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Article Review

Determinant Analysis of Hand Hygiene Compliance and Its Relation to HAIs in Hospitals: Systematic Literature Review

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ABSTRACT

Hand hygiene is one of the practical steps that healthcare providers can take to reduce the incidence of HAIs or nosocomial infections. The percentage of hand hygiene compliance is still low, between 35-55.3%. Several previous studies showed that many factors cause hand hygiene adherence. However, the results are still varied, so this study aimed to determine the factors of hand hygiene, determine the factors that most influence hand hygiene adherence, and the link between hand hygiene and the incidence of HAIs in hospitals. This systematic literature review follows the PRISMA protocol guidelines in three electronic databases (PubMed, Science Direct, and Google Scholar). Article quality was assessed using the JBI assessment tool and analyzed using meta-synthesis. The inclusion criteria are articles discussing hand hygiene compliance among hospital nurses and articles published in 2021-2023, so 15 selected papers. The determinants of hand hygiene compliance include knowledge, attitude, motivation, supervision from superiors or related parties, facilities, age, gender, years of service, and feedback. An electronic monitoring system also has significantly affected hand hygiene compliance. Several articles stated that the multimodal approach initiated by WHO positively impacted hand hygiene compliance. The most dominant factor is the knowledge variable. Hand hygiene compliance is closely related to the incidence of HAIs, when hand hygiene compliance is high, it can reduce the incidence of HAIs in health services.

Keywords: *Hand Hygiene, HAIs, Nosocomial, Compliance.*

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INTRODUCTION

Hand hygiene is an effective way to reduce the incidence of nosocomial infections. The prevalence of nosocomial infections is still high in both developed and developing countries. The results of several studies indicated that implementing good hand washing is one of the keys to reducing nosocomial infections in health services[1,2,3]. However, based on the Global Report Infection Prevention and Control 2021 - 2022, it is stated that the implementation of hand hygiene by health workers in health facilities is still below average with a compliance level of only 54.7%[3]. Compliance with the implementation of hand hygiene in Indonesia is still not in accordance with the standards set by the Indonesian Ministry of Health, namely 85%.[4] The previous studies showed that the average implementation of hand hygiene among health workers in hospitals ranges from 35% - 55.3%[5,6].

Health workers are obliged to carry out correct hand hygiene practices, especially when in contact with patients. The health workers who most often come into contact with patients are nurses[7]. Nurses in providing nursing services, of course, have intense contact with patients and the patient's family. Nurses, in providing nursing care, often carry out nursing procedures and actions that may come into contact with the patient's body fluids. This contact certainly creates a greater risk of HAI transmission.[8] The results of the previous studies showed that the implementation of hand hygiene not in accordance with the guidelines.

Several literature studies stated that low hand hygiene compliance is caused by several causal factors among health workers. It also explains how hand hygiene is related to the incidence of HAIs, but the results are still varied. This literature review aims to provide information about what hand hygiene compliance has to do with the incidence of HAIs in health services, what determinants influence compliance with hand hygiene implementation among health workers, especially nurses, in implementing hand hygiene and what factors most influence hand hygiene compliance.

METHOD

The study was systematic literature Review. PRISMA protocol was used to select appropriate articles frow three electronic databases (PubMed, Science Direct and Google Scholar/Google Scholar). The keywords used are adjusted to Medical Subject Headings (MeSH) and Boolean operators. The article was published in English and Indonesian from January 2021 – March 2023 with the keywords (Determinant) AND (Compliance) OR (Adherance) OR (Policy Compliance) OR (Protocol Compliance)) AND (Hand hygiene) OR (Hand Disinfection) AND (Nurse) AND (Hospital) AND (Healthcare Associated Infections). Search results for articles on PubMed found 68 articles, Science Direct 313 articles and Google Scholar 180 articles (Figure 1). Screening articles using the PICOS method as inclusion criteria: (1) the articles used by researchers are articles discussing the determinants or factors causing hand hygiene compliance related to HAIs; (2) the population and sample are nurses in hospitals; (3) the results measured are determinants or factors causing hand hygiene compliance; (4) full text available. There were two screenings carried out, namely title screening which found 69 suitable articles and then abstract screening with 15 relevant articles. Article eligibility assessment was carried out using The JBI Critical Appraisal Tools. All articles had assessment results above 50% (Figure 1).

