International Journal of Community Medicine and Public Health
Ravi D et al. Int J Community Med Public Health. 2021 Jun;8(6):3003-3007
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20212006

Original Research Article

Knowledge of disinfection and personal protective equipment usage amongst health care workers in the COVID-19 scenario

Ravi D., Vivek Anand, Arun Kumar Yadav*

Department of Community Medicine, Armed Forces Medical College, Pune, Maharashtra, India

Received: 11 April 2021
Accepted: 10 May 2021

***Correspondence:**
Dr. Arun Kumar Yadav,
E-mail: arunyadavpsm@gmail.com

ABSTRACT

Background: Sudden amplification of COVID-19 from pneumonia of unknown etiology to a pandemic has led to overwhelming demand for healthcare resources. Among the critical components of infection and prevention control (IPC) in hospital settings is the mandatory use of personal protective equipment (PPE) by health care workers (HCWs). This study aimed to assess the knowledge of the HCW's in the usage of appropriate disinfection procedures and PPE usage in each scenario as per MoHFW guidelines.
Methods: The study was a questionnaire-based cross-sectional study conducted in a COVID-19 hospital for one month from May 2020 to June 2020. The questionnaire was based on the MoHFW guidelines on disinfection and PPE usage and was pre-validated.
Results: Of the 146 HCWs who had responded, 50.7% were directly involved in patient care as frontline health care workers (FHCW), and the rest of 49.3% were non-frontline health care workers (NFHCW). 76.7% underwent training on PPE usage, 98 (67%) had training in disinfection procedures and PPE use. The knowledge of the HCWs, irrespective of them being frontline or non-frontline healthcare workers was lacking in certain areas.
Conclusions: As we understand more about the disease, more and more treatment protocols are developed, but the prevention of infection in HCWs depends on appropriate PPE usage and disinfection procedures.

Keywords: COVID 19, Disinfection, PPE, Healthcare workers

INTRODUCTION

A novel strain of coronavirus was found in December 2019 in Wuhan, China, Hubei province, with the first few cases being connected to a seafood and animal market in Wuhan.[1] Coronaviruses are a broad class of viruses that cause most of the common colds and several viral illnesses transmitted from animals to humans. They are so named due to their similar appearance under electron microscopy to the sun's corona during a total solar eclipse.[2] The virus responsible for the current outbreak was originally called novel coronavirus, now renamed SARS-CoV-2 since it is related to the SARS virus that caused an epidemic in China in 2002-2003 (postulated at that time to have originated in civet cats and then jumped to humans and the MERS coronavirus-related to transmission from camels). The infection is now called COVID-19 and within a few weeks, it became clear that COVID-19 infection was easily spread from person to person as there was an exponential rise in newly reported cases seen in China. Spread of the disease form China to other countries in the Asian and European continents gradually increased. Responding to which, the WHO to declare the disease as an epidemic a global health emergency on 30 January 2020.[3]

Sudden amplification of the disease from pneumonia of unknown etiology to a pandemic has led to overwhelming demand for healthcare resources. This, in turn, has given limited time to form new resources and strengthen the supply chain for the healthcare facilities for their requirements and priorities for facing the pandemic's challenges, especially for PPE and disinfection procedures. Interim guidelines have been given for disinfection procedures and usage of PPE by the Ministry of health and family welfare (MoHFW), Government of India.[4,5]

Among the critical components of IPC in hospital settings is the mandatory use of PPE by HCWs.[4,6] It is a physical barrier worn by HCWs prevents the spreading of a pathogen from either a suspected case or a pathological specimen, preventing the transmission from patient to HCWs and another way round. The components of PPE of are N95 respirators, face shields, googles hood cover and body suit or apron or surgical gown with boot covers/heavy duty rubber boots, in addition with disinfection activities and other IPC activities. Wang et al in their study reported that large-scale infections in HCWs in China, was due to a lack of adequate use of PPE.[7] Disinfection also plays an essential role in IPC activities. Without the right concentration of the right disinfectant, there are less chances of breaking in the infection chain. Basic knowledge of appropriate concentration and type of disinfectant is also required by HCWs during the pandemic scenario. Protecting HCWs is of paramount importance to any organization. Understanding HCW exposure to COVID-19 virus and how this translates into the risk of infection is critical for informing IPC recommendations. WHO has released several guidelines for the assessment of the same.[8] Based upon these guidelines and other supporting evidence, countries formulate their policies for the IPC activities and to break the transmission of diseases.

