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Hand hygiene knowledge, perception, and compliance among healthcare workers

Enty Tjoa[1,2], Cipta Mahendra[3], Suryanto Suryanto[4], Sandy Theresia[5], Marcella Wirjanata[6], Daniel Ardian Soeselo[7,8]

[1]Department of Microbiology, Atma Jaya Hospital, Jakarta, Indonesia
[2]Department of Microbiology, School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, Jakarta, Indonesia
[3]Department of Chemistry-Biochemistry, School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, Jakarta, Indonesia
[4]Kemayoran Regional General Hospital, Jakarta, Indonesia
[5]Kramat Hospital 128, Jakarta, Indonesia
[6]Atma Jaya Catholic University of Indonesia, Jakarta, Indonesia
[7]Department of Surgery, Atma Jaya Hospital, Jakarta, Indonesia
[8]Department of Surgery, School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, Jakarta, Indonesia

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ABSTRACT

Healthcare-associated infections (HAIs) is a great issue to concern in healthcare services because it accounts for prolonged hospital stay and may lead to morbidity or mortality. Proper hand hygiene behavior in the healthcare environment is indispensable in minimizing the risk of HAIs. This study aimed to identify the impact of hand hygiene education on healthcare workers' (HCWs) compliance, knowledge, and perception of hand hygiene at Atma Jaya Hospital, Jakarta, Indonesia. The compliance of hand hygiene was evaluated using the World Health Organization's (WHO) five moments for hand hygiene as the reference. Data on hand hygiene knowledge and perception were collected using a translated version of the WHO's hand hygiene knowledge questionnaire and hand hygiene perception questionnaire, respectively. Results showed a significant increase in compliance with hand hygiene after the online session's intervention had been implemented, except hand hygiene compliance for the 'after touching patient surroundings' moment. There was also a significant increase in the HCWs' hand hygiene knowledge after the intervention. The HCWs' perceptions are also found to be positive even before the intervention. This study concludes that the HCWs' knowledge and compliance with hand hygiene at Atma Jaya Hospital increase significantly after an educational intervention had been conducted.

Corresponding Author:

Daniel Ardian Soeselo
Department of Surgery, School of Medicine and Health Sciences Atma Jaya Catholic University of Indonesia
Pluit Raya No. 2, North Jakarta 14440, DKI Jakarta, Indonesia
Email: daniel.ardian@atmajaya.ac.id

1. INTRODUCTION

Healthcare-associated infections (HAIs) (synonyms: health care-associated infections/HCAIs, nosocomial, nosocomial infections) are infections that patients acquire while receiving treatments for medical or surgical conditions and are the most frequent adverse event during healthcare delivery [1], which appear 48 hours or more after hospital admission, or within 30 days after having received health care [2]. HAIs are

one of the adverse events that often occur in hospitalized patients, along with drug side effects and surgical complications [2].

HAIs are a great issue to concern in healthcare services because they cause prolongation of hospital stay and sometimes may lead to disability and even death, which make HAIs contribute to the increase of economic burden both for patients and the hospitals [3], [4]. HAIs are a worldwide phenomenon occurring in low-, middle-, and even high-income countries, although with different prevalences [1]. The most recent World Health Organization (WHO) report on hand hygiene in health care states that the HAIs prevalence percentage ranges from 5-15% in developed nations; the percentage is higher among developing countries, ranging from 5.7 to 19.1% according to the report [1]. Several risk factors contribute to HAIs include medical procedures and use of antibiotics, length of stay in the hospital, and patient characteristics [5]. Consequently, the incidence of HAIs sometimes happens unavoidably, even with optimal care [6], [7].

However, HAIs occasions can be minimized with some concrete interventions, from an antibiotic stewardship program to a simple hand hygiene procedure (i.e. hand washing) [8]. A research has suggested that at least 20% of HAIs are potentially avoidable, with the highest reduction proportion (>50%) for the surgical site and device-associated infections [7]. Hand hygiene for healthcare workers (HCWs) as a mean to prevent the spread of HAIs has been promoted by the WHO since 2010 in its 'Save Lives: Clean Your Hands' program [9]. Several papers have proposed the importance of hand hygiene to control infection spread in healthcare facilities, which thereupon will reduce HAIs [5], [8]. Furthermore, hand washing is eventually the simplest and most basic effort to mitigate the problem of HAIs, as it needs relatively unsophisticated utilities (clean water, bar/liquid soap, alcohol) to perform such endeavor [9], [10].

In 2014 the joint organization of The Society for Healthcare Epidemiology of America - Infectious Diseases Society of America (SHEA-IDSA) has issued guidelines to prevent HAIs in healthcare facilities [11]. Along with it, since 2016 the WHO has also published the infection prevention and control programs guideline to help the countries across the globe in managing the HAIs [12]. These guidelines highlight the importance of HAIs education for the HCWs and hand hygiene procedures as a way to overcome the HAIs problems in healthcare facilities [11], [12].

