
Overview of the Accuracy of Hand Hygiene Implementation by Nurses at Ja'far Medika Karanganyar Hospital

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Abstract: *Healthcare-associated infections (HAIs) remain an important patient safety issue that can be prevented through proper hand hygiene practices. An audit conducted at Ja'far Medika Karanganyar General Hospital from October to December 2025 showed hand hygiene accuracy rates of 77.5%, 77.7%, and 78.9%, respectively, which remained below the optimal standard of $\geq 85\%$. This study aimed to describe the accuracy of hand hygiene implementation among nurses at Ja'far Medika Karanganyar General Hospital and to describe the characteristics of nurses based on age, gender, education level, and length of service. This study employed a quantitative approach with a descriptive observational design. The population and sample consisted of 49 nurses selected using total sampling. Data were collected through direct observation using an observation sheet developed based on the hospital's hand hygiene SOP. The instrument was assessed for content validity using the Item-Content Validity Index (I-CVI) and Aiken's V. Data were analyzed using univariate analysis and presented as frequencies and percentages. The results showed that 28 nurses (57.1%) had good hand hygiene accuracy, 8 (16.4%) had adequate accuracy, and 13 (26.5%) had poor accuracy. The highest level of accuracy was observed in performing hand hygiene according to the five moments (100%), whereas the lowest levels were observed in rubbing the fingertips/nails (63.2%), rubbing the thumbs (69.3%), and rubbing the backs of the fingers using a locking motion (75.5%). In conclusion, the overall accuracy of hand hygiene implementation among nurses was categorized as good; however, several technical steps, particularly those involving the fingertips/nails, thumbs, and backs of the fingers, still require improvement. These findings may serve as an evaluation basis for strengthening supervision, training, and coaching related to hand hygiene practices.*

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Introduction



Hospitals play a crucial role in improving public health through effective, efficient, and patient-safety-oriented services (Irene et al., 2024). However, the complexity of hospital services also increases the risk of Healthcare-Associated Infections (HAIs) for patients, staff, and visitors if infection prevention is not consistently implemented (Safitri et al., 2025). Patient safety is a crucial aspect of service quality, as stipulated in Indonesian Minister of Health Regulation Number 11 of 2017, including efforts to minimize nosocomial infections, which can prolong hospitalization and increase medical costs (Zihan and Sirajudin, 2024; Astari and Sari, 2023).

Infection risk prevention is also a patient safety goal in the JCI and KARS standards (Abdillah, 2024). HAIs remain a concern, as WHO data in 2022 showed an HAIs prevalence of 8.70% in hospitals across several countries, with the highest prevalence in the Eastern Mediterranean and Southeast Asia. In Indonesia, the average HAIs incidence in 2021 reached 9.1%, making infection prevention through the implementation of appropriate procedures, including hand hygiene, a crucial component of maintaining patient safety (Elida et al., 2023).

One of the challenges in infection prevention is the suboptimal implementation of hand hygiene. The 2024 Infection Prevention and Control Team report showed an average hand hygiene accuracy of 86.15%, although in some periods, performance was still below the 85% standard (Fauziah et al., 2025). In service practice, hand hygiene is not always carried out at every recommended moment, especially in service settings with high work pressure. Limited supervision and differences in staff understanding also contribute to the suboptimal implementation of infection prevention policies (Astari and Sari, 2023; Ismara, 2024).

Nurses play a crucial role in infection prevention due to their 24-hour direct interaction with patients (Thirayo et al., 2021). However, inconsistencies in hand hygiene implementation, lack of training, and high workloads remain issues that can increase the risk of cross-transmission (Annisa et al., 2025). Research by Nurwijayanti and Noelio (2025) showed that 48% of healthcare workers performed hand hygiene correctly, while Suminar and Safitri (2022) found that 35.7% of nurses still performed hand hygiene incorrectly. Furthermore, a weak safety culture and irregular supervision are also factors that influence SOP implementation (Novitarum et al., 2025). These conditions indicate that inaccurate hand hygiene practices constitute an implementation gap that can increase the risk of infection and threaten patient safety (Madya et al., 2022; Elida et al., 2023).

