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Major Article

Comparison of hand hygiene compliance among healthcare workers in Intensive care units and wards of COVID-19: A large scale multicentric study in India

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A B S T R A C T

Background: Hand hygiene is a significant component involved in preventing transmission of health care associated infections including COVID-19. Compliance to hand hygiene among the health care workers (HCWs) requires evaluation and timely feedback. "You can't improve what you can't measure" is a famous saying and this multicentric study was designed to measure hand hygiene compliance and have birds eye view on hand hygiene compliance in COVID Intensive care units (ICUs) and wards across India.

Methods: A prospective multicentric observational study was conducted for a period of 6 months in 92 health care facility across India which included varied type of public and private hospitals. Hand hygiene audit was conducted in COVID ICU and COVID non-ICU wards in all these facilities by their HCWs using the IBHAR mobile application based on WHO's hand hygiene audit tool. Hand hygiene total adherence rate (HHTAR) and hand hygiene complete adherence rate (HHCAR) were analyzed and compared between 2 locations. Adherence rates were analyzed based on the zones, institute type, profession and for each WHO moments.

Results: A total of 1,61,056 hand hygiene opportunities were documented and adherence rates were recorded higher in COVID wards (HHTAR-61.4%; HHCAR-28.8%) than COVID ICUs (HHTAR-57.8%; HHCAR-25.6%). Overall, the adherence rates were observed higher in COVID wards (HHTAR- 68.1%; HHCAR-38.3%) of private hospitals, COVID wards of the west zone (HHTAR- 70.2%; HHCAR-36.8%), cleaning staffs of the COVID ward scores better compliance than all other professions in COVID ICUs and COVID wards. HHTAR was found to be the higher in moment 3 (After body fluid exposure-76.3%) followed by moment 4 (after touching patient-73.7%) done in COVID wards compared to moments done in ICUs.

Conclusions: This study highlights the practice of hand hygiene in COVID care locations across India. Effective strategies need to be implemented in COVID ICUs across the facilities to improve the compliance.

INTRODUCTION

Hand hygiene is considered as one of the significant components of hospital infection control. By improving hand hygiene adherence, health care associated infections can be significantly reduced.[1,2]

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COVID-19 caused by SARS-CoV2(severe acute respiratory syndrome coronovirus-2) are transmitted by respiratory droplets by mode of droplet and contact.[3,4] World health organization (WHO) strongly recommends hand hygiene practices to prevent COVID-19 cross transmission and transmission of health care associated infections.[5,6] The good side of COVID-19 pandemic is enormous public health messages are made available through various sources which substantially has increased the awareness of hand hygiene among general public as well.[7] However, the compliance of hand hygiene among the health care workers remains to be less which may be attributed to high workload, prolonged use of gloves, and false belief among HCWs that use of gloves may substitute hand hygiene.[8,9,10] The degree of illness of the patients and nature of workload among health care workers are different in intensive care units (ICU) and non-ICU setup. The admitted patients stay for longer duration in ICU due to severity of their disease and they are more likely to be colonized with multidrug resistant organism (MDROs).[11] The ICU protocol for admission of patients varies across the hospitals and it is changing from time to time due to fluctuating case load in hospitals during the pandemic. Patients with respiratory distress and risk factors are directly shifted to ICUs. Non-ICU patients are shifted to ICUs based on risk categorization, considering factors like worsening of clinical condition, radiological, and laboratory parameters. During the peak times of pandemic, some patient may not have access to ICUs because of unavailability of beds and they may be continued to be monitored in wards. When standard and transmission-based precautions are inappropriately followed in any health care unit including ICUs and non-ICU wards, transmission of hospital acquired infections (HAI) occurs at higher pace. Such infections can worsen the condition of patients admitted in non-ICU wards and those patients finally gets shifted to ICUs for more vigilant monitoring. Therefore, non-ICU wards should be considered as high-risk locations and hand hygiene compliance should be monitored by conducting regular hand hygiene audits. A large-scale data in hand hygiene compliance in COVID care location and comparison of adherence in ICUs and non-ICU wards are not available in India. Therefore, the hand-hygiene compliance in ICU and wards of COVID care locations was evaluated in this multicentric study, which was conducted across 92 health care facilities of India, with Jawaharlal Institute of Post-graduate Medical Education and Research (JIPMER), Puducherry being the nodal center.

