Usage of Personal Protective Equipments during Covid-19 Pandemic: Quality assessment and problems faced by the workers in Pediatric Covid-19 Ward of Medical College, Kolkata

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Abstract

Background: Covid-19 pandemic is a rapidly spreading outbreak which has caused sudden respiratory distress and death all over the world. **T**his pandemic situation is a major concern for all the health related professionals globally. Treating patients, reducing spread of infection and side by side protecting themselves during rendering care to patients is the main concern for health care workers.

Objectives: The study is aimed at assessing training status, correctness of use, problems faced during use of Personal Protective Equipment (PPE) and occurrence of Covid-19 positivity among health care workers at Pediatric Covid-19 ward at Medical College, Kolkata.

Patients and methods: 194 doctors, nurses, technician, house -keeping staffs from Pediatrics department of Medical College Kolkata, engaged in Covid-19 related care from June 2020 to October, 2020, were included in this prospective observational study. A self administered questionnaire was used to collect data. Statistical analysis was done in MS-Excel. Descriptive statistics were calculated in terms of number & proportions.

Results: 84(43.3%) doctors, 70 (36.1 %) nurse, 20 (10.3%), scavengers, 20(10.3%) technician participated in the present study. Headache and difficulty in vision due to fogging, 'fear of infection', 'early irritability' are main health problems as stated by the participants after wearing PPE. Availability of PPE in different sizes, quality improvement was some of the key suggestions. 10.5% of participants contracted COVID-19 in three months follow up period.

Conclusion: Adequacy of supply and familiarity with PPE was not a concern for the study subjects but there was poor comfort and difficulty in doffing.

Keyword: PPE; Physical problem; Psychological problem; COVID19; India.

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Introduction

Covid-19 (corona virus disease , 2019 and SARS- cov2) is the newly discovered emerging respiratory disease which is caused by a new member of the corona virus family called novel corona virus (**Verbeek et al., 2020**). It started in December 2019 from Wuhan, China and spread all over the world in very short time. The disease is highly infectious and it has varied clinical presentation like fever, dry cough, myalgia and severe cases may progress to acute respiratory distress syndrome (**Oldfield and Malwal, 2020**). The disease is predominantly a respiratory illness and transmission occurs through respiratory droplets when an infected person coughs, sneezes or talks.

Most people infected with the Covid-19 virus remain asymptomatic or experience mild to moderate respiratory symptoms and recover within short time. Severe cases may present with respiratory distress and coagulation dysfunction(**Kong et al., 2021**). Unique feature of the virus is its high transmissibility but low virulence that distinguish it from other members of the corona virus family such as SARS-CoV(severe acute respiratory syndrome) and MERS-CoV (Middle Eastern Respiratory Syndrome)(**Epidemiology Working Group for NCIP Epidemic Response, Chinese Center for Disease Control and Prevention, 2020**). Elderly, immune-compromised or persons suffering from chronic diseases like hypertension and diabetes are more prone to severe diseases but young healthy population are not completely safe from severe form of the disease. It is seen globally that health workers, even of younger age group, were affected by Covid-19 and many of them died too.

Health care workers are amongst the most vulnerable groups who have the greatest risk of getting infected. Health care workers have to come directly in contact with the Covid19 patients. To prevent health care workers (HCWs) from getting infected by aerosol generated from the patients, personal protective equipment (PPE) kit is being used all over the World (**Loibner et al., 2019**) . Personal Protective Equipments (PPEs) are protective gears designed to safeguard the HCWs by minimizing the exposure to a biological agent. PPE kit consists of a head cap, safety goggles, a surgical mask (150gsm) or N95 mask, one pair of gloves, full body cover (95GSM) and a pair of full sized shoe cover. PPE is being used in several endemic infectious diseases such as HIV infections, Hepatitis B infections etc and in other outbreaks like Ebola, Nipah virus infection etc. For Covid19 pandemic also use of PPE has become essential to render proper health care to patients while maintaining safety of the health workers.