Based on a preliminary study conducted on January 30, 2026, at Ja'far Medika General Hospital in Karanganyar, the hospital had an Infection Prevention and Control Team and a hand hygiene SOP. However, audit results from October to December 2025 showed that the average hand hygiene accuracy was only 77.5%, 77.7%, and 78.9%, respectively, thus remaining below the optimal standard of $\geq 85\%$. These data indicate improvement, but do not yet provide a detailed description of the compliance of each hand hygiene stage with the SOP or the consistency of its implementation at each opportunity. Therefore, direct observation is needed to obtain a more realistic picture of hand hygiene implementation by nurses.

This study aims to determine the accuracy of hand hygiene implementation among nurses at Ja'far Medika General Hospital, Karanganyar, and the characteristics of nurses based on age, gender, education level, and length of service. This research is important as evaluation material to improve the implementation of SOPs, supervision, and patient safety. The novelty of this study lies in the assessment of hand hygiene through direct observation of the conformity of each stage with the hospital's SOP, thus providing a more detailed picture of which parts of the procedure have been carried out correctly and which still require improvement.

Method

This study used a quantitative approach with a descriptive observational design to describe the accuracy of hand hygiene implementation among nurses at Ja'far Medika Karanganyar General Hospital based on the applicable SOP. The study was conducted without intervention and did not aim to test the relationship or influence between variables. Data were obtained through direct observation of nurses' hand hygiene practices in daily service activities, then analyzed descriptively to obtain an overview of the accuracy of hand hygiene implementation.



The research instrument was an observation sheet compiled based on the SOP for hand hygiene using the handrub method at Ja'far Medika Karanganyar General Hospital. The instrument assessed the preparation stage, six steps of handrub implementation, and the closing stage. Each action was given a score of 1 if performed according to the procedure and a score of 0 if not performed or not in accordance. The validity of the instrument was carried out through content validity with expert judgment involving the supervising lecturer, the Infection Prevention and Control (PPI) Team of Ja'far Medika Karanganyar General Hospital, and clinical nursing practitioners. Validity assessment used I-CVI and Aiken's V. The assessment results showed an I-CVI value between 0.83 and 1.00 and an Aiken's V of 1.00 for all items, so that 10 instrument items were declared valid and suitable for use. Data collection was carried out through direct observation at each opportunity for hand hygiene implementation. The data then went through the process of editing, coding, processing, and cleaning, then analyzed using univariate analysis with SPSS for Windows. The results of the analysis are presented in frequency distribution and percentage. Accuracy of hand hygiene is categorized as good if $\geq 85\%$, adequate 75 to 84%, and poor $\leq 75\%$.

The study population was all 49 nurses working in the service unit of Ja'far Medika Karanganyar General Hospital (Mushofa et al., 2024). The sample was determined using a total sampling technique, where all members of the population were used as samples due to the relatively small population size. Thus, the study sample consisted of 49 nurses (Dewi et al., 2023). The study respondents were nurses working at Ja'far Medika Karanganyar General Hospital, while the observation unit was every opportunity for hand hygiene implementation that arose during the observation period. Each opportunity was assessed based on the suitability of the action with the hospital's SOP.

The research was conducted at Ja'far Medika Karanganyar General Hospital in June 2026. The preparation stage included determining the title, consulting with the supervisor, arranging a cover letter for the preliminary study, conducting the preliminary study, preparing the proposal, determining the population and sample, preparing the observation sheet, and conducting a proposal and revision seminar. In the implementation stage, the researcher arranged for research permits from 'Aisyiyah University Surakarta and Ja'far Medika Karanganyar General Hospital, then conducted a perception alignment with three enumerators regarding the observation procedure, observed variables, and filling out the observation sheet. The enumerator conducted direct observations of the nurses using the prepared instruments. The observation sheets were then re-checked by the researcher and collected on the same day. The completion stage was carried out by processing and analyzing the data using SPSS for Windows, presenting the results in the form of frequency and percentage tables, and compiling a research report for consultation with the supervisor.

The research was conducted in accordance with ethical research principles, namely respect for persons, beneficence, non-maleficence, justice, and informed consent. Respondents were given the freedom to determine their willingness to participate in the study without pressure. Observations were conducted safely and did not disrupt nurses' work activities. All respondents were treated fairly without discrimination based on specific characteristics. Prior to the observation, the researcher explained the purpose, procedures, benefits, and rights of the respondents, and then willing respondents provided voluntary consent.