METHODOLOGY

This was a prospective multicentric observational study conducted for a period of 6 months in 92 health care facility in India. The study included 4 different types of health care settings such as government teaching, government non-teaching, private teaching and private nonteaching institutes. The study was initiated after receiving approval from JIPMER ethics committee which is the nodal center for this multicentric study and also from the individual centers where institute ethics committee was established. Government and private sector hospitals are near equally participated—33 government and 58 private sector hospitals. Multiple awareness and motivational sessions were conducted to create interest among the government sector hospitals to participate in the study. Initially the hand hygiene auditors from each center were trained in direct observation method using hand hygiene audit application developed by IBHAR technologies in collaboration with JIPMER.[12] The training was done through virtual mode by project principal investigator covering the basics of hand hygiene from various guidelines such as World Health Organization (WHO) and Centre for disease Control (CDC).[13] The auditors were initially monitored using dummy audit programs with model case scenario for recording the following information such as date and time of audit, profession of the health care workers (HCWs) posted in COVID ICU/wards, Hand Hygiene opportunities (HH moments) available, duration for which the HH is performed, the steps of HH followed and presence of gloves when the HH is performed. Following a series of virtual meetings with nodal center and training of auditors by investigators of individual centers, certificate was issued to the trained auditors before initiating the study. The HH audit was conducted by those trained auditors for an observation period of ≥ 20 min/d, until a daily minimum of 20 HH opportunities were recorded. The HH event were marked as “completely followed” when ≥ 4 WHO steps of HH were performed, for the recommended duration (≥20 seconds for hand rub and ≥ 40 seconds for hand wash). When ≥ 3 WHO’s HH steps were missed and/or the duration of HH, if less than recommended, such HH events were marked as “partially followed.” We have compared Hand hygiene complete adherence rate (HHCAR), and Hand hygiene total adherence rate (HHTAR) between COVID ICU and COVID wards for the study period using below mentioned formula.

HH Complete Adherence rate (HHCAR): Number of times HH followed completely (≥4 steps and ≥20 seconds duration))/No. of opportunities of HH available X 100

HH Total Adherence rate (HHTAR): Number of times HH followed completely+ partially/No. of opportunities of HH available X 100

Profession-specific HHAR: HH performed by each profession / total opportunities available for that profession X 100

Month-wise trend analysis was performed to observe significant improvement in HH adherence rate across the study period. The rates were compared for all 5 moments of hand hygiene between these 2 locations. Profession specific adherence rates were compared for 4 different types of health care workers such as doctors, nurses, cleaning staffs and allied staffs/others in these 2 locations. The institutions participated in this study were divided into 4 zones based on geographic location such as East, west, North and South and adherence rates were compared.

RESULTS

A total of 161,056 opportunities were recorded during the study period. As shown in the Figure 1A, maximum number of opportunities was recorded in COVID ICUs (136,786) during the study period compared to COVID wards (24,270). However, as shown in the Figure 1B, adherence rates such as HHTAR and HHCAR were higher in COVID wards compared to COVID ICUs. Figure 2 represents increasing trend in monthly HHTAR of COVID ICUs during the study period which increased from 53.1% in the first month to 65.6% in the 6th month. However, HHCAR in COVID ICUs and wards was at increasing pace from the first month till 5th month but it was decreased in the 6th month of the study. The statistical analysis was done by chi-square test. There is no statistically significant difference in adherence rate across months (*P* value -.937). HHTAR in COVID wards showed fluctuating trends throughout the study period. Overall, the highest HHTAR (72.2%) and HHCAR (39.6%) was recorded in COVID ward during month-5.

