



**UTILIZATION OF CLOSED CIRCUIT TELEVISION  
IN IMPROVING NURSES' COMPLIANCE WITH HAND HYGIENE  
IN BUDHI ASIH HOSPITAL, JAKARTA**

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**ABSTRACT**

Health-care associated infections (HAIs) are infections occurring in hospitalized patients. The most effective way to prevent HAIs is through hand hygiene. However, hand hygiene compliance amongst health workers is still low. This research aimed to understand the association between CCTV utilization as a reminder tool in improving the nurses' hand hygiene compliance in Budhi Asih Hospital, Jakarta. The study used a quantitative method with a quasi-experimental approach. The 60 subjects were divided into two groups: treatment and control groups based on their workplaces. Quantitative data were obtained by filling-in a WHO-standardized questionnaire and observing each group before and after the intervention. Data were analyzed by univariate and bivariate analyses with chi-square test and multivariate analysis with logistic regression test. Nurses' hand hygiene compliance through CCTV observation in Budhi Asih Hospital was 57%. The use of CCTV as reminder media significantly improved hand hygiene compliance ( $p = 0.002$ ), compliance with the 6 steps process ( $p = 0.002$ ) and compliance with the standard time of hand hygiene ( $p = 0.003$ ). There was no significant correlation between individual characteristics (sex, age, education, working experience, and infection control training participation) and nurses' compliance on hand hygiene. The use of CCTV as reminder media significantly improved nurses' compliance with hand hygiene.

Keywords: CCTV, Hand Hygiene, Compliance, Reminder.

**ABSTRAK**

Infeksi terkait pelayanan kesehatan (Healthcare associated infections/HAIs) adalah infeksi yang terjadi pada pasien yang dirawat di rumah sakit. Cara paling efektif untuk mencegah HAIs adalah melalui cuci tangan. Namun, kepatuhan cuci tangan petugas kesehatan masih rendah. Penelitian ini bertujuan untuk memahami hubungan antara pemanfaatan CCTV sebagai alat pengingat dalam meningkatkan kepatuhan cuci tangan perawat di Rumah Sakit Budhi Asih, Jakarta. Penelitian ini menggunakan metode kuantitatif dengan pendekatan kuasi-eksperimental. Subjek dibagi menjadi dua kelompok: kelompok perlakuan dan kontrol. Data kuantitatif diperoleh dengan mengisi kuesioner dan mengamati setiap kelompok sebelum dan sesudah perlakuan. Data dianalisis dengan analisis univariat dan bivariat dengan uji chi-square dan analisis multivariat dengan uji regresi logistik. Kepatuhan cuci tangan perawat melalui pengamatan CCTV di Rumah Sakit Budhi Asih adalah 57%. Penggunaan CCTV sebagai media pengingat secara signifikan meningkatkan kepatuhan cuci tangan ( $p = 0,002$ ), kepatuhan terhadap 6 langkah ( $p = 0,002$ ) dan kepatuhan terhadap waktu standar cuci tangan ( $p = 0,003$ ). Tidak ada korelasi yang signifikan antara karakteristik individu (jenis kelamin, usia, pendidikan, pengalaman kerja dan partisipasi pelatihan pengendalian infeksi) dengan kepatuhan perawat untuk cuci tangan. Penggunaan CCTV sebagai media pengingat secara signifikan meningkatkan kepatuhan perawat untuk melakukan cuci tangan.

Kata kunci: CCTV, Cuci Tangan, Kepatuhan, Pengingat.

## BACKGROUND

Health care-associated infections (HAIs) are infections that can occur while receiving health care in a hospital or other health care facility that first appear around 48 hours or more after hospital admission, or within 30 days after having received health care (Haque, Sartelli, Mckimm, & Bakar, 2018). HAIs adversely affect patients because of the extended length of hospital stay. Consequently, the cost incurred to be greater even cause death. The most effective and cost-effective way to prevent HAIs is through correct hand hygiene implementation. However, the hand hygiene compliance rate amongst health-care workers, especially nurses, is still very low (Ahmed et al., 2020; Anwar & Elareed, 2019).

