

# Novel COVID-19 Pandemic: A Cross-Sectional Survey among Global Health Care Providers

**Nazish Jaffar** (1)  
**Amna Khan** (2)  
**Kiran Abbas** (3)  
**Aliya Jafri** (4)  
**Sarmad Jamal Siddiqui** (5)  
**Vinita Kumari** (6)

(1) Assistant Professor, Pathology Department, Sindh Medical College, Jinnah Sindh Medical University  
 (2) Fourth Year MBBS students, Sindh Medical College, Jinnah Sindh Medical University  
 (3) House Officer, Jinnah Postgraduate medical center  
 (4) Assistant Professor, Biochemistry Department, Sindh Medical College, Jinnah Sindh Medical University  
 (5) Assistant Professor, Faculty of community medicine and public health sciences, Shaheed Mohtarma Benazir Bhutto Medical University Larkana.  
 (6) Lecturer, Pathology Department, Sindh Medical College, Jinnah Sindh Medical University

## Corresponding author:

Amna Khan  
 Sindh Medical College, Jinnah Sindh Medical University  
 Pakistan  
 Cell: +92 3035167967  
 Email: amnasajidkhan@gmail.com

Received: November 2020; Accepted: December 2020; Published: January 1, 2021.

Citation: Nazish Jaffar et al. Novel COVID-19 Pandemic: A Cross-Sectional Survey among Global Health Care Providers. World Family Medicine. 2020; 19(1): 110-118 DOI: 10.5742/MEWFM.2021.93956

## Abstract

**Background:** Covid-19, a highly infectious disease was first reported in Wuhan, China on 31 December, 2019. It was declared a pandemic by World Health Organization on 11 March, 2020 when 118,326 cases were reported globally.

The present study was designed to determine the knowledge, practices, availability of personal protective equipment to health care providers and hindrance to delivering health care facilities during the COVID-19 pandemic.

**Methods:** A descriptive cross sectional study was conducted with 217 health care workers serving in different hospitals/departments across the globe. Sample size was calculated by using Open EPI software and data was analysed by using SPSS version 22.0.

**Results:** Knowledge of many 152(73.4%) participants regarding guidelines for isolation of suspected cases and recommendations for wearing a mask in a community setting was not satisfactory. About 51(24.63%) did not receive any

personal protective equipment. Inadequate provision of personal protective equipment was reported by 78(37.7%) participants as the most common factor that might impede their willingness to work during the COVID-19 pandemic. About half, 98(47.3%) of the participants admitted that they are not well prepared/trained in handling COVID-19 cases. PCR was correctly reported as diagnostic test for SARS CoV-2 by 136(65.7%) respondents.

**Conclusions:** Our study recorded lack of knowledge about newly emerged COVID-19 pandemic among health care workers. Shortage of ventilators, testing kits and personal protective equipment was noted in many hospitals and departments. Lack of personal protective equipment and insufficient training in infection control management may act as barriers in delivering health care during COVID-19.

**Key words:** COVID-19, Healthcare personnel, practice, knowledge, barriers, pandemic, global.

## Introduction

Corona virus infectious disease is caused by severe acute respiratory syndrome corona virus type-2 (SARS CoV-2), which belongs to the family coronaviridae [1-3]. The disease was first reported in Wuhan, Hubei province of China in December 2019 which then spread rapidly throughout the country in merely 30 days [4, 5].

It is a highly infectious disease with an incubation period ranging from 2-14 days [6]. It is estimated that the number of individuals infected with the virus doubles every 6-7 days [7].

It is suspected that bats serve as the main animal reservoir of SARS CoV-2 [8]. Old age, male gender, and underlying co-morbidities such as hypertension, diabetes mellitus, chronic obstructive pulmonary diseases, liver diseases and renal diseases serve as important risk factors [3].