Zone-wise hand hygiene adherence

The institutes participated in this multicentric study was divided into 4 zones according to geographic location namely, east, west, north, and south zones. In ICUs, a greater number of opportunities were recorded by South zone institutes (77,327) followed by East (26,295) and in COVID wards, a greater number of opportunities were recorded by East zone institutes (9,158) followed by South (8,378). West zone institutes recorded the least opportunities in ICUs (15,570) as well as wards (3,042). HHTAR was best documented in COVID wards of west zone (83.3%), followed by COVID ward of south zone (64.4%). There is statistically significant difference in the

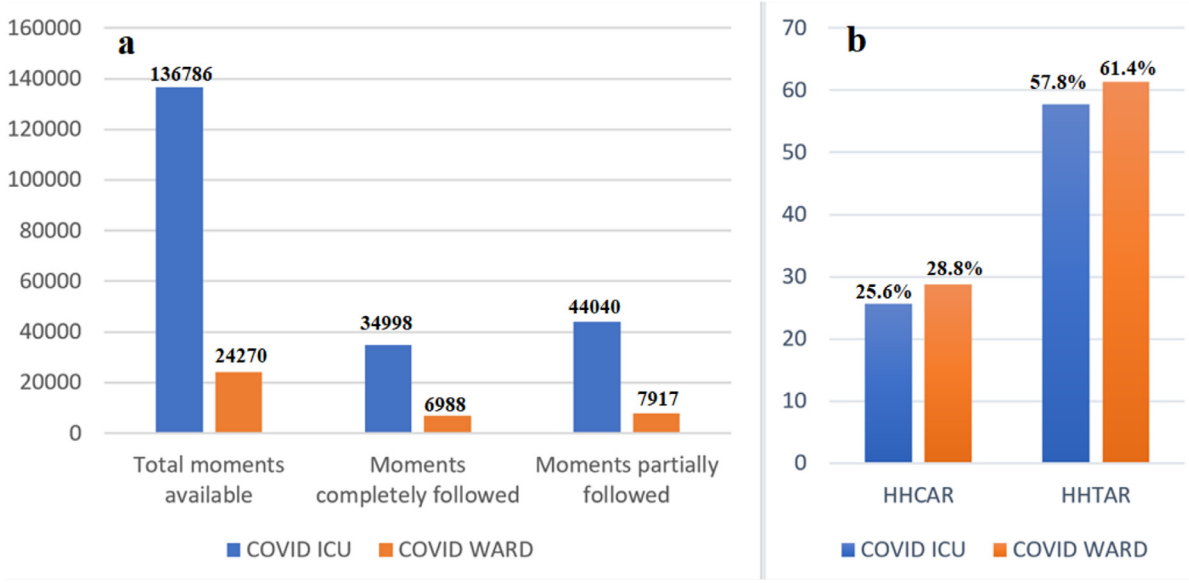

Fig 1. Hand hygiene audit analysis of COVID Intensive care units and COVID wards of 92 health care facilities.ICUs, intensive care units; HHCAR, hand hygiene complete adherence rate; HHTAR. hand hygiene total adherence rate.

distribution of HHCAR across the months (*P* value-.006). Figure 3 shows zone wise HH adherence in COVID ICUs and wards.

Institution type HHAR

As shown in the Figure 4, HHAR was higher in private sector health care in both ICUs (HHTAR-65.1%; HHCAR-33.2%) and wards (HHTAR-68.1%; HHCAR-38.3%) than public sector health care locations. Adherence was higher in non-teaching hospitals compared to teaching hospitals. Overall, hand hygiene adherence (HHTAR and HHCAR) was best observed in COVID wards (HHTAR-73%; HHCAR-42.2%) of private non-teaching hospitals. The HHCAR between ICU and ward in private institutes was not found to be statistically significant (*P* value-.744). The HHCAR between ICU and ward in public institutes was found to be statistically significant (*P* value- <.001)

Profession specific HHAR

Profession specific HHTAR and HHCAR are depicted in the Table 1, Overall analysis of HHTAR shows that this rate was high in cleaning staffs employed in COVID wards (68.3%) followed by nurse in COVID wards (60.8%) and doctors in COVID wards (59.2%). In COVID ICU, nurses recorded high compliance compared to other professionals. Cleaning staffs in COVID wards showed highest compliance (68.3 % [2,657/3,893]). However, cleaning staffs employed in the COVID ICUs recorded the least (55.1% [9,605/17,419]).

