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Major Article

Factors influencing the adherence of nurses to standard precautions in South Korea hospital settings

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Background: Standard precautions (SPs) serve as the first line of defense against exposure to blood and body fluids. The objective of this study was to explore the adherence of nurses to SPs and to identify factors influencing adherence to SPs.

Methods: This study was an exploratory cross-sectional survey. A total of 339 nurses from 9 general hospitals and 3 tertiary hospitals located in 3 South Korean cities were selected. Hierarchical regression was used to examine the effects of sociodemographic, individual, and institutional factors.

Results: A higher, or positive, attitude was the strongest influencing factor in adherence to SPs in the final model, followed by administrative support, hospital types, and safety climate, in descending order. These 4 variables accounted for 26.0% of the variance in adherence to SPs.

Conclusions: The attitudes of nurses toward SPs is important for increasing the adherence to SP best practices. The adherence of nurses to SPs will improve if safe environments are created in different hospital types and if managerial support and administrative efforts are supportive and sustained.

Health care workers are at risk of exposure to blood and body fluids containing bloodborne pathogens. Nurses are especially prone to exposure, owing to their involvement in direct, invasive, and continuous nursing activities.[1,2] Standard precautions (SPs) serve as the first line of defense against exposure to bodily fluids such as blood and secretions, mucous membranes, and nonintact skin, which were deemed infectious, regardless of a patient's diagnosis.[3] In 2007, the Centers for Disease Control and Prevention added respiratory hygiene and/or cough etiquette and safe injection practices to the list of SPs.[3]

Adherence to SPs is essential in preventing health care–associated infection (HAI).[4,5,6] The 2015 Middle East Respiratory Syndrome (MERS) outbreak in South Korea was the second largest health care–associated outbreak in the world. Failure to adhere to basic SPs and protocols, pursuant to different routes of disease transmission, contributed to the outbreak.[7] This has assisted with an increased awareness of HAIs and efforts with improving the levels of adherence to SP. However, the level of adherence among nurses remains insufficient, requiring a behavioral change to improve adherence and prevent HAIs.[4,5,6,8]

Studies on the influencing factors of SP adherence have been investigated, including individual, work-related, and organizational factors[9] or sociodemographic, individual, and institutional factors.[10] Occasionally, factors such as knowledge, attitude, safety climate, protective device, and workload have been examined without distinction of categories.[11] Haile et al [10] reported that the sociodemographic factors reported to affect adherence to SP include being female,[11] length of work experience,[12] age,[13] higher level of education,[6,13] and department the nurse is stationed in.[6] Health belief, awareness, and risk perception have been identified as influencers of adherence to SP among individuals,[4,5,10,12] with results varying by country, hospital type, and subject. Recently, institutional factors such as safety equipment availability and accessibility, management support for safe work practice, safety performance feedback, and workplace safety climate have received attention for their importance in SP adherence.[10]

A study of registered nurses from 25 public hospitals in China were affected by protective equipment, safety climate, and workload,[11] whereas other studies show that workplace safety climate influences SP adherence among nurses in dialysis care[12] and adherence to SP by nurses in psychiatric wards is correlated with

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organizational factors, including availability of personal protective equipment (PPE) and the security climate.[9] Haile et al[10] also show that medical staff in university hospitals were found to be affected by training on SP, accessibility of PPE, and management support. This suggests it is necessary to investigate institutional factors affecting workplace safety climates, including physical, and other circumstances, together with administrative support.[10,13] This study aimed to understand how sociodemographic and individual factors, such as knowledge and attitude, along with institutional factors such as safety climate and administrative support, influence the adherence of nurses to SPs in South Korean hospitals following the 2015 MERS outbreak.[7,8] Evaluating the effects of sociodemographic, individual, and institutional factors, whereas considering the hospital size and type, will contribute to the improvement of SP adherence and to the creation of a safe environment and administrative system.

METHODS

Design

This study is a descriptive survey exploring the adherence of nurses to SPs and identifying factors that influence adherence to SPs.