Patients infected with SARS CoV-2 commonly present with fever, cough, myalgia, fatigue and shortness of breath. Anorexia, sore throat, sputum production, headache, diarrhoea and haemoptysis are reported as less commonly occurring symptoms [9]. Frequent hand washing with soap and water, use of alcohol based sanitizers, avoiding public gatherings and maintaining good respiratory hygiene are some important preventive measures. People with respiratory symptoms (coughing sneezing shortness of breath) and travel history should wear a mask also [10-11].

Adequate supply of ventilators and testing kits is required for the diagnosis and treatment of the patients. However, hospitals around the world are already reporting shortage of personal protective equipment and ventilators [12]. Lack of provision of protective gear will cause deteriorating effects on our health care providers who are playing an important role in prevention and management of COVID-19 pandemic. Up to date knowledge regarding the disease, adequate provision of personal protective equipment and sufficient training in infection control management thus serve as an important factor in identifying the cases and treating them. Hence, the present study was aimed to determine the knowledge and practices of health care workers, availability of personal protective equipment and hindrance to delivering health care during the COVID-19 pandemic.

## Materials and Methods

A descriptive cross sectional study was conducted during March, 2020 with a total of 217 health care workers working across the globe. Ethical approval was obtained from the institutional review board of Jinnah Sindh Medical University (JSMU/IRB/2020/-359) and informed consent was acquired before data collection. All the consenting doctors, house officers, residents, physicians, surgeons, paramedics, nurses, medical students, pathologists, virologists, and laboratory technicians practicing across the globe were included in our study.

Dentists, physiotherapists, psychologists and those who were not practicing medicine were excluded. Data was collected through a self-administered online questionnaire designed by using software online google forms [13] as it was difficult to approach all health care providers physically due to lockdown. Participants were selected by using non-probability convenient sampling technique. The questionnaire was prepared after extensive literature review from Google Scholar and consisted of three parts. The first section included socio-demographic data, location and workplace information. The second segment enquired about the knowledge and practices of the participants regarding coronavirus infection and the third section investigated the experience of health care workers related to patient exposure and protective equipment. Doctors, nurses, paramedics, laboratory personnel, general physicians, surgeons, consultants and technicians were invited to participate in a survey via posting an online questionnaire on different social media platforms including Facebook, email and Whatsapp. Sample size was obtained by using Open EPI software ([www.openepi.com/Menu/OE\\_Menu.htm](http://www.openepi.com/Menu/OE_Menu.htm)). Keeping confidence interval of 95% (Z score=1.96) 83% [14] as prevalence from previous study and 5% allowable error of known prevalence, sample size obtained was n=217

Data was analysed by using SPSS version 22.0. Descriptive statistics were used to determine mean and standard deviation for numerical variables. Categorical variables were expressed in frequency and percentages.

## Results

A total of 217 health care workers working across the globe were included in the current study. More than one-half of the participants were females. The age range was 20-30 years. Mean age with standard deviation was 2.48±0.78. More than half of the participants belonged to different provinces of Pakistan. About 137 (63.1%) participants were Doctors, house officers and residents practicing in government hospitals 155 (71.4%) for 1-5 years. (Table 1)

Only 74 (34.1%) correctly identified the name of virus causing COVID-19 whereas bat was reported as animal reservoir of the SARS CoV-2 by most 167 (76.9%) of the respondents. Fever, cough, dyspnoea and myalgia were reported as the most common symptoms by 108 (49.7%) participants. Knowledge of most 162(74.6%) of the respondents regarding patient isolation and recommendations for wearing surgical mask was not satisfactory according to WHO guidelines (Table 2).

Gloves and surgical masks were reported as the most common protective equipment supplied to health care providers (Figure 1). Visitors' restriction in hospitals was the most common infection control measure taken in 46(22.2%) hospitals. More than half 131(60.3%) of the participants reported that their hospital/department is not well prepared for the COVID-19 pandemic and inadequate provision of personal protective equipment might impede their willingness to serve during the pandemic (Table 3).

