient excretions.	69 (39.9%)
15	Q 9. I cover my wound(s) or lesion(s) with a waterproof dressing before contact with patients.	59 (34.1%)
16	Q 18. I decontaminate surfaces and equipment after use.	54 (31.2%)
17	Q 6. The sharps box is disposed only when it is full.[a]	41 (23.7%)
18	Q 15. I reuse a surgical mask or disposable personal protective equipment.[a]	19 (11.0%)
19	Q 4. I recap used needles after giving an injection.[a]	17 (9.8%)
20	Q 2. I only use water for hand washing.[a]	8 (4.6%)
	Overall compliance rate	173 (50.5%)

[a]Reverse scored items.

Table III. Participants' self-reported compliance with standard precautions according to their characteristics (N = 176)

Characteristic		Compliance rate (%)	t or F	p
Sex	Male	51.8	0.223	0.826
	Female	50.4		
Age (years)	20–21	46.9	2.760	.066
	22–23	53.8		
	≥ 24	46.3		
Year of study	3	48.8	1.295	0.197
	4	52.8		
Practicum department	Surgical (Yes)	51.8	2.045	0.042
	(No)	43.3		
	Paediatrics (Yes)	51.6	2.004	0.047
	(No)	42.3		
Needlestick or sharps injury	Yes	42.3	2.709	0.007
	No	52.5		
Contact with blood or bodily fluids	Yes	49.4	0.415	0.678
	No	50.9		
Contact type	Faeces (Yes)	26.7	2.127	0.035
	(No)	50.9		
Infectious disease experience	Yes	47.2	0.512	0.609
	No	50.7		
Standard precaution training	Yes	53.0	1.690	0.093
	No	47.9		

Table IV. Factors influencing participants' self-reported compliance with SPs (N = 176)

Variable	B	SE	β	t	p
Needlestick or sharps injury	-11.3	3.7	-0.225	3.026	0.003
Practicum department (surgery)	10.05	4.1	0.182	2.446	0.015
$R = .272$, $R^2 = .157$, Adj $R^2 = .063$, $F = 6.768$, $p = .001$					

whenever there is a possibility of a splash or splatter" was much lower in comparison to the compliance rate of Saudi nursing students (72.9%)[10] and Hong Kong nursing students (89.3%).[23] "I reuse surgical mask or disposable personal protective equipment" was also strikingly low compared to the results of a study that examined Saudi nursing students (52.5%).

The very low compliance rates with "use of protective devices" items was similar to one Korean study.[24] This is because the ability to use gowns, protective goggles, and masks in Korea is limited because of reduced accessibility in clinical contexts.[17] However, compliance with wearing masks was high, and compliance with mask reuse was markedly low in the present study; this is thought to be the result of key curricula training by the Korean Accreditation Board of Nursing Education.[25]

Compliance with the "disposal of sharps" was similar to the results displayed by Saudi (84.3%)[10] and Hong Kong (95.3%) nursing students.[23] This signifies that nursing students in Korea also recognize the importance of immediately disposing of used needles effectively; however, they are still exposed to needle-stick injuries due to needle recapping.[26] We assume that students have insufficient opportunities to practice various needle-stick prevention in Korea because students usually only practice with needles that measure blood glucose levels. Therefore, further education and training concerning the prevention of needle-stick and sharps injuries is necessary in schools and hospitals.

Concerning the "prevention of cross infection from patient to patient," the compliance rate with "I cover my wounds or lesion with a waterproof dressing before contact with patients" was markedly low (34.1%) compared to the compliance rate of Saudi (61.4%)[10] and Hong Kong (56.4%) nursing students.[23] This is perhaps because Korean nursing students think that they can only use hospital items with a nurse's approval and because they received an insufficient facility orientation.[17] However, thorough training is necessary because nursing students are exposed to the same clinical sites as nurses, and, despite being novices, are required to provide the same nursing behaviour and may even be exposed to more risky situations compared to nurses.[12] Further, compliance rates with "washing hands after contact with patients (73.4%) and "hand hygiene immediately after taking off gloves" were markedly higher than the results displayed by Hong Kong nursing students.[23]

Concerning environmental and disposal management, several items were often complied with; however, compliance with "I decontaminate surfaces and equipment after use" was low compared to nursing students from other countries.[10,23] This may be because environmental and disposal management is performed by staff or nurses' aides under the direction of nurses in Korean clinical settings.

