Compliance of Health Care Workers with infection prevention and control practices in COVID-19 pandemic

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Abstract

Background: Protecting Health Care Workers (HCWs) from infection with SARS-CoV2 is a crucial element and that depends on rational use of PPE and adherence to IPC practices. Early targeted training will reduce the infection rate in HCWS.

Objectives: To determine adherence/compliance of HCWs to IPC practices during the COVID-19 pandemic.

Patients and methods: Prospective observational study, conducted at atertiary care centre, from July to December 2020. HCWs in theCOVID ward were constantly observed for adherence to IPC practices separately in donning area, doffing area and inside the ward and ICU by trained infection control nurses.

Results: There were a total of 792 HCWs involved in COVID duty, including doctors (44%), nurses (29%), cleaning staff (17%) and supporting staff (10%).In donning area adherence to standard precautions for hand hygiene was 89.4%, following steps of donning was 90.7%, appropriate use of personal protective equipment (PPE) was 98.2% and to environmental disinfection was 94.6%. In the COVID ward, rational use of PPE was done 100% by doctors and nurses, 93.8% by cleaning staff, 92.7% by supporting staff and overall 98.2%. In doffing area overall adherence to standard precaution for hand hygiene was 95.1%, following steps of doffing was 93.4%, biomedical waste (BMW) segregation was 92.4% and to environmental disinfection was 90.7%.

Conclusion: Compliance of HCWs to infection prevention and control (IPC) practices is critical in limiting transmission of not only COVID-19 infection but also other infectious diseases. Change in attitude of HCWs can be brought in by regular training sessions as evidenced by the present study.

Keywords: COVID-19; Health care worker; Infection control practices; Personal protective equipment; SARS-CoV2.

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Introduction

Since the reporting of acluster of pneumonia cases in the Province of Wuhan, China in late December 2019, COVID-19 has rapidly evolved into full-blown pandemic all over the world.(**WHO COVID-19 Guidelines,2020; Zhu et al, 2020**) As the pandemic is evolving, Governments rush to increase health care facility to cope up with the increasingly acute need. However, ensuring the protection and safety of HCWs is a crucial element of any country's strategic plan against pandemic response. At the same time WHO has issued recommendations for the proper and rational use of personal protective equipment (PPE) in hospital and community settings (**WHO COVID-19 Guidelines,2020**)

Based on this, several institutes and hospital settings have formulated algorithms and guidelines to decrease therisk of COVID-19 transmission in their specialty field (**COVIDSurg,2020;Dashraath,2020**) .However, protecting health care workers (HCWs) remains a challenge, where the shortage of PPE is an important concern. Even with an adequate supply of PPE, few HCWs fail to follow an adequate guidelines of infection prevention and control (IPC)practices such as hand hygiene, donning and doffing of PPE and biomedical waste (BMW) management as well (**Bandyopadhyay et al,2020**)

Asymptomatic and pre symptomatic carrier HCWs, contribute to the major transmission of COVID-19. Therefore protecting HCWs from infection with SARS-CoV2 is a crucial element and that depends on rational use of PPE and adherence to IPC practices. (**Neuwirth et al, 2020**). In order to reduce infection rate in HCWs, compliance/deficits with IPC practices are to be identified and analysed early to provide HCWs with targeted training. Hence, this observational study was conducted to determine adherence/compliance to IPC practices by HCWs during the COVID-19 pandemic.

Patients and Methods

Prospective observational study was conducted at Rajarajeswari Medical College and Hospital from July to December 2020. HCWs working in ward and intensive care unit (ICU) which were exclusively dedicated to COVID-19 patients were included in the study. (Henceforth referred to as COVID ward).The study was approved by Institutional Ethics Review Board.HCWs with comorbidities like diabetes mellitus, hypertension, respiratory diseases, other chronic medical illness and pregnant staff were excluded from the study, as they were already exempted from COVID duty.

HCWs in COVID ward were constantly observed without informing the HCWs being observed, to rule out Hawthorne effect. HCWs were observed for adherence to IPC practices separately in donning area, doffing area and inside the ward and ICU by the institute's trained infection control nurses (ICN), without HCWs notice, to avoid later informed them and took consent for publishing results.Separate checklist was prepared for donning area, doffing area and within the ward, following national and international guidelines.(**Basu,2020;MHFW GOI guidelines 2020;WHO COVID-19 Guidelines 2020**). In donning area, procedures observed and scored were hand hygiene, steps of donning, rational use of PPE and environmental disinfection. In thedoffing area, hand hygiene, steps of doffing, BMW segregation and

environmental disinfection were observed and scored and inside the ward and ICU, hand hygiene, BMW segregationand environmental disinfection were observed.