**Table 1: Distribution of socio-demographic data and workplace information:**

| Variables:                             |  | N (%):                   | Mean ± STD deviation: |
|--|--|--------------------------|-----------------------|
| City/country/state/country:            | National:  | Pakistan:                | 29(14)                |
|  | Provincial:                                      | Sindh:                   | 53(25.6)              |
|  |  | Punjab:                  | 95(43.7)              |
|  |  | Khyber Pakhtunkhwa:      | 18(8.7)               |
|  |  | Baluchistan:             | 3(1.4)                |
|  |  | Azad Jammu and Kashmir:  | 3(1.4)                |
|  | Global:  | United states of America | 2(0.9)                |
|  |  | United Kingdom           | 3(1.44)               |
|  |  | Hong Kong:               | 1(0.48)               |
|  |  | Algeria:                 | 1(0.48)               |
|  |  | Saudi Arabia:            | 3(1.44)               |
|  |  | India:                   | 2(0.9)                |
|  |  | Malaysia:                | 1(0.48)               |
|  |  | Dubai                    | 1(0.48)               |
| Srilanka:                              | 1(0.48)  |                          |                       |
| Bangladesh                             | 1(0.48)  |                          |                       |
| Gender:                                | Male:  | 96(46.4)                 |                       |
|  | Female:  | 121(58.4)                |                       |
| Age in Years:                          | <20  | 2(1.0)                   | (2.48±0.78)           |
|  | 20-30  | 144(66.3)                |                       |
|  | 31-40  | 44(21.3)                 |                       |
|  | 41-50  | 23(11.1)                 |                       |
|  | >50  | 4(1.9)                   |                       |
| Profession/ Health care work category: | Doctor/house officer/resident:                   | 137(63.1)                |                       |
|  | General physician/surgeon/consultant:            | 33(15.9)                 |                       |
|  | Pathologist/virologist/laboratory director/:     | 5(2.4)                   |                       |
|  | Nurse:   | 12(5.8)                  |                       |
|  | Paramedic:                                       | 11(5.3)                  |                       |
|  | Laboratory personnel/technologist:               | 6(2.9)                   |                       |
|  | Medical student:                                 | 5(2.4)                   |                       |
|  | Other:   | 8(3.9)                   |                       |
| Workplace:                             | Government hospital/public sector hospital:      | 155(71.4)                |                       |
|  | Private hospital/tertiary care unit:             | 30(14.5)                 |                       |
|  | University hospital/laboratory:                  | 10(4.8)                  |                       |
|  | Private hospital (small scale)                   | 7(3.4)                   |                       |
|  | Temporary build isolation centre/field hospital: | 4(1.9)                   |                       |
|  | Private clinic:                                  | 7(3.4)                   |                       |
|  | Paediatric unit:                                 | 3(1.4)                   |                       |
|  | Diagnostic lab:                                  | 1(0.5)                   |                       |
| Professional experience in years:      | <1   | 47(22.7)                 |                       |
|  | 1-5  | 100(46.0)                |                       |
|  | >5   | 70(33.8)                 |                       |

**Table 1: Distribution of socio-demographic data and workplace information: (continued)**

|  |                |           |
|--|----------------|-----------|
| Approximate number of suspected coronavirus infected cases brought to your setup on daily basis: | >100           | 6(2.9)    |
|  | 76-100         | 3(1.4)    |
|  | 51-75          | 5(2.4)    |
|  | 26-50          | 17(8.2)   |
|  | 1-25           | 186(85.7) |
| Facility of ventilator at hospital:  |                | 142(65.4) |
| Number of patients currently on a ventilator due to coronavirus infection at your workplace?     | >10            | 10(4.8)   |
|  | 6-10           | 7(3.4)    |
|  | 1-5            | 24(11.6)  |
|  | None           | 126(58.0) |
|  | Not applicable | 50(24.2)  |

