

# Adherence to Infection Prevention and Control Measures among Healthcare Workers Serving in COVID-19 Treatment Centers in Punjab, Pakistan

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## Abstract

Infection prevention and control (IPC) measures are easily adoptable activities to prevent the spread of infection to patients as well as among health care workers (HCWs). This cross-sectional study evaluated the adherence to IPC measures among HCWs working at COVID-19 treatment centers in Punjab, Pakistan. HCWs were recruited via convenient sampling through Google form<sup>®</sup> using the World Health Organization risk assessment tool. All data were analyzed using SPSS 20. A total of 414 HCWs completed the survey (response rate=67.8%), and majority of them were males (56.3%). Most of the HCWs were nurses (39.6%) followed by medical doctors (27.3%). Around 53% reported insufficiency of personal protective equipment (PPE), 58.2% didn't receive IPC training and 40.8% didn't have functional IPC team at their health facilities. The majority of HCWs (90%) used disposable gloves and N95 facemasks while interacting with COVID-19 patients. Nearly 45% used protective face shields and gowns before providing care to their patients. Hand hygiene practices while touching, and performing any aseptic procedure was adopted by 70.5% and 74.1% of HCWs, respectively. In conclusion, the adherence to IPC measures among Pakistani HCWs working in COVID-19 treatment centers is good despite the limited availability of PPEs. Their practices can be optimized by establishing institutional IPC teams, periodic provision of IPC training and necessary PPE.

**Key words:** COVID-19, Disease outbreaks, Infection control, Pandemics, Pakistan

## Introduction

As of October 29<sup>th</sup> 2021, more than 245 million confirmed cases of Corona virus disease of 2019 (COVID-19) have been reported worldwide with 4.9 million deaths [1]. In Pakistan, the first case of COVID-19 was reported on 26<sup>th</sup> February, 2020 and after that a substantial number of positive cases have been reported throughout the country in different phases of the COVID-19 outbreak [2-5]. To date, more than 1.2 million laboratory confirmed cases of COVID-19 with 28,449 deaths have been reported in Pakistan. COVID-19 recovery rate in Pakistan is more than 95% and there are currently approximately 23 thousand active cases in the country [6]. In the province of Punjab, 440,139 laboratory confirmed cases of COVID-19 have been reported with more than 12 thousand deaths [6]. While providing health care services, more than 115,000 HCWs have lost their lives

around the globe after being infected with COVID-19 up till May 24, 2021 [7]. Local media reports revealed that 14,627 HCWs were infected throughout Pakistan with 143 deaths as of March 22, 2021 [8].

Health care workers (HCWs) are considered as a highly vulnerable population to experiencing severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) due to their clinical roll particularly in hospital settings [9-11]. HCWs need to perform their duties in highly critical settings including emergency units, isolation wards, intensive care units (ICUs) and critical care units (CCUs) [12-15]. Since the emergence of COVID-19 pandemic, HCWs have shown remarkable resilience and professional dedication during routine care process despite fear of becoming infected and infecting others [16]. However, HCWs possess an appreciably greater risk of being positive with SARS-CoV-2 compared with the population at large [17]. Consequently, the protection of frontline warriors against COVID-19 is of great importance for a country's preparedness against current and future pandemics. In addition, ensuring as far as possible available HCWs to deal with COVID-19 as well as other priority disease areas. Pakistan is currently under the sixth COVID-19 wave with restrictions on the movement of citizens re-implemented in recent months [18]. The availability of effective vaccines against COVID-19 should help with reducing such activities in the future.

In order to prevent infection spread among HCWs, and to their patients, many standard precautions have been developed and practiced throughout the world, and HCWs have been advised to follow them strictly while attending their patients [19]. Many international organizations including the WHO and the Center for Disease Control and Prevention (CDC) have advised HCWs to follow standards infection control and prevention (IPC) principles while providing care to suspected or confirmed cases of COVID-19 in hospitalized settings as well as in the community [20, 21]. All these guidelines stress that HCWs exposed to actual or suspected COVID-19 patients in hospitals should adopt hand hygiene, respiratory hygiene, environmental cleaning, disinfection and the use of personal protective equipment (PPE) while providing care to patients besides vaccination. The government of Pakistan initiated vaccination campaigns for COVID-19 on 2nd February 2021 and in the first phase of the vaccination drive, front-line HCWs received COVID-19 vaccines free of charge from the state [22].