Studies conducted in some developed and developing countries showed a low level of hand hygiene compliance amongst health-care workers. Baccolini et al. (2019) reported that compliance was only 41.9% in Italy. In Turkey, Karaaslan et al. (2014) reported that the compliance with hand hygiene in Turkey was 37.0%. In another study, Muller, Carter, Siddiqui, & Larson (2015) reported that in Canada, hand hygiene compliance was 29%. In Indonesia, hand hygiene compliance was reported as 19.5% by Santosaningsih et al. (2017) in Malang. In Jakarta it was reported as 27% by Saharman et al. (2019) and in Bandung it was reported as 48.3% by Damanik et al. (2012).

Since most HAIs are likely to spread by direct contact with health care-workers' hands, hand hygiene should provide an effective way of reducing the risks of cross-infection (Willemsen & Kluytmans, 2018). Guidelines to promote hand hygiene in health care settings have been provided by some organizations but amongst them, the guideline developed by The World Health Organization (WHO) is the most comprehensive. WHO recommend a multimodal intervention such as increasing the availability of alcohol-based hand rub (ABHR), different types of hygiene education for staff, reminders (both written and verbal), a specific type of performance feedback, administrative support, and staff

involvement. However, this intervention would need to be adapted to local needs and available resources (Gould, Moralejo, Drey, Chudleigh, & Taljaard, 2017).

Amongst health-care workers, nurses have the most major role in preventing the transmission of infection because of their continuous close contact with patients. The WHO campaign "save lives – clean your hands" is one of the patient safety programs, which is an action designed to reduce the risk of transmitting HAIs. Hand hygiene is one effective step to prevent the transmission of infection and reduce the incidence of HAIs. Health-care workers, especially nurses who have close contact with patients, should ensure their hand hygiene is carried out according to proper hand hygiene guidelines and done effectively (*WHO Guidelines on Hand Hygiene in Health Care: a Summary*, 2009).

Budhi Asih hospital is a private hospital in Jakarta. Based on the information from The Infection Control Committee, in 2016, the compliance of nurses' hand hygiene at Budhi Asih Hospital was 57.6% while the target was 80%. Various efforts have been made to improve the health-care workers' hand hygiene compliance in Budi Asih Hospital. The Joint Commission suggested some strategies such as education and training, auditing and feedback, reminders, and work in a multidisciplinary team to improve hand hygiene compliance. However, it is difficult to determine which strategies are most effective in improving compliance with hand hygiene (Squires et al., 2013).

Various efforts have been made by Budhi Asih Hospital to improve compliance with hand hygiene, such as conducting education and training and holding a hand hygiene competition. Even so, the monthly compliance rate is always reported to be less than 80%. Using rewards and punishment is one strategy that can be used to improve compliance with handwashing. However, due to limited funds, this strategy cannot be applied at Budhi Asih Hospital. Considering available resources, as well as the needs of the hospital during the assessment, Budhi Asih Hospital decided to use CCTV as a reminder to improve compliance with hand

hygiene.

Various media and technologies can be used to improve hand hygiene compliance. One of them is Closed Circuit Television (CCTV), which can be used as a reminder. In hospitals, CCTVs are generally used for security purposes. However, CCTV can be used as a reminder as per the strategy mentioned by The Joint Commission and WHO. There is limited data about the utilization of CCTV as a reminder to improve nurses' hand hygiene compliance. Therefore, the authors are interested in conducting research on the utilization of CCTV to improve nurses' hand hygiene compliance.

## **METHOD**

### **Subjects**

This study was conducted in Budhi Asih Hospital, Jakarta, from July to August 2017. Nurses who work in Cempaka Ward (Surgical Ward) and Dahlia Ward (Internal Medicine Ward) were chosen as the subjects of this study.