This study aimed to assess the knowledge of the HCWs in the usage of appropriate disinfection procedures and PPE usage in HCWs for a given scenario, as per the guidelines laid down by MoHFW.[5]

METHODS

The study was conducted in a COVID-19 hospital. It was a questionnaire-based cross-sectional study. It was conducted for one month, from May 20 to June 20. The study population consists of all HCWs working in COVID-19 hospital. These included specialists, postgraduation residents and medical officers.

A questionnaire was developed based upon the MoHFW guidelines for usage of PPE and disinfection procedure.[9] The questionnaire was pre-tested among 20 participants for content and comprehensiveness. The questionnaire was divided into three parts assessing the respondents' training, disinfection procedures and usage of PPE (Table 1).

Table 1: Summary of the questionnaire.

Sections	Questions	Area of knowledge assessed
Section -I	1-6	Professional qualification, area of work in covid patient care and training received.
Section-II	7-14	Assessing the knowledge on disinfection on various given scenarios.
Section-III	15-20	Assessing the knowledge on PPE usage.

The questionnaire was sent using google forms administered via email ids and whatsApp platforms. Voluntary participation was sought and electronic consent was requested. Logic checks were inbuilt so that only one person can fill the form from one email id. Acceptance to be part of the study was regarded as consent to the study. There were no exclusion criteria. A total of 160 HCW were sent this questionnaire and of which 146 responded and were included in the study.

The sample size was calculated under the following assumption; the expected proportion of having adequate knowledge as 75%, 95% confidence interval and absolute error of 10% of the expected proportion. The calculated sample size was 146. Hence, it was decided that 146 HCWs would be enrolled into the study.

Institutional ethics review committee (IEC) approval was given by institutional ethical committee vide their letter number IEC/2020 dated 5 May 2020.

Data were recorded in the google sheet and later downloaded in MS excel. The continuous variable was a variable described as mean and standard deviation and the categorical variables were described as numbers and percentages. The contingencies table was made and p value of <0.05 was taken as significant. The data was analyzed using StataCorp, 2019. Stata statistical software: release 16, college station, TX: StataCorp LLC.

RESULTS

A total of 146 (91.3%) HCWs out of 160 had responded. Of the total respondents, post-graduation residents were 69 (47.3%), medical officers 41 (27.7%), faculty 21 (14.4%) and 15 (10.3%) were other specialist staff. A total of 75 (51.4%) were directly involved in patient care as FHCW and the rest of 59 (40.4%) were NFHCW, while 12 (8.2%) were others. 103 (70.5%) underwent formal training on the usage of disinfectants in covid wards and clinics and 112 (76.7%) underwent training on

PPE usage. 98 (67%) had training in both disinfection procedures and usage of PPE.

135 (92.5%) of the HCWs have responded that the risk involved in treating non-COVID-19 infections and non-infectious patients with unknown history if COVID-19 infection depended upon the case-to-case scenario. 75 (51.4%) of the HCWs preferred using alcohol-based hand sanitizer as a better method of hand hygiene than soap and water for the caretaker or person accompanying confirmed COVID-19 case. 127 (87%) of the HCW considered that 1% (v/V) concentration of sodium hypochlorite solution was preferred over other concentrations.103 (71%) preferred cleaning high contact surfaces using 1% (v/V) concentration of sodium hypochlorite solution to lizol/phenyl solution or using alcohol-based disinfectants or soap and water solution. 102 (70%) preferred cleaning and disinfecting their BP instrument and cuff after recording the BP of a confirmed covid patient using 70% alcohol or spirit swab. 136 (93.2%) of the HCW preferred wiping the bell of their stethoscope with a spirit swab after every patient they examined. 134 (91.8%) preferred the usage of full components of PPE while treating a case of COVID-19 confirmed case in ICU settings.