Setting and sample

This study was conducted with nurses from 9 general hospitals (180-250 beds each) and 3 tertiary hospitals (800-1,300 beds) with infection control offices, all located within the metropolitan area of Incheon, South Korea. Ten general hospitals and 1 tertiary hospital declined participation. The inclusion criteria for this study's participants were nurses working in direct contact departments, excluding administrative departments and insurance review departments. Participants were selected through convenience sampling, and the number of participants was calculated using G*Power 3.1.9.2.[14] The minimum sample size required for regression analysis, with medium effect size of 0.15, significance level of 0.05, power of 0.95, and 11 predictive factors, was calculated to be 178.

Data were collected via a survey from February 7, 2018, to April 30, 2018. A total of 360 questionnaires were collected by allocating 180 persons from 20 nurses per general hospital (n = 9) and 180 persons from 60 nurses per tertiary hospital (n = 3). Questionnaires were collected from a total of 352 nurses (response rate 97.8%). After excluding 20 incomplete questionnaires, a total of 332 nurse responses were included in the analysis. The total number of questions was 86, and the survey took about 15 minutes. All research tools were approved for use by the authors.

All procedures followed were in accordance with the ethical standards of the institutional review board of Gachon University (1044396-201801-HR-004-01). Informed consent was received from all patients prior to data collection. The participants were kept anonymous throughout the survey, and their personal data were kept confidential. The participants were given the option to stop the survey process at their discretion. The researcher visited the hospitals to collect the completed questionnaires in person.

Instruments

Adherence to SPs and attitude toward SPs

Adherence to SPs and attitude toward SPs were measured using a 21-item questionnaire developed by Askarin et al,[15] then edited and translated to Korean by Jeung.[16] The tool consisted of 5 questions on hand hygiene, 5 items on PPE, 3 items on environmental management (cleaning, disinfecting, and laundry), 4 items on needlestick and sharps injury prevention, and 4 items on respiratory hygiene and cough etiquette. Adherence to SP was measured on a 4-point Likert scale (1 = "never adhered," 2 = "adhered sometimes," 3 = "adhered most of the time," and 4 = "always adhered"); a higher score indicated a higher level of adherence. The Cronbach alpha with all questions was 0.85 in the study by Jeung[16] and in this study with all questions was 0.93.

Attitude toward SP is defined as the degree to which the participant perceives SP to be important in the prevention of exposure to blood and body fluids. Attitude toward SP was measured on a 4-point Likert scale (1 = "disagree," 2 = "somewhat disagree," 3 = "somewhat agree," and 4 = "agree"); a higher score indicated a higher level, or more positive, attitude. The Cronbach alpha was 0.83 in the study by Jeung[16] and in this study with all questions was 0.93.

Knowledge on SPs

Knowledge on SPs was measured using the 27-item survey developed by Baek,[13] who added 2 items addressing respiratory hygiene and cough etiquette to the 25-item survey developed by Suh and Oh,[17] based on the 2007 Healthcare Infection Control Practices Advisory Committee guidelines.[3] These guidelines consisted of 4 items on the definition of SP, 4 items on hand hygiene, 11 items on PPE, 4 items on environmental management (cleaning, disinfecting, and laundry), and 2 items on needlestick and sharps injury prevention. Each item was measured based on the following scale: 1 point if "yes" and 0 point if "no" or "not sure." A higher score indicated greater knowledge on SPs. In a previous study conducted by Baek,[13] the Content Validity Index value of the whole questionnaire was found to be 1.0 when testing for the tool's validity; the knowledge section was scored on a range of 0 to 27 points, which was then converted into a percentage.

Safety climate

Safety climate refers to the physical, and other circumstances necessary to perform actions delineated by SP to prevent the risk of exposure to blood and body fluids. Safety climate was measured using a 7-item questionnaire developed by Cho and Choi,[5] and then revised and supplemented by Suh and Oh.[17] Each item was answerable by either "yes" (1 point) or "no" (0 point). Reserved items were reversely coded. A higher score indicated a safer climate for prevention of infection. The safety climate score ranged from 0 to 7 points and was converted into percentage. The Cronbach alpha was 0.66 in the study by Suh and Oh,[17] and 0.61 in this study.