Moment specific HHTAR

Figure 5 shows the comparison of moment specific HHTAR between COVID ICUs and wards. HHTAR was found to be the highest

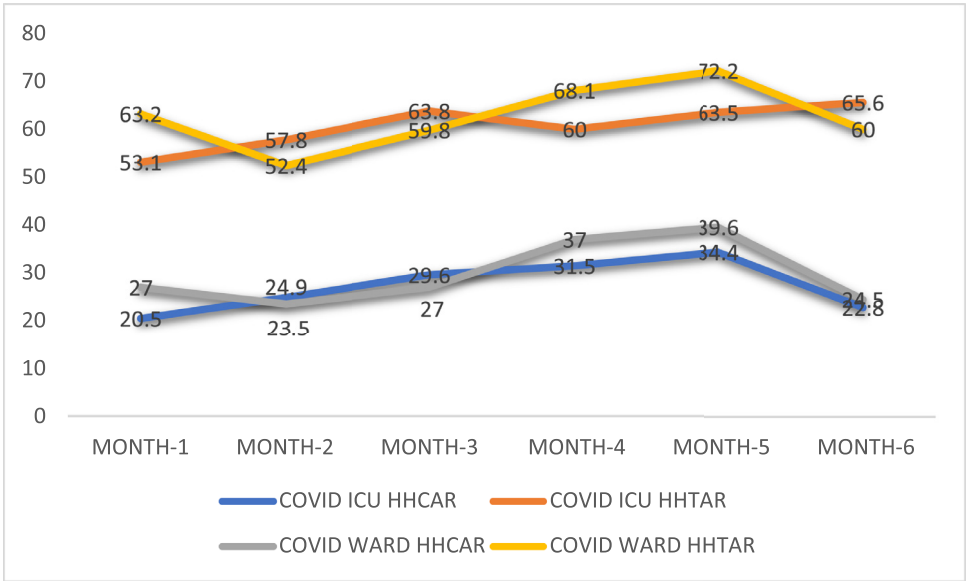

Fig 2. Month wise HH audit analysis of COVID ICU and COVID wards of 92 HCFs.HH, hand hygiene; HCFs, health care facilities; ICUs, intensive care units; HHCAR, hand hygiene complete adherence rate; HHTAR, hand hygiene total adherence rate.

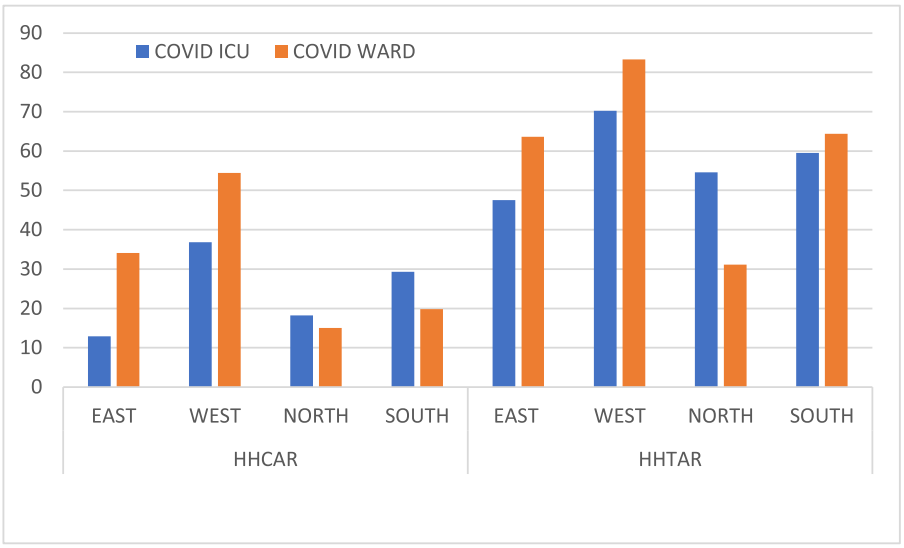

Fig. 3. Zone wise HHTAR and HHCAR of COVID ICU and COVID wards.ICU, intensive care units; HHCAR, hand hygiene complete adherence rate; HHTAR, hand hygiene total adherence rate.