Table 2: The distribution of the HCWs as per their training and place of work in COVID-19 care.

S. no.	Professional qualifications	FHCW (%)	NFHCW (%)	Others (%)	Trained in disinfection procedures (%)	Trained in usage of PPE (%)
1.	Medical officers	27 (65.8)	10 (24.3)	4 (9.9)	23 (22.3)	22 (19.6)
2.	PG resident or super specialty resident	27 (39.1)	35 (50.8)	7 (10.1)	55 (53.3)	65 (58)
3.	Faculty including clinical tutors	13 (61.9)	7 (33.3)	1 (4.8)	19 (18.4)	19 (16.9)
4.	Specialist staff at a hospital	7 (46.6)	5 (33.3)	3 (20)	6 (4)	6 (5.3)
5.	Sub total	74	60	12	103 (70.5)	112 (76.7)

Table 3: Distribution of correct responses among FHCW and NFHCW.

S. no.	Questions	FHCW (n=74) N (%)	NFHCW (n=72) N (%)	P value
1	Risk involved in treating infectious (non-COVID-19 infections) and non-infectious patients in non-COVID region of the hospital	71 (95)	65 (90)	0.18
2.	Preferred method of hand hygiene for caretaker (person accompanying) of patient admitting COVID-19 confirmed case	68 (91)	63 (85)	0.73.
3	Most preferred concentration of sodium hypochlorite used for disinfection	62 (83)	65 (90)	0.18
4	Preferred method of cleaning floor in flu OPD	73 (98.6)	69 (95)	0.15
5	High contact surfaces such as doorknobs desks chairs etc are to be preferably disinfected using	48 (64.8)	54 (75)	0.09.
6	Disinfection of stethoscope after examining every patient is to be done with 70% alcohol pad	69 (93.2)	67(93)	0.45
7	BP instrument and cuff after recording the BP of a case of COVID-19 patient is to be cleaned with	52 (70.2)	67 (93)	0.00
8	For disinfection of an ambulance after transporting a confirmed case of COVID -19, 1% sodium hypochlorite is used for corrosive substances	37 (50)	37 (51.3)	0.00
9	Disinfection of linen of COVID-19 confirmed case is disinfected with 1% hypochlorite for 20 minutes	57 (77)	64 (89)	0.03
10	Hand protection is preferred while examining COVID-19 positive case	53 (71.6)	64 (89)	0.00
11	Pre-powdered hand gloves more preferred in COVID -19 situation	46 (62.1)	49 (68)	0.23
12	Mouth and nose protection is preferred while transporting a dead body of COVID-19	65 (87.9)	49 (68)	0.00

Continued.

S. no.	Questions	FHCW (n=74) N (%)	NFHCW (n=72) N (%)	P value
	confirmed case			
13	Body protection is preferred while treating a COVID-19 confirmed case in ICU settings	16 (21.6)	62 (86.1)	0.00
14	Foot protection component is preferred while working in isolation rooms	60 (81)	29 (40.2)	0.00
15	Component of eye protection gear is preferred while examining SARI pts	60 (81)	58 (80.5)	0.46
16	Is hand hygiene important irrespective of PPE in COVID -19 situation	74 (100)	72 (100)	0.00
17	Head cover should be used while	54 (73)	57 (79)	0.2

127 (87%) of the HCW preferred using respirator masks as mouth and nose protection while transporting a dead body of a COVID-19 positive patient. At the same time, 8.9% preferred using a 3-ply surgical mask. Ambulance disinfection with 1% sodium hypochlorite was preferred after transportation of COVID-19 positive patient, even for the instruments and substances that can get corroded by the presence of chlorine in hypochlorite solution. Around 121 (82.9%) preferred hospital linen to be soaked in 1% sodium hypochlorite solution for 20 minutes followed by a detergent wash. 84.7% preferred using a face shield while examining a patient with SARI. 146 (100%) of the HCW prefer hand hygiene as an important part of clinical practice in COVID-19 scenario. 87 (59.6%) preferred wearing a head-cover while giving clinical are to confirmed case of COVID-19 disease and 58 (40.4%) preferred using head-cover all the time they are in COVID-19 ward.