Administrative support

Administrative support refers to an organizational form of assistance and support that may encourage preventive action against infection. It was measured using a 10-item survey, which borrowed 4 questions addressing "manager expectations and actions promoting patient safety" from the Hospital Survey on Safety Culture by the Agency for Healthcare Research and Quality[18] and 6 items about "administrative reinforcing" from the survey developed by Baek.[13] It was measured using a 5-point Likert scale (1 = "disagree," 2 = "somewhat disagree," 3 = "neutral," 4 = "somewhat agree," and 5 = "agree"); a higher score indicated better administrative support. The Cronbach alpha was 0.86 in the study by Baek[13] and 0.88 in this study.

Data analysis

The collected data were analyzed using SPSS/WIN 23.0 (IBM, Armonk, NY). Major variables were normally distributed (Kolmogorov-Smirnov test), and 2-tailed P values of <.05 were considered significant. The participants' general characteristics and related variables were calculated using frequency, percentage, mean, and. Reliability of the variables was calculated using the Cronbach alpha.

Differences in the level of adherence to SP in relation to general characteristics were analyzed using the independent Student t test, analysis of variance, and Scheffe test. Correlations were computed using the independent Pearson correlation coefficient. To identify the respective effects of knowledge, attitude, safety climate, and administrative support of nurses on adherence to SP, this study conducted a hierarchical linear regression, controlling for confounding variables that were found to have significant difference and correlation. Based on the study of Haile et al,[10]analysis of sociodemographic factors as level 1 (age, hospital types, and length of clinical experience), individual factor as level 2 (attitude), and institutional factors as level 3 (safety climate and administrative support) was performed in descending order.

RESULTS

General characteristics and differences in the level of adherence to SPs

Most of the participants were women (96.1%), and the mean age was 32.4 ±7.8 years. Approximately 58.7% of the participants held a bachelor's degree or higher. A total of 51.8% of the participants were employed in tertiary hospitals, and most of the participants were staff nurses (80.7%). Approximately 54.8% of the participants worked in wards, and 77.7% worked under a 3-shift system.

Adherence to SP differed significantly according to hospital type ($P < .001$), with tertiary hospitals having higher adherence scores (Table 1).

Level of knowledge, attitude, and adherence to SP, safety climate, and administrative support

The mean score for knowledge on SP was 88.8 ± 7.5 (out of 100 points), 3.9 ± 0.3 (out of 4 points) for attitude, and 3.5 ±0.4 (out of 4 points) for adherence to SP.

The safety climate score was 76.5 ± 20.9 (out of 100 points). The question with the highest score (94.6 ± 22.7) was "Hand hygiene can be maintained with ease because washbasins and waterless alcohol hand sanitizers are readily available." By contrast, the question with the lowest score (36.7 ± 48.3) was "There is not enough time to perform tasks while adhering to SPs (reversed item)."

The administrative support score was 4.1 ± 0.7 (out of 5 points). The question with the highest score (4.5 ± 1.0) was "Manager does not take infections of patients in the ward seriously (reversed item)." By contrast, the question with the lowest score (3.4 ±1.1) was "Manager gives praises when I perform tasks according to SPs" (Table 2).

Correlation of the main study variables

The adherence of the participants to SP was significantly correlated with their attitude, the safety climate, administrative support, age, and length of clinical experience ($P < .05$) (Table 3).

Factors influencing adherence to SP

Hierarchical regression was used to examine the effects of 3 major factors on the adherence of nurses to SP: the respondents' sociodemographic, individual, and institutional factors.[10] In the first model, age, hospital types, and length of clinical experience increased the explanatory power of variance by 6.4% ($F = 7.51$; $P < .001$). The standardized coefficients of hospital types ($\beta = 0.195$; $P = .001$) was significant. When the attitude of nurses was entered into the second model, the explanatory power of variance increased by 12.5% ($F = 19.11$; $P < .001$). The second model accounted for 18.9% of the variance in the adherence of the nurses to SPs. When administrative support and safety climate were entered into the third model, the explanatory power increased by 7.1% ($F = 19.03$; $P < .001$).