in moment 3 (After body fluid exposure-76.3%) followed by moment 4 (after touching patient-73.7%) done in COVID wards compared to moments done in ICUs. HHTAR was recorded high for moment 2 (before aseptic procedure) in ICUs compared to other moments. Moment 5(after touching patients' environment) has been least followed in both ICUs (42.3%) and in wards (45.2 %).

DISCUSSION

The present study is a large-scale multicentric study involving 92 centers, with about 1.6 lakh number of hand hygiene opportunities. To the best of our knowledge, no other published literature on hand hygiene involved such a huge number of centers worldwide. The prime novelty in the present study was to conduct HH audit inside COVID care locations as very limited research has been carried out till date. Monitoring hand -hygiene adherence by direct observation method is the simplest and cost-effective method which involves designated hand hygiene auditors to be available in the health care location for a particular time period and requires standard method of data collection.[14] Direct observation method remains gold standard method in monitoring hand hygiene compliance.[15] Hand-hygiene audit mobile based applications are available which replaces conventional observation form-based auditing and further reduces the difficulty of data collection by auditors and also reduces intensive final analysis by infection control team. WHO recommends adequate training of HCWs before involving them in audit process. To ensure uniformity of data collection auditors from various health care settings involved in this multicentric study were uniformly trained about opportunities of hand hygiene, understanding my 5 moments of hand hygiene, indications and use of IBHAR hand hygiene tool making them a validated observer to participate in this multicentric study.

This multicentric study is first of its kind to involve various types of institution from different zones of India, so that we will have an overall picture on hand hygiene compliance in various locations, based on which various interventions can be planned to improve the

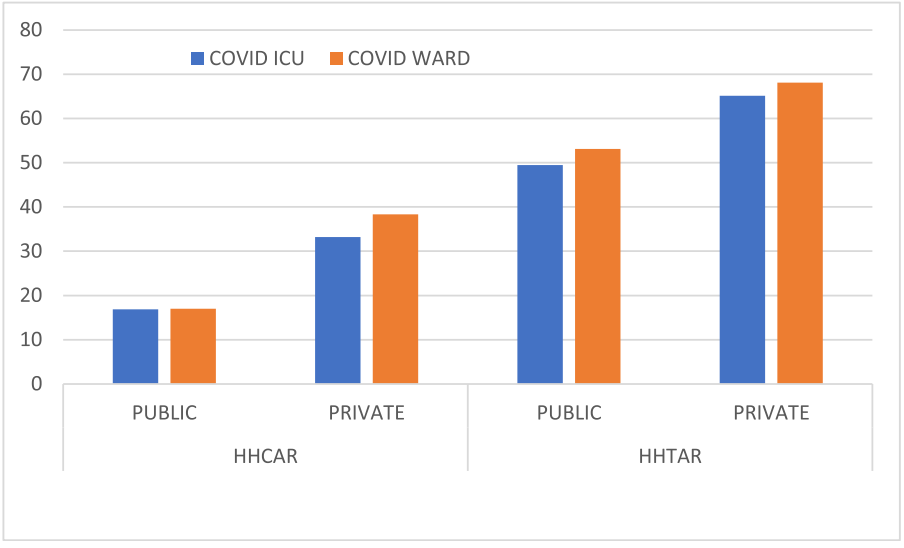

Fig 4. Institution type wise HH audit analysis of COVID ICU and wards of 92 HCFs.ICUs, intensive care units; HHCAR, hand hygiene complete adherence rate; HHTAR, hand hygiene total adherence rate.

