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Original Article

Measures Taken By Indian Hospitals toward Healthcare Worker and Workplace Safety during COVID-19 Pandemic

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Abstract

Background: Healthcare workers at hospital settings were increasingly vulnerable to the COVID-19 virus and it was therefore essential to ensure that steps were taken to reduce the risk of both nosocomial transmissions to patients under their care as well as to each other. The aim of this study was to analyze the effect of measures taken by various Indian hospitals, toward the safety of their healthcare workers during the pandemic. **Materials and Methods:** The data were collected as the part of a competition conducted among the interested healthcare organizations (HCOs) on measures taken by Indian hospitals toward healthcare worker and workplace safety during the COVID-19 pandemic. Information about the various health and safety measures undertaken was collected from 93 Indian hospitals, through a self-reported questionnaire, which were compiled and analyzed. **Results:** The HCOs demonstrated 100% compliance with providing adequate personal-protective equipment based on risk stratification and physical distancing precautions, with 94% of organizations redesigning their workflows, accordingly. They also showed 97% compliance to mandatory handwashing protocols and 99% compliance to thermal screening. However, only 52% provided psychological counseling for workers, 35% provided medical care for dependents, 31% undertook WASH (water, sanitation and hygiene) certifications, and 40% obtained feedback from staff for areas of improvement. Out of the 110,679 staff involved in clinical care among the 93 HCO, 6189 staff (6%) tested positive for COVID-19, being higher (13%) among staff working in the COVID-19 wards compared to 4% among those working in the non-COVID-19 wards. **Conclusion:** Healthcare workers are at a higher risk of exposure to SARS-CoV-2 infection and can also transmit infections to the community. The HCOs surveyed incorporated innovative solutions to tackle the threat of COVID-19, which demonstrated success with relatively low incidence of infections among the staff evaluated. This study highlights strengths and exposes weaknesses, which should be considered for disaster mitigation plans as an effective step toward future pandemic preparedness.

Keywords: COVID-19 pandemic, healthcare workers, hospital safety, safety precautions, workplace safety

Introduction

COVID-19 infection was identified among a cluster of patients at Wuhan, China in December 2019 and had spread all over the world, becoming a global pandemic that brought all industries to a halt and put a large burden on overwhelmed healthcare organizations (HCO). As of December 31, 2020, over 1 million cases were documented in India, with nearly 1.45% deaths.[1] The rapid spread of COVID-19 greatly impacted almost everyone, especially the healthcare delivery systems and healthcare workers (HCWs) who were at the forefront battling against the infection.

The HCWs faced various challenges while performing their duties such as increased risk of infection for self and close family members, long working hours with personal protective equipment (PPE), or days away from home, burnout, fatigue, psychological stress, anxiety, etc., In addition, widespread fear and misinformation on COVID-19 also induced sporadic violence against healthcare providers and ostracization by the society. Therefore, protection of HCWs from infection as well

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as looking after their physical and emotional wellbeing was critical to build resilience as they faced the insurmountable hurdles in dealing with COVID 19. However, despite all efforts to protect HCWs, some exposure is inevitable, which could have occurred at the hospital settings and/or in the community. Initial studies estimate that about 10%–20% of the frontline healthcare professionals could be infected with COVID-19 infection.[2] The highest among those are usually in the nursing homes followed by home care settings, in and outpatient settings.[3] India already had a scarcity of HCWs and the increasing infection rate among them could further deplete the existing resources.

In a bid to both protect and strengthen the healthcare workforce, organizations nationwide readily researched and implemented safety guidelines and alternative workflow solutions. Periodically, updated guidelines issued by different governmental agencies such as the *Ministry of Health and Family Welfare*,[4] *Indian Council of Medical Research* (ICMR),[5] and *National Center for Disease Control*[6] could be adopted, wherever feasible in different healthcare settings. Based on these guidelines, technological advancements as well as other innovative ideas, efforts were taken by various healthcare facilities to improve efficiency in the safe delivery of health care, pooling of resources, reduced workplace exposure, and provided planned care to those exposed.