Results and Discussion

Univariate Analysis

Table 1 Frequency Distribution of Respondent Characteristics

No.	Respondent Characteristics	Frequency (f = 49)	Percentage (%)
1.	Gender		
	Man	19	38.8
	Woman	30	61.2
2.	Age		
	≤ 25 Years	10	20.4
	25-35 Years	28	57.1

	36-45 Years	3	6.1
	≥ 45 Years	8	16.3
3.	Level of education		
	D3 Nursing	40	81.6
	Nursing Profession	9	18.4
4.	Length of work		
	≤1 year	5	10.2
	1-5 Years	30	61.2
	6-10 Years	3	6.1
	≥10 years	11	22.4

Source: Primary Data

Table 1 shows the characteristics of the research respondents in terms of gender, age, education level, and length of service with a total of 49 respondents. In terms of gender, the majority of respondents were female (30 people) (57.1%). In terms of age group 25-35 years, there were 28 people (36.7%), and in the age range 36-45 years, there were 3 people (6.1%). In terms of education level, the majority of respondents had a D3 education level of 40 people (81.6%). Meanwhile, in terms of length of service, 5 respondents had worked for ≤1 year (10.2%), and 30 respondents had worked for 1-5 years (61.2%).

Table 2 Frequency Distribution of Hand Hygiene Accuracy

Category	Frequency	Percentage (%)
Good	28	57.1
Enough	8	16.4
Not enough	13	26.5
Total	49	100.0

Source: Primary Data

Table 2 shows the frequency distribution of respondents based on the accuracy of hand hygiene implementation with a total of 49 respondents. Based on the table, it is known that respondents in the good category in implementing hand hygiene were 28 people (57.1%), respondents in the less accurate category were 13 people (26.5%), and respondents in the sufficient category were 8 people (16.4%).

Table 3 Frequency Distribution of Observation Components

No.	Assessed Components	Number of Respondents	Yes		No	
			Amount	%	Amount	%
1.	Do not wear jewelry	49	42	85.7	7	14.2
2.	Perform hand hygiene with hand rub based on the five moments.	49	49	100	0	0
3.	Take enough hand rub.	49	41	83.6	8	16.3
4.	Rubbing palms.	49	46	93.8	3	6.1
5.	Back rubhand.	49	43	87.7	6	12.2
6.	Rubbing between the fingers	49	41	83.6	8	16.3
7.	Rubbing the backs of the fingers (locking motion).	49	37	75.5	12	24.5
8.	Rubbing thumbs	49	34	69.3	15	30.6
9.	Rub the fingertips (nails) of the right hand over the palm of the left hand in a circular (punched) motion alternately.	49	31	63.2	18	36.7

10. Let your hands dry naturally	49	47	95.9	2	4
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Source: Primary Data

Based on table 4.3, the results of observations on 10 indicators of hand hygiene accuracy, the indicator with the highest level of compliance is performing hand hygiene with a hand rub based on five moments with a compliance percentage of 100%. In contrast, the three indicators with the lowest level of compliance are rubbing the fingertips (nails) of the right hand over the palm of the left hand in a circular motion alternately (63.2%), rubbing the thumb (69.3%), and rubbing the back of the finger with a locking motion (75.5%). These results indicate that respondents tend to find it easier to perform the basic stages of hand hygiene, but still experience difficulties or often ignore the stages involving cleaning the thumb, back of the finger, and fingertips/nails.

The 100% accuracy rate for the five-moment handrub indicator indicates that nurses have a good understanding of when to perform hand hygiene. Three indicators had the highest compliance rates: performing hand hygiene with handrub based on the five moments (100%), allowing hands to dry naturally (95.9%), and rubbing the palms of the hands (93.8%). These results demonstrate that nurses are quite consistent in carrying out the initial and final stages of the handrub procedure. For the five-moment indicator, this perfect achievement stems from a work culture that consistently emphasizes the importance of critical moments in patient care, thus becoming ingrained in nurses' routines. The high score for the item allowing hands to dry naturally is due to the characteristics of alcohol-based handrubs, which evaporate quickly without the need for rinsing or drying with a tissue. Meanwhile, rubbing the palms of the hands showed high results because it is an easy movement and has become a habit for nurses when performing handrubs. However, low compliance with three technical indicators, namely rubbing the fingertips/nails (63.2%), rubbing the thumb (69.3%), and rubbing the back of the finger with a locking motion (75.5%), indicates that nurses tend to perform hand hygiene symbolically or simply fulfill the obligation of momentum, without ensuring that all hand surfaces are truly microbiologically clean.