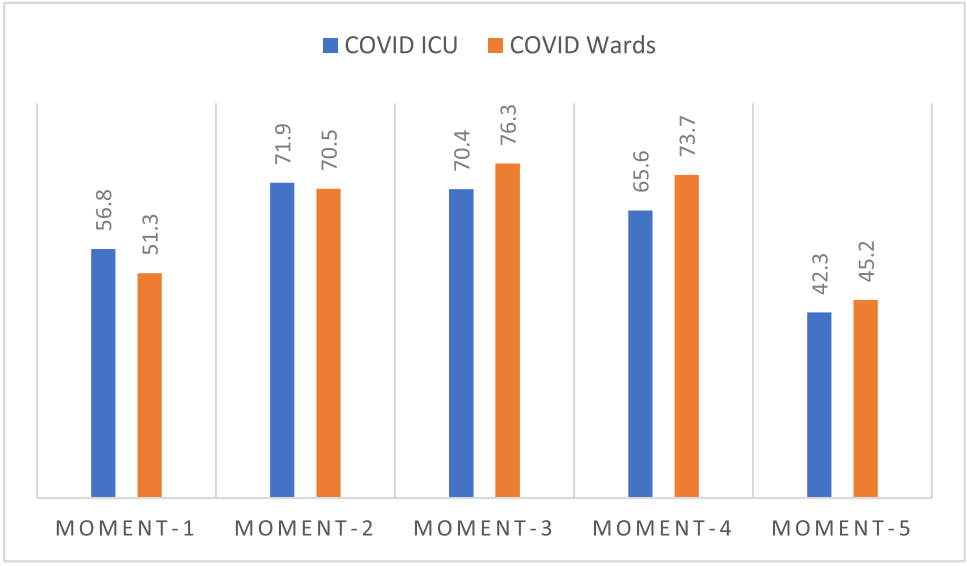

Fig. 5. Moment specific HHTAR of COVID ICU and COVID wards of 92 HCFsHH, hand hygiene; HCFs, Health care facilities; ICUs, intensive care units; HHCAR, hand hygiene complete adherence rate; HHTAR, hand hygiene total adherence rate.

same. Most of the hand hygiene audit studies available were carried out during pre-COVID time and fewer studies which were performed during COVID times involved non-COVID location only. Anguraj S et al conducted similar hand hygiene compliance study in only COVID ICU of single institution.[10]

The overall data showed that HHTAR and HHCAR was found higher in COVID wards compared to COVID ICU. This may be attributed to less emergency procedures being conducted in wards, However, remarkably the number of opportunities recorded in COVID ICU was less. There was month wise improvement in HHTAR from month 1 to month-6 in ICU, but fluctuating trend was recorded for wards. This may be due to extensive importance given to outcomes of COVID ICU patients where deaths are frequent and the concern of ICU HCWs to improve their adherence to hand hygiene may be noticed according to the feedback given by infection control team. Significant monthly improvement in HH compliance has been observed in many studies done by Mu X al, Anguraj et al.[10,16]

HHCAR in ICU and ward improved from month 1 to month-5 but decreased in month 6. This decrease in complete adherence in final months of the study may be related to reduced number of COVID-19 cases in India and probably due to loosened surveillance during this period.

Profession specific HHTAR was recorded highest in cleaning staffs of COVID wards whereas cleaning staffs of COVID ICUs recorded the least HHTAR among all the profession. The reason may be due to cleaning staffs were allotted only cleaning work in their wards and better supervised by their higher rank staffs, therefore may have better done the hand hygiene in most of the institutions. In COVID ICU, compliance of nurses was maximum compared to other health care workers. This is similar to most of the available studies in non-COVID era where profession specific HHTAR was highest in nurses by AS Sastry et al, Lohiya et al, Karaaslan et al. However, doctors showed high HHTAR in COVID care location study by Anguraj S et al. HH adherence rate improved over study period among nurses, cleaning staffs and allied staffs working in COVID ICUs except doctors which were decreased in the last month of the study.