Materials and Methods

The Consortium of Health Care Organization (CAHO), along with ENVIS resource partner, ICMR-NIOH, India and Global Society of HSE professionals (GSHP) conducted a national Level Competition on Measures Taken by Indian Hospitals toward healthcare worker and workplace safety during the COVID-19 pandemic during August 2020. A total of 93 Indian hospitals and 6 international hospitals (3 from Dubai and 1 each from Riyadh, Abu Dhabi, and Srilanka) participated in the competition. Information from hospitals on various healthcare safety measures instituted in their organization as they battled COVID-19 pandemic during the first wave of COVID-19 infections were collected. However, for this analysis, data from 93 Indian hospitals were collated and analyzed. Consent from the participating HCOs was obtained for reporting the cumulative data.

HCOs from Kerala represented the highest number (19) among the Indian hospitals from 13 different states across the country [Figure 1]. About 18 hospitals belonged to less than 100 bedded, 31, 27, and 17 hospitals belonged to the categories 100-300 bedded, 300-600 bedded, and more than 600 bedded hospitals category, respectively.

Results

All the HCOs based in India were assessed for the following cumulative safety preparedness and practice measures. Further, the individual safety preparedness and practice measures among the various categories of hospitals in absolute numbers are presented in Table 1. The relative loading of the cumulative measures is depicted in Figure 2.

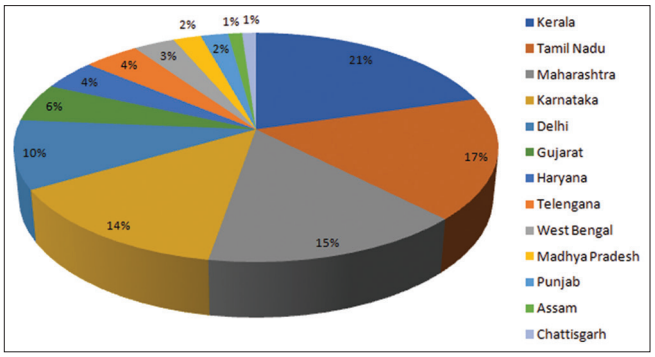

Figure 1: State wise distribution of participating HCO's from India. HCO's: Healthcare organizations

Discussion

The COVID-19 pandemic in 2020 exhibited the strengths of existing healthcare processes as well as the capacity of HCO to plan and pivot at a rapid rate to serve their patients safely, while protecting healthcare workers. However, it also served as a sobering reminder of the potential gaps in service delivery and taught many lessons in disaster preparedness for the evolved healthcare industry. Whether the next event is a natural disaster or other pandemic, healthcare services will have to face the challenges of sudden capacity adjustments, redesigning care, and redeployment of staff.

The analysis of the data from this multi-organizational study conducted by CAHO, the ENVIS resource partner, ICMR-NIOH and GSHP, India, has revealed many measures that were taken by the Indian HCO surveyed, in order to tackle various aspects of the pandemic, in addition to areas that showed scope for improvement. The efficacy of these measures was demonstrated by the prevalence of COVID-19 infection in the 6189 healthcare workers evaluated during the study, where 6% was positive on testing.

The HCOs also came up with innovative technological, process, and administrative changes to enhance worker safety and care delivery, some of which are discussed in detail.

Provision and utilization of personal-protective equipment

Adequate PPE based on risk stratification was seen uniformly in 100% of the HCOs surveyed (depicted in green). Early on, the WHO and the CDC stressed the importance of the appropriate use of PPE and described it as an effective and accessible measure within administrative, environmental, and engineering controls. The judicious use of PPE, especially the use of N95 masks was monitored across most organizations, with 97% of the HCOs establishing protocols for the suitable reuse of these masks if required.[7]

