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Hand Hygiene Compliance Behavior and Glove Use in the Pediatric Intensive Care Unit During COVID-19 Pandemic

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Abstract

Background: The condition of Covid-19 pandemic potentially influences hand hygiene compliance as a result of workload changes, increased awareness of healthcare workers (HCWs) and personal protective equipment procedures, especially in terms of hand glove use,

Objective to know the adherence of healthcare workers at the pediatric intensive care unit (PICU) to comply with hand hygiene and glove use during the pandemic.

Methods An observational prospective study was carried out including all HCWs stationed at the PICU Dr Soetomo General Hospital during January 2021. All participants were to sign an informed consent before the study took place. A target of 500 opportunities was estimated during the observation, and recorded using infra-red cameras placed at ten points. Hand hygiene compliances were evaluated according to the video surveillance records by an independent auditor. Compliance was measured by dividing total number of observed appropriate hand hygiene by the sum of opportunities. Data were analysed using Chi Square test at a significance of $p < 0.05$.

Results: A total of 28 HCWs were eligible for the study; 9 were excluded. The majority were female (21; 75%), the mean age was 37.9 (SD 5.2) years. During 72 hours' observation among 526 glove-use opportunities 104 (19.7%) actual glove-use episodes were evident. The hand hygiene compliance was lower (41.3%) when wearing gloves as compared to those with no glove use (68.2%) ($p < 0.001$).

Keywords: hand-hygiene compliance, hand-gloves, pediatric intensive care unit, Covid-19 pandemic

Introduction

Healthcare workers have been facing increased risk of Covid-19 occurring in hospitals during the pandemic

condition, consequently leading to increased awareness to comply with hand hygiene due to concerns for Covid-19 transmission. Moreover, it was also apparent that there was an increased workload related to higher number of patients and responsibility for personal protective equipment procedures at a higher rate of duration and quality. On the other hand, the working comfort while wearing high-level personal protective equipment would certainly be low, which could in turn lead to bad influence on hand hygiene compliance.^{1,2}

Reports on the prevalence of nosocomial infection especially in the pediatric ward globally varied, ranging

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³ from 4.8% in developed countries to 48% in developing countries, where the mortality rate also varied from 5% - 33.8%.³⁻⁷ Many cases hospital-acquired Covid-19 infection have been detected, where approximately 12.5% has been reported among the total cases in Europe.⁸ There has been no distinct data on total Covid-19 nosocomial infection in Indonesia.

The latest recommendation during a pandemic condition related to hand hygiene protocols and covid-19 infection control for HCWs has been issued. Local China guidelines accommodated additional hand hygiene ²² moments to the process of putting on and removal of personal protective equipment. Use of gloves as part of personal protective equipment also increased along with the contact risk level.^{1,2}

²⁷ Some experts expressed the hypothesis that there would be an increase in hand hygiene compliance during the pandemic. However, evidences measuring compliance have been scarcely published so far, globally as well as domestically.^{9,10} Although there has been a lot of research which concerned the relationship between hand hygiene compliance and glove use, the level of hand hygiene compliance and glove use during ¹⁸ the pandemic has never been studied. Accordingly, this study was conducted to explore the profile of hand hygiene compliance related to glove use at the pediatric intensive care unit during the pandemic.

Material and methods

This observational prospective study, conducted during January 2021, took place at the ¹⁶ pediatric intensive care unit (PICU) Dr Soetomo General Hospital, a third level teaching hospital of the Airlangga University. The PICU of this hospital consists of three parts, namely PICU 1, PICU 2, and the nurse station, bearing a capacity of 8 beds. Patients admitted were all negatively confirmed for Covid-19 by PCR swab. Health workers wore a level 1- protective equipment. Most of the patients were of respiratory and hematology emergencies. The bed occupancy ratio during the study was 50%, which did not significantly differ from the previous months.