**Figure 1: Basic personal protective equipment supplied to the participants by department or hospital N (%)**

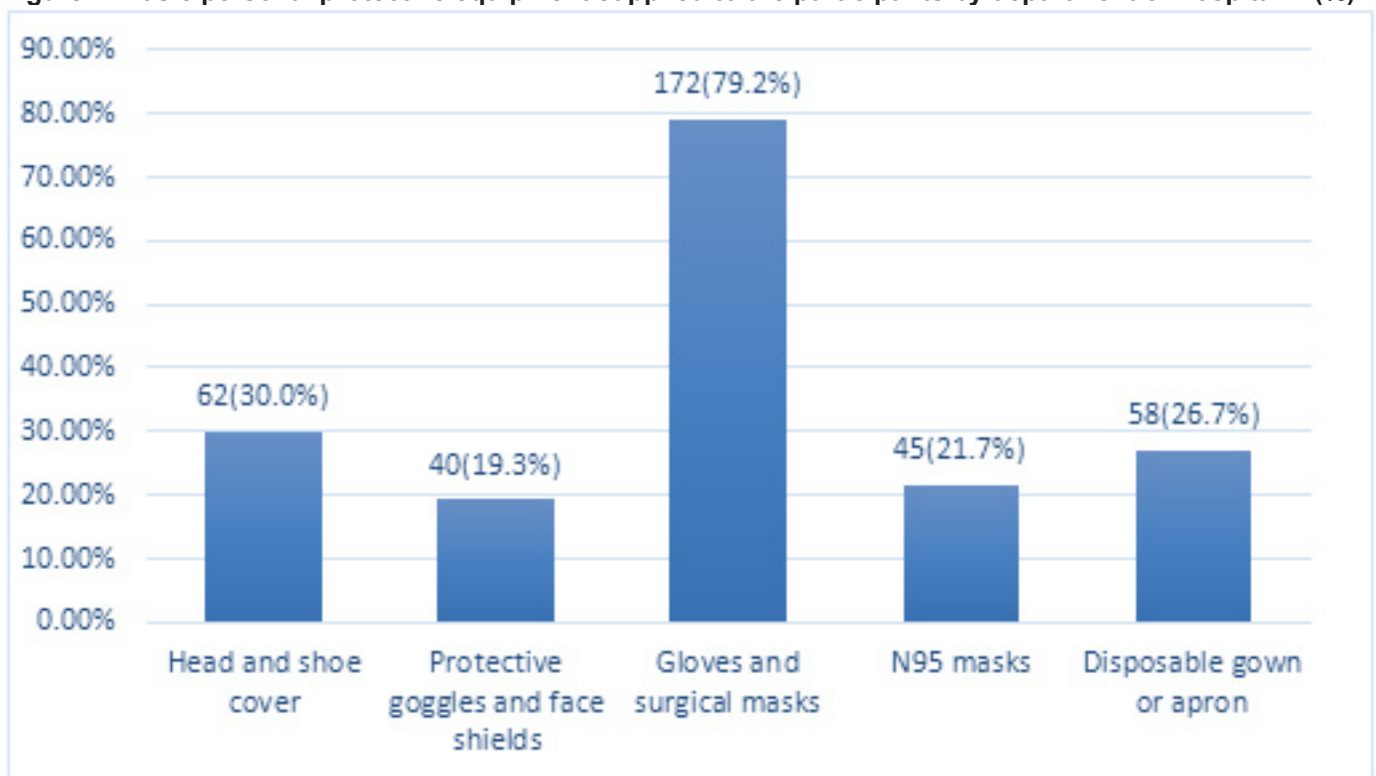


Table 2 Knowledge of participants related to COVID-19:

| Variables:  |  | N (%)      |
|---|--|------------|
| All suspected cases can be placed together in the same ward when single well-ventilated rooms are not available | Strongly agree                                 | 4(1.9)     |
|   | Agree  | 51(24.6)   |
|   | Disagree                                       | 162(74.6)  |
| Wearing a surgical mask is not mandatory in community settings if one does not have respiratory symptoms        | Strongly agree                                 | 13(6.3)    |
|   | Agree  | 51(24.6)   |
|   | Disagree                                       | 153(70.5)  |
| Screening of airline passengers on exit from an affected area and upon arrival can miss 50% cases of COVID-19   | Strongly agree                                 | 68(32.9)   |
|   | Agree  | 128(58.9)  |
|   | Disagree                                       | 20(9.7)    |
| Main reservoir of COVID-19 causing virus  | Camels   | 7(3.4)     |
|   | Bats   | 167(76.9)  |
|   | Sheep  | 2(1.0)     |
|   | All of them                                    | 25(12.1)   |
|   | None of them                                   | 16(7.7)    |
| Incubation period of SARS CoV-2   | 1-5 days                                       | 6(2.9)     |
|   | 1-14 days                                      | 130(59.9)  |
|   | 2-21 days                                      | 79(38.2)   |
| Mode of transmission of SARS CoV-2  | Aerosol droplets                               | 16(7.7)    |
|   | Person to person contact                       | 9(4.3)     |
|   | Air borne transmission                         | 8(3.9)     |
|   | Both aerosol and person to person transmission | 83(38.2)   |
|   | All of them                                    | 101(48.79) |
| Infection by coronavirus provide lifelong immunity  | Yes  | 39(18.8)   |
|   | No   | 65(31.4)   |
|   | Don't know                                     | 113(52.0)  |
| Source of knowledge about novel COVID-19  | Internet, colleagues, social media             | 13(6.3)    |
|   | Internet websites                              | 49(23.7)   |
|   | Colleagues/co-workers                          | 6(2.9)     |
|   | Medical journal                                | 27(13.0)   |
|   | Textbooks                                      | 1(0.5)     |
|   | News media                                     | 7(3.4)     |
|   | Social media                                   | 17(8.2)    |
|   | Laboratory literature                          | 2(1.0)     |
| All of them   | 95(43.7)                                       |            |
| Common symptoms of COVID-19   | Fever, cough, dyspnoea, myalgia                | 108(49.7)  |
|   | Fever, cough, dyspnoea, sore throat            | 95(45.9)   |
|   | Fever, cough, dyspnoea, sputum production      | 14(6.8)    |

The history of contact received from confirmed COVID-19 patients by our respondents showed traveling history in 128 (58.9%), followed by gatherings, handshake and close person to person contact. PCR was reported as the most common test used for diagnosis of COVID-19 by 146 (67.2%) participants whereas about one quarter 53(25.6%) of the respondents reported referring patients to other hospitals due to unavailability of testing kits (Table 3).



Table 3: Experience of health care providers related to patient exposure and protective equipment

| Variables:  |   | n (%)     |
|---|---|-----------|
| Factors that might impede willingness to work during COVID-19 pandemic                | Prioritizing wellbeing of family members              | 35(16.9)  |
|   | Inadequate provision of personal protective equipment | 88(40.5)  |
|   | Insufficient training in infection control management | 12(5.8)   |
|   | Fear of contacting virus and infection                | 11(5.3)   |
|   | All of the above                                      | 61(29.5)  |
|   | None of them  | 10(4.8)   |
| Department/hospital well prepared to diagnose/treat patients                          | Yes   | 69(33.3)  |
|   | No  | 131(60.3) |
|   | Not applicable  | 17(8.2)   |
| I understand the risk of pandemic novel COVID-19 for patients and healthcare workers. | Strongly agree  | 155(71.4) |
|   | Agree   | 60(29.0)  |
|   | Disagree  | 2(1.0)    |
| I know how to protect myself and my patients during a novel COVID-19 pandemic         | Strongly agree  | 67(32.4)  |
|   | Agree   | 126(58.0) |
|   | Disagree  | 24(11.6)  |
| I am well prepared/trained in handling novel COVID-19 cases.                          | Strongly agree  | 22(10.6)  |
|   | Agree   | 87(42.0)  |
|   | Disagree  | 108(49.7) |
| Use soap and water for hand washing before/after patient/sample contact               | Always  | 140(64.5) |
|   | Sometimes   | 18(8.7)   |
|   | Very often  | 59(28.5)  |
| Contact patients/samples without a surgical mask or N95 mask                          |   | 78(35.9)  |
| I contact patients without surgical/N95 mask due to unavailability of equipment       |   | 78(35.9)  |
| Preventive precautions can be taken until the patient is asymptomatic                 | Standard precautions                                  | 73(35.3)  |
|   | Air borne precautions                                 | 8(3.9)    |
|   | Contact and droplet precautions                       | 136(62.6) |
| Monitor body temperature daily  |   | 127(58.5) |
| Infection control measures are taken in different clinic/hospital/laboratory          | Visitors restriction                                  | 46(22.2)  |
|   | Closure of OPDs                                       | 32(15.5)  |
|   | Instituted fever triage ward                          | 9(4.3)    |
|   | Novel COVID-19 screening                              | 15(7.2)   |
|   | All of them   | 99(45.6)  |
|   | None of them  | 16(7.7)   |
| Number of confirmed Covid-19 cases reported in your hospital/department               | 1-10  | 88(40.5)  |
|   | 11-20   | 15(7.2)   |
|   | 21-30   | 10(4.8)   |
|   | 31-40   | 2(1.0)    |
|   | 41-50   | 5(2.4)    |
|   | 50-100  | 2(0.9)    |
|   | >100  | 5(2.4)    |
|   | No idea   | 30(14.5)  |
|   | None  | 58(28.0)  |
|   | Not allowed to tell                                   | 1(0.5)    |
|   | Referring suspected cases to relevant centres         | 1(0.5)    |