Experience with needle-stick or sharps injuries and experiences in the surgical department were associated with participants' SP compliance rate. General comparisons can be made because previous qualitative studies that examined nursing students found that students' attitude, negative role models, classroom and in-field gaps, blind spots, psychological barriers, physical barriers, lack of information, and various intentions were factors that affect compliance with SPs.[17,27] Further, a study with nurses found that the existence of sharps disposal boxes within the department, general self-efficacy, exposure experiences, and working department also affected compliance with SPs.[28] However, we found that one-fifth of nursing students had experience with needle-stick or sharps injuries, and that this influenced their compliance with SPs. Notably, compared to the results from a predictive study on compliance with SPs among Hong Kong nursing students,[8] the current participants were approximately 6 times more likely to have experienced a needle-stick/sharps injury. In addition, a large-scale Korean study that examined clinical nurses found that the needle-stick injury rate was 70.4%, and that the factors that influenced this were staffing and resource adequacy.[29] Therefore, further research should identify the cause of the high needle-stick/sharps injury rate and multidimensional safety training is necessary at all clinical sites to prevent needle-stick/sharps injuries. Additionally, half the current students had not received infection control training; therefore, a review of infection control training that includes repetitive recall training about infection control in nursing education is urgently needed. Also the quality of the infection control training needs to be reviewed. For this purpose, it is also necessary to provide

education in a variety of ways that incorporate not only traditional education but also informatics.[30]

Experience in surgical practicum training was another factor that affected compliance rate. This finding is likely because students' direct and indirect experiences or training in the ward during the practicum had a substantial impact on their practices, which may be attributed to the importance of aseptic techniques in the surgical ward.

This study had some limitations. First, the four items that had the lowest compliance rates were all reverse-coded; therefore, students may have been confused about the item wording or their competency may have been low. Specifically, compliance to items 2, 4, and 15 was markedly lower than in previous studies.[10,11] Considering that these items are used clinically with high frequency, carefully analysing the cause of the low compliance rates is needed. In addition, the Cronbach's α level of our measure was lower than that of the Korean-translation of the original tool.[21] We might attribute this to our sample—nursing students have fewer clinical experiences compared to registered nurses. Furthermore, since the validation of the Korean version of the original version was intended for certified personnel, this is also a limitation of the application of the tool. Future studies should include a description of the reverse-coded items for participants before they complete the questionnaires, and these items should be analysed in more detail and emphasized during nursing training.

Self-reported questionnaires can also lead to social desirability bias and we cannot exclude the possibility that they may have affected the outcomes of this study. Further, this study included third- and fourth-year nursing students who were enrolled from one university in one region. While a previous study[10] found that school year and age affected compliance rates, our research did not show significant differences. This might be because of a negligible variance in age in our sample. Consequently, there are limits to the generalisability of our results. Therefore, a large-scale study comprising more schools and students is necessary.

Conclusion

Korean nursing students' compliance rate with SPs was relatively low compared to previous studies that utilized the same measurement tool; therefore, appropriate training that focuses on items with a low compliance rate is necessary. Specifically, the proportion of participants who had sustained a needle-stick or sharps injuries, which affected nurses' performance, was considerably high. Research on the reasons underlying this finding may be useful. Students' adherence to SPs should be emphasized and should be regularly assessed to ensure strict adherence. In addition, nursing education to prevent needle-stick and sharps injuries should be urgently addressed.

Conflicts of interest

None declared

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