Adherence to single step/activity was marked as yes or no and adherence to total process was calculated as number of yes answers divided by sum of number of yes and no answers. If any step/activity was carried out incorrectly, then it was considered as no. Adherence was considered sufficient if percentage value is ≥ 80%.

Training session was conducted for all the HCWsof IPC practices including donning, doffing, BMW segregation and environmental disinfection, before being posted for COVID duty.

Results

There were total 792 HCWs involved in COVID duty, including doctors, nurses, cleaning staff and supporting staff. Doctors were 350 (44%), nursing staff 230 (29%), cleaning staff 130 (17%) and supporting staff were 82 (10%). Female staff outnumbered male staff with male to female ratio of 0.51 (**Table 1**).

Table 1. Demographic data of HCW

Variables	Male	Female	Total
Doctors	168 (48%)	182 (52%)	350 (44%)
Nurses	12 (5%)	218 (95%)	230 (29%)
Cleaning staff	36 (28%)	94 (72%)	130 (17%)
Supporting staff (Technicians, radiographers, pharmacystaff, clerical staff	52 (63%)	30 (37%)	82 (10%)
	268 (34%)	524 (66%)	792

HCWs belonged to age group of 25 to 50 years with mean age of 32.8 years. Details are shown in **Fig.1**. Among doctors and nurses maximum belonged to the age group of 25-30, whereas cleaning staff and supporting staff were in the age group of 31-40.

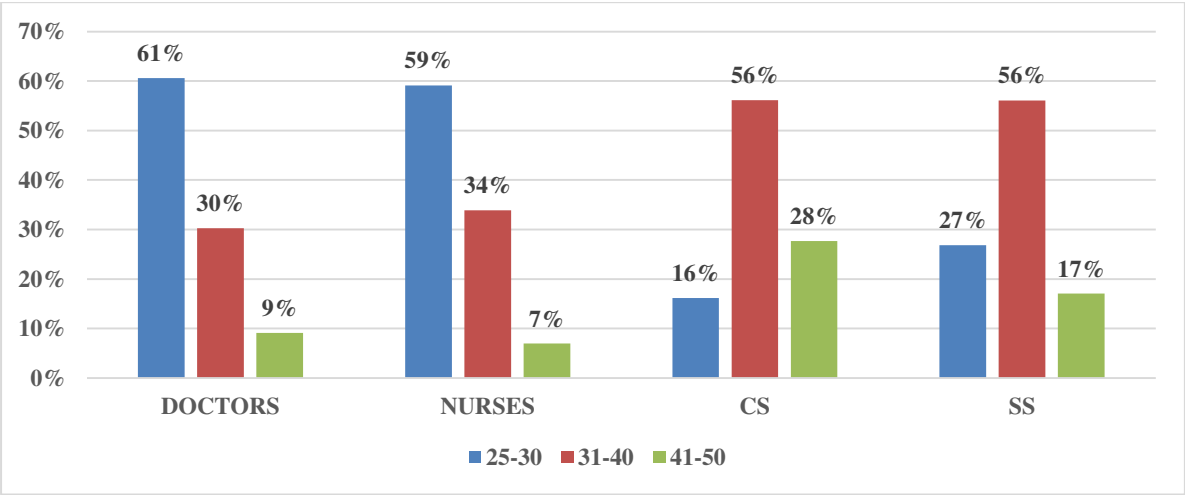

Fig.1. Age wise distribution of HCW involved in COVID-19 patient care. CS: Cleaning staff, SS: Supporting staff.

In donning area overall adherence to standard precaution for hand hygiene was 89.4%, following steps of donning was 90.7%, rational use of PPE was 98.2% and to environmental disinfection was 94.6% (**Table 2, Fig.2**). In the COVID ward, appropriate use of PPE was done 100% by doctors and nurses, 93.8% by cleaning staff, 92.7% by supporting staff and overall 98.2%.