**Table 3: Experience of health care providers related to patient exposure and protective equipment (continued):**

|  |  |           |
|--|--|-----------|
| Test/samples used for detection of novel COVID-19              | PCR  | 146(67.2) |
|  | ELISA  | 7(3.4)    |
|  | CBC, blood culture   | 2(1.0)    |
|  | On the basis of history                                    | 7(3.4)    |
|  | Referring the patients because test kits are not available | 53(25.6)  |
|  | Not applicable   | 2(1.0)    |
| No of colleagues infected with coronavirus in the line of duty | 1-5  | 36(17.4)  |
|  | 6-10   | 6(2.9)    |
|  | >10  | 7(3.4)    |
|  | None   | 74(35.7)  |
|  | Not sure   | 89(41.0)  |
|  | Not applicable   | 5(2.4)    |
| Most common contact history given by patients                  | Gathering, hand shake, person to person contact            | 39(18.8)  |
|  | Complain of fever and cough                                | 20(9.7)   |
|  | Traveling  | 128(58.9) |
|  | Not applicable   | 30(14.5)  |

## Discussion

Nearly every country across the globe has been reporting cases and deaths due to SARS CoV-2, [15] management of which has now become a great challenge for health care workers. In order to manage the COVID-19 pandemic effectively, health care workers should have adequate knowledge and relevant clinical skills along with adequate provision of personal protective equipment as they are at a higher risk of acquiring the infection.

The majority of the participants in our study reported 1-25 as the suspected number of cases brought to their setup on a daily basis however, confirmed COVID-19 cases reported by different hospital/departments was/were mostly 1-10. It indicates fear of acquiring infection among general public due to which people are visiting hospitals/laboratories unnecessarily to get themselves tested for COVID-19. Proper public service messages should be conveyed to masses regarding signs and symptoms of the disease and self-isolation in order to avoid unnecessary visits to the hospitals which may increase their chances of acquiring infection. Some 32(15.5%) health care units therefore, closed regular OPDs and many 46(22.2%) imposed visitor's restriction.

In the current study, we found that 36% hospitals/departments did not have facility of ventilators which is a worrisome situation as approximately 42% of the cases infected with SARS-CoV-2 develop acute respiratory distress syndrome [16] and according to World Health Organization, one in every six COVID-19 patients develop dyspnoea [17]. Ventilators help these patients to breathe and give more time to fight against virus. Unfortunately, prognosis is not good in such cases.