However, implementations in the [12] field vary. In low- and middle-income countries (LMICs), basic hygiene standards are often lacking [1]. It has been reported that the HCWs in LMICs often have understood the knowledge of HAIs well [13]–[15], but the executions remain poor due to low compliance [16]–[18]. On the other hand, in high-income countries, awareness and conformity to standard guidelines have been well established [19]–[21].

The compliance of health care workers with hand hygiene practices was associated a decrease in the incidence of health-care-associated infections [22], [23]. A randomized controlled trial study in Indonesia has demonstrated the health workers compliance improved after hand hygiene training intervention. The hand hygiene compliance improvement co-occurred with a statistically significant improvement of the knowledge score [24], [25]. Another study in Vietnam has also demonstrated hand hygiene compliance rates improved significantly and were sustained over a sixmonth period following the intervention [26]. So far, Atma Jaya Hospital has not conducted any hand hygiene training, HCWs hand hygiene compliance evaluation, and research pertaining to HAIs and hand hygiene. In the ongoing global pandemic of coronavirus disease 2019 (COVID-19), hand hygiene must be part of an integrated approach to control the spread of the infections. Furthermore, the Atma Jaya Hospital's status as a teaching hospital must serve as a good role model of hand hygiene behavior for the students. For these reasons, we carried out an intervention to increase the HCWs' knowledge and compliance toward hand hygiene. We were interested to see the most recent status of Atma Jaya Hospital HCWs' HAIs and hand hygiene knowledge. In addition, we were also measuring the HCWs' hand hygiene compliance using the WHO's five moments for hand hygiene reference. Hand hygiene is the simplest yet most basic procedure to reduce and prevent HAIs according to the WHO and SHEA-IDSA guidelines.

2. RESEARCH METHOD

The type of this study is quasi-experimental one-group only. The study was conducted at Atma Jaya Hospital in January-June 2021. The population sampled for this study was the nurses from all wards in the hospital. The hospital consists of nine wards: an isolation ward for COVID-19 patients, two internal medicine wards, two pediatric wards, an obstetrics ward, an intensive care unit (ICU), an emergency room, and an operating theatre. The data collected were the participants' knowledge, perception, and attitude toward hand hygiene before and after an online training session, as well as the demographic characteristics of the participants.

The knowledge and perception toward hand hygiene were assessed and measured using WHO hand hygiene questionnaires (hand hygiene knowledge questionnaire for health-care workers, perception survey for health-care workers) before and after the training. The attitude toward hand hygiene was surveyed by observing

the participants' adherence to hand hygiene, i.e., the compliance to the WHO's five moments for hand hygiene during the practices in their respective wards in the hospital. The observation was conducted indiscreetly by the respective ward's general practitioners using the WHO Hand Hygiene Observation Form instead of the investigators themselves to minimize the participants' awareness bias (i.e., hawthorne effect) due to the presence of the investigators in the wards. The observation was performed both prior to and after the online training. The observer surveyed and noted down the hand hygiene performance of each participant encountered during the working shift. Any perceived problems in the hand hygiene implementation were assessed by interviewing the study participants. Each participant was asked for the hurdles or constraints they found in doing proper hand hygiene procedures. The online training sessions were conducted using the Zoom® platform. The training's presentation materials were obtained from the WHO's hand hygiene module (WHO guidelines on hand hygiene in health care, 2009) [1], with the focus on the rationale and importance of hand hygiene to reduce HAIs, as well as how to perform correct hand hygiene techniques.

All obtained data were treated as descriptive data, based on the nature of the study's design. We use Wilcoxon signed-rank test to analyse the data because our population data are non-normally distributed. The analysis results are displayed in this article in charts and tables, accompanied with the respective relevant narratives to explain the displays. The post-intervention significance for the participants' hand hygiene knowledge and compliance was measured statistically based on the p-value analysis (95% confidence interval) using IBM® SPSS® Software, Version 22. Meanwhile, the participants' perception data were obtained and displayed as additional results.

3. RESULTS AND DISCUSSION

3.1. Implementation of the online training sessions and attitude surveillance for hand hygiene practices

The online training was conducted on February 18th, 2021 at two different sessions: morning (11:00 AM) and afternoon (15:00 PM). Both training sessions were delivered using the Zoom® platform and conducted in the form of a presentation using Microsoft PowerPoint®. The pre-intervention measures were obtained at the time when the participants logged into the platform but before the start of the session. The session was then started after all participants had completed both WHO questionnaires. The materials presented were as follows: HAIs introduction, the importance of hand hygiene to prevent HAIs, how and when to perform appropriate hand hygiene. Upon completion of the session, the same WHO questionnaires were again given to the participants as post-intervention measures. Both the morning and the afternoon sessions were treated in the same protocol (no difference). A total of 75 nurses participated in this study; the morning session was attended by 40 participants, while the afternoon session was attended by 35 participants.

The attitude toward hand hygiene was assessed using a surveillance form which consists of the WHO's five moments for hand hygiene (i.e., before touching a patient, before clean/aseptic procedure, after body fluid exposure risk, after touching a patient, and after touching patient surroundings). Each moment's compliance was measured using two parameters, i.e., whether the participant did clean his/her hands for the corresponding moment, and whether the cleaning techniques were applied correctly as shown in Table 1 (see Appendix). An additional parameter was also assessed: cleaning method (using an antiseptic hand rub or handwashing using water and soap).

