Jurnal Ilmu Kesehatan Masyarakat (JIKM)

HEALTH BELIEF MODEL AND HAND HYGIENE COMPLIANCE AMONG NURSES IN THE WARDS OF RSUD DR H. KUMPULAN PANE TEBING TINGGI

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ABSTRACT

One of the intermediaries for infection transmission between patients is through the hands of health workers. Hand hygiene is an easy, cheap, and effective precaution, but very difficult to implement. This study aims to determine the effect of health beliefs on nurse hand hygiene compliance in the inpatient ward of RSUD dr. H. Kumpulan Pane (HKP). This quantitative analytic study with a cross-sectional design was conducted at the inpatient ward of RSUD HKP. This study involved 210 inpatient ward nurses. Data collection was carried out using survey techniques, valid and reliable questionnaires, and direct observation. The majority of respondents were 36-40 years old (40.5%), were female (91.4%), had an associate degree (74.8%), had worked for 6-10 years (57.1%), and were civil servants (56.7%). All respondents had attended Infection Prevention and Control (IPC) training, experienced sharp object injuries and contact with patient body fluids, and 85.7% of respondents had experienced nosocomial infections. The majority of respondents had good perceptions of susceptibility, severity, benefits, cue to action, and self-efficacy, but the majority of respondents also had high perceptions of barriers. Further observation found that nurses' hand hygiene compliance was only around 56.7%. Data analysis found that nurses' hand hygiene compliance at RSUD HKP was influenced by perceived susceptibility ($p<0.001$), severity ($p<0.05$), cue to action ($p<0.001$), and age ($p<0.005$). It can be concluded that although all components of the health belief model were associated with hand hygiene compliance, only perceived susceptibility, severity, cue to action, and age had a significant influence on hand hygiene compliance.

Keywords: Compliance, hand hygiene, health belief model, nosocomial infection, nurse

Introduction

Nosocomial infection is still a matter of considerable concern and is one of the drivers that can increase morbidity, mortality, and medical costs in hospitals, which can lead to new health problems in developing and developed countries.[10–13] The prevalence of nosocomial infections in various countries is around 3.39-9.2% with an estimated incidence of 14 million worldwide, which causes 50,000 deaths and 2 million morbidities, which will result in an increase in length of stay and health costs for up to 14 days in the hospital.[11] World Health Organization/WHO data for 2022 shows that for every 100 patients, 7 patients experience nosocomial infection in developed countries, while in developing countries the figure is more than double, with 15 patients experiencing nosocomial infection. The same data also found that 1 in 10 patients with nosocomial infections die as a result of nosocomial infections.

Nosocomial infections are infections that develop when a patient is undergoing a treatment process in a hospital or other health facility and are not discovered at the time of admission.[1,2] Nosocomial infections can develop by airborne transmission or through direct or indirect contact with contaminated blood or bodily fluids and can result in a person becoming infected with hospital-acquired bacteria, viruses, fungi, and parasites. The risk of nosocomial infection generally increases with the level of patient traffic and the length of stay experienced by the patient. One of the intermediaries for transmission of infection between patients is through the hands of health workers during the hospital care process.[3,4] Infection control is a major challenge and objective for hospitals, especially in inpatient rooms, intensive care rooms, and post-surgical patient rooms.[5–9]

The Basic Health Research (Riset Kesehatan Dasar/Riskesdas) of the Ministry of Health of the Republic of Indonesia in 2013 shows that the incidence of nosocomial infections in Indonesia is quite high at 6-16% (average 9.8%), where as many as 9.8% of hospitalized patients get new infections during hospitalization.[14] The incidence of nosocomial infections differs from hospital to hospital. Urinary tract infections (UTIs), blood vessel infections (phlebitis), surgical site infections or surgical wound infections, and lower respiratory tract infections are the most common diseases in patients who experience nosocomial infections.[14–17]

Health workers have contact with patients for 24 hours, and thus have a very important role in the spread and prevention of nosocomial infections, be it nurses, doctors, and other supporting health workers.[4,8,10] To prevent and control nosocomial infections, hospitals generally have an infection prevention and control (IPC) committee or program. This committee or program generally develops and oversees the implementation of SOPs for the prevention and control of nosocomial infections. However, these activities may encounter barriers to implementation, if there is no support from administrators and poor compliance by doctors, nurses, and other health workers.