Eleven doctors (1 consultant, 10 residents) and 16 nurses were occupied in the PICU. The study was performed only by doing an observation using video surveillance without any intervention. The cameras used were of the eyeball type infra-red camera (Daihua technology, made in the People Republic of China) DH-HAC- T1A21P series, along with a size of 3.6 mm, which were placed at 10 points. The devices provided a high definition video picture of 1080 pixels and 30 frames per second, subsequently able to show the details of hand hygiene movements performed. One sink was provided in each part of the PICU, along with standard operational procedures (SOP) about hand hygiene in the PICU.

A 24 hours' recording was obtained without the need for an operator. Records were sorted and edited to produce a short video clip and further evaluated for hand hygiene compliance by an auditor of the ¹⁶ Infection Prevention and Control (IPC) committee at a certified hospital, and entitled as an Infection Prevention control Nurse (IPCN), certified by the Indonesian Association of Infection Prevention Control Nurses (Himpunan Perawat Pencegah dan Pengendali Infeksi Indonesia -HIPPII-). Evaluation of hand hygiene compliance was carried out by referring to the 5 moments for hand hygiene concept as well as adherence with proper hand hygiene procedures.

A minimum number of 500 opportunities was targeted. Audit was performed using an observation sheet similar to that used by the hospital team for Infection Prevention and Control, adapted from the WHO module.

All health professionals (doctors, nurses, physiotherapists) stationed at the PICU served as study samples, and were to sign an informed consent before the study commenced. Statistical analysis applied to judge differences ¹⁷ in hand hygiene compliances related to glove use was the Chi-Square's test at a significance level of $P < 0.05$.

Operational Definition

Hand Hygiene is a practical management of

handwashing as outlined by the 2009 WHO Guidelines, consisting of hand rub (alcohol-based) and hand wash (with water and common soap or antimicrobial soap).

Hand hygiene related to glove use is handwash or hand rub before wearing gloves, hand rub while wearing the same gloves, handwash or hand rub after glove removal.

7 Hand hygiene compliance is the accuracy of the hand hygiene procedures performed when indicated as outlined by the WHO. The number is measured using the formula: ((the action of proper hand hygiene/ opportunity) X 100), and stated as percentage

Opportunity is the moment of requiring the action of hand hygiene. Example: A doctor intends to do physical examination on a patient, which will be counted as 2 opportunities, before and after touching the patient.

28 Missed is failure to perform proper hand hygiene in the form of hand rub or handwash when there is an opportunity. Repeated hand rub of a glove-wearing hand is considered as missed.

Ethical Clearance: This study was approved by the medical researched ethical Health Research Ethics Committee, Dr. Soetomo Hospital Surabaya No. 0271/

LOE/301.4.2/I/2021. Access to acquire CCTV records has also been gained from the Director of the Dr Soetomo Hospital

Results

During the study period video recording in the PICU Dr Soetomo General Hospital took place using a total time of 72 hours, where 526 opportunities for hand hygiene were identified. A total of 37 subjects were recorded doing the activity necessitating hand hygiene in the PICU. However, 9 were excluded due to missing informed consent. Subjects studied consisted of 7 males (25%) and 21 females. Mean age of the studied subjects was 35.7 (SD 5.2, 95% CI) years. Studied subjects who were a doctor by profession comprised of residents and a consultant, who did the rounds and activities in the PICU. Among the 16 nurses considered as study subjects the majority have had a period of employment for more than 10 years. One physiotherapist stationed at the PICU was also a candidate for this study subject. Characteristics of the study subjects are shown in table 1. Total compliance was 62.9%. Among the total opportunities 104 (19.7%) of glove use opportunities was evident. Hand hygiene compliance when wearing gloves was 41.3%, which was significantly lower as compared with a 68.2% adherence to hand hygiene not using gloves. (p<0.001). (Table 2).

Table 1. Characteristics of study subjects.