As with the knowledge and perception survey, the attitude surveillance was also conducted in a pre- and post-intervention fashion. The pre-intervention assessment was conducted approximately two weeks prior to the day of the training sessions, while the post-intervention assessment was conducted a week after the training's completion. The participants had been informed of the surveillance to comply with the informed consent principles, however, the specific day(s) and time(s) for the assessment were not disclosed to minimize the awareness bias.

3.2. Attitude toward hand hygiene assessment

Table 2 shows the number of study participants who comply to do hand hygiene procedures for the respective moments. The statistical analysis shows significantly increased compliance for hand hygiene moments after the online sessions had been implemented, except the compliance for 'after touching patient surroundings' moment ($p=0.140$). Table 3 shows the proportion of the participants who perform appropriate hand hygiene procedures according to the WHO's hand hygiene techniques guideline. The data analysis shows that the online sessions intervention has given significant improvement in performing appropriate hand hygiene procedures ($p=0.000$). Table 4 shows the proportion of the participants' preference for water and soap or alcohol-based hand rub to clean their hands in the corresponding moments. The majority of the participants prefer to use alcohol-based hand rub over the traditional water and soap handwashing method for most hand hygiene moments, with the exception of the 'after body fluid exposure risk' moment.

Table 2. Number of study participants who comply to hand hygiene procedure

Moments	Pre-intervention (%)	Post-intervention (%)	p-value (CI 95%)
Before touching a patient	31 (52)	52 (87)	0.001
Before clean/aseptic procedure	35 (58)	55 (92)	0.000
After body fluid exposure risk	48 (80)	58 (97)	0.008
After touching a patient	27 (45)	50 (83)	0.000
After touching patient surroundings	27 (45)	43 (72)	0.140

CI: confidence interval

Table 3. Number of study participants who correctly perform the hand hygiene procedure

Moments	Pre-intervention (%)	Post-intervention (%)	p-value (CI 95%)
Before touching a patient	14 (45)	45 (87)	0.000
Before clean/aseptic procedure	19 (54)	46 (84)	0.000
After body fluid exposure risk	17 (35)	49 (84)	0.000
After touching a patient	19 (70)	49 (98)	0.000
After touching patient surroundings	12 (44)	38 (88)	0.000

CI: confidence interval

Table 4. Preference of the method for complying participants

Moments	Methods	Pre-intervention (%)	Post-intervention (%)
Before touching a patient	Water and Soap	1 (3)	3 (6)
	Alcohol-based	31 (97)	49 (94)
Before clean/aseptic procedure	Water and Soap	5 (14)	5 (9)
	Alcohol-based	30 (86)	50 (91)
After body fluid exposure risk	Water and Soap	47 (98)	58 (100)
	Alcohol-based	1 (2)	0 (0)
After touching a patient	Water and Soap	3 (11)	4 (8)
	Alcohol-based	24 (89)	46 (92)
After touching patient surroundings	Water and Soap	1 (4)	1 (2)
	Alcohol-based	26 (96)	42 (98)

3.3. Knowledge and perception of hand hygiene assessment

Eight participants were excluded from this study because their hand hygiene attitude had not been observed by the observer before the online training sessions, while seven other participants were excluded because of incomplete questionnaires' answers. Sixty participants' pre- and post-intervention questionnaires were analyzed in this study. Table 5 shows the mean score of the knowledge questionnaire's results before and after the online sessions. Statistical significance was obtained after the analysis (p=0.000), where 50 participants gained better marks in the post-intervention than the pre-intervention assessment and seven participants gained worse marks in the post-intervention assessment.

Figures 1 to 6 describes critical perception aspects regarding hand hygiene practices according to the participant's opinion. In general, the critical aspects assessed were related to their opinion about the impact of HAIs in healthcare and the hand hygiene policy implementations in the hospital. The participant's perceived degree of importance for the support from the patients, colleagues, and participant's department head to acknowledge hand hygiene procedures is also displayed in Figures 4 to 6.

The majority of participants perceive that the average percentage range of patients who will develop HAIs during hospitalization is 0-20%, both in the pre- (48.3% of participants) and post-intervention (51.7%) questionnaire assessments. Meanwhile, most participants also assume the impact of HAIs on patient's clinical outcomes to be high (35% in pre- and 36.7% in post-intervention) or very high (40% in pre- and 41.7% in post-intervention). Similar results were also obtained for the effectiveness of hand hygiene to mitigate the HAIs impact, where most participants considered it to be high (43.3% in pre- and 36.7% in post-intervention) or very high (43.3% in pre- and 51.7% in post-intervention). A relatively small proportion of participants rated the impact of HAIs and the importance of hand hygiene to be low (about 20% and 12-13% of participants, respectively).