One of the IPC efforts is the practice of hand hygiene, a preventive measure that is very easy, cheap, and effective to do but very difficult to implement.[16] Nurses play a central role in terms of pathogen transmission in the hospital environment, and most importantly to the patients being treated. Hand hygiene can significantly reduce the number of microorganisms but the level of compliance with the recommended hand hygiene procedures has deteriorated.[6,8,9,17] WHO recommends 5 moments to perform hand hygiene which is: Before contact with the patient, before medical/aseptic procedures, after exposure to body fluids at risk, after contact with the patient, and after contact with the patient's surroundings.

In behavioral psychology, one of the theories or models that seeks to predict the likelihood of a person taking preventive action to avoid health threats is the Health Belief Model (HBM).[18–20] This model was developed by Rosenstock, Strecher, and Becker and evolved with contributions from change theory and self-efficacy theory.[21] HBM consists of seven components: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, self-efficacy, and modifying factors. In the context of nosocomial infections as a form of health threat, one of the preventive actions that can be taken is hand hygiene. Research conducted in Urmia Hospital, Iran, found that the components of HBM influence hand hygiene compliance behavior among the nurses (p<0.001).[5] However, another research found that of all the components of HBM, only the modifying factor component (experience) was the only factor that influenced nurses' compliance with hand hygiene.[22]

RSUD dr. H. Kumpulan Pane Tebing Tinggi is a government hospital that serves the city of Tebing Tinggi. Currently, there are no reported data regarding nosocomial infections in this hospital, which is not an indication that no nosocomial infection occurred. However, there has been no study regarding RSUD dr. H. Kumpulan Pane's effort to control nosocomial infection and/or its staff's compliance with it. This study is the first study regarding nosocomial infection prevention, especially hand hygiene compliance, conducted in RSUD dr. H. Kumpulan Pane.

This study aims to determine the effect of nurses' health beliefs on their hand hygiene compliance in the inpatient ward of RSUD dr. H. Kumpulan Pane.

Methods

This study is a quantitative analytic study with a cross-sectional design. The population in this study were all nurses in the inpatient ward of RSUD dr. H. Kumpulan Pane Tebing Tinggi, which amounted to 213 people. The sample size in this study was calculated using the Lemeshow formula, and the minimum sample size required was 138 samples. However, in this study, the number of samples used was 210 people. Thus, the selection technique used in this study was total sampling.

Data collection in this study was carried out by two methods, namely by survey and direct observation. Surveys were conducted on the entire sample using valid and reliable questionnaires which were adapted from previous research questionnaires by Arini[23]. This questionnaire reflects respondents perceived susceptibility, severity, benefits, barriers, cue to action, and self-efficacy. Meanwhile, direct observations were conducted to assess nurses' hand hygiene compliance. These compliance direct observations were assessed using a checklist based on WHO Five Moments and Minister of Health Regulation No. 27 of 2017 regarding Infection Control and Prevention in Healthcare Facilities.

Data analysis in this study was carried out using bivariate, and multivariate methods. Bivariate analysis in this study was conducted to assess the relationship between each HBM component and compliance with hand hygiene practices and was carried out using the chi-square test. Meanwhile, multivariate analysis was conducted to determine the effect of several HBM components together on hand hygiene practices using binomial logistic regression.

This research and its protocol have received ethical clearance from the Prima Indonesia University Health Research Ethics Committee through Ethical Clearance Certificate Number 036/KEPK/UNPRI/IV/2024.

Results

Table 1. Respondents Demographic Characteristics

Characteristic	Frequency	Percentage (%)
Age		
31-35 Years	70	33.3
36-40 Years	85	40.5
41-45 Years	54	25.7
45-50 Years	1	0.5
Sex		
Male	18	8.6
Female	192	91.4
Education		
Associate Degree (DIII)	157	74.8
Undergraduate/Equivalent (S1/DIV)	53	25.2
Length of employment		
1-5 Years	71	33.8
6-10 Years	120	57.1
11-15 Years	19	9.0
Type of employment		
Civil servant	119	56.7
Non-civil servant	91	43.3
Total	**210**	**100.0**

In this study, the majority of nurses working at RSUD dr. H. Kumpulan Pane were in the age group of 36-40 years (40.5%), followed by nurses aged between 31 to 35 years (33.3%); the

number of nurses aged between 45 to 50 years was only one person (0.5%). In addition, more than 90% of the nurses at RSUD dr. H. Kumpulan Pane who participated in this study were female (91.4%) (Table 1).