Enforcement of physical distancing recommendations

All international and national health regulatory and advisory

Table 1: Health care safety practices among various categories of Indian HCOs

	18	31	27	17	93	%
Categories of hospitals as per number of beds	<100	100-300	300-600	>600	Total	%
Provision and Utilization of PPE						
Adequate PPE based on Risk Stratification	18	31	27	17	93	100
Reuse of N95/Adequate N95	15	31	27	17	90	97
Enforcement of Physical Barriers/Partitions in cubicles						
Physical distancing barriers/partitions in cubicles	18	31	27	17	93	100
Online Meetings	13	30	27	11	81	87
Reduced staff count	9	14	14	5	42	45
Redesigned flow of patients/staff and workflow	14	31	26	16	87	94
Thermal Screening						
Thermal Screening	17	31	27	17	92	99
Trainings						
Regular Training	16	31	27	17	91	98
Communication						
Posters on awareness of COVID-19	15	31	26	12	84	90
Regular Announcements/Circulars about covid preparedness	13	31	27	14	85	91
Staff wellbeing						
Salaries on time	8	15	11	5	39	42
Medical Care for staff turning positive	15	31	22	13	81	87
Medical care of dependants	7	12	10	4	33	35
Quarantine facility for staff	13	29	24	13	79	85
Feedback from staff working in COVID areas for improvement	7	13	11	6	37	40
Transport facility for staff by hospital	10	28	22	15	75	81
Psychological counselling for workers	9	17	16	6	48	52
Food/refreshments for staff managing Covid	12	31	25	14	82	88
Handwashing and Sanitation						
Mandatory Hand washing protocols	17	31	27	15	90	97
Hourly cleaning of all surfaces	10	14	17	7	48	52
Shower facilities	11	29	21	12	73	78
Scrub suits and cleaning	9	18	17	7	51	55
Certification like WASH	6	10	9	4	29	31
Prophylaxis						
Prophylaxis	7	13	13	4	37	40
Administrative Oversight						
Engineering controls in OT/ICU	10	15	18	10	53	57
Internal audits/Monitoring/Compliance check	8	17	17	10	52	56
COVID task force	9	16	18	6	49	53

100%, 41 - 69%, 70-99%, <40%

bodies also emphasized the need for physical distancing with barriers or partitions in cubicles, until vaccines and explicit treatment options were made available for the treatment of COVID-19 disease. The Center for Disease Control and Prevention (CDC) stated that close contact was considered as less than 6 feet away for over 15 min.[8] This proved challenging in the healthcare setting, considering that nearly all clinical interactions that occur within hospital teams, as well as between caregivers and patients involved close contact. However, various strategies were implemented to reduce nosocomial transmission of infection.[9]

Compliance to physical distancing mandates was 100% among the HCOs surveyed with 87% of them moving to online meetings and debriefings, while 45% reduced their staff count, carefully regulating the number of people per shift to decrease the chances of transmission. About 94% of the organizations redesigned their workflows to allow for segregated patient and staff movement within the facilities.

Thermal screening

Thermal screening was conducted in 99% of the HCOs, which helped them to monitor the health of incoming staff and patients. This was critical in reducing the chances of transmission in the HCOs, although its efficacy was not conclusive considering that temperature screening by itself was a transient parameter that could only identify fever at the time of scanning only. It could potentially miss those who were infected but asymptomatic at that point of time.

A study by Hsiao *et al*.[10] stated that almost all hospitals in Taiwan followed the recommendations for contactless

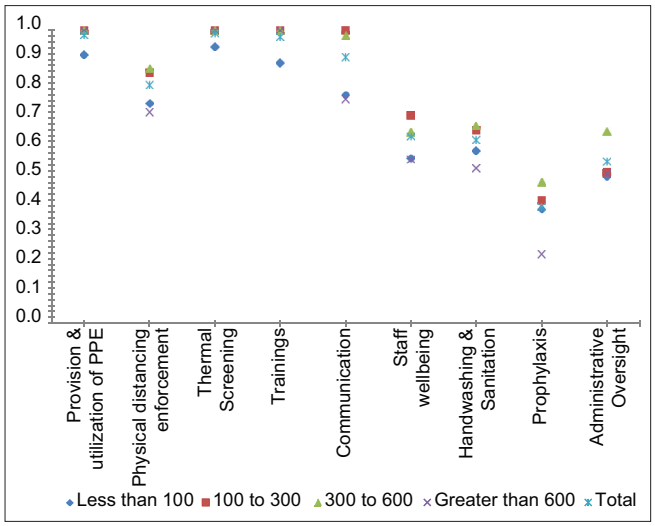

Figure 2: Cumulative relative loading of health care safety practices

temperature monitoring at hospital entries, where febrile patients were sent to the emergency department for evaluation. In response to the unknown efficacy of monitoring due to various factors, they recommended a second temperature check inside the hospital, after the patients' or visitors' body temperature was acclimatized to the indoor environment.