Table 5. Hand hygiene knowledge questionnaire result before and after the online sessions

Pre-intervention assessment mean value (%)	Post-intervention assessment mean value (%)	Mean difference	p-value (CI 95%)
56.8	82.27	25.47	0.000

CI: confidence interval

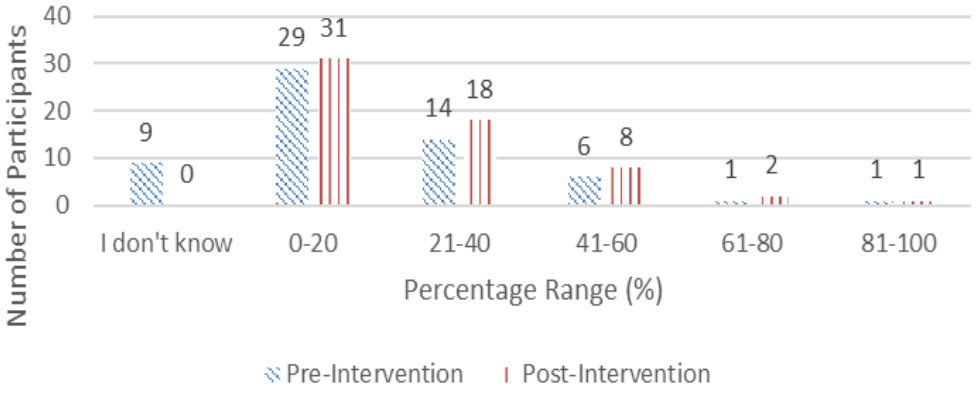

Figure 1. Participants' approximation of HCAIs incidence in the hospital

The support from the participant's department head, colleagues, and also patients is deemed important to the participants. Most give the highest rate (7 out of scale 1-7) in the Likert scale provided to the respective questions for both pre- and post-intervention assessments. More than 70% put the rate 7 for the importance of the participant's department head acknowledgment for his/her hand hygiene performance, while only around 20% put a slightly lower rate of 6. Similar percentages were also seen for the perceived importance of the participant's colleagues and patients; only approximately 10% of the participants put the rate 6 for the support of patients. A small fraction of participants (<5%) gave the rate of 5 or less.

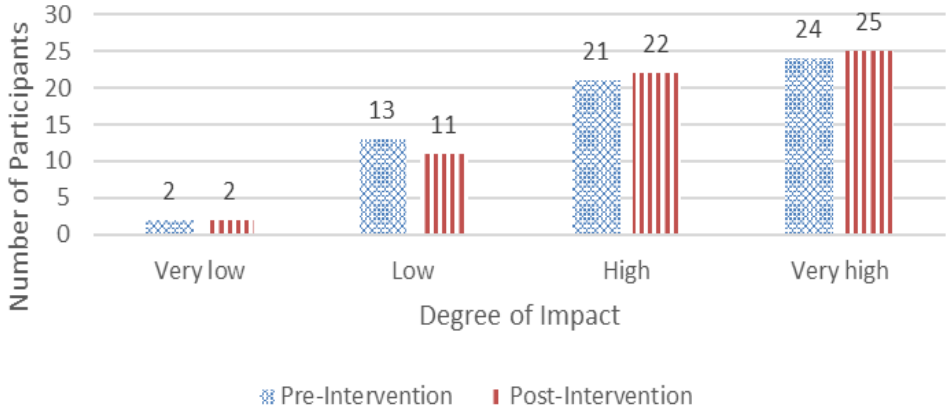

Figure 2. Participants' perception of HCAIs impact to a patient's clinical outcome

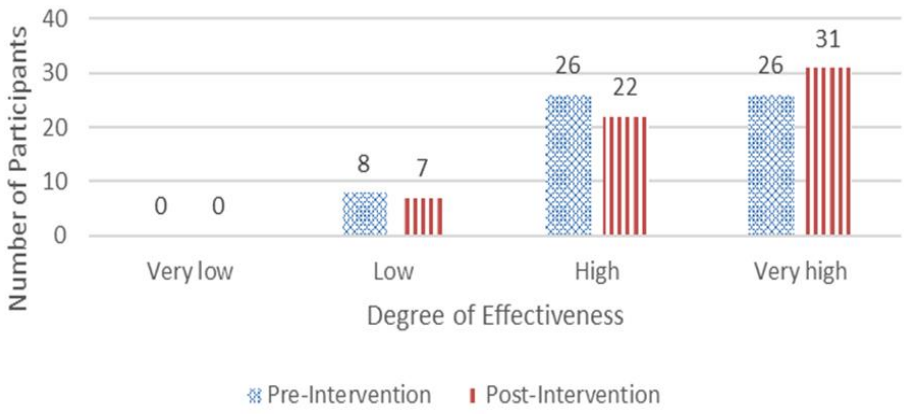

Figure 3. Participants' opinion concerning the effectiveness of hand hygiene in preventing HCAIs

3.4. Problems in hand hygiene implementation

A total of 30 random participants were interviewed for problems encountered regarding the hand hygiene procedures in the hospital as shown in Table 6. The majority (23 out of 30 participants) state oversight as the main hurdle in hand hygiene implementation. Meanwhile, 14 participants express that they do not perform hand hygiene procedures regularly because the hand rub containers are sometimes empty and not refilled shortly. Eleven participants complained about the scarcity of hand rub availability in the ward, while four participants opined the unpleasant scent of the hand rub as a hindrance for hand hygiene performance. A few other participants (two participants) are unable to do handwashing properly because the tissue napkins are quite often exhausted. All of these problems become obstacles for the hospital's HCWs in performing hand hygiene.