More than half of the nurses who participated in this study had an associate degree (74.8%) and had a working period between six to 10 years (57.1%). As a local government-owned hospital, the majority of nurses working at RSUD Dr. H. Kumpulan Pane are civil servants (56.7%)

Table 2 shown that all nurses at RSUD dr. H. Kumpulan Pane who participated in this study had attended infection prevention and control (IPC) training (100%), but still experienced sharps injuries (100%), and had direct contact with patient body fluids (100%). However, not all nurses participating in this study had experienced nosocomial infections (85.7%).

Table 2. Respondents Experience Characteristics

Characteristic	Frequency	Percentage (%)
History of IPC training		
Yes	210	100.0
History of sharp object injury		
Yes	210	100.0
History of contact with patient bodily fluid		
Yes	210	100.0
History of nosocomial infection		
Yes	180	85.7
None	30	14.3
Total	**210**	**100.0**

In general, more than half of the nurses at RSUD Dr. H. Kumpulan Pane who participated in this study had good perceptions of susceptibility, severity, benefits, cue to action, and self-efficacy. This is indicated by 68.6% of nurses who have a good understanding of their susceptibility to nosocomial infections, 61.9% of nurses who have a good understanding of the severity that can result from nosocomial infections, and 72.9% of nurses who have a good understanding of the benefits of preventing nosocomial infections (Table 3).

In addition, 136 nurses (64.8%) felt that the cue to action to prevent nosocomial infections at RSUD dr. H. Kumpulan Pane was good, and 70% of nurses believed they could prevent nosocomial infections well. However, as many as 73.8% of nurses have the perception that there are high barriers to performing nosocomial infection prevention practices at RSUD dr. H. Kumpulan Pane (Table 3).

Hand hygiene compliance of nurses at RSUD dr. H. Kumpulan Pane in this study was carried out by direct observation of hand hygiene compliance including the moment of doing hand washing and how nurses wash their hands when using running water and soap and by using hand

rub. This study found that the majority of RSUD dr. H. Kumpulan Pane nurses were compliant with the hand hygiene protocol (56.7%) (Table 3).

Based on the chi-square test between the components of the health belief model and hand hygiene compliance, it was found that all components of the health belief model had a relationship with hand hygiene compliance of nurses at RSUD dr. H. Kumpulan Pane (p<0.05) (Table 4).

Table 3. Respondents' Health Belief Characteristics and Hand Hygiene Compliance

HBM Component	Frequency	Percentage (%)
Perceived Susceptibility		
Poor	18	8.6
Fair	55	26.2
Good	137	65.2
Perceived Severity		
Poor	33	15.7
Fair	47	22.4
Good	130	61.9
Perceived Benefit		
Poor	19	9.0
Fair	33	15.7
Good	158	75.2
Perceived Barrier		
Low	28	13.3
Medium	27	12.9
High	155	73.8
Cue to Action		
Poor	42	20.0
Fair	34	16.2
Good	134	63.8
Self-Efficacy		
Poor	25	11.9
Fair	31	14.8
Good	154	73.3
Hand Hygiene Compliance		
Noncompliant	119	56.7
Compliant	91	43.3
Total	**210**	**100.0**

However, in modifying factors, age was the only modifying factor associated with hand hygiene compliance of nurses at RSUD dr. H. Kumpulan Pane (p<0.05), while other modifying factors such as gender, latest education, length of service, type of employment, and previous nosocomial infection experience were not associated with hand hygiene compliance (p>0.05). Meanwhile, the association between a history of IPC training, a history of sharp object injury, and a history of contact with patient bodily fluids with hand hygiene compliance could not be confirmed because all participating nurses had had these experiences.

The magnitude of the influence of this health belief model component on hand hygiene compliance of nurses at RSUD dr. H. Kumpulan Pane was then tested using multiple logistic regression. As a regression prerequisite, only variables with a significance value (p) smaller than 0.25 can be included in the logistic regression; thus, all variables of the health belief model components can be included in the logistic regression.