Since 9th May 2020 Mother and Child Hub (Paediatric department of Medical College and hospital, Kolkata) is being used as a Covid-19 designated hospital for children. Since then PPE is being used continuously by treating doctors, nurses and all other non medical personnel associated with patient care. Any item of PPE creates a barrier between the person who wears it and the working environment. This can create additional strains on the wearer; impair their ability to carry out their work and create significant levels of discomfort. It can discourage wearers from using PPE correctly, therefore placing them at risk of getting infected. Good ergonomic design

can help to minimise these discomforts and can therefore help to ensure safe and healthy working conditions through the correct use of PPE. Therefore, the study was carried out to assess the correctness of use of PPE and problems faced during or after wearing PPE by health care workers (HCWs) in treating pediatric Covid-19 patients in 'Mother and child health'(MCH hub), Medical College Kolkata.

Patients and methods

It was an observational descriptive study, with prospective design conducted between June to October 2020 by use of a self administered questionnaire with close ended questions. The study population consisted of all category of health care providers (doctors, nurses, paramedics, technicians and scavengers) assigned in Covid-19 ward and it includes only those who worked for at least 1 month in MCH Hub of Medical College, Kolkata. Those who did not give consent were excluded from the study. After fulfilling inclusion criteria all the workers who were engaged in patient care duty in the month of June were approached for the study. A total of 256 such health care workers were selected for the study; 200 subjects returned the questionnaire among which 6 questionnaires found to be incomplete. All these 194 subjects were further followed up for 4 months and noted whether they become Covid19 positive or not. Covid-19 was diagnosed by the presenting symptoms like fever, sore throat, anosmia, loose motion etc and confirmed by Covid-19 RT-PCR (Reverse Transcription–Polymerase Chain Reaction, Kit name: Covidsure) test. The study was aimed at assessing training status, correctness of use, problem during use of Personal Protective Equipment (PPE) and incidence of Covid-19 positivity among health care workers at Pediatric Covid-19 ward at Medical College, Kolkata.

Statistical Analysis

Statistical analysis was done in Excel workbook of Microsoft Office Software package in computer. Categorical variables were expressed as number and proportions and for continuous variables mean and standard deviation were calculated.

Results

84(43.3%) doctors, 70 (36.1 %) nurse, 20 (10.3%), scavengers, 20(10.3%) technician participated in the present study. All the nurses had 5 shifts in a week whereas doctors had undergone different pattern of shift duties like 4 (4.9%) had 3 shifts , 28 (34.6%) had 5 shifts , 22 (27.2%) had 6 shifts and 27 (33.3%) had 10 shifts in a week. Technicians and other staffs had 5 shifts in a week.

Institution had arranged training on PPE use and prevention of Covid-19 since initial days of Covid-19 pandemic. 165 (85.3%) study subjects had received training but 21(12.6%) were not satisfied with the training,(**Table .1**).

All the health care workers confirmed that there was a designated Donning and Doffing area in the ward and Donning is done under supervision of fellow worker. 192 (98.9 %) health workers said there was no problem during Donning.

One hundred seventy-eight (91.6%) said that there was adequate alcohol based hand sanitizer; 170 (87.7%) said there was adequate soap; 164 (84.7%) said there was proper basin for washing hands and 148 (76.4%) said there was proper bathing facility in Doffing areas. Regarding

difficulty faced during doffing, 1(0.5%) faced difficulty with removal of mask, 10 (5.4%) had difficulty with removal of gown. 1(0.5%) had difficulty with face shield, 48 (24.6%) had difficulty with removing gloves and 63 (32.5%) said they had problem with removal of shoe cover during doffing. 90.6% healthcare workers admitted that they used to doff in supervision of fellow worker.

All admitted that there is a proper chart for doffing in doffing area present and 97.8 % of them used to follow that during doffing.

Table 1.Training status among different category of health care worker under study

Training status on PPE & Covid-19 Prevention (n=194)			
Designation	**Untrained No.(%)**	**Trained No.(%)**	**Total No.(%)**
Doctor	5(5.95)	79(94.05)	84(43.30)
Nurse	6(8.57)	64(91.43)	70(36.08)
Sweeper	3(15.00)	17(85.00)	20(10.31)
Technician	4(20.00)	16(80.00)	20(10.31)
Total	18(9.28)	176(90.72)	194(100.00)

All health workers said that they faced difficulties while working after wearing PPE. Among them 97.9% had breathing difficulty, 97.9% had walking difficulty, 97.9% had difficulty with communication. Due to discomfort 3.7% of health workers removed their PPE by themselves during duty at least once in their entire duty hours. During disposal of PPE 95.8% follows the proper steps and none reused any used PPE. 97.4% used to clear their shoes with hypochlorite solution after duty hours, (**Table. 2**)