Trainings

Trainings were conducted in 98% of the HCOs. Even though they were predominantly conducted online, it proved to be useful in establishing and strengthening standardized practices. In addition, upskill training programs helped the healthcare professionals to work outside their current roles, as they adapted to the changing job profiles and responsibilities.

Study material was available from courses provided by international organizations, like the online learning platform OpenWHO.org,[11] or modules provided by the Technical and Vocational Education and Training, UNESCO New Delhi,[12] in order to upskill nursing and healthcare professionals in India, treating COVID-19 patients.

In addition, the Indian government launched a training module for the management of COVID-19 named the iGOT platform[13] (Integrated Govt. Online training) portal on Ministry's DIKSHA website (Digital Infrastructure Knowledge Sharing) to train all frontline healthcare workers and first responders.

Communication

Information about COVID-19 was developing and changing at a rapid pace during the pandemic, and it could be hard to keep track of the changing procedures or regulations. In order to keep the staff, as well as patients and relatives updated about these changes, 90% of the organizations disseminated information through awareness posters displayed at their facilities, while 91% gave regular announcements or circulars about COVID-19 preparedness.

The Centres for Disease Control (CDC) developed a Crisis and Emergency Risk Communication (CERC).[14] framework that required feedback from healthcare workers who benefitted from communications made by their organizations. A study conducted in Singapore,[15] used the CERC survey to evaluate the effectiveness of the communication healthcare providers received from authorities, which in turn helped them to plan for future emergencies. In this survey, 92.5% of respondents stated that accurate, concise, and timely information helped to keep them safe.

Staff wellbeing

The unexpected intensive work during the pandemic drained most health-care providers physically and emotionally, but caring for caregivers was evidenced in most of the HCO. Nearly nine-tenth of the HCOs offered coverage of medical care if staff were diagnosed with COVID-19, while around two-fifth of the institutes extended the medical care to staff dependents as well.

A meta-analysis conducted by Salari *et al*.[16] discovered that 24.3% of healthcare workers involved in patient care during the pandemic exhibited signs of depression, while 25.8% reported anxiety and 45% experienced stress. The prevalence of mental health effects on healthcare professionals indicates a pressing requirement for policy-makers to provide support in this area. In the current study, 52% of the institutes provided psychological counseling to the healthcare professionals who needed it.

Food, beverages, and quarantine facilities were provided to those working in COVID areas, by 88% and 85% of HCOs, respectively. About 90% of the facilities provided transportation considering the mandated lockdown of all public transportation. However, only 42% of the organizations were able to pay salaries on time, and only 40% took feedback from staff regarding areas of improvement in the COVID areas.

Frequent information and feedback sessions with local managers and the broader facility community, complemented by clear, concise, and measured communication, have been known to help teams stay focused on care and secure in their roles.

Handwashing and sanitation

Handwashing protocols were made mandatory by 97% of the organizations and 78% of them offered shower facilities. However, only 52% of the organizations enforced hourly surface cleaning instructions, while 55% provided scrub suits. The adoption rate for WASH certification programs in the organizations was the lowest ranking parameter at 31%. An online learning platform developed to arm professionals with the knowledge and tools they need to create lasting water, sanitation, and hygiene (WASH) services,[17] the certification is a credible initiative, especially during a pandemic. This again, may be considered as part of organizational preparedness for the future. However, considering the pattern of spread of COVID-19, mandatory handwashing protocols should have been followed by 100% of the HCOs.