Table 2. Adherence to standard precautions in donning area

Variables	Doctor	Nurses	Cleaning staff	Supporting staff	Total adherence	P value (<0.05)
Hand hygiene	90.9%	93.5%	80.8%	85.4%	89.4%	0.000553 Significant
Steps of donning	92%	94.8%	83.1%	85.4%	90.7%	0.000414 Significant
Rational use of PPE	100%	100%	93.8%	92.7%	98.2%	0.00001 Significant
Environmental disinfection	-	-	94.6%	-	94.6%	

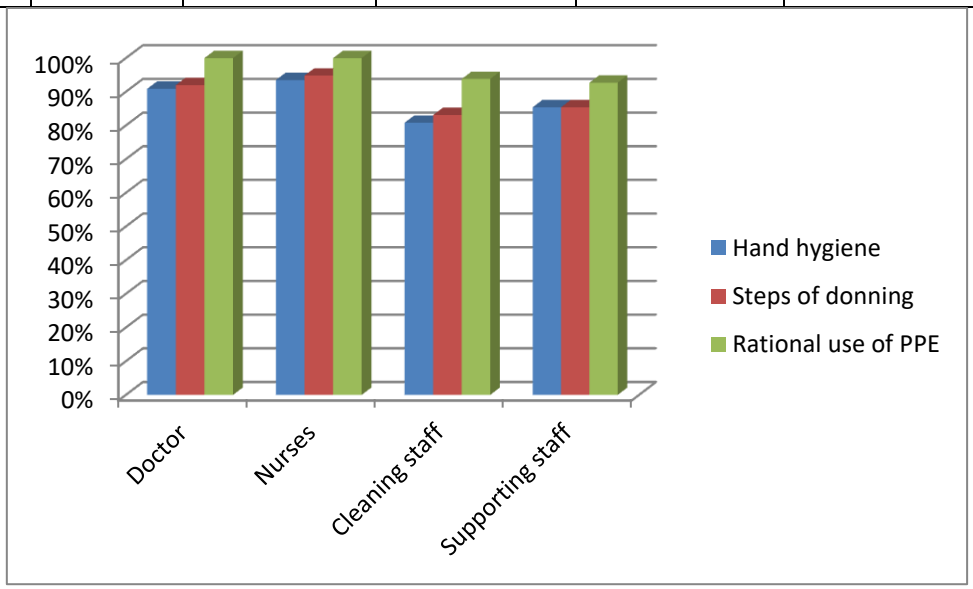

Fig.2.Percentage of HCW adhering to standard precautions in donning area

In doffing area overall adherence to standard precaution for hand hygiene was 95.1%, following steps of doffing was 93.4%, BMW segregation was 92.4% and to environmental disinfection was 90.7% (**Table 3, Fig.3**).

Table 3.Adherence to standard precautions in doffing area

Variables	Doctor (%)	Nurses (%)	Cleaning staff (%)	Supporting staff (%)	Total adherence (%)	P value (p<0.05)
Hand hygiene	97.4	96.5	90.8	87.8	95.1	0.000232 Significant
Steps of	96.5	96.9	83.8	85.4	93.4	0.00001

doffing						Significant
BMW segregation	91.1	93.9	93.8	91.5	92.4	0.56 Not significant
Environmental disinfection	-	-	90.7	-	90.7	