	Mean (SD)/ total (percent)
Total subjects	28
Age	35.7 years (5.2, 95% CI)
Gender	
Male	7 (25%)
Female	21 (75%)
Profession	
Doctor	11
Consultant	1
Resident	10
Nurse	16
Physiotherapist	1

Table 2. Hand hygiene compliance related to glove use

		Glove use		<i>p value</i>
		Yes n (%)	No n (%)	
Hand hygiene	Yes, n (%)	43 (41.3)	288 (68.2)	<0.001
	Missed, n(%)	61 (58.6)	134 (32.8)	

Discussion

This study involved health workers as subjects consisting of 28 study subjects. The majority were nurses with a year-service for more than 10 years. Bin Ibrahim in his study found that seniority, profession being a nurse, and female gender were positively associated with good hand hygiene compliance, and that seniors, nurses, and women were more likely to perceive a need for improvement. They more likely have the ability to influence other healthcare workers to achieve a better hand hygiene behavior.¹¹

This study showed a 19.7 % frequency of glove use. This result was certainly lower than the majority of other studies where this action could reach 26% to 40% in a ward with high risk setting.¹² Glove usage refers to the wearing of gloves to either prevent the hands becoming contaminated with organic matter or microorganisms, or to prevent the transfer of microorganisms to both patients and healthcare workers.¹³ Hand glove use as a component of personal protective equipment increased during a pandemic, and this was related to a personal protective equipment policy. Universal mandatory gloving in relation with the level of personal protective equipment (PPE) was not considered necessary as a policy at our research sites. Nor were we able to evaluate the increase of hand glove use during the pandemic condition due to lack of data before the pandemic.

We did not analyze the nosocomial infection rate in this study. A systematic review by Picheansanthian

collected evidences of successful hand glove use to decrease contamination of health care workers' hands.

¹³ A decrease in contamination rate does not necessarily mean a decrease in nosocomial infection. The effect on decrease of nosocomial infection would only be achieved by high adherence to proper glove use. This fact has been proved by the implementation of a tight protocol as practiced by Janota in his study where participants of glove use were obliged to perform hand rub using alcohol. It was evident that this action resulted in a decrease of late sepsis in the neonatal intensive care unit (NICU).¹⁴ Universal mandatory gloving during RSV season was associated with significantly lower rates of bloodstream infection (BSI), central line associated blood stream infection (CLABSI) and Hospital Acquired pneumonia (HAP) in the pediatric care unit.¹⁵

Our study indicates that compliance with hand hygiene at the moment of hand glove use was only 41.3%, which was lower than when gloves were not worn, where the adherence was 68.2%. Data obtained from a study before the pandemic also revealed an inversely proportional relationship between the use of hand gloves and the compliance of hand hygiene,¹⁶ a finding that was consistent with the present study. Cusini proved that removal of the mandatory glove program was followed by an increase in hand hygiene compliance.¹⁷ This previous study also showed that although the overall compliance rate for glove use was high, gloves were also overused. Gloves were worn inappropriately for tasks that did not necessitate the use of gloves, and

healthcare workers did not always remove gloves and decontaminate hands between different patients and tasks, besides non-compliance with hand hygiene which could have occurred at the moment of shifting from dirty to clean body sites of the same patient.¹⁷ A small increase in hand hygiene compliance especially during the moment after patient's contact has also been reported.^{17,18} A converse result where hand hygiene compliance was better during glove use has been shown by a more previous study.¹⁹ However, this study was dealing with a far smaller number of opportunities as compared with our observation.

Another issue concerning glove use during a pandemic is glove wearing hand disinfection using alcohol-based hand rub. This protocol has been recommended in light of problems and lack of logistics at the beginning of the pandemic.²⁰ Our study did not necessarily use this protocol; routine use of hand gloves was not needed because all patients have been negatively confirmed for Covid-19. The latest WHO recommendation prohibited this practice, and required hand hygiene at the moment of gloving and ungloving.²¹ At the moment this research was undertaken the scarcity has been handled by the government authorities.

This study is the first research on hand hygiene compliance in Surabaya and also East Java Regional Area. We have controlled the Hawthorne effect, high false positive compliance as a result of health workers' awareness of being audited, by indirect evaluation using video records. Time limits and the study location were the weakness of this observation so that the overall level of long-term compliance could not be depicted.

Conclusion

Healthcare workers' hand hygiene compliance at the moment of wearing gloves was significantly lower compared with adherence to glove use in the Pediatric Intensive Care Unit during Covid-19 pandemic.

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Conflict of Interest: None declared.

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