### **Methods**

The study used a quantitative method with a quasi-experimental approach. The subjects were divided into two groups: Treatment and Control Groups based on their workplace. The Cempaka ward is dedicated to caring for surgical patients, whereas Dahlia Ward is dedicated to caring for internal medicine patients. The Treatment Group consisted of nurses working on Cempaka Ward, whereas the Control Group consisted of nurses working on Dahlia Ward. The study started when the researchers installed 3 CCTV cameras in the nurses' handwashing area on Cempaka Ward and 3 CCTVs on Dahlia Ward, without notifying staff that CCTVs had been installed.

The position of the CCTVs was adjusted to record all activities without disturbing patients' privacy. Using the CCTVs, the researchers observed the compliance of nurses with hand hygiene, including compliance with the five moments, compliance with the six steps of hand hygiene and compliance with the standard time for hand hygiene. After obtaining the nurses' compliance in a certain period, the researchers socialized

the results to the Treatment Group, but not to the Control Group. Then the poster informing that CCTVs had been installed and used to observe the compliance of nurses' hand hygiene was implemented to remind the nurses in the treatment group. However, there was no poster in the control group as a reminder.

Researchers continued to observe the nurses' compliance using CCTVs in both the treatment and the control groups.

### **Statistical Analysis**

Quantitative data were obtained by filling-in a WHO-standard questionnaire and observing each group before and after the intervention. The data were analyzed by univariate analysis in the form of frequency distribution, bivariate analysis with the chi-square test, and multivariate analysis with logistic regression test.

### **Ethics**

The research protocol was approved by the Medical and Health Research Ethics Committee, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia with number KF/FK/1006/EC/2017.

## **RESULT**

There were 30 nurses in Cempaka Ward, and only 20 were eligible to continue until the end of the study. In Dahlia Ward, there were 30 nurses and all of them participated until the end of the study. Most of the subjects were female, aged less than 40 years old, with diploma level education, had working experience of less than 10 years and did not have any infection control training previously. The characteristics of subjects are presented in Table 1.

Based on the observation by the CCTVs, none of the nurses in Dahlia Ward followed the rule for performing hand hygiene with 6 steps for 40-60 seconds as suggested by the WHO's guideline. In Cempaka Ward, some nurses followed this rule. This study showed that the disobedience of the female subjects was higher than the males (45% of females in Cempaka Wards vs 75% in Dahlia Wards). Most of the nurses with a

working experience of fewer than 10 years tended to be disobedient regarding performing hand hygiene (90 % in Cempaka Ward vs 92% in Dahlia Ward).

Based on the statistical analysis,

there was no significant correlation between individual characteristics (sex, age, education, working experience, and training participation) and the nurses' hand hygiene compliance (Table 2).

**Table 1. Characteristics of subjects in Cempaka and Dahlia Wards at Budhi Asih Hospital**

Variable	Cempaka Ward (Treatment)		Dahlia Ward (Control)	
	Number	Percentage	Number	Percentage
<b>Sex</b>				
Male	4	20%	8	27%
Female	16	80%	22	73%
<b>Age</b>				
< 40 Years old	19	95%	25	83%
≥ 40 Years old	1	5%	5	17%
<b>Education</b>				
Associate degree (diploma)	13	65%	20	67%
Bachelor degree	7	35%	10	33%
<b>Working experience</b>				
< 10 years	18	90%	24	80%
≥ 10 years	2	10%	6	20%
<b>Infection Control Training</b>				
Ever	10	50%	5	17%
Never	10	50%	25	83%
<b>T o t a l</b>	20	100%	30	100%

**Table 2. Correlation of Subject Characteristics with Hand Hygiene Compliance to The Standard of Time for hand washing in Budhi Asih Hospital**