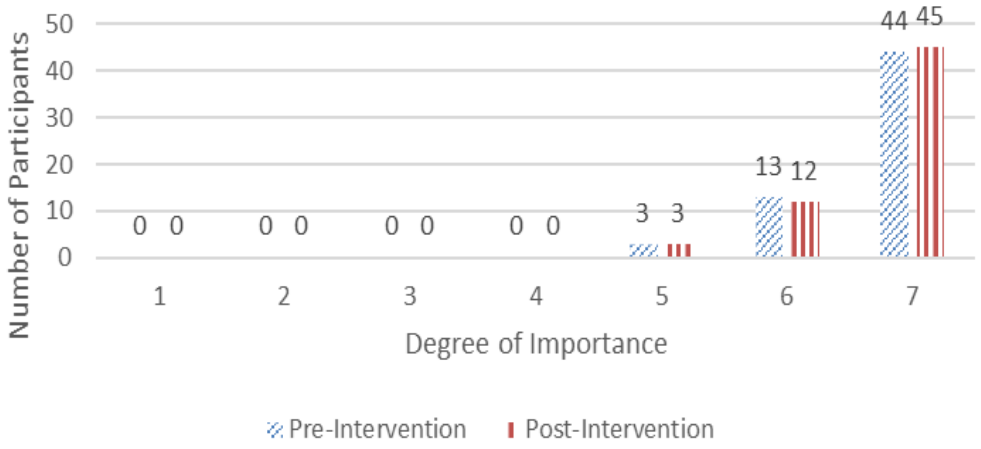

Figure 4. Participants' perception for the importance of head of department's support toward their hand hygiene performance

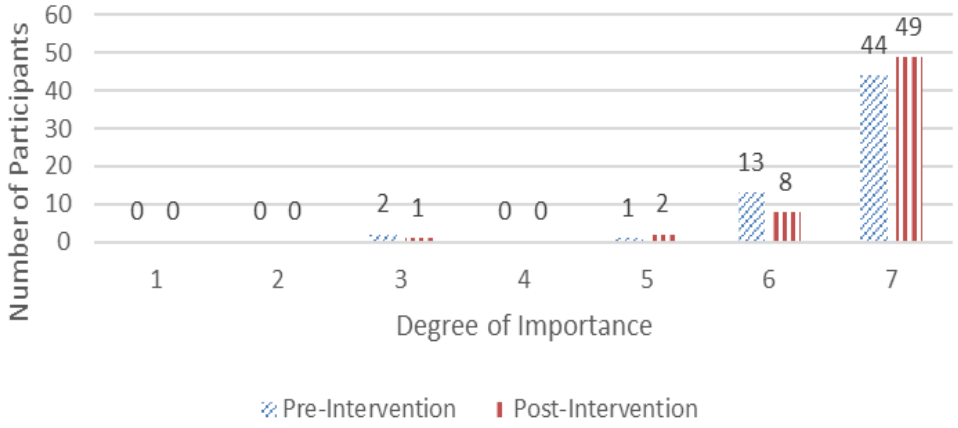

Figure 5. Participants' perception for the importance of colleagues' support toward their hand hygiene performance

Table 6. Proposed problems in hand hygiene implementation at Atma Jaya Hospital

Problems	Number of participants (out of 30)
Forget to wash hands	23
The hand rub is sometimes empty and not refilled shortly	14
Hand rub is not available on every patient bed	11
Unpleasant hand rub scent	4
The tissue wipes are often exhausted	2

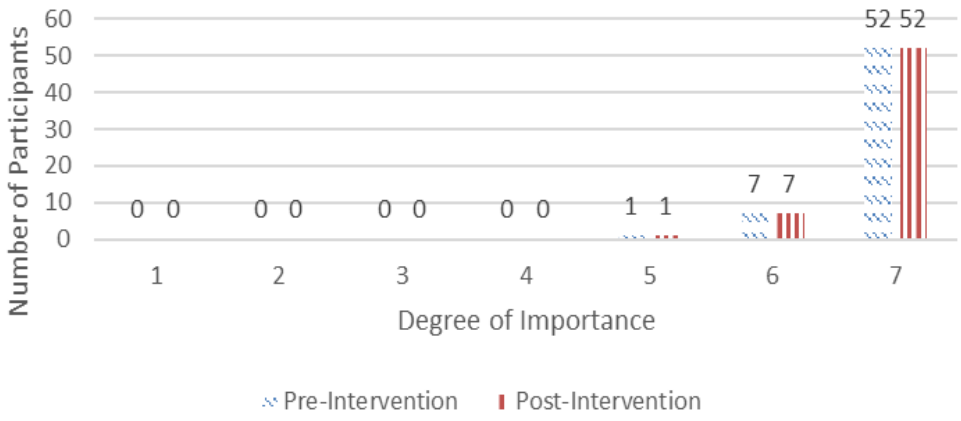

Figure 6. Participants' perception for the importance of patients' support toward their hand hygiene performance