In the final model, the standardized coefficients of attitude was the most influential factor ($\beta = 0.296$; $P < .001$), followed by administrative support ($\beta = 0.171$, $P < .05$), hospital types ($\beta = 0.167$; $P < .05$), and safety climate ($\beta = 0.148$; $P < .05$). These variables accounted for 26% of the variance in adherence to SP (Table 4).

DISCUSSION

Adherence to SP is affected by various factors, and changes in institutional factors, in addition to changes in sociodemographic and individual factors, must be explored to bring about a behavioral shift.[10] Among individual changes required to increase adherence to SP best practices, knowledge, attitude, awareness, risk perception, and health beliefs have been studied.[4,6,9,15,16] In some studies, knowledge and attitude were found to be major influencers and have positive effects on adherence to SP best practices.[4,11,17] However, in other studies, they did not exert a significant effect, or only 1 exerted meaningful influence.[9] In this study, the biggest influencer on adherence to

Table 1
General characteristics and differences in adherence to standard precautions (N = 332)

Variables		N (%)	Adherence to SPs M ± SD	t or F (*P*)
Sociodemographic characteristics				
Gender	Female	319 (96.1)	3.47 ± 0.38	0.87
	Male	13 (3.9)	3.37 ± 0.37	(.352)
Age in years (M ± SD, range)	32.4 ±7.8 (23.0-57.0)			
Education level	Diploma	137 (41.3)	3.45 ± 0.36	0.82
	≧ Bachelor	195 (58.7)	3.49 ± 0.39	(.366)
Work-related characteristics				
Hospital types	General hospital (with 180-250 beds)	160 (48.2)	3.39 ± 0.40	14.67*
	Tertiary hospital (with 800-1,300 beds)	172 (51.8)	3.55 ± 0.34	(<.001)
Length of clinical experience (y, M ± SD, range)		7.7 ± 6.9 (0.1-30.5)		
Position	Staff	268 (80.7)	3.45 ± 0.39	1.80
	Charge	36 (10.8)	3.55 ± 0.28	(.167)
	Head	28 (8.4)	3.55 ± 0.36	
Department	Medical/surgical ward	182 (54.8)	3.46 ± 0.41	2.45
	Intensive care unit	63 (19.0)	3.58 ± 0.31	(.064)
	Emergency unit	33 (9.9)	3.38 ± 0.44	—
	Other	54 (16.3)	3.45 ± 0.28	—
Three-shift system	Yes	258 (77.7)	3.47 ± 0.40	0.021
	No	74 (22.3)	3.48 ± 0.30	(.885)

*$P < .05$

Table 2
Level of knowledge, attitude, and adherence to standard precautions, safety environment, and administrative support (N = 332)

Items	% or
% or M ± SD	
Knowledge (possible range: 0.0%-100.0%)	88.8 ± 7.5
Attitude (possible range: 1-4)	3.9 ± 0.3
Adherence to SPs (possible range: 1-4)	3.5 ± 0.4
Safety climate (possible range: 0.0%-100.0%)	
I know where to contact for questions related to SPs and I expect to be assisted as soon as I need it.	82.2 ± 38.3
I received systematic training on SPs.	74.7 ± 43.5
Hand hygiene can be maintained with ease because washbasins and water-free alcohol hand sanitizers are readily available.	94.6 ± 22.7
PPE (gloves, masks, goggles, and disposable gowns) are always available for immediate use when needed.	82.3 ± 37.8
I don't feel comfortable wearing protective equipment when my colleagues are not.*	77.4 ± 41.9
I am told by senior nurses or nursing officers to perform my tasks while adhering to SPs.	86.7 ± 33.9
There is not enough time to perform tasks while adhering to SPs.*	36.7 ± 48.3
Total	76.5 ± 20.9
Administrative support (possible range: 1-5)	
Manager gives praises when I perform tasks according to SPs.	3.4 ±1.1
Manager takes my suggestions on infection prevention seriously.	3.7 ± 0.9
Manager does not take infections of patients in the ward seriously.*	4.5 ± 1.0
Manager wants the tasks to be handled quickly even by resorting to expediencies when workload is heavy.*	4.4 ± 1.0
Manager is concerned about staff's exposure to infection.	4.1 ± 1.0
My hospital conducts infection prevention training on a regular basis.	4.0 ± 1.1
My hospital provides manuals on infection prevention.	4.2 ± 1.0
My hospital provides protocols for exposure to infection.	4.2 ± 1.0
My hospital conducts health checkups on its staff for infection control on a regular basis.	4.4 ± 0.9
My hospital conducts vaccination (with charge or no charge) on its staff for infection control on a regular basis.	4.4 ± 1.0
Total	4.1 ± 0.7