Variable	Cempaka Ward				p (95%CI, p<0.05)	Dahlia Ward				p (95%CI, p<0.05)
	Obedient		Disobedient			Obedient		Disobedient		
	n	%	N	%		n	%	N	%	
<b>Sex</b>					0.822					
Male	2	10	2	10		0	0	3	23	
Female	7	35	9	45		0	0	10	77	
<b>Age</b>					0.353					
< 40 yr	9	45	10	50		0	0	12	92	
≥ 40 yr	0	0	1	5		0	0	1	8	
<b>Education</b>					0.888					
Associate degree (diploma)	6	30	7	35		0	0	9	69	
Bachelor	3	15	4	20		0	0	4	31	
<b>Working experience</b>					0.881					
< 10 years	8	40	10	50		0	0	12	92	
≥ 10 years	1	5	1	5		0	0	1	8	
<b>Infection control training</b>					0.178					
Ever	3	15	7	35		0	0	9	69	
Never	6	30	4	20		0	0	4	31	

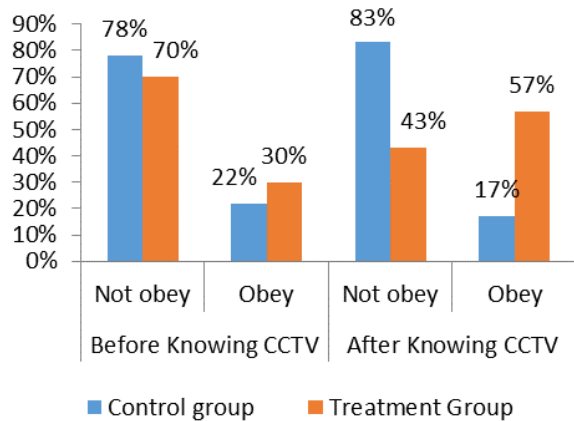


Figure 1. Nurses' compliance before and after knowing there were CCTV observations based on the five moments for hand hygiene in both the Treatment and Control Group

The use of CCTV as a reminder media improved nurses' compliance with hand hygiene based on the five moments (Figure 1). Nurses' compliance in the Cempaka Ward (Treatment Group) increased from 30% to 57 % based on 65 observed moments. Meanwhile, in the Dahlia Ward (Control Group), nurses' compliance decreased from 22 % to 17% based on 72 observed moments.

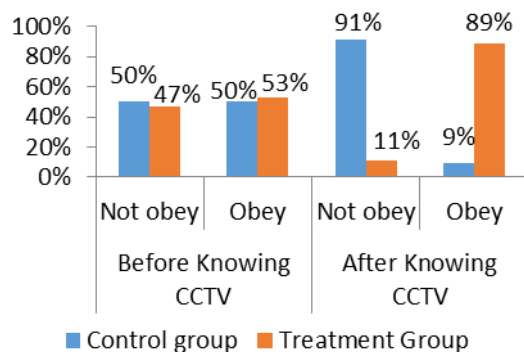


Figure 2. Nurses' compliance before and after knowing there were CCTV observations based on the six steps of hand hygiene in both the Treatment and Control Groups.

CCTV as a reminder media also improved the nurses' compliance with the six steps of hand hygiene (Figure 2). Nurses' compliance in the Treatment Group increased from 53% (19 observed moments) to 89 % based on 37 observed moments. Meanwhile, in the Control Group, nurses' compliance decreased

from 50 % (10 observed moments) to 9% based on 11 observed moments.

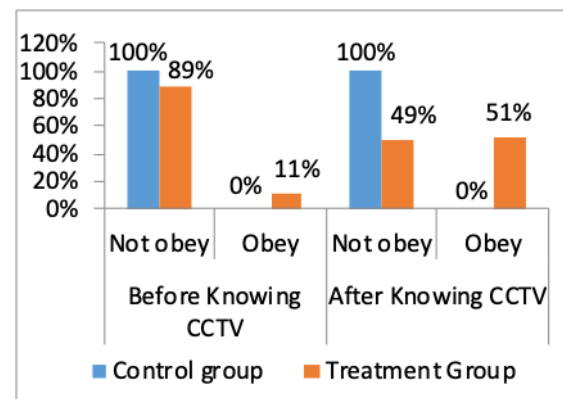


Figure 3. Nurses' compliance before and after knowing there were CCTV observations based on the time standard of hand hygiene in both the Treatment and Control Groups

The use of CCTV as a reminder media improved nurses' compliance with hand hygiene based on the time standard of hand hygiene (Figure 3). Nurses' compliance in the Treatment Group increased from 11% (19 observed moments) to 51 % based on 37 observed moments. Meanwhile, in the Dahlia Ward (control group), based on 10 observed moments, no nurses followed the standard time for hand hygiene.