Table 6 shows the multivariate analysis conducted to determine the effect of health beliefs on hand hygiene compliance using multiple logistic regression.

Table 4. Relationship Between Health Belief and Hand Hygiene Compliance

	Hand Hygiene Compliance				Total	p-value
	Noncompliant		Compliant			
	n	%	n	%		
Perceived Susceptibility						
Poor	12	66.7	6	33.3	18	0,000
Fair	50	90.9	5	9.1	55	
Good	57	41.6	80	58.4	137	
Perceived Severity						
Poor	23	69.7	10	30.3	33	0.043
Fair	31	66.0	16	34.0	47	
Good	65	50.0	65	50.0	130	
Perceived Benefit						
Poor	13	68.4	6	31.6	19	0.007
Fair	26	78.8	7	21.2	33	
Good	80	50.6	78	49.4	158	
Perceived Barrier						
Low	13	46.4	15	53.6	28	0.028
Medium	10	37.0	17	63.0	27	
High	96	61.9	59	38.1	155	
Cue to Action						
Poor	37	88.1	5	11.9	42	0.000
Fair	21	61.8	13	38.2	34	
Good	61	45.5	73	54.5	134	
Self-Efficacy						
Poor	18	72.0	7	28.0	25	0.014
Fair	23	74.2	8	25.8	31	
Good	78	50.6	76	49.4	154	
Total	**119**	**56.7**	**91**	**43.3**	**210**	

In the first step, it can be seen that the variables of perceived benefits, barriers, and self-efficacy are variables that do not have a significant influence on nurse hand hygiene compliance (p>0.05). Therefore, the next selection was carried out by excluding the variable with the largest p-value, namely perceived barriers (p=0.110). In step II, the regression without the perceived barrier variable, it was seen that the p-value and OR of some variables changed but not significantly; however, the p-value of the self-efficacy variable still did not have a significant influence on nurses' hand hygiene compliance (p>0.05). Therefore, the regression was continued to step III by

excluding the self-efficacy variable. In step III, there was a slight change in the p-value and OR on the remaining five variables, especially the perceived benefit variable changed from significant in step II ($p<0,05$) to not significant ($p>0.05$) in step III. Thus, the step III model was rejected and regression continued to step IV by removing the perceived benefit variable.

Table 5. Relationship Between Modifying Factor and Hand Hygiene Compliance

Modifying Factor	Hand Hygiene Compliance				p-value
	Noncompliant		Compliant		
	n	%	n	%	
Age					
31-35 Years	45	64.3	25	35.7	
36-40 Years	53	62.4	32	37.6	0.012
41-45 Years	21	38.9	33	61.1	
45-50 Years	0	0.0	1	100.0	
Sex					
Male	9	50.0	9	50.0	0.551
Female	110	57.3	82	42.7	
Education					
Associate Degree (DIII)	91	58.0	66	42.0	0.514
Undergraduate/Equivalent (S1/DIV)	28	52.8	25	47.2	
Length of employment					
1-5 Years	40	56.3	31	43.7	
6-10 Years	67	55.8	53	44.2	0.834
11-15 Years	12	63.2	7	36.8	
Type of employment					
Civil servant	71	59.7	48	40.3	0.316
Non-civil servant	48	52.7	43	47.3	
History of IPC training					-*
Yes	119	56.7	91	43.3	
History of sharp object injury					-*
Yes	119	56.7	91	43.3	
History of contact with patient bodily fluid					-*
Yes	119	56.7	91	43.3	
History of nosocomial infection					
Yes	101	56.1	79	43.9	0.691
None	18	60.0	12	40.0	
Total	**119**	**56.7**	**91**	**43.3**	

*Because all respondents responded "yes", chi-square test can not be conducted.

In step IV, the four remaining variables were found to have a significant influence on the hand hygiene compliance of nurses at RSUD dr. H. Kumpulan Pane. At this stage, it was found that the stage IV regression model was suitable as indicated by the results of the Hosmer & Lemeshow test which resulted in a p of 0.181, so the model was declared suitable (fit) ($p>0.05$). In addition, this model also has a specificity of 76.5%, a sensitivity of 75.8%, and an overall accuracy of 76.2%. Thus, the stage IV regression model was adopted as the most suitable model to describe the influence of the health belief model on nurses' hand hygiene compliance at RSUD dr. H. Kumpulan

Pane. In step IV, it was seen that perceived susceptibility was the factor that most influenced nurses' hand hygiene compliance (OR: 3.246; p<0.001), followed by cue to action (OR: 2.401; p<0.001), age-modifying factors (OR: 1.889; p<0.005), and perceived severity (OR: 1.687; p<0.05).

