

# Feasibility of Direct Observation and Consumption Method for Hand Hygiene Compliance in an Intensive Care Unit of a Tertiary Care Hospital

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## Abstract

**Background:** Emerging pandemics, rampant multidrug resistance, and diversity of healthcare-associated infections entail hand hygiene (HH) compliance, surveillance, and documentation as the cornerstone of infection control practices. **Methods:** HH adherence rates (HHARs) were determined by the WHO's "Direct Observation" technique and compared with the "Indirect Hand-Rub Consumption" method, in the main intensive care unit of a tertiary care hospital over a period of 15 days, encompassing 3000 HH opportunities. HHARs were also compared over the study duration and among doctors and nurses. **Results:** The overall HHAR estimated by direct observation as per the WHO criteria was 28.5% and by "indirect hand-rub consumption" method was 12.12%. Healthcare workers adhered maximally to the WHO HH moment 3 (64.6%) followed by 5 (31.6%), 4 (27%), and 2 (27%). **Conclusion:** The direct observation technique for monitoring HH, though conventionally deemed as the gold standard, mandates skilled personnel and devoted time which may deter daily surveillance in resource-limited settings. The time constraints in addition to the observation biases often confound or may even push HH surveillance to the backburners. The indirect "hand-rub consumption" technique, on the other hand, might prove to be an attractive alternative in resource-limited settings, which, in addition to providing an overall glimpse of existing HH culture, is also devoid of observation biases.

**Keywords:** Antimicrobial resistance, hand hygiene, infections, infection control

## INTRODUCTION

Healthcare-associated infections (HAIs) account for a significant bulk of patients in hospital settings. With an approximation of 10 in 100 patients in developing nations and 7 in 100 HAIs in the developed world, HAI levies high burden on the healthcare system in terms of morbidity, mortality, and management costs. With the escalating threat of infections with multidrug-resistant organisms (MDROs) and colonization with the same, hand hygiene (HH) has emerged as the single most crucial, simplest, and cheapest infection control measure to curtail adverse outcomes.<sup>[1,2]</sup> Implementation of HH alone has been documented to curb the transmission and infection rates due to several MDROs, which attain greater significance especially in critical care settings such as intensive care units (ICUs), which essentially serve as the "epicenter" for HAI and colonization with MDROs.<sup>[3-5]</sup>

The World Health Organization (WHO) emphasizes upon the "five moments of hand hygiene" in its "SAVE LIVES: Clean

Your Hands" program for the protection of the patients and healthcare workers (HCWs) simultaneously. A vast majority of agents with varying degrees of efficacies against diverse group of microorganisms have been studied for HH.<sup>[1,2,6]</sup> HH practices with alcohol-based hand rubs instead of soap and water have proven to have better compliance rates possibly on the account of a significant reduction of time, lesser skin irritation, and a wider microbial spectrum with respect to hand washing with soap and water.<sup>[2,7,8]</sup>

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**Submitted:** 11-Dec-2020

**Revised:** 17-Dec-2020

**Accepted:** 17-Dec-2020

**Published:** 17-Mar-2021

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**How to cite this article:** Kashyap B, Jhamb R, Saha R, Prasad P, Singh NP. Feasibility of direct observation and consumption method for hand hygiene compliance in an intensive care unit of a Tertiary Care Hospital. *Indian J Med Spec* 2021;12:64-8.

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10.4103/ijms.ijms\_165\_20

Since approximately 75% of health infrastructure and resources are concentrated in urban areas, with a meager 27% of resources catering to the rural healthcare needs, there is a glaring imbalance in resource-to-consumer ratio. The relative overburdening, in addition to local environmental conditions, varied cultural practices, as well as legislation and requirements of accreditation, together contribute to the varied HH culture.<sup>[9]</sup> Thus, a targeted multipronged approach to expedite HH practices backed by administrative support, motivation, accessibility of alcohol-based hand rubs at stations, continued training exercises, strategic reminders in the workplace, and positive role modeling have all proven to increase compliance to HH.<sup>[7,10,11]</sup>