The moment specific HHTAR is maximum for “after moments” such as after body fluid exposure(moment-3) and after touching patient(moment-4). This shows the health care workers may be more concerned to reduce contracting COVID-19 from the patients by performing hand-hygiene for after moments. “Before moments” should also be emphasized equally and adequate education to be done to health care workers to prevent the transmission of hospital acquired infection through the gloved/nongloved hands of the health care workers to the patients. These results are similar to study done by Rodrigues et al, Naglaa et al, AS sastry et al and AM Laskar et al which are done during pre-COVID period.[14,17,18,19] Our study results slightly differ from study by Anguraj S et al which was done during pandemic times in COVID ICU where HHTAR is higher for moment 2 and 3.[10] Frequent educational programme including display of visual reminders, knowledge attitude practice study to understand the lacunae in the system are absolutely essential to emphasize the importance of before moments also. A study done by Teker et al showed improvement in adherence for “before moments” was observed after extensive educational interventions on hand hygiene and nosocomial infections.[20]

Private non-teaching health care performed satisfactorily in this study. This may be because of less patient load in such hospitals, higher staff to bed ratio, the need to achieve accreditation and good administrative support.

Limitations of the study

The main limitation of this study is that there is no data on month-wise device associated infections (DAI) rates in these locations. Increase or reduction of DAIs serves as good indicator of hand hygiene practice in any location. Variation of HHAR in different shifts of health care workers, its distribution based on years of experience, gender variation, were not analyzed as the observation periods were based on convenience sampling and were not randomized.

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Table 1
Profession-specific HH total adherence rate (HHTAR) % (n/N)

Month	Doctor		Nurse		Cleaning staffs		Allied staffs/others	
	Covid ICU	COVID ward	Covid ICU	Covid ward	Covid ICU	Covid ward	Covid ICU	Covid ward
Month-1	54.4 (7,096/13,041)	56.0 (592/1,058)	53.8 (15,820/29,414)	63.7 (1,895/2,973)	50.2 (2,994/5,964)	71.2 (616/865)	50.2 (3,465/6,903)	61.7 (348/564)
Month-2	59.7 (4,373/7,319)	51.8 (536/1,035)	55.8 (7,072/12,676)	50.5 (1,586/3,143)	57.6 (2,112/3,665)	59.0 (496/841)	60.4 (2,471/4,089)	54.1 (338/625)
Month-3	63.6 (3,458/5,438)	60.1 (591/983)	66.0 (6,680/10,128)	59.2 (1,786/3,016)	60.3 (1,821/3,021)	65.1 (501/769)	61.2 (2,117/3,459)	54.8 (267/487)
Month-4	56.8 (2,616/4,602)	68.3 (529/774)	65.2 (4,855/7,447)	67.6 (1,160/1715)	54.4 (1,387/2,548)	72.8 (402/552)	55.7 (1,286/2,309)	63.5 (261/411)
Month-5	61.3 (2,235/3,644)	66.9 (407/608)	67.2 (4,016/5,977)	72.4 (917/1,266)	57.4 (1,152/2,008)	81.7 (405/496)	62.7 (929/1,482)	66.3 (193/291)
Month-6	57.3 (286/499)	55.6 (245/441)	71.4 (535/749)	62.9 (501/796)	65.3 (139/213)	64.1 (237/370)	64.4 (123/191)	50.3 (96/191)
Total	58.1 (20,064/34,543)	59.2 (2,900/4,899)	58.7 (38,978/66,391)	60.8 (7,845/12,909)	55.1 (9,605/17,419)	68.3 (26,57/3,893)	56.4 (10,391/18,433)	58.5 (1,503/2,569)

HH, hand hygiene; ICUs, intensive care units; HHCAR, hand hygiene complete adherence rate.

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CONCLUSION

This study was conducted in large scale to highlight the practice of hand hygiene in COVID care locations across India. Thorough analysis of this kind of multicentric studies can result in drastic improvement in infection control behavior among health care workers. Large pan India data of this sort enlightens us regrading HH practices in various zones of India and local authorities can take action on escalating education on hand hygiene practices. Prompt feedback, effective educational intervention, multidisciplinary campaigns supported by hospital administration are mandatory to consistently have good hand hygiene adherence. As there is no such large-scale multicentric study conducted so far in India and globally, the results of this study can be considered as national benchmark data to compare the hand hygiene compliance data of other health care facilities.

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