FHCWs have similar knowledge about appropriate PPE, but the knowledge of disinfection was different in two groups. The summary of which is given in Table 3.

DISCUSSION

Knowledge and training in standard precautions, high-risk perception and longer duration of professional experience are associated with improved compliance with standard precautions among health workers.[10] Proper use of PPE and good adherence to IPC measures would decrease the risk of SARS-CoV-2 infection of HCWs caring for patients with COVID-19.[11]

Given the present scenario of COVID-19 disease being spread at the community level, the knowledge of the HCW's irrespective of them being FHCWs or NFHCWs was found to be lacking in certain areas.[6] It is recommended that the HCW's be trained and refreshed periodically through info-graphs/training capsules to use disinfectants and usage of PPE, even though it is not part of their professional work. The chances of infection amongst the HCWs through faulty disinfection practices or usage of inappropriate PPE for different scenario's in COVID-19 situation are high.[4]

Several studies done in the past, have shown that hospital acquired infectious are most common in HCWs. Liu et al in a study done in November 2009 showed that usage of appropriate PPE and disinfection procedures reduced the risk of SARS infection amongst health care workers in Beijing.[14] A cross-sectional survey done from 4 February to 8 February 2020 by Zhang et al involving a total of 1357 HCWs across ten hospitals in Henan, China showed that among all the HCWs surveyed, 89% of HCWs had sufficient knowledge of usage of precautions regarding COVID-19 disease. More than 85% feared self-infection with the virus and 89.7% followed correct practices against COVID-19 disease transmission.[12] In Netherlands, a hospital-based study done by Sikkema et al showed 96 (5%) of 1796 HCWs had tested positive for COVID-19 infection.[13]

Inadequate knowledge among HCWs and inadequate infection control practices and usage of PPE may lead to the increased risk of COVID-19 nosocomial transmission.[15] Effective IPC measures augmented with regular screening followed by skill-set based training with subsequent refresher courses for all cadres of HCWs can improve infection control practices in health facilities and reduce the risk of infections of COVID-19 among all categories of HCW.[15]

As we get to know more and more about the disease and its causative virus, better modalities would be in place for its treatment, till then the HCWs must rely upon the preventing the transmission of the disease, more so be safe as to not acquire the disease themselves. Measures must be taken to protect HCWs from risks linked to job category, work experience, working hours, educational attainment and frontline HCWs. Lai et al in their study have shown that with increase in the patient load there is an increase in the poor IPC activities shown by the HCWs.[16] This may be attributable to the stress faced due to the disease and many other factors related. Adequate training and refreshers courses on the usage of appropriate PPE usage, disinfection procedures would help the HCWs to be better prepared for facing the pandemic.[17]

All HCWs are being vaccinated on priority after the declaration of vaccination policy and availability of vaccines in India. However, even after vaccination the IPC practices and proper PPE practices need to be followed. The training and retraining of the HCWs in IPC and PPE are required.

This is a single centre questionnaire-based study, hence the generalisability of the study is limited. However, it showed the existing gap in knowledge. After the study was completed, the training of the HCWs was done according to the latest guidelines on IPC and PPE.