Country guidelines have also been issued to HCWs to follow standard operating procedures. In the case of Pakistan, these include guidelines by The Ministry of National Health Services, Regulation and Coordination concerning the selection and recommended use of PPE by the HCWs against COVID-19 [23], with correct PPE seen as a physical barrier to prevent the spread of the virus from either a suspected or confirmed case of COVID-19 [24]. Medical masks, gloves, gowns and protective face shield/googles are the recommended PPE that must be worn by HCWs while interacting with COVID-19 patients [25]. Hospital settings are considered as a site of infection spread particularly between COVID-19 patients and between patients and HCWs; consequently, necessitating effective water sanitation and hygiene (WASH) protocols to support IPC activities. However, we are currently unaware of any study that has been reported from Pakistan among exposed HCWs regarding their compliance with IPC in established treatment centers for COVID-19 patients. We are aware that certain health authorities in Pakistan as well as the WHO have advocated such practices, and similar studies have been undertaken in neighboring countries during the ongoing pandemic [26-29], however, nothing to date in Pakistan. Consequently, the objectives of the current study are to evaluate IPC compliance among exposed HCWs in COVID-19 treatment centers in the Punjab province, Pakistan. The findings can potentially be used to improve future compliance with IPCs and their directives in this province and wider in Pakistan if there are concerns. In addition, provide guidance to other low- and middle-income countries (LMICs) during these challenging times. This is important since the Pakistani health care system, similar to health care systems in other LMICs, has been under considerable strain since the emergence of this pandemic. Initially, this was due to the non-availability of sufficient medical and testing facilities, lack of trained HCWs to handle such disasters, and insufficient PPEs to treat COVID-19 patients. In addition, in Pakistan and elsewhere, the emergence of the COVID-19 pandemic has an appreciable adverse psychological impact on HCWs [24, 30-32].

## **Methods**

### **Study design**

This cross-sectional study was conducted among HCWs currently working in different COVID-19 treatment centers in both public and private sectors hospitals of the four divisions in the Punjab province (Lahore, Sahiwal, Faisalabad and Bahawalpur). The health department in the government of Punjab is partitioned into Specialized Healthcare and Medical Education Departments as the

administrative body for tertiary/teaching hospitals, while the Primary & Secondary Health Care department controls primary and secondary hospitals established throughout the province of Punjab. Secondary and tertiary care hospitals in the Punjab were equipped with COVID-19 isolation wards for the treatment of hospitalized COVID-19 patients. Moreover, the private sector hospitals also established COVID-19 wards to accommodate suspected or positive COVID-19 patients. All these health facilities were provided with the necessary health personnel and laboratory facilities to treat COVID-19 patients since the start of the pandemic in Pakistan.

### **Study population**

The study population includes HCWs working in COVID-19 treatment centers in both public and private hospitals established in the four divisions of Punjab. All HCWs including medical doctors, nurses, pharmacists and laboratory personnel who were willing to participate in the study were included. Those who declined to participate were excluded. All HCWs currently serving in other departments of the hospitals besides COVID-19 wards and HCWs in COVID-19 wards unwilling to participate due to any reason, were excluded from this study. The sample size was calculated using the Raosoft sample size calculator using 50% response rate from the study participants, 95% confidence interval and 5% margin of error [33]. The calculated sample was 377. A convenient sampling method was used to recruit the study participants.