PCR was reported as the most common test used for detection of COVID-19 by the majority of the participants however CT chest has proved to be more sensitive [9]. Referring suspected cases to more advanced hospitals or centres because of unavailability of testing kits was noted in one quarter of 53(25.6%) the participants. It shows that there were still some hospitals/departments which were not well prepared for the diagnosis of disease. Furthermore, referring the suspected COVID cases may have been a cause of further spread of the disease because there must have been some among those referred individuals who might not go to that relevant centre and take necessary precautions till their condition starts deteriorating.

Our study showed that the majority of the health care workers were not well aware of the World Health Organization guidelines for isolation and wearing surgical masks. All suspected cases of COVID-19 can be placed in the same ward when a single well ventilated room is not available [18]. Moreover, wearing surgical mask is not mandatory in community settings if one does not have respiratory tract infection symptoms [19]. Approximately half of the participants agreed that they were not well prepared/trained in handling COVID-19 cases and insufficient training in infection control management might impede their willingness to serve during the COVID-19 pandemic. Earlier, the world has faced different pandemics including plague, influenza, Spanish flu, Asian flu, Ebola virus disease etc. which caused the death of many health care workers also, due to insufficient knowledge about proper use of personal protective equipment and other infection control strategies including environmental and administrative strategies [20]. We should learn from our past experiences and devise a proper system in which health care workers from different departments be given opportunity to perform in infection control management

programs which will not only enhance their clinical skills but will also boost their confidence to perform in case of any upcoming pandemics in future.

Many participants faced unavailability of personal protective equipment during duty hours. Since SARS CoV-2 spreads through close person to person contact [3] and aerosol droplets, [21] wearing mask is necessary for safety of health care workers as they are in close contact with infected patients but unfortunately N95 masks were available to only some 45(21.7%), whereas surgical masks and gloves were provided to most 172(79.2%) of the respondents. Health care workers during this pandemic are acting as frontline warriors and are trying to protect the entire world from this virus. Unavailability of personal protective equipment is increasing their risk of contracting the virus which will cause deteriorating effects not only to their health but also to their colleagues as well as to their patients which will ultimately make the situation more disastrous.

According to the World Health Organization, diagnosis of COVID-19 should be suspected in any individual presenting with fever, cough, dyspnoea, myalgia, either having history of travel or close contact with confirmed or suspected cases of COVID-19 in previous 14 days [22]. Participants in our study also reported traveling 128(58.9%) as most common history given by laboratory confirmed COVID-19 patients.

#### Limitations of study:

The limitation of this study was the small sample size and less number of responses from health care providers serving especially outside Pakistan. Moreover, we were not able to conduct face to face interview.

## Conclusion

Our study concluded lack of knowledge about newly emerged COVID-19 pandemic among health care workers. Shortage of ventilators testing kits and personal protective equipment was reported in many hospitals/ departments. Lack of personal protective equipment and insufficient training in infection control management may act as barriers in delivering health care facilities during COVID-19.

#### Acknowledgements:

We are thankful to Jinnah Sindh Medical University, Karachi for facilitating the research project.