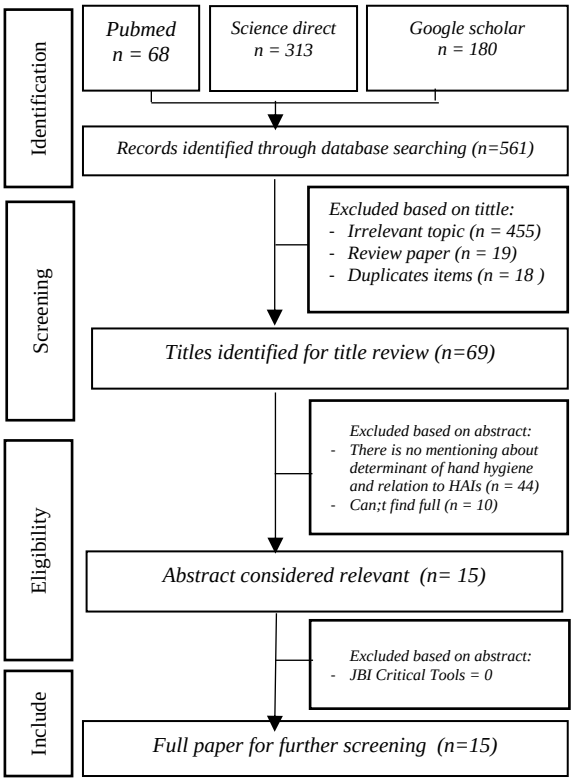

Figure 1. PRISMA Research Protocol

Data analysis used meta-synthesis because homogeneity analysis showed that the articles were not homogeneous. Researchers look for similarities (compare), differences (contrast) in each article, and criticize them according to theory and previous research. Then the researcher synthesized the results of the review articles in narrative form.

RESULTS

Table 1. Characteristics of respondents from articles included in the review

Author (s), year, country	Age (years)	Gender		Education Level
		Male	Female	
Rahim *et al.,* 2021 (Malaysia)[9]	38	30	408	Diploma
Dewi *et al.,* 2022 (Indonesia)[10]	≥25	38	52	Diploma
Umar et al., 2022 (Ethiopia timur)[11]	18 - 35	298	137	Bachelor
Ayu *et al.,* 2022 (Indonesia)[12]	30 - 41	19	73	Diploma
Gurning *et al.,* 2022 (Indonesia)[40]	17-45	46	23	Diploma

The average age of the nurses who were respondents was 38 years. Most respondents were dominated by women with a nursing diploma level of education. Three articles discuss the role of leadership, three articles discuss perceptions of hand hygiene and knowledge in which there is also a discussion of monitoring factors, five articles discuss acceptance of electronic hand hygiene systems and performance feedback, two articles discuss the influence of respondent characteristics on compliance. hand hygiene, two other articles discuss motivation, facilities and human resources which influence hand hygiene compliance. The research results of each article are explained in detail in Table 2.

Table 2. Research Description and Main Results of the studies reviewed

Author (s), year, country	Study methods (design, subjects, variables, instruments and analysis)		Main findings	Article quality
Rahim *et al.*, 2021 (Malaysia)[9]	D	*Cross-sectional*	Factors that influence hand hygiene behavior were perceived hand hygiene (β = 0.260; 95% CI: 0.020, 0.417; p<0.001), pediatric department (β = -0.014; 95% CI: -9.335, -2.467; p<0.001), orthopedic beta (β = -5.957; 95% CI: -9.539, -0.720; p<0.023). Compared with pediatric and orthopedic departments, surgical departments have better hand hygiene compliance.	75%
	S	438 nurses		
	V	Perceived of hand hygiene, sociodemographic characteristics, hospital departments		
	I	Questionnaires		
	A	Simple and multiple linear regression		
Dewi *et al.*, 2022 (Indonesia)[10]	D	*Cross-sectional*	The description of the interpersonal role of the head of the room in implementing hand hygiene compliance is good 52 (57.8%), the role of the head of the room in implementing hand hygiene compliance is good 65 (72.2%) and the role of the head of the room in making decisions regarding the implementation of hand hygiene is less than 50 (55.6%).	75%
	S	90 inpatient nurses		
	V	Overview of leadership roles, implementation of hand hygiene		
	I	Questionnaires		
	A	Univariate analysis (mean, median, standard deviation, CI, maximum value, (frequency distribution and proportions)		
Knudsen et al., 2021 (Denmark)[13]	D	*Quasi-experimental*	Hand hygiene compliance among doctors and nurses increased significantly during the intervention phase and received follow-up group and individual feedback from electronic hand hygiene monitoring systems (EHHMs) with a p value > 0.001 for doctors and nurses. The incidence rate per 10,000 patient days in the first control (July 2018) was 14.7, the second control was 19.1 after receiving intervention with an incidence rate of 0.	100%
	S	99 inpatient nurses in the nephrology department		
	V	Electronic-based hand hygiene monitoring, incident rates, patients treated and hand hygiene compliance		
	I	*Electronik hand hygiene monitoring system* (EHHMSs)		
	A	*Log rank test*		