Table 6. The Effect of Health Beliefs on Hand Hygiene Compliance

	β	p-value	OR	95% CI	
				Lower	Upper
Step I					
Modifying factor (age)	0.606	0.007	1.832	1.183	2.838
Perceived Susceptibility	1.210	0.000	3.354	1.847	6.090
Perceived Severity	0.547	0.015	1.728	1.114	2.681
Perceived Benefit	0.538	0.055	1.712	0.989	2.964
Perceived Barriers	-0.391	0.110	0.677	0.419	1.092
Cue to Action	0.813	0.001	2.255	1.376	3.695
Self-Efficacy	0.430	0.101	1.538	0.919	2.572
Constant	-9.601	0.000	0.000		
Step II					
Modifying factor (age)	0.662	0.003	1.940	1.262	2.982
Perceived Susceptibility	1.157	0.000	3.180	1.773	5.705
Perceived Severity	0.525	0.018	1.691	1.094	2.615
Perceived Benefit	0.551	0.048	1.734	1.006	2.991
Cue to Action	0.789	0.001	2.200	1.358	3.566
Self-Efficacy	0.471	0.071	1.602	0.961	2.670
Constant	-10.613	0.000	0.000		
Step III					
Modifying factor (age)	0.679	0.002	1.971	1.289	3.015
Perceived Susceptibility	1.160	0.000	3.190	1.796	5.666
Perceived Severity	0.533	0.016	1.704	1.104	2.629
Perceived Benefit	0.522	0.059	1.685	0.979	2.897
Cue to Action	0.827	0.001	2.286	1.424	3.670
Constant	-9.438	0.000	0.000		
Step IV					
Modifying factor (age)	0.641	0.003	1.899	1.250	2.886
Perceived Susceptibility	1.178	0.000	3.246	1.838	5.734
Perceived Severity	0.523	0.016	1.687	1.101	2.585
Cue to Action	0.876	0.000	2.401	1.509	3.822
Constant	-8.107	0.000	0.000		

Discussion

The importance of hand hygiene has been widely acknowledged by the general public since the onset of the Coronavirus Disease 2019 (COVID-19) pandemic. In health care, hand hygiene has a very important role in the prevention and control of nosocomial infections; both between patients and between patients and health care staff. This study found that nurses' compliance with hand hygiene is influenced by nurses' perceptions of their susceptibility to nosocomial infections, the

severity of nosocomial infections, barriers to performing hand hygiene, and their cues to perform hand hygiene.

The findings in this study are in accordance with a study involving nursing students from ten universities in Indonesia which found that the perceived susceptibility of nursing students directly affects individual compliance with Covid-19 transmission prevention practices such as washing hands with soap or hand sanitizer, wearing masks, maintaining distance, and avoiding crowds.[24] However, this finding contradicts the findings of another study in Ethiopia which found that the perceived susceptibility of an individual did not affect the frequency of individual hand hygiene.[25] The discrepancies in these results may be due to differences in the population of the study, where the Indonesian study and this study used a population with adequate health knowledge (nursing students and nurses), while the Ethiopia study was a study involving the general public.[24,25] These population differences result in different levels of knowledge, and knowledge plays an important role in building an individual's perception of their risk of experiencing a condition.[26]

An individual's perception of the severity of a condition was also found to influence an individual's compliance with preventive measures. In this study, it was clear that nurses who had a higher perceived severity of nosocomial infection directly influenced their compliance with hand hygiene (p<0.05). This result is consistent with the study by the aforementioned Ethiopia study which found that perceived severity of illness positively influences individual compliance to preventive measures, where individuals who have higher perceived susceptibility tend to perform hand hygiene more frequently.[25] Another study in Urmia city involving 370 health workers from 196 health centers also found that perceived severity directly affects individualized compliance to preventive measures.[27] In contrast to perceived susceptibility, which strongly influences compliance, perceived severity can also be influenced by ignorance and fear. This is because individuals can have inaccurate information about a condition, thus fostering excessive fear, thus taking excessive precautions.[26] An example of this condition is the Covid-19 pandemic, wherein the first wave of the pandemic, there was mass fear caused by inaccurate and repetitive news coverage, resulting in a perception of severity that exceeded proportion; people's response was to take excessive preventive actions: buying ultraviolet lamps to decontaminate personal objects, hoarding masks and hand sanitizers, and other irrational actions. However, if the perception of severity comes from the right knowledge and information, individuals will take preventive action proportionally.