Prophylaxis

The most commonly used prophylactic medication was hydroxychloroquine, an antimalarial drug which inhibits the viral entry into the cell membrane and decreases the viral duration of SARS COV 2. Although a few studies[18] showed that maintenance doses of hydroxychloroquine were associated with a significantly lower risk of COVID-19, it carries the risks of adverse drug reactions as well as unsure complete protection. Guidelines did not emphasis the use of prophylaxis, as a result only 40% of the HCOs provided it to their employees.

Administrative oversight

Considering the continuously changing scenario, it is not surprising that internal audits, monitoring or compliance checks as well as engineering controls in the OT and ICU facilities were not as robust, showing only a 57% and 56% occurrence rate, respectively.

In addition, only 53% of the organizations had a committed COVID task force, which is something to consider in the future, while making disaster mitigation policies for hospitals.

Evaluating the prevalence of COVID-19 infections in the healthcare organizations surveyed

Comparison of COVID resource allocation across the healthcare organizations

A total no of 10186 (28%) of the beds were allocated for COVID care among the 36384 beds of the 93 HCOs analyzed and about 18918 (17%) of the staff were deployed in COVID-19 wards [Figure 3].

Incidence of COVID infections among staff deployed in the healthcare organizations

In the current study, out of the 110679 staff involved in clinical care among the 93 HCO 6189 staff (6%) tested positive for COVID, being higher (13%) among staff working in the COVID wards compared to 4% among those working in the Non COVID wards. COVID positive was the highest among >600 bedded hospital category (18%) and the least infected among the <100 category of staff in the non-COVID wards (3%).

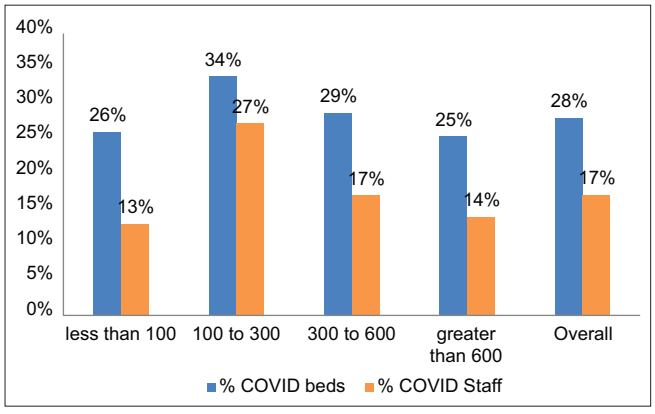

Figure 3: Average COVID resource allocation across hospital size

Strengths and limitations of the study

The information collected was unique in the large number of hospitals and healthcare providers, especially during uncertain times, in a climate of frequent changes to guidelines for both prevention and treatment. While it is an insightful snapshot of the current status, it could benefit from a follow-up study to determine if areas that required attention were dealt with in the participating organizations.

Interpretation within the context of wider literature

Comparative data were obtained from a meta-analysis of 97 studies including 230,938 healthcare workers, conducted by Gomez Ocha *et al*.[19] throughout the pandemic. This revealed that the estimated prevalence of SARS-CoV-2 infection was 11% using RT-PCR, and 7% using the presence of antibodies. The incidence of infection ranged from 0.4% among 498 Spanish as opposed to 57.06% American health care workers, with a pooled average prevalence of 10%. Nurses who spent more time with close patient care were the most affected (48%), followed by physicians (25%) and other HCWs. Most of the personnel positive for SARS-CoV-2 were working in hospital non-emergency wards followed by the operating rooms and surgery services. The pooled prevalence of health-care workers with COVID-19 diagnosed by RT-PCR who did not show symptoms at time of diagnosis was 40%, 5% of the HCWs presented with serious illness and 0.5% of the infected HCWs died of complications of the disease.

Implications for policy, practice, and research

There were many new and creative initiatives identified by the HCOs, which were simple yet very profound that made their healthcare facility safe, detailed in Table 2.