This gap can be explained by the declining quality of nurses' psychomotor movements due to high workloads. When the number of patients is high and service is required quickly, steps that do not produce immediate results, such as rubbing the fingertips/nails, rubbing the thumb, and rubbing the backs of the fingers with a locking motion, are the most easily shortened or skipped. Therefore, when nurses are pressed for time, these are the parts that are most often missed or shortened. This is in contrast to rubbing the palms of the hands, which is a simple and habitual movement. This condition is in line with the opinions of Sabirin et al., (2023) and Joshua et al., (2025), who stated that workload and limited service time can reduce the quality of a clinical procedure, even if the nurse's knowledge of the procedure is actually good.

This phenomenon is also influenced by the work culture at Ja'far Medika General Hospital in Karanganyar, a Type D hospital, where the number of nurses available is still limited compared to the number of patients to be treated. A work culture that prioritizes speed of service has the potential to shape nurses' habits to prioritize the number of actions completed over thoroughness in every detail of hand hygiene procedures. If this culture is not balanced with a strengthening of a patient safety culture that truly emphasizes the importance of accurate hand hygiene techniques, not just adherence to the moment, then this gap between understanding and technical implementation risks recurring and being difficult to correct in the future.

This finding relates to the Patient Quality and Safety Program (PMKP) and hospital accreditation standards, which indicate that hand hygiene audit results, which are currently presented as percentages, do not necessarily reflect the accuracy of hand hygiene techniques in the field. In accreditation standards, hand hygiene assessments are not only based on the implementation of actions, but also on their compliance with evidence-based guidelines, as stated in STARKES 2024. Therefore, the PMKP Team and the PPI Team at Ja'far Medika Karanganyar Hospital need to consider a more detailed audit method, not only assessing the presence or absence of hand hygiene actions, but also assessing the accuracy of each component of the technique, especially the fingertips/nails, thumbs, and backs of fingers so that future quality improvement efforts can be more targeted.

Discussion

1. Respondent Characteristics

The results of the univariate analysis in Table 4.1 show that of the 49 nurse respondents, the majority were female, 30 (61.2%). According to research by (Nurmansyah, 2025), the general characteristics of the nursing profession in Indonesia are dominated by female staff, especially in direct patient care units. Meanwhile, according to (Madya et al., 2022), nurses are the health workers who interact most frequently and longest with patients during the treatment process in hospitals, thus having a significant responsibility in implementing hand hygiene as part of infection prevention efforts. The dominance of female nurses in this study also strengthens the picture that the role of nurses as the main implementers of routine nursing actions, including hand hygiene, is still predominantly female at Ja'far Medika Karanganyar General Hospital.

Based on age characteristics, the majority of respondents were in the 25-35 year age range, namely 28 people (57.1%), who fell into the early adulthood category. Meanwhile, 8 respondents were aged ≥ 45 years (16.3%). In early adulthood, a person's physical condition and motor skills are still in good condition, thus better supporting the implementation of the six-step hand hygiene technique with proper movements. This is supported by research by Ahmad and Diah (2024), which explains that nurses of productive age tend to be more receptive and understand the training and socialization of SOPs provided.

Characteristics of educational level show that the majority of respondents had a Diploma III (D3) in Nursing (81.6%), while 18.4% had completed professional nursing education. The D3 level of nursing education places more emphasis on practical skills, including the implementation of hand hygiene, which is often trained directly, while professional nursing education places more emphasis on understanding theory and the ability to determine appropriate actions according to the patient's condition (Nita et al., 2024). According to research by Ruhayati and Dyah (2025), nurses' knowledge of hand hygiene is related to compliance with the implementation of the five moments. Therefore, the high number of respondents with D3 education indicates the need for increased knowledge through regular training so that existing skills can be supported by a better understanding of the importance of each step of hand hygiene.

The length of service characteristics show that most respondents have worked for 1–5 years (61.2%). This finding indicates that the majority of nurses at Ja'far Medika Karanganyar Hospital are in the early to mid-stages of their professional careers, thus possessing sufficient experience in providing nursing services. According to research by

Thirayo et al., (2021) stated that nurses' knowledge, attitudes, and compliance with handwashing practices found that work experience also influenced the consistency of hand hygiene SOP implementation, as nurses with longer tenure were generally more accustomed to the routines and patient safety culture in their work environment. Based on this, the relatively short tenure of most respondents indicates the need for hospital support, such as providing orientation and guidance regarding hand hygiene SOPs for new nurses. This is also supported by Wahyuni (2026), who emphasized the importance of ongoing coaching to improve nurse compliance with hand hygiene.