### **Study instrument**

The questionnaire used in this study was adapted from the WHO risk assessment and management tool among HCWs specifically designed in the context of COVID-19 [25]. A pilot study was conducted among 25 HCWs to enhance the utility of study instrument. During this study, all the participants were asked about the clarity, understandability and relevance of all the questions and response options of the study tool. **The final study sample did not include participants of this pilot study.** Based on the finding of the pilot study, the content validity reached 1. Moreover, Cronbach's alpha of the questionnaire was found to be 0.77, showing adequate internal consistency. The final version of questionnaire has four sections including section one, which consists of eleven items covering demographic characteristics and the availability of IPC facilities at the hospital. Section 2 collected information on the activities performed by the HCWs on COVID-19 patients and has four items. Section 3 has ten items and assessed the adherence to IPC measures among HCWs during their interactions with COVID-19 patients. Each item in section three has four different

options, and HCWs were required to select one option according to their usual practices of wearing PPE and hand hygiene when they provide care to COVID-19 patients. The four options were ‘always, as recommended’ (which means more than 95% of the time they follow this practice), ‘most of the time’ (which means 50% or more but not 100%), ‘occasionally’ (which means 20% to below 50%) and ‘rarely’ (which means less than 20% following these practices). Section 4 comprised ten items regarding IPC activities during aerosol-generating procedures. All the study participants were classified as either compliant or non-compliant. A compliant category assigned to those HWCs who were following IPS measure ‘Always’ as recommended and most of the time, while non-compliant were those HCWs who were adopting IPC measures occasionally or rarely.

### **Data collection procedure**

Due to COVID-19 restrictions, online versions of the data collection tool were developed using Google Forms<sup>®</sup>. The hyperlink of the questionnaire was sent to all the participants through social media channels including WhatsApp, Facebook and Gmail with the request to provide their responses. All the participants were recruited using convenient sampling techniques to complete the questionnaire voluntarily according to their routine practices while providing care to COVID-19 patients.

### **Statistical analysis**

The statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 22.0 for Microsoft Windows. The categorical data were presented as frequencies and percentages deviation. Kruskal-Wallis (three or more groups) and Mann Whitney (two groups) tests were used to assess the difference based on the demographic characteristics. A  $p < 0.05$  was accepted as statistical significance.

### **Ethical considerations**

The study protocol was approved by the Research Ethics Committee, Department of Pharmacy Practice, University of Lahore, Lahore (reference no. REC/DPP/FOP/42). Approval was also obtained from the various hospital administrators before data collection. All participants provided a written informed consent prior to their participation in the study. Participation was voluntary and all the participants were assured about the confidentiality of their data.

## **Results**

### **Demographic characteristics of study population and availability of the IPC facilities**

A total of 610 HCWs were invited for participation with 414 subsequently responding giving a response rate of 67.8%. The majority of the study participants were males (56.3%), and aged 25 - 36 years (60.9%). More than two-third resided in urban areas (76.8%). Most of the participants (62.4%) had less than 6 years working experience. More than one-third of the participants were nurses (39.6%) followed by medical doctors (27.3%) and laboratory personnel (13.3%). The majority of the participants (90.3%) were working in the public hospitals. Most of the HCWs (52.9%) reported that they did not have sufficient PPE. 59% indicated that their hospitals had functional IPC teams while 41.8% had attended IPC training. Table 1 summarizes the demographic characteristics of the respondents.

Insert Table 1

### **Healthcare workers activities performed on COVID-19 patients**

The different activities performed by HCWs on COVID-19 patients are shown in Table 2. More than two thirds (67.1%) were providing direct care to COVID-19 patients while 64.5% indicated that they had face-to-face contact (within 1 meter) with COVID-19 patients. Approximately 50% of the study participants indicated that they were present around the patients when aerosol generating procedures were performed.

Insert Table 2

### **Adherences to IPC measures during healthcare interactions**

The majority of the participants used disposable gloves (89.4%) and N95 masks (90.3%) when they had health interactions with COVID-19 patients. However, less than half of the study participants used protective face shield/googles (45.1%) and disposables gown (44.9%) when they had health interaction with COVID-19 patients. Most of the HCWs (70.6%) removed their PPE according to the predefined protocols. More than two-thirds practiced hand hygiene practices before and after touching a patient (70.5%) and before and after performing any aseptic procedure (74.1%). Table 3 shows the adherence to IPC guidance among HCWs during healthcare interactions with COVID-19 patients.