In this study, although it was found that perceived benefits were associated with nurses' hand hygiene compliance, the effect of perceived benefits was not significant on hand hygiene compliance. This result contradicts the findings in several other studies[5,27,28] which found that perceived benefits affect individual compliance to take preventive actions. Perceived benefits obtained by taking preventive action greatly influence individual motivation to take preventive

action.[27] These contradictory results may be related to the level of individual knowledge of nurses at RSUD dr. H. Kumpulan Pane regarding the benefits obtained by nurses by performing proper hand hygiene. Two quasi-experimental studies in Iran (one in Fasa and another one in Tehran) found that before receiving educational interventions on hand hygiene and nosocomial infections, perceived benefits did not affect the hand hygiene compliance of nurses involved in the study (p>0.05); however, after receiving educational interventions, nurses' perceived benefits became higher and were found to affect nurses' hand hygiene compliance (p<0.05).[29,30] However, in the Tehran study, three months after the intervention, there was no effect of perceived benefits on hand hygiene compliance (p>0.05). This indicates that incidental education only fosters temporary perceived benefits that will decline or even disappear over time.[30]

Perceived barrier refers to an individual's perception of what limits or hinders them from performing an action. In this study, the perceived barrier was the only variable that had a negative but insignificant influence on individual hand hygiene compliance (β: -0.541; p<0.001). This finding is consistent with the research of a previous study in Ethiopia which found that the perceived barrier has a significant influence on compliance with hand washing with water and soap or with hand sanitizer to prevent transmission of Covid-19.[25] The Ethiopian study also found that this relationship was a negative one, where an increase in perceived barriers would decrease compliance with handwashing practices with water and soap or hand sanitizer.[25] Various studies[5,24,27,28,30] have found that perceived barriers have a negative relationship with preventive compliance, but not a significant effect.

Cue to action in this study was found to affect the hand hygiene compliance of nurses at RSUD dr. H. Kumpulan Pane (p<0.001). This result is in accordance with the Tehran study which found that the cue to action directly affects nurses' compliance with hand hygiene.[29] In the Fasa study it was found that educational interventions can improve nurses' compliance with hand hygiene but only temporarily, which is characterized by a decrease in compliance after three months.[30] Providing continuous education with the presence of cues such as the presence of hand hygiene reminder posters at the entrance to the patient care room, at the patient's bedside, and at the nurse/doctor's desk can increase nurse compliance.

Self-efficacy refers to a person's belief in being able to perform an action correctly, which in this study refers to the practice of hand hygiene in the correct way and at the right moment. This study found that although self-efficacy was associated with hand hygiene compliance of nurses at RSUD dr. H. Kumpulan Pane (p<0.05), this self-efficacy did not significantly affect hand hygiene compliance (p>0.05). The HBM study in Ethiopia found that good self-efficacy affects individual compliance with hand hygiene.[25] Furthermore, the previous Indonesian study also found that individuals with low self-efficacy have a lower rate of compliance than individuals with higher self-efficacy.[24] This is due to the fact that individuals with better or higher self-efficacy or

confidence in their abilities tend to have better commitment, have greater effort to achieve something, and try something repeatedly despite facing obstacles; whereas individuals with low self-efficacy will tend to avoid challenges and give up without trying at all.[24] Another study in dentistry students of Rafsanjan University of Medical Science Research, Iran found that education can increase the level of individual self-efficacy.[31] Just like the cue to action, incidental education will only temporarily foster self-efficacy, so the best option is continuous education through visual media in necessary places as well as through regular socialization in the hospital. In addition, good social support, such as mutual reminders between health workers in the hospital, also has a positive effect on individual self-efficacy to take preventive measures.[32] However, another study in Dr. R. M. Djoelham General District Hospital Binjai found that self-efficacy does not affect hand hygiene in nurses, contrary to the findings in this study.[22] The difference in these results may be influenced by individual experience factors, where in the Dr. R. M. Djoelham General District Hospital Binjai study[22], the majority of nurses involved had never experienced nosocomial infections, sharp object injuries, or contact with patient bodily fluids and not all nurses had participated in IPC training; whereas in this study all nurses involved had participated in IPC training, had experienced sharp object injuries, and had experienced contact with patient bodily fluids, and more than 80% had experienced nosocomial infections.[22] This experience plays a role in shaping individual self-efficacy.