Based on statistical analysis, this study suggested that the use of CCTV as a reminder media significantly improved nurses' hand hygiene compliance with the five moments ( $p = 0.002$ ), compliance with the six steps of hand hygiene ( $p = 0.002$ ) and compliance with the standard time of hand hygiene ( $p = 0.003$ ) (Table 3).

**Table 3. Correlation of CCTV as a reminder with nurses' hand hygiene compliance based on observational variables**

Variables	Treatment Group		
	p	OR	Lower Upper
Five moments	0.002	3.06	1.477 6.34
Six steps	0.002	7.425	1.879 29.34
Time standard	0.003	8.972	1.81 44.47

## DISCUSSION

This study supported the data that age was found to have no significant relationship with nurses' compliance in hand hygiene ( $p < 0.05$ ). Despite there being no significant relationship, the result showed that the compliance of nurses aged less than 40 years was higher. This study is in line with a study conducted by Pratama, Koeswo, & Rokhmad (2015) who reported that nurses aged 30 years or younger have a higher compliance with hand hygiene, which was also reported by Damanik et al. (2012) and Sansam et al. (2016).

In this study, sex was reported to have no significant relationship with nurses' compliance with hand hygiene ( $p < 0.05$ ). Even though there was no significant relationship, the result showed that the compliance of female nurses was lower. This result was similar to a study conducted by Pratama et al. (2015) as well as the results reported by Sansam et al. (2016).

There was no significant relationship between educational background and nurses' compliance with hand hygiene ( $p < 0.05$ ). This result was in line with a study conducted by Damanik et al. (2012). However, Pratama et al. (2015) reported that nurses with a diploma (associate degree) showed higher compliance with hand hygiene.

In this study, participation in infection control training previously was found to have no significant relationship with nurses' compliance with hand hygiene ( $p < 0.05$ ). However, Abdella et al. (2014) found that health care providers who had trained about hand hygiene previously had a significant association with hand hygiene compliance. In that study, those who were trained had 2.6 times more compliance than those who were not trained.

This study showed that there was no significant correlation between educational level and nurses' hand hygiene compliance with a test value of 0.888 (95% CI,  $p < 0,05$ ). This result is consistent with the study reported by Ponco & Faridah (2016) who reported that there was no correlation between educational level and compliance with hand hygiene with a test value of 0.916

(95% CI,  $p < 0.05$ ).

Based on the length of the working period, nurses with shorter experience had a lower level of compliance, even though this was not statistically different. This result is in line with the research conducted in Manado that reported no relationship between the working period and nurses' compliance (Moniung, Rompas, & Lolong, 2016). Damanik et al. (2012), who conducted a study in Bandung, also reported that there was no significant association between the length of working period and nurse's compliance with hand hygiene.

Hand hygiene compliance is considered a major quality performance indicator. The World Health Organization (WHO) recommends that the normal rate of hand hygiene compliance should be above 91% (Pittet, Allegranzi, & Boyce, 2009). In this study, we reported that nurses' compliance with hand hygiene either in the Cempaka or Dahlia Wards was still low, less than 50%. Low levels of health care compliance also are reported by some other studies. In Malang, it was reported by Santosaningsih et al. (2017) that hand hygiene compliance was 19.5%. Saharman et al. (2019) reported that hand hygiene compliance in Jakarta was 27%. In another study, Pratama et al. (2015) reported that nurse's compliance with hand hygiene in Tulung Agung was 36%. In Bandung, Damanik et al. (2012) reported that nurse's compliance with hand hygiene was 48.3%.