2. Accuracy of Hand Hygiene Implementation

The accuracy of hand hygiene implementation is the conformity between the hand hygiene practices carried out by nurses and the applicable standard operating procedures (SOPs). Therefore, it is not enough to only look at whether or not the action has been carried out, but also from the accuracy of the time or moment of implementation, the accuracy of the six-step technique according to WHO standards, and the accuracy of the selection of methods that are appropriate to the patient's clinical condition. Thus, a nurse can be said to have implemented hand hygiene, but it is not necessarily appropriate if one of the three aspects has not been fully fulfilled (Nita et al., 2024).

The results in Table 4.2 show that of the 49 respondents, 28 (57.1%) performed hand hygiene in the good category, 8 (16.4%) in the sufficient category, and 13 (26.5%) in the poor category. This illustrates that in general the accuracy of the implementation of hand hygiene by nurses at Ja'far Medika Karanganyar Hospital is good, but there are still some respondents who perform hand hygiene in the less accurate category. The achievement of the accuracy percentage of 57.1% in the good category when viewed from the achievement of the National Quality Indicator (INM) of the Ministry of Health of the Republic of Indonesia still does not reach the optimal target set at $\geq 85\%$. The failure to achieve this INM target indicates that the quality of service related to

the accuracy of hand hygiene and infection prevention at Ja'far Medika Karanganyar Hospital still needs to be improved. This less than optimal accuracy has the potential to increase the risk of Healthcare-Associated Infections (HAIs) or nosocomial infections in treated patients. The occurrence of nosocomial infections due to inadequate hand hygiene practices has direct implications for the potential risk of prolonged length of stay (LOS). Patients who experience additional infections during treatment require longer recovery times and additional medical care (Nurul, 2021). This prolonged length of stay (LOS) ultimately has a significant impact on increasing hospital operational costs, such as increased need for medications, use of medical devices, inefficient bed utilization, and increased workload for healthcare workers (Annisa et al., 2025). Furthermore, in a package-claim-based healthcare financing system, such as BPJS Kesehatan/INA-CBGs, costs resulting from extended hospital stays due to complications of nosocomial infections cannot be fully billed to the insurer, so the increased operational costs will become a financial efficiency burden borne directly by the hospital (Wardani, 2025).

The results of this study are in line with research conducted by Sari et al., (2023) which showed that most nurses have good hand hygiene implementation, but still found around 20-30% of health workers who have not implemented hand hygiene optimally, especially in the technical aspects and the timing of implementation. The accuracy of hand hygiene implementation is a more comprehensive concept than just compliance, because accuracy includes three dimensions: the accuracy of time/moment, the accuracy of the six-step technique, and the accuracy of method selection according to clinical indications (Nita et al., 2024). A nurse can be said to be compliant in implementing hand hygiene, but it is not necessarily appropriate if the technique used does not meet standards (Sri et al., 2026). Therefore, the results of the poor category in the 13 respondents in this study are most likely not caused by nurses who did not perform hand hygiene at all, but by implementation techniques that were not fully in accordance with the six-step SOP from WHO.

These results are also relevant to the study of Dorothea Orem's Self-Care Theory, which explains that every individual, including nurses, has the ability to self-care agency to take necessary actions to maintain their health and the health of the patients they care for (Rahmalia and Desi, 2026). Nurses who have high self-awareness of the importance of hand hygiene will tend to carry out each step correctly even in busy work conditions, while nurses with low awareness are more at risk of skipping or shortening certain stages. Research conducted by Dea et al., (2024) found the Hawthorne Effect phenomenon in nurses' hand hygiene practices, namely the tendency of nurses to increase the accuracy of implementation when aware of being observed. In this study, researchers have attempted to minimize this bias by not introducing themselves as researchers to the nurses being observed, so that the good category results of 57.1% are expected to be closer to the picture of nurses' actual hand hygiene behavior in daily service activities, not merely a response to awareness of being observed.

In addition to individual awareness, the accuracy of hand hygiene implementation is also inseparable from the availability and ease of access to supporting facilities. According to Sabirin et al., (2023), the availability of handrub at the point of care significantly influences the frequency and accuracy of nurses' hand hygiene, as limited access to facilities will encourage nurses to skip or shorten hand hygiene steps for the sake of service time efficiency. Research by Joshua et al., (2025) also emphasized that suboptimal facility conditions can reduce nurses' motivation to consistently implement hand hygiene. Thus, the achievement of the good category among respondents in this study indicates that the hand hygiene facilities at Ja'far Medika Karanganyar General Hospital are generally quite supportive.