Of the nine modifying factors measured in this study (age, gender, education, length of service, type of employment, history of IPC training, history of sharp object injury, history of contact with patient bodily fluids, and history of nosocomial infection), age was the only factor that influenced nurses' hand hygiene compliance at RSUD dr. H. Kumpulan Pane Tebing Tinggi ($p<0.05$). This result contradicts several studies that found age characteristics did not affect compliance with preventive measures, both in the prevention of nosocomial infections and in the prevention of COVID-19.[7,24] In the Indonesian study[24] which involved nursing students and assessed compliance with preventive measures for Covid-19 transmission, one of which was the practice of washing hands with soap, it was found that nursing students' hand washing practice compliance was inadequate. The difference in findings with this study may be due to the fact that in this study the age range of respondents was greater, while in the aforementioned study, the age range of respondents was smaller because respondents were nursing students.

The implementation of optimal hand hygiene practices is very important for all health workers to prevent nosocomial infections, both patient-to-patient and patient-to-nurse. According to Regulation of the Minister of Health Number 30 of 2022 concerning National Indicators of Quality of Health Services for Independent Practices of Doctors and Dentists, Clinics, Community Health Centers, Hospitals, Health Laboratories, and Blood Transfusion Units, the target for hand hygiene compliance in health facilities is >85%.[33]. This high standard is an effort to improve the

safety of patients and health workers working in hospitals. A systematic review found that hand hygiene compliance was negatively associated with the incidence of nosocomial infections, whereas with an increase in compliance, there was a 60% decrease in the incidence of nosocomial infections.[34] Another study in West Jutland, Denmark found that there was an increase in hand hygiene compliance after the Covid-19 pandemic when compared to the level of hand hygiene compliance before the Covid-19 pandemic.[35] In the early phase of the COVID-19 pandemic, due to very limited information about COVID-19, preventive practices such as hand hygiene were strongly emphasized to be practiced by everyone, including health workers. With the pandemic lasting for almost three years, the general public has become very familiar with hand hygiene, as well as health workers. After the Covid-19 pandemic, preventive measures taken by nurses in hospitals increased significantly such as hand hygiene and the use of masks. Study in China's General Teaching Hospital found that continuous intervention can significantly improve hand hygiene compliance, whereas in a longitudinal study, there was an increase in compliance from 68.9% to 91.7% in four years.[36] Another study conducted with electronic compliance monitoring found electronic surveillance increased hand hygiene compliance from 47% before the surveillance intervention to >70% during the electronic surveillance period.[37]

However, it also needs to be addressed that this study has its limitations. First, this study grouped all samples from different wards as a single group. This might mask the lower/higher perceived health beliefs among the nurses. Also, there is a chance that the nurses involved in this study increased their compliance with the hand hygiene protocols due to direct observations by the researcher.

Conclusion

Although all the main components of the health belief model are associated with compliance with hand hygiene practices, only perceived susceptibility, severity, and cue to action have a significant impact on compliance with hand hygiene practices in inpatient nurses at RSUD dr. H. Kumpulan Pane. Hence, continuous education and training for the nurses at RSUD dr. H. Kumpulan Pane is highly recommended to increase their knowledge of susceptibility to and severity of nosocomial infection. Putting signs to remind the nurses of hand hygiene practice in critical places is also encouraged. Because many nurses have a fairly high perceived barrier, it is highly recommended for RSUD dr. H. Kumpulan Pane to eliminate or minimize barriers to compliance with hand hygiene practices in nurses by providing soap, running water, disposable wipes, and alcohol-based hand rubs for nurses.

Acknowledgment

Conflict of Interest

The authors declare that they have no conflict of interest.

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