CONCLUSION

The prevention of infection in HCWs depends upon appropriate usage of PPE and disinfection procedures. Interim guidelines are given out by WHO and MoHFW, which need to be strictly adhered to and HCWs trained appropriately.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Bogoch II, Watts A, Thomas-Bachli A, Huber C, Kraemer MUG, Khan K. Pneumonia of unknown aetiology in Wuhan, China: potential for international spread via commercial air travel. J Travel Med. 2020;27(2).
2. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. J Autoimmun. 2020;109:102433.
3. WHO. Fact sheet: IHR Emergency Committee on Novel Coronavirus (2019-nCoV), 2020. Available at: https://www.who.int/dg/speeches/detail/who-director-general-s-statement-on-ihr-emergency-committee-on-novel-coronavirus-(2019-ncov). Accessed on 10 October 2020.
4. Ministry of Health and Family Welfare. Fact sheet: Guidelines on rational use of Personal Protective Equipment.pdf. Available at: https://www.mohfw.gov.in/pdf/GuidelinesonrationaluseofPersonalProtectiveEquipment.pdf. Accessed on 10 October 2020.
5. Ministry of Health and Family Welfare. Fact sheet: National guidelines for clean hospitals, 2015. Available at: https://main.mohfw.gov.in/sites/default/files/7660257301436254417_0.pdf. Accessed on 10 October 2020.
6. World Health Organisation. Rational use of personal protective equipment for coronavirus disease (COVID-19). Interim Guidance 19 March 2020. Accessed on 10 October 2020.
7. Wang J, Zhou M, Liu F. Reasons for healthcare workers becoming infected with novel coronavirus disease 2019 (COVID-19) in China. J Hosp Infect. 2020;105(1):100-1.
8. WHO. Fact sheet: Health workers exposure risk assessment and management in the context of COVID-19 virus, 2020. Available at: https://apps.who.int/iris/bitstream/handle/10665/331340/WHO-2019-nCov-HCW_risk_assessment-2020.1-eng.pdf. Accessed on 13 January 2021.
9. Google Docs. Fact sheet: Knowledge Attitude and Practices of Health Care Workers (HCW), regarding usage of PPE and basic Disinfection procedures. Available at: https://docs.google.com/forms/d/e/1FAIpQLScidKWhXy7U_ULqjtwVI0VDZstQ_g9J9p-5xkGbq_uifKE1UA/viewform?usp=drive_web&usp=embed_facebook. Accessed on 10 October 2020.
10. Kermode M, Jolley D, Langkham B, Thomas MS, Holmes W, Gifford SM. Compliance with Universal/Standard Precautions among health care workers in rural north India. Am J Infect Control. 2005;33(1):27-33.
11. Bielicki JA, Duval X, Gobat N, Goossens H, Koopmans M, Tacconelli E, et al. Monitoring approaches for health-care workers during the COVID-19 pandemic. Lancet Infect Dis. 2020;20(10):261-7.
12. Zhang M, Zhou M, Tang F, Wang Y, Nie H, Zhang L, et al. Knowledge, attitude, and practice regarding COVID-19 among healthcare workers in Henan, China. J Hosp Infect. 2020;105(2):183-7.
13. Sikkema RS, Pas SD, Nieuwenhuijse DF, O'Toole Á, Verweij JJ, Linden A, et al. COVID-19 in health-care workers in three hospitals in the south of the Netherlands: a cross-sectional study. Lancet Infect Dis. 2020;20(11):1273-80.
14. Liu W, Tang F, Fang LQ, Vlas SJD, Ma HJ, Zhou JP, et al. Risk factors for SARS infection among hospital healthcare workers in Beijing: a case control study. Trop Med Int Health. 2009;14(1):52-9.
15. Ayinde O, Usman AB, Aduroja P, Gbolahan A. A Cross-Sectional Study on Oyo State Health Care Workers Knowledge, Attitude and Practice Regarding Corona Virus Disease 2019 (COVID-19). Res Gate. 2020.
16. Lai X, Wang X, Yang Q, Xu X, Tang Y, Liu C, et al. Will healthcare workers improve infection prevention and control behaviors as COVID-19 risk emerges and increases, in China? Antimicrob Resist Infect Control. 2020;9(1):83.
17. Chan R, Molassiotis A, Eunice C, Virene C, Becky H, Chit-Ying L, et al. Nurses' knowledge of and compliance with universal precautions in an acute care hospital. Int J Nurs Stud. 2002;39(2):157-63.

Cite this article as: Ravi D, Anand V, Yadav AK. Knowledge of disinfection and personal protective equipment usage amongst health care workers in the COVID-19 scenario. Int J Community Med Public Health 2021;8:3003-7.