## References

1. Wang S, Guo L, Chen L, Liu W, Cao Y, Zhang J, Feng L. A case report of neonatal COVID-19 infection in China. *Clin Infect Dis*. 2020 Mar 12. doi.org/10.1093/cid/ciaa225
2. Wang W, Xu Y, Gao R, Lu R, Han K, Wu G, Tan W. Detection of SARS-CoV-2 in Different Types of Clinical Specimens. *Jama*. 2020 Mar 11. doi:10.1001/jama.2020.3786
3. Xu XW, Wu XX, Jiang XG, Xu KJ, Ying LJ, Ma CL, Li SB, Wang HY, Zhang S, Gao HN, Sheng JF. Clinical findings in a group of patients infected with the 2019 novel coronavirus (SARS-Cov-2) outside of Wuhan, China: retrospective case series. *Bmj*. 2020 Feb 19; 368. doi.org/10.1136/bmj.m606
4. Zhao D, Yao F, Wang L, Zheng L, Gao Y, Ye J, Guo F, Zhao H, Gao R. A comparative study on the clinical features of COVID-19 pneumonia to other pneumonias. *Clin Infect Dis*. 2020 Mar 12. doi.org/10.1093/cid/ciaa247
5. Novel CP. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China. *Zhonghua liu xing bing xue za zhi= Zhonghua liuxingbingxue zazhi*. 2020 Feb 17; 41(2):145. doi: 10.3760/cma.j.issn.0254-6450.2020.02.003.
6. Linton NM, Kobayashi T, Yang Y, Hayashi K, Akhmetzhanov AR, Jung SM, Yuan B, Kinoshita R, Nishiura H. Incubation period and other epidemiological characteristics of 2019 novel coronavirus infections with right truncation: a statistical analysis of publicly available case data. *J. Clin. Med*. 2020 Feb; 9(2):538. doi.org/10.3390/jcm9020538
7. Sanche S, Lin YT, Xu C, Romero-Severson E, Hengartner N, Ke R. High Contagiousness and Rapid Spread of Severe Acute Respiratory Syndrome Coronavirus 2. *Emerg Infect Dis* 2020 Apr 7; 26(7).
8. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, Zhao X, Huang B, Shi W, Lu R, Niu P. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med*; 2020 Jan 24. DOI: 10.1056/NEJMoa2001017
9. McMichael TM. COVID-19 in a long-term care facility—King County, Washington, February 27–March 9, 2020. *MMWR*. 2020; 69. doi.org/10.15585/mmwr.mm6912e1
10. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020 Feb 15; 395(10223):497-506. doi.org/10.1016/S0140-6736(20)30183-5
11. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public> World Health Organization, Coronavirus disease (COVID-19) advice for the public 2020
12. Ranney ML, Griffeth V, Jha AK. Critical supply shortages—the need for ventilators and personal protective equipment during the Covid-19 pandemic. *N Engl J Med*. 2020 Mar 25. DOI: 10.1056/NEJMp2006141
13. <https://docs.google.com/forms/u/0/d/1MvgdHPQOm7hqJIBnY7hmQENxVwXs11YNSEHnlllWUyw/edit>
14. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, Qiu Y, Wang J, Liu Y, Wei Y, Yu T. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*. 2020 Feb 15; 395(10223):507-13. doi.org/10.1016/S0140-6736(20)30211-7
15. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/> Coronavirus disease (COVID-19) weekly epidemiological update and weekly operational update
16. Wu C, Chen X, Cai Y, Zhou X, Xu S, Huang H, Zhang L, Zhou X, Du C, Zhang Y, Song J. Risk factors



associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. *JAMA Intern Med.* 2020 Mar 13 doi:10.1001/jamainternmed.2020.0994

17. <https://www.who.int/news-room/q-a-detail/q-a-coronaviruses> Coronavirus disease (COVID-19) pandemic

18. <https://www.cdc.gov/coronavirus/2019-ncov/downloads/managing-COVID19-in-correctional-detention.pdf> CDC guidance on management of COVID-19 in correctional and detention facilities.

19. [https://www.who.int/publications-detail/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-\(2019-ncov\)-outbreak](https://www.who.int/publications-detail/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak) Advice on the use of masks in the community during home care and in healthcare settings in the context of COVID-19

20. Chughtai AA, Khan W. Use of personal protective equipment to protect against respiratory infections in Pakistan: A systematic review. *J. Infect. Public Health* 2020 Mar 4. doi.org/10.1016/j.jiph.2020.02.032

21. Van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, Tamin A, Harcourt JL, Thornburg NJ, Gerber SI, Lloyd-Smith JO. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *N Engl J Med.* 2020 Mar 17. DOI: 10.1056/NEJMc2004973

22. [https://www.who.int/publications-detail/global-surveillance-for-human-infection-with-novel-coronavirus-\(2019-ncov\)](https://www.who.int/publications-detail/global-surveillance-for-human-infection-with-novel-coronavirus-(2019-ncov)) Global surveillance for human infection with novel coronavirus (2019-nCoV)