PPE, personal protective equipment; *SP*, standard precaution.
*Conversion.

SP was attitude. Whereas SP adherence was not correlated with knowledge, knowledge had a correlation with attitude. A positive attitude was highly correlated to knowledge about infection control prevention around body fluids, including blood, which led to an overall improved adherence to SP. This shift in attitude indicates that it is possible to shift behavior. The higher degree of perception should take place across sub-items under attitude, including hand hygiene, PPE, environmental management (cleaning, disinfecting, and laundry), needlestick and sharps injury prevention, respiratory hygiene, and cough etiquette.[3] Given that SP should be applied to all patients before identifying the source of infection, an effective training system should be established to promote adherence to SP at all times as well as promotional and managerial programs addressing each sub-item under SP.

This study sets itself apart from others in that it considers hospital type as a significant factor influencing adherence level. South Korean tertiary hospitals serve as both educational institutions and advanced general hospitals. Tertiary hospitals with 800-1,300 beds are likely to have more infection control personnel and an infection control fee commensurate with their bed count.[19] The infection control fee is paid to a hospital as compensation if the hospital meets staffing requirements: 1 infection control doctor and 1 or more infection control nurses for every 150-200 beds.[19] Additionally, tertiary hospitals are also required to have a strict infection control system based on hospital accreditation evaluation.[8,19] A similar study on nurses in hemodialysis care showed that adherence to SP was significantly lower among nurses in private hospitals than those in general or tertiary hospitals, which is a reflection of poor infection control system in private hospitals owing to blind spots created by medical laws.[12] In spite of the heightened national and social awareness of HAI and the amendment of the Medical Services Act following the MERS outbreak in 2015, further efforts should be made to improve adherence to SP and to strengthen infection control in small to medium-sized general hospitals.[12]

The safety climate score was 76.5 (out of 100 points), which was higher than 71.4 in a 2010 study of nurses working in South Korean general hospitals.[17] This increase is likely owing to the legal and administrative efforts following the outbreak of a new infectious disease.[7] However, the fact that "There is not enough time to perform tasks, whereas adhering to SPs (reversed item)" scored the lowest, with 36.7 ± 48.3 points, shows that hospitals must not only supply sanitizers and PPE, but also work toward adequate arrangement of personnel and nursing so nurses can both finish tasks and adhere to SP. The high standard deviation in this item was considered to be owing to variance in the various subjective perceptions of time as well as in 12 different hospitals and departments with various scale of bed counts. A previous study reported that Chinese hospitals are also faced with frequent occupational exposure owing to a shortage of nurses and an increased workload, which detrimentally affect the adherence to SP,[11] highlighting the importance of sufficient nursing personnel.