3. Accuracy of Hand Hygiene Implementation Per Component

The analysis results in Table 4.3 show that the component with the highest level of accuracy is the implementation of hand hygiene based on five moments (100%), which means that all respondents have understood when the right time to perform hand hygiene according to clinical indications. This result also strengthens the implementation of the Minister of Health Regulation Number 27 of 2017 concerning Guidelines for Infection Prevention and Control which stipulates hand hygiene as one of the basic efforts to prevent infections related to health services (Dumaris et

al., 2025), and shows that the socialization of five moments at Ja'far Medika Karanganyar Hospital has been effective.

The components with the lowest accuracy levels were found in the steps of rubbing the fingertips in a circular motion (a cupped motion) (63.2%), rubbing the thumb (69.3%), and rubbing the back of the finger in a locking motion (75.5%). These three areas are part of the six-step WHO hand hygiene technique (2009) which have anatomical shapes that are difficult to reach if nurses do not perform the movements thoroughly. The fingertips and under the nails are the main reservoirs of pathogenic microorganisms because of their curved anatomical contours, so they require more pressure and a greater number of circular movements than the relatively flat surface of the palm. The low accuracy in these components indicates that some nurses tend to shorten the duration or number of movements in areas that are considered less visibly dirty, even though these areas actually have a high risk of contamination. The results of this study are in line with research found by (Nita et al., 2024) which confirms that nurses' competence in performing hand hygiene does not only include theoretical knowledge regarding the WHO 6-step technique, but also motor skills to perform the technique correctly, including the ability to pay attention to critical areas of the hand such as the thumb, between the fingers, and fingertips which are very vulnerable if not carried out correctly.

Overall, the results of this study show that nurses at Ja'far Medika Karanganyar General Hospital are more consistent in carrying out basic, easily observed steps, such as rubbing the palms (93.8%) and letting the hands dry naturally (95.9%), compared to technical steps that require more complex precision and movement skills. According to research by Astari et al., (2023) stated that in low- and middle-income countries also found a similar pattern, namely compliance with hand hygiene in general tends to be higher than the accuracy of its implementation techniques, so the findings in this study reinforce the importance of retraining that emphasizes the detailed techniques of the six steps of hand hygiene, not just awareness of the timing of its implementation.

Conclusion

Based on the research results, the accuracy of hand hygiene implementation among nurses at Ja'far Medika Karanganyar General Hospital was generally in the good category, with 28 respondents (57.1%) included in the good category, 8 respondents (16.4%) in the sufficient category, and 13 respondents (26.5%) in the poor category. The observation results showed that the highest accuracy was found in the implementation of hand hygiene based on five moments at 100%, followed by letting hands dry naturally at 95.9% and rubbing the palms of the hands at 93.8%. Conversely, the lowest accuracy was found in the movement of rubbing the fingertips or nails at 63.2%, rubbing the thumb at 69.3%, and rubbing the back of the fingers with a locking motion at 75.5%. These findings indicate that nurses have quite good understanding of the timing of hand hygiene implementation, but there are still weaknesses in several technical stages. Practically, these results can be used as evaluation material for Ja'far Medika Karanganyar Hospital, especially the PPI and PMKP Teams, to strengthen supervision, retraining, and coaching that emphasizes the accuracy of each hand hygiene step, especially in the fingertips, thumbs, and backs of the fingers.

This study has limitations because it used a descriptive observational design with 49 nurses in one hospital. Therefore, the results only describe the conditions at Ja'far Medika General Hospital, Karanganyar, and cannot be widely generalized. Furthermore, observations of nurses' behavior may still be influenced by service conditions and respondents' awareness of the observation process. Future research is recommended to involve a wider number of respondents and locations, and consider observations over different periods to obtain a more comprehensive picture. Future research can also expand the study by identifying factors related to hand hygiene accuracy, such as knowledge, workload, supervision, facility availability, and patient safety culture. Practically, the results of this study demonstrate the need for a more detailed evaluation of hand hygiene techniques, beyond simply assessing the implementation of actions, so that efforts to improve quality and patient safety can be carried out more precisely.

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