While telemedicine was introduced in India in 2001, its applications were not widespread and adoption rates were low. Tele-consultations increased in scope only during the COVID-19 pandemic, when its scope for delivering value-based healthcare, while keeping both patients and doctors safe, was realised. The Board of Governors of Medical Council of India (MCI) introduced the "Telemedicine Practice Guidelines"[20] which include both the overarching principles and a practical framework of telemedicine. In addition, an amendment to the Indian Medical Council (Professional Conduct, Etiquette, and Ethics) Regulations, 2002 and has been approved by the Ministry of Health and Family Welfare, Government of India officially on March 25, 2020.

Another breakthrough in the implementation of technology to circumvent social distancing mandates while delivering care to patients was the introduction of the Sevili robot, which was manufactured and scaled by the Center for Automation and Robotics, Hindustan Institute of Technology and Science, Chennai, India. 'Sevili' is a Tamil word which means 'Caretaker', and it truly lived up to its name as the robot could navigate isolation wards to deliver medication, food and other necessities to the patient bedside, while sparing healthcare workers the interaction, relieving them to address other pressing tasks.[21]

Table 2: Initiatives identified by various healthcare organizations to improve safety in their facilities

Parameter	Technological change	Process change	Administrative change
Physical distancing	Sevilli robot teleconsultations Video laryngoscope Bluetooth stethoscope wireless uninterrupted communication Bedside documentation of vitals on HIS Smart thermal surveillance	Swab collecting kiosk with two sided mikes for communication Home delivery by medicine on wheels Dedicated equipment - Blood gas X-ray or ultrasound, laryngoscope Switch to electronic medical records with central ICU monitoring	Restricting representatives, relatives and visitors for patients All meetings online
Sanitation and PPE	UV chamber Pedal operated hand rub dispenser CCTV surveillance on adherence to PPE use	Ensure buddy/observation during PPE use misting as part of enhanced environmental cleaning Steel decontamination box for safe recycling of reusables	Making their own PPEs to reduce overhead costs
Staff well-being	Serenity app for psychological counselling; health scan; Sensei app, Amar app, staff hotline for support	Staff risk score for staff and provide them with colour codes (change in uniform colour for easy identification)	Fitness OPD for staff SUN course "Zero tolerance" for workplace violence and a blame-free environment for reporting of positivity "Lean on me" - Psychological support
New initiatives	Awareness videos on social media Electronic notice board	Early mitigation program 3Es Six stage ultra-safety program Skip the "Q" for vulnerable Mock drill in COVID wards	COVID war room/COVID control room

SUN: Specialized upskilling nursing, ICU: Intensive care unit, UV: Ultraviolet, OPD: Out-patient department's, PPE: Personal protective equipment, HIS: Hospital information system