Insert Table 3

### **Adherences to IPC measures during aerosol-generating procedures**

During aerosol-generating procedures including tracheal intubation, open airway suctioning, sputum collection, nebulizer treatment, tracheostomy, bronchoscopy, and cardiopulmonary resuscitation, the most compliant IPC measures among HCWs were hand hygiene before and after any clean or aseptic procedure (89.6%), hand hygiene before and after touching COVID-19 patient regardless of whether HCWs were wearing gloves (88.9%), wearing single-use gloves (82.1%) and wearing an N95 mask (or equivalent respirator) (79.3%). The least compliant IPC measures were wearing a face shield or goggles/protective glasses (54.8%) and wearing a disposable gown (56.2%). Table 4 describes the adherence to IPC measures when participants were performing aerosol-generating procedures.

Insert Table 4

### **Association between demographics and IPC facilities variables with IPC adherence**

The association between demographics variables including gender, age, marital status, residence, working experience, level of education, medical staff, hospital ownership, hospital type, study areas, and availability of different IPC facilities with IPC adherence are shown in Table 5. Significant ( $p < 0.05$ ) association were observed with the medical staff category with IPC adherence indicating that highest adherence manifested by HCWs.

Insert Table 5

### **Discussion**

To the best of our knowledge, this is the first study undertaken in Pakistan that has assessed adherence to IPC measures among HCWs providing care for COVID-19 patients. In addition, one of the first exploratory studies from a LMIC determining adherence levels to IPC measures among HCWs working in COVID-19 treatment centers providing guidance for others. The current study revealed that more than half of the HCWs indicated that the availability of PPE is insufficient in their health facilities. However, these findings are higher than the results reported in a multinational study conducted in South America which reported that only 13% of HCWs had enough PPEs [34]. Sarfraz et al (2020) reported similar findings from LMICs where there were



appreciable differences in the availability of PPE among HCWs across LMICs [35]. This is a concern since, as mentioned, the availability and correct use of PPE is essential to help prevent HCWs from getting COVID-19 [36], and could be one of the major obstacles to implement effective IPC measures in many LMICs. Our survey also reported that around one-quarter of the participants experienced interruption in water supply in the previous week, which is concerning, given the necessity of WASH protocols to support IPC activities. This is in contrast with the results of a recent study conducted in Ghana where majority of hospitals did not experience any interruption in fresh water supply in their COVID-19 treatment centers. This is a reflection generally of the proactive approach in Ghana during the pandemic [36, 37]. Consequently, interventions to ensure uninterrupted water supply at COVID-19 treatment facilities are essential to enhance IPC adherence.

The WHO IPC guideline also recommends training and education of the HCWs at health facility level to optimize IPC measures [38]. In the current study, the majority of the HCWs were not trained in IPC measures. This observation contrasts with the findings of a Ghanaian study in which almost all HCWs received training on IPC measures at the health facility level [36]. However, other studies conducted among LMICs have shown poor compliance among HCWs with IPC measures. [29, 39, 40].

Most of the HCWs in our survey used disposable gloves and masks during their interaction with COVID-19 patients, similar to the findings in Saudi Arabia [41, 13]. Encouragingly, this is higher than a study in Ethiopia, where only a small proportion of HCWs used facemasks in a correct way; however, a higher proportion were wearing PPE correctly before entering the patient area [42]. Of concern is that approximately half of the HCWs in our study were not using protective face shield/goggles and gowns before interacting with COVID-19 patients and during aerosol-generating procedures, which needs to be addressed going forward. These results are in contrast to a study conducted in Saudi Arabia where appreciably greater adherence was reported among HCWs relating to their usage of protective face shield/goggles and gowns [41], and a study conducted by Sokkary et al. (2021) in Egypt with a similar high adherence to correct PPE among HCWs [43].