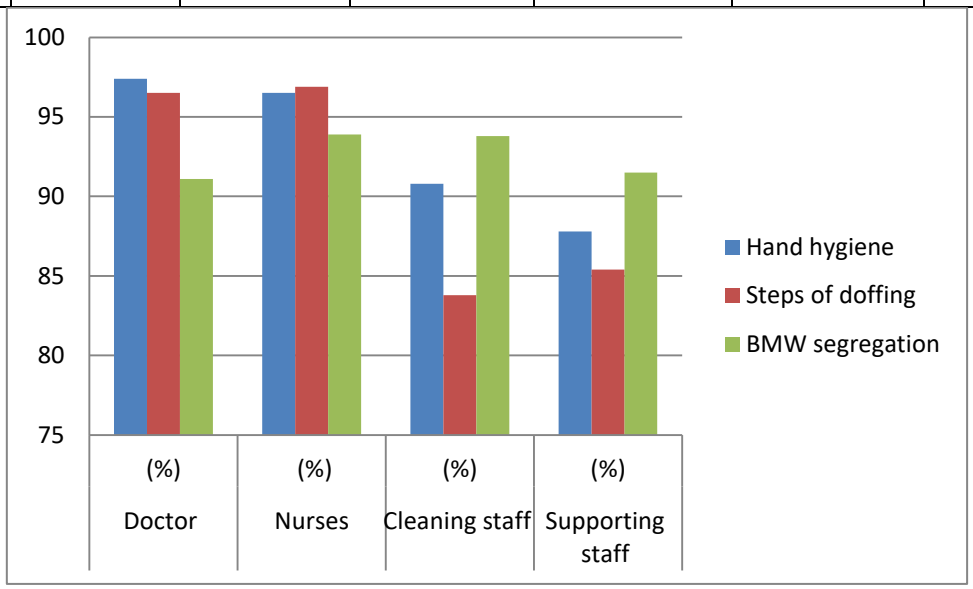

Fig.3.Percentage of HCWadhering to standard precautions in doffing area

Percentage of staff who received training on infection control practices before getting posted to COVID duty is shown in **(Fig.4)**. Among doctors 96.6%, nurses 95.7%, cleaning staff 86.2% and supporting staff 78.1% attended the training session.

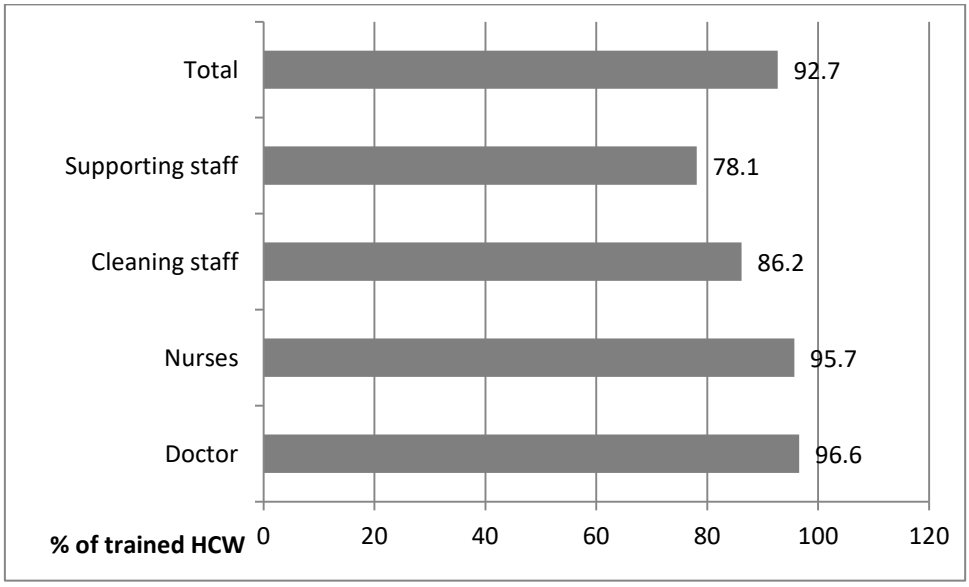

Fig.4.Percentage of HCW who received training on infection control practices

Discussion

COVID-19 pandemic has affected millions of frontline HCWs, with thousands of them succumbing to the disease (**WHO COVID-19 Guidelines, 2020**). This can be attributed to overburdening of thehealth care system with anincrease in thenumber of cases, increased psychosocial stress, lifestyle related factors and suboptimal adherence to IPC practices (**Ranjan et al, 2020**) Compliance with IPC practices is essential in minimising transmission of infection especially during SARS-CoV2 infection.

IPC practices include hand hygiene, correct PPE use (donning and doffing) and BMW management. Use of PPE was evidenced from before 18th century as recorded by doctors treating plague patients by wearing mask, leather gown and black overcoat to prevent transmission of infection (**Honda and Iwata, 2016**) In 1983, Centre for Disease Control and Prevention (CDC) updated guidelines for theproper use of PPE based on likelihood of exposure to infective agents with special reference to respiratory pathogens (**Garner and Simmons, 1983**). Corona viruses survive for several hours on used PPE, hence hand hygiene is strongly recommended in between the doffing steps and also after completion of doffing. Several factors influence adherence to IPC practices and they are inadequate training, solving technical difficulties, tolerability of PPE, environmental limitations such as heat stress and variations in recommendations on use of PPE by different professional societies (**Honda and Iwata, 2016**).