Hastuti et al., 2021 (Indonesia)[30]	D	*Cross-sectional*	The factor related to hand hygiene compliance is knowledge p = 0.005. Factors that are not related to hand hygiene behavior were attitude (p=0.619), motivation (p=1.000), and work experience (p = 1.000).	87,5%
	S	87 nurses		
	V	Knowledge, attitude, motivation and work experience, hand hygiene		
	I	Questionnaire and observation guide		
	A	*Chi square test*		
Umar et al., 2022 (Ethiopia timur)[11]	D	*Cross-sectionl*	Overall hand hygiene compliance was 37.4% [95% CI (0.33, 0.42)]. The mean knowledge score was 21.6% (SD: 2.08). In addition, there was a statistically significant relationship between hand hygiene compliance and gender, work experience, hand hygiene training, availability of running water, and knowledge of hand hygiene.	100%
	S	436 nurses		
	V	Sociodemographic characteristics, work experience, training, availability of running water, knowledge and compliance with hand hygiene		
	I	Questionnaire and observation guide		
	A	Binary logistic regression model and Hosmer-Lemeshow test		
Ayu *et al.*, 2022 (Indonesia)[12]	D	Cross-sectional	There is a relationship between motivation and compliance with five moments hand hygiene (p=0.009), and there is no relationship between the level of knowledge and compliance with five moments hand hygiene (p=0.158)	100%
	S	92 nurses		
	V	Sociodemographic characteristics, knowledge, motivation and five moments hand hygiene compliance		
	I	Questionnaire and observation guide		
	A	Spearman rho correlation test		
Gurning *et al.*, 2022 (Indonesia)[40]	D	*Cross-sectional*	There is a relationship between knowledge and supervision of hand hygiene compliance (p= 0.001; p= 0.003.	75%
	S	69 nurses in the inpatient room		
	V	Knowledge, supervision and hand hygiene behavior		
	I	Questionnaire		
	A	Chi square test		
Budianto *et al.*, 2021 (Indonesia)[42]	D	Correlative descriptive	There is a significant relationship between supervision by the head of the room and hand hygiene compliance (p= 0.001 < 0.05)	100%
	S	56 nurses		
	V	Head of room supervision and hand hygiene compliance		
	I	Questionnaire and observation guide		
	A	Chi square test		
Kibira *et al.*, 2022 (Kenya, Afrika)	D	Cross-sectional	Hand hygiene indications/moments, location, professional category of health workers (nurse, midwife, doctor, student, other health staff) and department have a significant relationship to hand hygiene compliance. Moments after exposure to body fluids and after patient contact had higher compliance values, namely (aOR 1.43; 95% CI 1.17 -1.74; p=0.01) and before aseptic procedures had lower values with values (aOR 0.93; 95% CI 0.08-0.17 ; p=0.01) and the internal medicine department had a higher compliance value compared to the surgery department.	100%
	S	4227 nurses		
	V	Hand hygiene indication/moment, location, health worker professional category, department, hand hygiene behavior		
	I	Observation guidelines		
	A	*Mixed effects logistic regression*		
Ataiyero *et al.*, 2023 (Nigeria)[14]	D	Interpretative (qualitative) approach	Barriers and facilitators in implementing hand hygiene consist of individual and institutional factors, namely (1) knowledge, skills and	100%
	S	12 nurses and 4 doctor		