4. DISCUSSION

The concern for HAIs in healthcare settings has been noticed for many years, looking from the WHO's hand hygiene report and guideline which had been published worldwide since 2009 [1]. HAIs increase the morbidity, mortality, length of hospital stays, and healthcare costs, of which are not only burden the diseased patient but also the healthcare providers as well [2]. Therefore, it is important to mitigate the impact of HAIs in healthcare services by appropriate hygiene practices. One significant effort to reduce such nosocomial infections is by implementing hand hygiene practices [1], [2].

The WHO advocates the well-known 'five Moments for Hand Hygiene': before touching a patient, before clean/aseptic procedure, after body fluid exposure risk, after touching a patient, and after touching patient surroundings [1]. The WHO hand hygiene guideline emphasizes the necessity of hand hygiene promotion to improve HCWs' knowledge and awareness of such practice [1], as hand hygiene is deemed the most fundamental practice component of the infection prevention programs in a healthcare facility [8]. This notion is the background for this research, where the online sessions are meant to be as a way to promote hand hygiene to improve the participant's compliance of hand hygiene in his/her practices.

In this study, the attempt to promote the hand hygiene practice appears to be beneficial, as shown by the results in Table 2 and Table 3. Table 2 shows that the number of participants doing hand hygiene practices increases significantly after the online sessions ($p<0.05$), except the 'after touching patient surroundings' moment ($p=0.140$). Nevertheless, the raw number comparison shows an increase (27 to 43 participants) which implies that at least, the intervention has given a positive impact for the participants. Similar results are seen in Table 3, where the number of participants who perform the correct hand hygiene steps increases significantly post-intervention ($p=0.000$). A positive outcome is also seen for the participants' hand hygiene knowledge, where a significant increase in post-intervention mean score was obtained ($p=0.000$). All these results are in line with the study results from several other countries, where similar HAIs prevention education sessions were given to the HCWs and showed positive outcomes post-intervention [13], [15], [19], [27].

Most participants also tend to utilize alcohol-based handrub instead of conventional water and soap handwashing in most hand hygiene moments, except in the 'after body fluid exposure risk' situation as shown in Table 4. This may stem from the 'common sense' perception or the school education that visible secretes or excretions from a sick patient are 'dirty' and potentially infectious, although there has been no other study elsewhere, to the authors' knowledge, that confirms this notion or the result observed in this study. It is also possible that most participants preferred the handrub over hand washing method because of some common reasons: it requires lesser time, is faster to perform, more accessible than the sinks, and has fewer skin issues [28]. The WHO guideline states that handrub method can be used for invisible contamination on hand; the handwashing using water and soap method should be chosen instead when the contaminants are visible on the hand [1]. This study was not planned to observe whether the correct method was chosen in certain situations requiring a hand hygiene practice. Therefore, this study only confirms the correct hand hygiene procedure (Table 3) by means of correct handrub and/or handwashing steps, not the appropriate hand hygiene method to choose in the corresponding moment or situation. This also explains the rationale for not doing p-value (significance) analysis for the results in Table 4.

Regarding the participants' perceptions, this study shows some interesting results. About a half of participants estimated the HAIs incidence to be around 0-20% as shown in Figure 1 in both pre- and post-intervention assessment, which is in accordance with the WHO estimation [1]. This may indicate that our study participants had already a right approximation of HAIs impact in the first place before the online session intervention, although this may also mean that the session did not give any significant change to the perception of this matter (31 participants in post-intervention, compared to 29 in pre-intervention).

A similar tendency was observed when the participants rated their perception of HAIs impact on patient's clinical outcomes. We did not find a significant change in rating response after the online sessions, which only differs by one participant between the pre- and post-intervention assessment in both high or very high rating. Combined, about 75% of participants rated the impact of HAIs to be high or very high. A higher proportion was reported by Sreegiri *et al.* where about 88% perceived the impact to be important (33.33% rated it to be high and 55% rated it to be very high) [29]. Payghan *et al.* similarly reported that 95% of their study participants felt that hand hygiene is effective [30]. Meanwhile, Kusain and Jeffrey's study reported a similar percentage (about 75%) but the proportion of the study participants who gave a high rating was much higher (54%) than those who gave a very high rating (21.8%) [28]. Taken together, our study indicates that our study participants, more or less, have equal perception with the participants from other similar studies.