In one of the multicentric study by Powell-Jackson et al, overall compliance was 6.9% with hand hygiene compliance being higher in nurses and midwives compared to assistant and senior consultants. In the same study, for BMW management with special reference to non-sharp management was below 20%. Female HCWs were better at IPC compliance compared to males (**Powell-Jackson et al, 2020**).

In the present study, total 350 doctors, 230 nurses, 130 cleaning staff and 82 supporting staff were involved in COVID duty. Among them, 268 (34%) were males and 524 (66%) were females.In donning area, overall hand hygiene adherence was 89.4% with highest adherence by nurses (93.5%) followed by doctors (90.9%), supporting staff (85.4%) and cleaning staff (80.8%). The same order follows for appropriate donning. In doffing area, hand hygiene adherence got better by all the categories with highest adherence by doctors (97.4%), nurses (96.5%), cleaning staff (90.8%) and supporting staff (87.8%) with improved overall adherence of 95.1%. Appropriate doffing was done by 96.9% of nurses, 96.5% of doctors, 85.4% of supporting staff and 83.8 % of cleaning staff. BMW segregation guidelines were followed by 93.9% of nurses, 93.8% of cleaning staff, 91.5% of supporting staff and 91.1% of doctors. Despite of highest attendance (96.6%) in training sessions by doctors, lowest compliance was seen among doctors for BMW segregation. Lowest compliance among doctors could be because of wrong/bad attitude of doctors towards BMW segregation, however statistically it is not significant. Therefore re arrangement of special training sessions were done for doctors.

Overall, it is observed that there is tremendous improvement in hand hygiene. In a study by Agarwal et al, 52.82% of HCWs adhered to hand hygiene steps and

appropriate donning and doffing was done by 57%. Reasons for low compliance were lack of helping person, lack of knowledge and absence of dedicated doffing area (**Agarwal et al, 2021**). But in the present study, overall adherence to steps of donning and doffing were 90.7% and 93.4% respectively and for appropriate use of PPE was 98.2%. This may be because of periodic training of all HCWs for donning, doffing, BMW management and there were separate designated area for donning and doffing with mirror, doffing buddy, hand rub dispenser, hand washing station and poster regarding donning and doffing inside each area.

Although India has put forward National guidelines on IPC practices in India, only recently in January 2020, these guidelines were revised and more comprehensive recommendations on IPC practices and clinical management of COVID-19 were released on March 31st 2020. Implementation of these guidelines at different health care facilities is yet to be fully accessed (**Behera et al, 2020**) Present study is one step moving forward in this process. Although Infection Control Committee (ICC) is commonly found in many health care facilities, their effective implementation remains questionable or is yet to be accessed (**Diwan et al, 2016; Gupta et al, 2018**).

Effectiveness of IPC measure and PPE use depends on their appropriate use. According to WHO, all these are rights of HCWs before being exposed to COVID-19. In the present study overall 92.7% of HCWs had attended training session, which was conducted systematically and regularlyevery 15 days with hands on training along with addressing previous non compliances towards IPC practices. Among the regularly attended HCWs, doctors were 96.6%, nurses 95.7%, cleaning staff 86.2% and supporting staff 78%. This impact has been seen in following IPC practices and use of PPE which is summarised in table 2 and 3. Lowest compliance was seen with supporting staff who attended less training sessions.

Previous studies from India and other south Asian countries have reported inadequate training with reasons being time constraints and excess workload (**WHO COVID-19 Guidelines, 2020; Loba et al,2019; Vinodhini and Devi, 2016**). A study by Suzuki et al, have demonstrated limitingCOVID-19 infection among HCWs by adequate and rigorous training of HCWs for IPC practices and appropriate use of PPE (**Suzuki et al, 2020**).

Thus there is need for systematic and rigorous training of all HCWs including supporting staff like personnel working in pharmacy, counselling, rehabilitation centre etc and cleaning staff. Even though regular and systematic training was conducted in our hospital, not all attended it. Hence there should be strict implementation of training programme on IPC in all the hospitals with mandatory attendance.

In most of the studies cited in the literature, are based on questionnaire. However, the present study is unique in that, it was observational study with consent of HCWs to observe and file the report of adherence to IPC practices in different areas like donning and doffing area.

Conclusion

Compliance of HCWs to IPC practices is critical in limiting transmission of not only COVID-19 infection but also other infectious diseases among HCWs. Change

in attitude of HCWs can be brought in by regular training sessions as evidenced by the present study.

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