	V	Barriers and facilitators of hand hygiene	education; (2) perception of the risk of infection to oneself and others; (3) influence of other people; (skin disorders). Institutional factors are (1) environment and resources; (2) workload and staffing levels	
	I	*In depth interview*		
	A	The interview results were transcribed and analyzed in Nvivo (version 12)		
Blomgren *et al.*, 2021 (Swedia)[15]	D	Qualitative descriptive	There is positive acceptance of the electronic hand hygiene reminder system and it is able to change the behavior of respondents. Regarding knowledge, respondents said that employees received training and education about hand hygiene. Attitudes, subjective norms and behavioral control show positive acceptance of the electronic hand hygiene reminder system.	100%
	S	38 respondents (nurses, assistants and doctors)		
	V	Perception of acceptance of the electronic hand hygiene reminder system, knowledge, attitudes, subjective norms and behavioral control		
	I	Semi-structured interview guide		
	A	Analysis with focus group discussion		
Ojanpera *et al.*, 2022 (Finlandia)[16]	D	Longitudinal observational study	Direct observation and feedback significantly improved hand hygiene to both doctors and nurses over an eight year period. The level of hand hygiene compliance has increased in both medical wards and surgical wards. The implementation of hand hygiene among nurses is higher than doctors with respective values, namely in medical wards of OR=3.36; 95% CI=2.90.90; p=0.001 while in the surgical ward OR=9.85%; 95% CI=8.9, 10.8; p=0.001	100%
	S	24,614 nurses and 6,396 doctors		
	V	Hand hygiene moments, wards (medical, surgical), direct observation, feedback related to hand hygiene		
	I	Observation guidelines		
	A	Poisson regression model, multivariable logistic regression analysis		
Iversen *et al.*, 2021 (Denmark)[48]	D	Prospective observational study	Doctors and nurses have significantly improved hand hygiene in patient rooms and work spaces. The p value = 0.001 for the doctor in the patient's room and the p value = 0.006 in the work room. Meanwhile, nurses in patient rooms have a p value = 0.005 and p value = 0.001 in the work room. Hand hygiene compliance increases significantly with the encouragement of light sensors on the dispenser tube and data-based performance feedback using automatic hand hygiene	100%
	S	26 nurses dan 10 doctor		
	V	Hand hygiene compliance for nurses and doctors, automatic hand hygiene systems		
	I	Automatic hand hygiene monitoring		
	A	T independent test		

DISCUSSION

Respondent characteristics

The average age of respondents in this study was 38 years. In line with other research, the increasing age of a person influences his mindset at work, especially safety for himself[17–20]. The theory of age maturity states that the maturity of a person's thinking is influenced by age, where someone who is said to be old enough will also have thoughts and behavior that are more rational and can adapt to the surrounding circumstances[21]. Most of the respondents in this review were women. One study conducted in Saudi Arabia stated that female nurses were more compliant with hand hygiene than male nurses[22]. Other literature stated that women dominate in providing services[23]. Another factor that influences hand hygiene compliance is education. Previous research results show that the higher a person's education, the more likely they are to comply with hand hygiene. The higher a person's level of education, the easier it is to receive material or input from other people and the broader their insight[18,19].

Factors influencing hand hygiene compliance

Several literatures convey in their

research results that one of the factors causing hand hygiene compliance is knowledge. The higher the knowledge, the better the behavior displayed by a person, in this case hand hygiene[24–28]. Notoatmodjo (2010) states that a person's knowledge influences behavior.

Nurses who worked more than 2 years had higher compliance than nurses who worked <2 years[17,29]. Disagreeing with the research above, other research states that a person's work period does not affect hand hygiene compliance[30]. However, there is a theory which states that a longer working period creates more effective employee performance because they can control various situations according to previous experiences. Candra (2018) stated that length of service influences employee skills at work. Years of work provide experience so that a worker's professionalism increases. Workers who have worked longer have adapted to the environment so they are better able to handle problems and make decisions[32].

A person's attitude and motivation can also influence hand hygiene compliance[27,33,34]. Harlinisari (2018) stated that attitude has a positive and significant influence on behavior, the better the attitude, the better the behavior that appears. A person's attitude is driven by motivation. The higher the nurse's motivation, the higher the chance of compliance with hand hygiene implementation[12,18,36–38] .

Hand hygiene behavior is not only influenced by internal factors, but also external factors, one of which is the role of the leader which is applied in the form of supervision. Supervision here is intended to provide support and direction so that the implementation of hand hygiene is in accordance with Standard Operating Procedures (SOP) and WHO provisions. The PPIRS leadership and team have an important role in carrying out the supervisory function. Based on the results of the review, it was found that the higher the level of supervision, the better the nurse's performance in implementing hand hygiene. Supervision that is not carried out routinely provides a 2 times greater chance of not carrying out hand hygiene[39–42]. Astuti et al. (2023) stated in their research results that supervision is a strong factor that influences nurses' compliance performance. The success of a work program depends on how the organization's functions can be carried out[44].