Table 2. Difficulties faced after wearing PPE as per the study subjects

	Experienced by study subjects (n=194)	
Difficulty in	No.	(%)
Excessive Sweating	194	100
Breathing	190	97.9
Walking	190	97.9
Working	194	100
Communication	190	97.9

Regarding physical effects after PPE wearing (during duty and after duty) all reported exhaustion; 97.6% reported pain in the back of ear by straps of mask; Light headedness, headache and difficulty in vision due to fogging in face shield were reported by 91.6%, 21.6% & 88.4% respectively. Mental effects as reported during and following duty were 'fear of infection' by 96.8%, 'early irritability' by 78.4%, 'feeling low due to wok pressure' by 71.6%, **(Table .3**)

Table 3. Physical and psychological effects of wearing PPE as per the study subjects

Physical and psychological effects	**Experienced by study subjects (n=194)**	
	No.	(%)
Pain in the back of ear	188	96.9
Light headedness	178	91.7
headache	40	20.6
Difficulty in vision due to fogging	33	17.0
Fear of infection	32	16.5
irritability	28	14.4
Feeling low due to work pressure	24	12.4

Though availability of PPE was not a concern but some improvement suggestions were there; 88.4% health workers opined for using tape to seal mask to avoid fogging of vision. All wanted change in shoe-cover. 90% of all opined to make available PPE of adequate sizes for all. 98.4% wanted improvement in PPE quality & all asked for reduction in duty hours after wearing PPE

Among the study population 20 (10.5 %) health workers became Covid-19 positive during the follow up period. 18 of them experienced mild symptoms and recovered within 2 weeks. Two (1.05%) HCWs experienced severe form of Covid-19 characterised by shortness of breathing and oxygen saturation (SpO2<95%) and one needed hospitalisation

Discussion

Importance of training on PPE use was suggested by many studies all over the World. A study conducted in Australia & New Zealand **(Barratt and Gilbert, 2020)** suggested that HCWs' confidence, competence and familiarity with PPE are a concern, which in the context of the current global COVID-19 pandemic is problematic. Medical College Kolkata had arranged hands on training on PPE use and prevention of Covid-19 since initial days of Covid-19 pandemic & 165 (85.3%) study subjects had received that training

which increased familiarity to PPE and acted as confidence booster.

Adequate availability of PPE is another concern as pointed out by many previous studies. A study conducted in India(**Sharma et al.,2020**) inferred that India has responded swiftly to enhance the accessibility of PPE and put in place strategies for the judicious use of PPE to reduce the incidence of the COVID-19 infection. Similarly present study also pointed out adequate supply of PPE though some improvements in quality were suggested by the subjects.

When asked about difficulties faced, subjects mainly pointed out problems in time of doffing. Exhaustion, headache, light headedness etc. due to long working hours after wearing those PPEs were also reported. Similar results were found in a study conducted in China(**Fan et al.,2020)** which observed many difficulties like inappropriate PPE sizes, design of the PPE and its complexity of use, doubts related to the quality and effectiveness of PPE, potential risks during doffing, space layout between clean and contaminated area, and poor comfort with PPE use.

When these PPE users were followed up, a significant number of users were found to be Covid-19 positive (10.5%) over the course of 4 months. It is difficult to conclude though whether this disease is from wrong usage of PPE or they incurred that infection from somewhere else other than Hospitals. This is the limitation of the study and needs further clarification.

Adequacy of supply and familiarity with PPE usage was not a concern for the study subjects but mainly poor comfort and physical and mental exhaustion after long working hours after wearing PPE was main concern for the participants. They mainly found difficulties while doffing of the PPE and suggested quality improvements in shoe covers and eye protections.

Conclusion

In Medical College Kolkata, India, adequate supply of PPE and adequate training regarding PPE use were present. Physical and mental exhaustion due to long working hours may have lead to inappropriate use of the PPE by some HCWs. 10.5% of the HCWs got infected by COVID-19 subsequently and inappropriate PPE usage may be one of the risk factors that lead to the event.

List of abbreviations

PPE: Personal protective equipments
HCW: Health Care Worker
MCH hub: Mother & Child Health hub
SARS: Severe Acute Respiratory Syndrome
MERS: Middle Eastern Respiratory Syndrome
Covid-19: Corona Virus Disease-2019

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