In our study, about 88% of participants (post-intervention) put the importance of hand hygiene to prevent HAIs to be high (36.7%) or very high (51.7%). A shift in the proportion between the high and the very high rating post-intervention may suggest that the online sessions indeed contribute to the shifting, although the significance is not powered by the p-value analysis due to the purpose of this study. Sreegiri *et al.* study reported a somewhat reversed proportion, where 72.8% perceived it to be effective (high) and only 16.2% assumed it to be very effective (very high), although a similar total number of participants was also obtained from these two ratings [29]. Similar reversed proportion was also reported in Aldeen and Kheder's study [31]. Kusain and Jeffrey's study reported almost 100% of their study participants put the importance of the matter to be either high or very high, where only 1 out of the 87 participants included in their study perceived it to be low (1.1%) [28]. Compared to our study, we found that about 12% of participants (post-intervention) were still assumed hand hygiene effectiveness to be low as shown in Figure 3.

Our study also found the acknowledgment of hand hygiene practices by the participant's department head, colleagues, and patients to be important. Approximately, about 90% of our participants (post-intervention) rated the importance to be either 6 or 7 out of a Likert scale of 1-7 (Figure 4-6) which indicates that support from these parties is necessary. In our opinion, we did not observe a significant number of participants' shifting between pre- and post-intervention for the respective chosen rating number despite, again, the lack of p-value analysis. Additionally, unlike some other studies [29], [31], we did not classify the scales to maintain the results in their pure forms (rating numbers).

Our results are in contrast to the Sreegiri *et al.* study which reported that less than half their participants rated 'high importance' to the support from patients and their coworkers, with the lowest proportion in the patient support aspect (only 13.5%) [29]. On the other hand, Aldeen and Kheder's study reported 32.3% and 34.1% of their participants perceived the support from the department head and colleagues, respectively, to be 'highly important', while 53.1% and 52.2% (support from the department head and colleagues, respectively) viewed it to be just 'important' [31]. It was not explained for the classification of the rating number(s) corresponding to the respective labeled importance category.

Overall, our study shows that the online sessions intervention significantly increases the participants' hand hygiene knowledge and practice compliance in Atma Jaya Hospital, but appears to be trivial in shifting of hand hygiene perceptions although not powered by statistical analysis for this notion. Nonetheless, the participants' perceptions in this study seem to be already advantageous even before the intervention was given. The improvement of hand hygiene practice compliance this study finds that the online session intervention successfully supplies the participants' knowledge and subsequently changes their attitude toward hand hygiene practice in the hospital. An interesting finding in this study is the relatively unchanged perception rating post-intervention. The results may be explained by the fact that these perceptions were already highly positive in the first place and so that subsequent intervention may change the perceptions of those who were still uncertain, of which are few compared to the already-positive participants and hence did not increase the number or proportion significantly. Needless to say, this speculation not powered by the p-value analysis and only based on the absolute number of participants, making such notion is only a conjecture at the moment and needs to be verified in future studies.

Nevertheless, the favorable results for the post-intervention knowledge, compliance, and perception observed in this study should be maintained for as long as possible. Most studies reported the discrepancy between knowledge and implementation for hand hygiene practices, in that the study participants' knowledge is high enough but it is not translated into real and concrete hand-rubbing and/or handwashing in their daily practices [28], [29], [31]. The hand hygiene practice should be routinely promoted and assessed by the Atma Jaya Hospital

management so that the positive results could be maintained and transform such practice to be a culture that benefits not just the patients but also all other stakeholders as well, i.e., doctors, nurses, staffs and employees, and also the management. WHO [1] and SHEA-IDSA [10], [11] hand hygiene guideline could be used as references to formulate and enact the hospital's hand hygiene standard operation and procedures.

The barriers to appropriate hand hygiene practices as described in Table 6 should also be considered for the hospital's management, as these hurdles may also decrease the hand hygiene compliance of the HCWs. Several studies had reported such matters; a survey in a hospital in Vietnam proposed the lack of accessible sinks for handwashing and scarcity of 'within reach' alcohol-based hand rub in the hospital as the causes for the HCWs' poor hand hygiene compliance in the hospital [32]. Similar problems were also reported in Kirk *et al.* study, where the lack of accessible sinks and empty hand rub bottles or dispensers contributed to the hand hygiene barriers and hence the HCWs' compliance [33]. These issues need to be addressed by the management board to optimize the hand hygiene practice in the hospital. Instituting more available and accessible sinks and hand rubs, and also regular hand rub bottle or dispenser inspection should be implemented [32]–[34]. A portable hand rub dispenser can be also a promising solution [32].

We identify several limitations of this research. This study was designed as a cross-sectional study, implying that the results obtained reflect the present conditions only and not for the long term. Continuous assessments to ensure and sustain the hand hygiene practice in the hospital will be needed. Routine sessions may also be necessary as a reminder for the HCWs to maintain hand hygiene practices. Because hand hygiene education is provided through online training, some participants might follow the session while doing other activities in the ward. This factor might render the participants be distracted and unable to comprehend the training material properly. In addition, this study was also designed as a preliminary survey to get the baseline data about the most recent HAIs and hand hygiene knowledge and attitude/compliance of the HCWs in Atma Jaya Hospital, since there has been no data regarding the matter before this study. Therefore, the perception results in this study were displayed as additional data to see the HCWs' predisposition toward hand hygiene in general. More thorough and in-depth analysis is needed for future studies to gain a better and detailed view of the hospital's hand hygiene practice status. The number of participants who had been observed in this study does not reach the sample target due to time constraints. The investigators suggest allocating a longer period to do follow-up studies in the future.