With the availability of numerous modalities of monitoring HH practices, the appraisal of compliance in comparable attributes is invaluable in curtailing HCAI. The limitations arising from the conventionally employed “direct observation” method for HH with respect to time, personnel, training, as well as several bias arising during observation have known to confound results obtained thus. The “consumption” method, on the other hand, estimates HH adherence rate (HHAR) by extrapolation from the volume of consumed product. The method not only bypasses the bottlenecks of physical presence and variations in the monitoring skills of an observer but also furnishes an inexpensive, rapid, easy, and often efficient way of determining HHAR in resource- or time-limited settings. The present study was undertaken to observe the HH practices and to analyze HHARs by the WHO-recommended “direct observation” technique and compare it with the “indirect hand-rub consumption” method, in the main ICU of a tertiary care center. The study also attempts to compare the HH practices among doctors and the nursing staff.

## MATERIALS AND METHODS

A prospective study was conducted in the main ICU, University College of Medical Sciences and Guru Teg Bahadur Hospital. The institute harbors a capacity of 1700 beds, and with eight beds in the main ICU, the hospital caters to a vast inflow of patients from various parts of Delhi as well as adjoining states. In February and March 2020, HH adherence was observed among healthcare practitioners by employing two distinct approaches over a period of 15 days. The study population comprised doctors, nurses, and technicians involved in patient care in the main ICU. The study group was divided into two: Group A comprised doctors and Group B included nursing staff and technicians. HH practices were estimated by “direct observation and “consumption of hand rub.”

### Direct observation method

The HH practice in the main ICU was observed by a single observer as per the WHO HH technical reference manual (HHTRM).<sup>[12]</sup> A total of 100 HH opportunities were recorded for each of the groups: A and B. Over a duration of 15 working days between 9 AM to 2 PM, 200 HH opportunities were recorded as per the WHO five moments of HH as described in the HHTRM.<sup>[12]</sup>

### Indirect “hand-rub consumption” technique

For the indirect “consumption” estimation of HH practices, 200 HH opportunities were recorded and the time duration to complete the same was also noted. The daily consumption of alcohol-based hand rub was recorded in volumes and the cumulative consumption of hand rub was calculated over the entire study period. Considering an average of 166 hand washes per 500 ml (1 bottle) of alcohol-based hand rub, the HHAR was calculated by the following:

$$\text{HHAR} = \frac{(166 \times \text{number of hand rub bottles consumed})}{\text{HH opportunities}} \times 100$$

where HH opportunities can be calculated as follows:

$$\text{Hygiene opportunities in 15 days} = \frac{\text{Observed opportunities}}{\text{Total number of hours of observation}} \times 24 \times 15$$

## RESULTS

A total of eight hand sanitization stations are dispersed throughout the main ICU. Over a period of 15 days encompassing 120 patient-days, 3000 HH opportunities were recorded over a total duration of 15 h. To ensure uniformity and curtail interobserver variations, a single observer conducted the survey during the entire study duration. Data were collected to meet a daily requirement of 200 HH opportunities spanning over a minimum of 20 min. The average duration of completion of 200 HH opportunities during 9 AM to 2 PM was 60 min.

The overall HHAR during the study duration was estimated by two distinct approaches.

### Direct observation method

The overall HHAR estimated by direct observation as per WHO criteria was 28.5%. HCWs in the ICU were most adherent to the WHO HH moment 3 (after body fluid exposure) with a moment-specific HHAR of 64.6%. This was closely followed by the WHO HH moments: 5 (31.6%), 4 (27%), and 2 (27%). Noncompliance was most common at moment 1 (before touching patient) amounting to as low as 14.4%. Table 1 depicts the moment-specific HHAR observed among nursing staff, while Table 1 illustrates the moment-specific HHAR observed among doctors. The comparison between the WHO HH moment-specific HH rates among the two groups is shown in Table 1. Figure 1 depicts the trend of HHAR over the study period (15 days spanning over February to March, 2020).