Based on several review articles, facilities are one of the supports that have an influence on compliance with hand hygiene implementation. Handrub bottles are often empty in health care facilities, the distance between sinks and services is an obstacle to hand hygiene compliance, thus providing an opportunity 2 times greater than the availability of supporting facilities[39,45,46]. WHO states that to increase the implementation of hand hygiene, a multimodal strategy is needed. One of the approaches taken is changing the system by providing alcohol-based hand rub on a regular basis in addition to providing wash basins and antiseptic soap. This approach has been empirically proven to be able to increase hand hygiene compliance[47].

Apart from that, performance feedback is needed by employees or staff to evaluate their activities while working. Several research findings stated that hand hygiene compliance increases after direct monitoring and feedback. Hand hygiene compliance increased 10.8% (86.2% to 95.5%) in medical wards. Surgical wards also experienced an increase of 32.7% (67.6% to 89.7%). Overall the implementation of hand hygiene increased significantly for nurses by 17.8%.[16] Other research stated that feedback strategies are effective in improving nurses' performance in implementing hand hygiene. The feedback strategy is one of the approaches initiated by WHO which is combined into a multimodal strategy. This strategy includes (1) system change; (2) training & education; (3) evaluation & feedback; (4) reminders in the workplace; (5) institutional safety climate[48,49].

The selected articles in this study were dissimilar to the respondents' intake and intervention. Some articles use total sampling while others only focus on nurses in several wards. This can be explained that all nurses have the same obligation to carry out hand hygiene[50]. Several articles convey research limitations related to research instruments. Researchers used self-assessed questionnaires so there was a possibility of bias. Validity and reliability testing needs to be carried out to ensure that the questionnaire items can measure what they are supposed to measure and ensure that the instrument can be used on the same object to produce the same data[51].

Compliance with hand hygiene and its relationship with the incidence of HAIs in hospitals

Compliance with hand hygiene or washing hands is still low. The percentage of hand hygiene compliance is still at 59%, not reaching the predetermined standard, namely 85%. The implementation of the five moments in hand hygiene is still not implemented optimally. The percentage before contact with patients was 66.7%, before asepsis measures 73.4%, after contact with body fluids 100%, after patient contact 100% and after environmental contact 86%. It is known that the implementation of hand hygiene moments is lowest before patient contact, while the highest percentage is after contact with body fluids and after patient contact[52].

The incidence of HAIs or nosocomial infections is closely related to compliance with hand hygiene or hand washing, where hands are the main medium of contact between health workers and patients or the environment around the health service area. Low compliance with hand hygiene is certainly one of the triggers for high levels of nosocomial infections. Compliance with the five moments and six steps of hand hygiene is very important in preventing the occurrence of HAIs[53].

Increased hand hygiene compliance is in line with a decrease in the incidence of nosocomial infections or HAIs. The higher the level of hand hygiene compliance can reduce the incidence of HAIs in health services. Based on literature studies, increasing hand hygiene by 10.8% can reduce the incidence of HAIs by 15.9% in medical wards. The percentage of hand hygiene in surgical wards increased by 32.7% and reduced the incidence of HAIs from 13.7% to 12.0 per 1000 patients[16].

Windyastuti, et al. (2020) stated that the incidence of nosocomial infections is closely related to hand washing compliance. Not only health workers, but hand washing compliance also has an impact on patients. Based on the 30 respondents studied, only 1 person (3.3%) complied with the implementation of the five moments and six steps of hand hygiene, which did not result in nosocomial infections or HAIs, while 7 (23.3%) other respondents did not carry out hand hygiene according to the procedure, resulting in 22 (73.3%) %) people exposed to nosocomial infections.

CONCLUSIONS

Based on the results of the literature review, it can be concluded that the factors causing hand hygiene compliance are knowledge, attitude, motivation, supervision from superiors and the hospital infection control team, facilities, age, gender, length of service and feedback. The most dominant variable is the knowledge factor. Hand hygiene compliance is closely related to the incidence of HAIs, where when hand hygiene compliance is high it can reduce the incidence of HAIs in health services. Future research can consider factors that influence and do not influence hand hygiene compliance as an intervention. We recommend further research regarding the implementation of multimodal strategies that have been designed to determine their effectiveness and impact on hand hygiene compliance. The use of in-depth methodology and direct research can be carried out, for example group discussions with related parties, knowing the perceptions of hospital managers regarding hand hygiene can be explored more deeply so that it is related to the commitment to providing adequate hand hygiene facilities.

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