This study was also conducted during the COVID-19 pandemic, which may bias the results. Several studies had confirmed the increased compliance of hand hygiene during the COVID-19 pandemic, especially at the peak moment when a lockdown was enforced [35]–[37]. The heightened awareness of the risk caused by continuous reporting of virulent COVID-19 may consequently prompt our study participants to more often clean their hands [32], hence the increased compliance to the hand hygiene practice.

5. CONCLUSION

This study concluded that HAIs and hand hygiene knowledge and compliance of Atma Jaya Hospital's HCWs are sufficient after an educational intervention had been conducted. The HCWs' perceptions toward hand hygiene are also found to be positive even before the intervention. These results should be maintained so that such positive behaviors could be established as a culture for optimal healthcare services in the hospital, as the practice of hand hygiene to reduce and prevent HAIs in healthcare settings is indispensable and always necessary.

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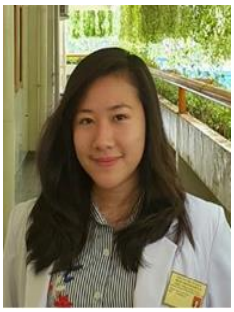
BIOGRAPHIES OF AUTHORS

Enty Tjoa graduated in 2006 as an MD from the School of Medicine, the Atma Jaya Catholic University, Indonesia. Her passion in the field of microbiology motivated her to join the residency program in Clinical Microbiology at the School of Medicine, University of Indonesia, which she successfully completed in 2012. At present, Enty is working at the Department of Microbiology, the School of Medicine, and the Atma Jaya Catholic University, Indonesia. Her expertise in the field includes the antibiotic susceptibility pattern of *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and other MDR Gram-negative bacteria. She also a hands-on experience in the management of biosafety, biosecurity and biorisk management. She has published scientific content in her field of expertise in various national and international journals. She can be contacted at email: enty@atmajaya.ac.id, entytjoa@gmail.com.

Cipta Mahendra graduated from the faculty of medicine, Atma Jaya Catholic University of Indonesia as a medical doctor in 2019. During his study, he had followed a student exchange program at Leiden University Medical Centre in The Netherlands, with the subject in cellular therapies. Currently, he is a medical assistant in department of chemistry-biochemistry, School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, Jakarta, Indonesia. He can be contacted at email: ciptamahendra@yahoo.com.

Suryanto Suryanto graduated from the faculty of medicine, Atma Jaya Catholic university of Indonesia as a medical doctor in 2020. Currently, he is a medical intern in Rumah Sakit Umum Daerah Kemayoran, Jakarta, Indonesia. He can be contacted at email: surysuryanto7@gmail.com.

Sandy Theresia is a medical doctor working at Kramat 128 Hospital. She finished her medical degree from the Atma Jaya Catholic University of Indonesia. She has done several types of research in medicine and continues her passion as a clinical doctor. She can be contacted at email: sandytheresia.md@gmail.com.



Marcella Wirjanata is a medical student from Medical Faculty of Atma Jaya Catholic University. Marcella received her bachelor of medicine from the same university and currently registered as clinical clerkship student in Atma Jaya Hospital. Her previous research focus on public health science regarding children's knowledge and behavior towards childhood circumcision. She also involved in research focusing on ascaris infection and its relation with stunted children. She can be contacted at email: MARCELA.2016060224@student.atmajaya.ac.id.

Daniel Ardian Soeselo is a surgeon. Currently working as a teaching staff at the School of Medicine and Health Sciences, Atma Jaya Catholic University, Jakarta, Indonesia. Paying attention to antimicrobial stewardship. In addition, he is also active in writing about surgery and medical education. He can be contacted at email: daniel.ardian@atmajaya.ac.id.

APPENDIX

OBSERVATION OF HAND HYGIENE COMPLIANCE

DATE	NAME	ROOM	BEFORE TOUCHING A PATIENT						BEFORE CLEAN/ASEPTIC PROCEDURE						AFTER BODY FLUID EXPOSURE RISK						AFTER TOUCHING A PATIENT						AFTER TOUCHING PATIENT SURROUNDINGS					
			WASHING HAND		PROPER TECHNIQUE		METHOD		WASHING HAND		PROPER TECHNIQUE		METHOD		WASHING HAND		PROPER TECHNIQUE		METHOD		WASHING HAND		PROPER TECHNIQUE		METHOD		WASHING HAND		PROPER TECHNIQUE		METHOD	
			Y	N	Y	N	S&W	AL	Y	N	Y	N	S&W	AL	Y	N	Y	N	S&W	AL	Y	N	Y	N	S&W	AL	Y	N	Y	N	S&W	AL

Abbreviations

Y : yes
N : No
S&W : using soap and water
AL : using alcohol-based handrub
ROOM : M = Mawar, G = Gabriel, S = Soka, I = ICU, C = Cempaka

Table 1. Surveillance form for the attitude toward hand hygiene