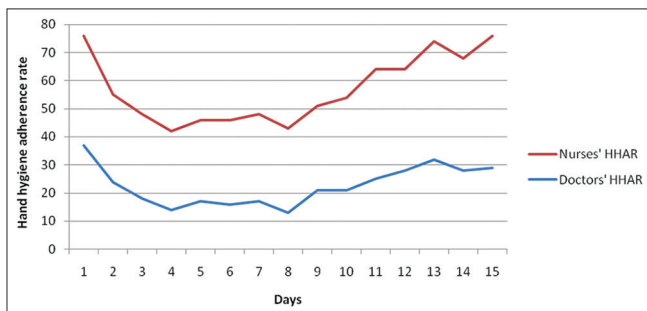
### Indirect “hand-rub consumption” technique

Over a period of 15 days, 7500 ml or 15 bottles (500 ml per bottle) of alcohol-based hand rub was consumed in the main ICU. 855 HH opportunities were observed during the study period over a total duration of 15 h (approximately 60 min/day to record 200 HH opportunities). Thus, the expected number of HH opportunities during the entire study duration is 20,520.

**Table 1: World Health Organization’s moment-specific hand hygiene adherence rates observed among doctors and nursing staff**

WHO’s HH moment	Observed adherence (X)		Total HH opportunities (Y)		Percentage adherence $X/Y \times 100$	
	Doctors	Nurses	Doctors	Nurses	Doctors	Nurses
1	45	50	309	350	14.6	14.3
2	4	65	41	215	9.8	30.2
3	19	94	33	142	57.6	66.2
4	47	120	249	360	18.9	33.3
5	225	186	868	433	25.9	43

WHO: World Health Organization, HH: Hand hygiene



**Figure 1:** Trend of hand hygiene adherence rates during study period (15 days, February–March 2020)

Using the mentioned formulae, the overall HHAR by the indirect “consumption method” is 12.12%. The amount of hand-rub consumed per patient-day was 62.5 ml and the mean HH episodes per patient-day were 7/patient day.

## DISCUSSION

The importance of HH as the cornerstone of infection control in high-risk critical care settings such as ICUs cannot be emphasized enough. With the rapid evolution and spread of MDROs contributing to substantial morbidity, mortality, and therapeutic costs, HH alone has proven time and again as an effective countermeasure. The plausible impact of HH practices on HCAs as well as healthcare-associated colonization with MDRO necessitates documentation and surveillance of these essential infection control indices. The “Five Moments of Hand Hygiene” devised by the WHO provide a standardized approach for training, execution, surveillance, and recording of HH compliance statistics. Several methods have been devised for the estimation of HH practices in various settings.

The WHO endorses the “direct observation” technique for HHAR estimation and is presumably considered the “gold standard.”<sup>[13]</sup> The direct observation technique is the only way to reliably capture all moments of HH and decide appropriateness of HH opportunity, considering the preceding and following sequence of events. If considerable time can be devoted by a single skilled observer to record HHAR rates, the direct observation method is an excellent tool for the job. Nevertheless, care has to be taken to avoid observation bias arising from the alertness induced by the presence of observer,

observer bias, or selection bias such as recording observations on specific days or time of the day. Studies have documented higher HH compliance rates (45%) with overt observations, whereas compliance rates were only 29% on covert observations.<sup>[14]</sup> Similar finding was observed during the 1<sup>st</sup> day of the present study yielding higher compliance rates [Table 1]. The ideal method of eliminating observation bias would be blinding; nevertheless, this is neither advocated nor feasible during continuous recording of data. There is however a possible benefit of desensitization of HCWs to the observation process arising from being observed repeatedly.<sup>[15,16]</sup> The same phenomenon has been observed with a sizable decline in HHAR over the initial few days of observation. In fact, a few studies have even advocated observation of HH practices to promote HH culture in targeted settings.<sup>[15,16]</sup>