Conclusion

Healthcare workers are at a higher risk of exposure to SARS-CoV-2 infection and significant proportion of those infected could be asymptomatic carriers who can transmit infection in the healthcare facility, family members, and community. Hence, it was imperative to introduce measures that protected both staff and patients from potential nosocomial transmission. Taking stock of the initiatives made as well as the lacunae in resources or processes, paves the path ahead for more robust disaster preparedness in the Indian healthcare industry, armed with digital health technologies, administrative support, effective leadership, trustworthy communication and a renewed appreciation for the mental and physical well-being of its healthcare workers.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. India Coronavirus: 11,473,946 Cases and 159,249 Deaths – Worldometer Worldometers.info; 2021. Available from: https://www.worldometers.info/coronavirus/country/india//. [Last accessed on 2021 Mar 17].
2. Burrer S, de Perio M, Hughes M, Kuhar D, Luckhaupt S, McDaniel C, *et al*. Characteristics of health care personnel with COVID-19 – United States, February 12-April 9, 2020. Morb Mortal Wkly Rep 2020;69:477-81.
3. Nguyen LH, Drew DA, Graham MS, Joshi AD, Guo CG, Ma W, *et al*. Risk of COVID-19 among front-line health-care workers and the general community: A prospective cohort study. Lancet Public Health 2020;5:e475-83.
4. Home | Ministry of Health and Family Welfare | GOI. Mohfw.gov.in; 2021. Available from: https://www.mohfw.gov.in/pdf/. [Last accessed on 2021 Mar 17].
5. Delhi I. Indian Council of Medical Research, New Delhi. Icmr.gov.in; 2021. Available from: https://www.icmr.gov.in/. [Last accessed on 2021 Mar 17].
6. India M. COVID19 India. National Centre for Disease Control (NCDC). Ncdc.gov.in; 2021. Available from: https://www.ncdc.gov.in/. [Last accessed on 2021 Mar 17].
7. Rational use of Personal Protective Equipment for Coronavirus Disease (COVID-19) and Considerations during Severe Shortages. Who.int; 2021. Available from: https://www.who.int/publications/i/item/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(COVID-19)-and-considerations-during-severe-shortages. [Last accessed on 2021 Mar 17].
8. Healthcare Workers. Centers for Disease Control and Prevention. 2021 Available from: https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-risk-assesment-hcp.html. [Last accessed on 2021 Mar 17].
9. Arora VM, Chivu M, Schram A, Meltzer D. Implementing physical distancing in the hospital: A key strategy to prevent nosocomial transmission of COVID-19. J Hosp Med 2020;15:290-1.
10. Hsiao SH, Chen TC, Chien HC, Yang CJ, Chen YH. Measurement of body temperature to prevent pandemic COVID-19 in hospitals in Taiwan: Repeated measurement is necessary. J Hosp Infect 2020;105:360-1.
11. Online Training as a Weapon to Fight the New Coronavirus. Who.int; 2021. Available from: https://www.who.int/news/item/07-02-2020-online-training-as-a-weapon-to-fight-the-new-coronavirus. [Last accessed on 2021 Mar 17].
12. Free Online Course for Healthcare Workers to Fight COVID-19. UNESCO; 2021. Available from: https://en.unesco.org/news/free-online-course-healthcare-workers-fight-COVID-19. [Last accessed on 2021 Mar 17].
13. Government of India Launches a Training Module for Management of COVID-19 named 'Integrated Government Online training' (iGOT) portal on DIKSHA platform of MHRD. Pib.gov.in; 2021. Available from: https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1612437. [Last accessed on 2021 Mar 17].
14. Crisis & Emergency Risk Communication (CERC)|CDC [Internet]. Emergency.cdc.gov. 2021. Available from: https://emergency.cdc.gov/

cerc/ [Last accessed on 2021 Mar 17].
15. Ow Yong L, Xin X, Wee J, Poopalalingam R, Kwek K, Thumboo J. Perception survey of crisis and emergency risk communication in an acute hospital in the management of COVID 19 pandemic in Singapore. BMC Public Health. 2020;20.
16. Salari N, Khazaie H, Hosseinian-Far A, Khaledi-Paveh B, Kazeminia M, Mohammadi M, *et al*. The prevalence of stress, anxiety and depression within front-line healthcare workers caring for COVID-19 patients: A systematic review and meta-regression. Hum Resour Health 2020;18:100.
17. WASH Systems Academy. IRC. Available from: https://www.ircwash.org/wash-systems-academy. [Last accessed on 2021 Mar 18].
18. Singh H, Chauhan P, Kakkar AK. Hydroxychloroquine for the treatment and prophylaxis of COVID-19: The journey so far and the road ahead. Eur J Pharmacol 2021;890:173717.
19. Gómez-Ochoa SA, Franco OH, Rojas LZ, Raguindin PF, Roa-Díaz ZM, Wyssmann BM, *et al*. COVID-19 in health-care workers: A living systematic review and meta-analysis of prevalence, risk factors, clinical characteristics, and outcomes. Am J Epidemiol 2021;190:161-75.
20. Agarwal N, Jain P, Pathak R, Gupta R. Telemedicine in India: A tool for transforming health care in the era of COVID-19 pandemic. J Educ Health Promot 2020;9:190.
21. SEVILI – CARING THE CARE TAKERS OF COVID -19, ROBOT DEVELOPED BY HITS Hindustan Institute of Technology and Science. Top 10 Deemed Universities in Chennai. Available from: https://hindustanuniv.ac.in/events/SEVILI-CARING-THE-CARE-TAKERS-OF-COVID-19-ROBOT-DEVELOPED-BY-HITS. [Last accessed on 2021 Mar 18].