In this study, administrative support consisted of several subitems, including management support, staff education, infection control protocols, staff health checkups, and vaccination. Whereas items for administrative support vary across different studies, Brazilian studies found that nurses with management support were more likely to comply with SP than those who had less frequent support[20] and that training on SP guidelines enhances adherence level, encourages learning of recently updated protocols, and serves as a major contributor to continued adherence.[21] An additional Ethiopian study showed that managerial support for safety and staff training increased adherence to SP 2.23- and 2.90-fold, respectively.[10]

Table 3
Pearson's correlation coefficients for the main study variables (N = 332)

Variables	1	2	3	4	5	6	7
1. Adherence to SPs	1.00	-	-	-	-		
2. Knowledge	0.069	1.00	-	-	-		
3. Attitude	0.366†	0.144†	1.00	-	-		
4. Safety climate	0.291†	0.164†	0.118*	1.00	-		
5. Administrative support	0.341†	0.226†	0.256†	0.494†	1.00		
6. Age	0.117*	−0.131*	0.032	−0.006	0.053	1.00	
7. Length of clinical experience	0.155†	−0.071	0.053	0.041	0.108*	0.898†	1.00

*$P < .05$.
†$P < .01$; computed using the dependent Pearson correlation coefficient.

Table 4
Hierarchical linear model predicting adherence to SPs (N = 332)

Variables	Model 1		Model 2		Model 3	
	β	T	β	T	β	T
Age	−0.077	−0.635	−0.051	−0.448	0.012	0.112
Hospital types (tertiary hospital = 1)	0.195	3.641†	0.190	3.802†	0.167	3.462*
Length of clinical experience	0.213	1.749	0.171	1.504	0.094	0.858
Attitude			0.355	7.107†	0.296	5.990†
Safety climate					0.148	2.675*
Administrative support					0.171	3.018*
Adj. R^2	6.4		18.9		26.0	
$\triangle R^2$	6.4		12.5		7.1	
F	7.51†		19.11†		19.03†	

NOTE. Analysis of sociodemographic factors (age, hospital types, and length of clinical experience) as model 1, individual factor (attitude) as model 2, and institutional factors (safety climate and administrative support) as model 3.
*P <.01.
†P <.001.

Organizational infrastructure for infection control cannot be created without commitment and support from the management, hindering efficient adherence to SP. Given that "Manager gives praises when I perform tasks according to SPs" was the item with the lowest score, not only surveillance but a reward system should be considered as well. Managers should set up a training system to correct nurses' nonadherence, act as role models in adherence to SP, and stand at the forefront of SP amendment and policy making. Administrative support would improve adherence of nurses to SP and enable efficient management.

The results of this study suggest that administrative support and safety climate are additional factors to be considered for promoting adherence to SP. However, even if all of these environmental factors were provided, the most influential factor in adherence to SP was the attitude of the nurse. Therefore, nurses should be encouraged to promote adherence to SP, and to cultivate a positive attitude toward SP.

Limitation

This study had some limitations. We used self-report questionnaires as opposed to actual observation to assess adherence. Therefore, we suggest a follow-up study using observation to ensure objectivity in regard to adherence to SP. In addition, since general and tertiary hospitals were selected using convenience sampling, a selection of hospitals via systematic allocation considering the area and facility size would be necessary. Furthermore, male nurses only accounted for 3.9% of the sample, which is insufficient given that the average ratio of male nurses in South Korea is 10%. Last, this study focused on South Korea, whose circumstances are rather particular with respect to the national outbreak of MERS in 2015; and therefore, its results should be interpreted with caution.

CONCLUSIONS

Adherence by nurses to SP is critical in the prevention of HAI, and behavioral change is needed to improve adherence levels. In a hierarchical analysis, the sociodemographic (model 1), individual (model 2), and institutional (model 3) factors, with significant influence on adherence to SP, were found to be hospital type, attitude, and safety climate and administrative support, respectively. Attitude was the biggest influencer of adherence to SP, followed by administrative support, hospital types, and safety climate. Adherence to SP by nurses will improve if safe environments are created in different hospital types, and if managerial support and administrative efforts are sustained. To change the attitude of nurses toward SP, consistent promotion and a reward system should be put into place, along with practical training applicable to clinical practice. Special care should be put into small and medium-sized hospitals, which are more likely to be overlooked when it comes to infection control, and institutional efforts should be made to secure adequate staff, physical safety environment, and nursing time required for creating safety climate. Hospital administrators should take responsibility as role models and demonstrate consistent adherence to SP with determination and commitment.

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