Self-reporting of HH practices by HCWs has been widely employed owing to its simplicity and in-expensive nature, though it exhibits doubtful reliability as they tend to over-estimate compliance. On the contrary, the newer “automated” techniques for monitoring HH, devoid of all observer bias, provide illustrious data regarding HH practices and opportunities. The use of electronic monitoring systems at the sinks and hand-rub dispensers greatly diminish person-hours and enable quantitative analysis of HH activities.<sup>[17,18]</sup> The major limitations to these new technique are their cost-effectiveness and relative dearth of experience. There are only a handful of studies delving into the use of automated HH monitoring systems.<sup>[19]</sup>

The “indirect hand-rub consumption” technique, on the other hand, eliminates all selection bias, in addition to being time and cost-effective. For all practicality, the quantity of hand rub consumed over a defined time period is translated into HH actions using the average volume per hand wash (3 pumps per hand wash). The denominator for determining HHAR is either substituted with a surrogate measure or extrapolated from databases.<sup>[20]</sup> Thus, the denominator is often difficult to determine and results are frequently confounded by additional usage by patients, visitors, etc. In the present study the “indirect hand-rub consumption” technique yielded much lower overall HHAR (12.12%) in comparison to “direct observation” technique (HHAR = 28.5%). These discrepancies may be attributed to additional hand-rub consumption by healthcare providers in activities other than HH, viz., dressing and cleaning. The validity of the method has



been confirmed by certain studies who have reported correlation between direct observation and indirect method,<sup>[3,15]</sup> while several studies reported no correlation.<sup>[21]</sup> In a nutshell, the consumption technique for ascertaining HH practices is highly dubious and has numerous pitfalls in addition to those mentioned above, as they fail to elicit information about the number, appropriateness, and sequence of HH opportunities.

The overall HHAR observed in the present study by both the methods seem to be lower than similar studies,<sup>[22-25]</sup> while a handful of studies have reported HHAR findings lesser than our study.<sup>[26]</sup> Similar to several other studies, the present study also portrayed a higher HHAR practices among the nursing staff as compared to doctors [Table 1].<sup>[27]</sup> The WHO moment of HHAR that was most readily complied with, among both the study subgroups, was after body fluid exposure (WHO moment 3) followed by after touching the patient environment (WHO moment 5) as depicted in Table 1. This reflects upon the basic urge of healthcare personnel to protect themselves against infection. On the other hand, the HCWs complied least with HH before touching the patient (WHO moment 1) as was echoed by the findings of other studies.<sup>[28]</sup> It is interesting to note that an increasing trend of HHAR during the latter part of the study (days 11, 12, 13, 14) coincides with the beginning of COVID-19 pandemic with an increasing number of cases being reported in Delhi in the same geographical setting in India.<sup>[29]</sup>

Thus, it is evident that there is no standard method of measuring HH compliance and people have adopted several different modalities ranging from direct observation to sophisticated automated monitoring systems. With the ease, convenience, availability, and validity of several newer options, the direct observation method still remains as the most reliable measure of HH practices owing to their valuable outcome measures, such as ascertaining the sequence, opportunity, and timings of HH in relation to patient care activities.<sup>[30]</sup> However, in resource- and time-limited healthcare settings, documentation of HHAR on a regular basis may not only be neglected but may even infringe upon valuable time devoted for patient care. The surveillance and documentation of infection control indices inclusive of HHAR, nevertheless, are indispensable in such settings. The indirect “hand-rub consumption” technique might prove to be an attractive alternative in resource-limited settings, which, in addition to providing an overall glimpse of existing HH culture, is also devoid of observation biases. Timely sensitization, regular training exercises, vigilant surveillance of HH practices, performance feedback, and verbal reminders not only help track infection control measures but also give impetus to HH practices.

### Acknowledgments

We would like to acknowledge Amrita Rani, Infection Control Nurse, Guru Teg Bahadur Hospital, Dilshad Garden, Delhi.

### Financial support and sponsorship

None.

### Conflicts of interest

There are no conflicts of interest.

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