Cempaka Ward is a ward for surgical patients where many aseptic procedures are performed, while the Dahlia ward is a ward for internal medicine patients with few aseptic procedures. CCTVs were installed in both wards, but the health education interventions and installations of CCTV reminder posters were only carried out in the Cempaka Ward because more aseptic procedures are performed there. Although the compliance was still low, there was an increase in hand hygiene compliance in the Cempaka Ward compared to the Dahlia Ward. Nurse compliance with the five-moments hand hygiene, steps of hand hygiene, and doing it in standardized time in the Cempaka Ward increased after

becoming aware that they were being monitored.

In this study there was a poster showing CCTV as a reminder for nurses to do hand hygiene properly. Although CCTV does not directly give a signal as a reminder, the presence of these posters makes nurses aware that they are being monitored so that they would be more careful in doing hand hygiene.

This study showed the role of CCTV as a reminder media in improving the compliance with hand hygiene in the 5 moments. As recommended by the WHO, the researcher observed the nurse's compliance with the 5 moments of hand hygiene: (1) before touching a patient, (2) before clean/ aseptic procedures, (3) after body fluid exposure risk, (4) after touching a patient, and (5) after touching patient surroundings. Based on statistical analysis, by using CCTV as a reminder media, the compliance will increase 7.425 times.

The WHO suggests health workers should clean their hands by rubbing them with an alcohol-based formulation, as the preferred method for routine hygienic hand antisepsis if hands are not visibly soiled. It is faster (20-30 seconds), more effective, and better tolerated by your hands than washing with soap and water. If the hands are visibly dirty or visibly soiled with blood or other body fluids or after using the toilet, it is suggested to wash with water and soap for 40-60 seconds. In this study, based on statistical analysis, by using CCTV as a reminder of the compliance, the nurse compliance to the standard time of hand hygiene will increase 8.972 times.

The management support from Budi Asih Hospital to improve hand hygiene compliance is good. Based on the questionnaire results, all nurses in Cempaka and Dahlia Wards stated that the facilities for hand hygiene were adequate. The management provided sinks with sufficient water flow and handwashing soaps. Hand rub liquids were also available at the ward's entrance and in every patient's room. Some nurses stated that the tissue for drying the hands was sometimes not available in the correct place at the handwashing sink. This situation also happened in Immanuel

Hospital Bandung as reported by Damanik et al. (2012) and in Ade Muhammad Djoen Sintang Hospital Pontianak as reported by Dewi (2017).

Based on the observations during the study, Budi Asih Hospital's management had already implemented some strategies to improve the health care worker compliance. They provided posters explaining the procedure for how to do the right handwashing near the available sinks and how to do hand-rubbing. There was also a poster attached to the elevator as a reminder about proper hand hygiene. The hospital management always reminds the Infection Control Committee (ICC) about improving the health worker's hand hygiene compliance at morning coffee. Regularly, personnel from the ICC visit the ward for supervision and observe the performance of hand hygiene directly. However, compliance is still relatively low. This suggests the need to implement immediate strategies for infection control. Direct supervision may not effective in improving hand hygiene compliance in Budhi Asih Hospital. Therefore, the situation requires indirect supervision by using media such as CCTV.

## CONCLUSION AND RECOMMENDATION

The use of CCTV as reminder media significantly improved nurses' compliance with hand hygiene, including compliance with the five moments, compliance with the six steps of hand hygiene and compliance with the standard of time for hand hygiene.

This finding can be used by hospital management to develop policies and regulations related to the use of CCTV for hospital quality control. Further research is needed regarding the use of other technology-based equipment as a tool to improve compliance with hand hygiene amongst health care workers.

## ACKNOWLEDGMENTS

The authors want to thank the nurses in Cempaka and Dahlia Wards involved in this study for their willingness to participate and Budhi Asih Hospital management who strongly support the implementation of research. We also want

to thank dr. Syahra Kurnia Putri for critical editing of the manuscript.

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