Encouragingly again, most of the HCWs in our study were practicing doffing of PPE according to the recommendations during interactions with COVID-19 patients or during aerosol-generating

procedures. These findings are similar to a study conducted in India which reported that majority of HCWs practice donning and doffing of PPE according to the guidelines [44]. Our findings though are higher than a study from Nigeria where only 6-12% HCWs perform doffing of PPEs as per recommended protocols [45].

Hand hygiene is another recommended strategy to prevent the spread of infection. Consequently, it is highly recommended that HCWs practice hand hygiene while providing care to COVID-19 patients especially in LMICs where there can be concerns with the cleanliness of wards. In the current study, encouragingly more than three-quarters of HCWs practiced recommended hand hygiene techniques before and after touching COVID-19 patients, after exposure to patient's body fluid, and when carrying out any aerosol generating procedures. This contrasts to a study in Sri Lanka where only one-third of medical students surveyed were performing recommended hand hygiene during care provision for COVID-19 patients [46].

We are aware that this study has a number of limitations. These include the inclusion of only four divisions of the Punjab Province, which will impact on the generalizability of the findings. In addition, a convenient sampling technique was used, which is associated with the risk of biasness. The responses were self-reported, which make the results vulnerable to social desirability bias. Despite these limitations, we believe this study has described adherence to IPC measures among HCWs in Pakistan and other low-resource settings, giving direction for the future.

## **Conclusion**

Adherence to IPC strategies among Pakistani HCWs is encouraging. However, key areas were identified for improvement to enhance future protection. Institutional IPC teams comprising all stakeholders need to be established to effectively execute all infection prevention activities. Moreover, the provision of necessary PPE, training of their proper donning and doffing, development and implementation of effective IPC guidelines at hospital level are critical going forward for maximum protection of HCWs. We will be monitoring this in the future in Pakistan.

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### **Conflict of interest**

All the authors declared that no conflict of interest is associated with this project.

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### **Data availability statement**

The data set for this study are available on appropriate request from corresponding author.

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## Tables

**Table 1: Demographics characteristics and availability of IPC facilities**

Variables	Frequency (n = 414)	Percentage (%)
<b>Gender</b>		
Male	233	56.3
Female	181	43.7
<b>Age group (in years)</b>		
≤ 25	85	20.5
26-35	252	60.9
36-45	59	14.3
46-55	14	3.4
> 55	4	1.0
<b>Marital status</b>		
Married	168	40.6
Unmarried	246	59.4
<b>Residence</b>		
Rural	96	23.2
Urban	318	76.8
<b>Experience</b>		
< 1 year	76	18.4
1-5 years	182	44.0
6-10 years	105	25.4
> 10 years	51	12.3
<b>Education</b>		
Matriculation	15	3.6
Higher school education	14	3.4
Diploma	196	47.3
Graduation	149	36.0
Masters/specialization	40	9.7
<b>Medical staff</b>		
Medical doctor	113	27.3
Nurse	164	39.6
Pharmacist	22	5.3
Physical/respiratory therapist	26	6.3
Laboratory personnel	55	13.3
Ward servant/cleaner	24	5.8
Others staff	10	2.4
<b>Hospital ownership</b>		



Public	374	90.3
Private	40	9.7
<b>Hospital type</b>		
Tertiary care	258	62.3
Secondary care	156	37.7
<b>City (Division)</b>		
Lahore	155	37.4
Sahiwal	112	27.1
Faisalabad	88	21.3
Bahawalpur	59	14.3
<b>Availability of IPC facilities</b>		
Experienced an interruption in water supply	96	23.2
Had sufficient PPEs	195	47.1
Availability of IPC team	245	59.2
Had attended training on IPC	173	41.8

**Table 2: Healthcare worker activities performed on COVID-19 patient in a health care facility**

<b>Questions</b>	<b>Yes</b>	<b>No</b>	<b>Unknown</b>
Did you provide direct care to a confirmed COVID-19 patient?	278 (67.1)	92 (22.2)	44 (10.6)
Did you have face-to-face contact (within 1 meter) with a confirmed COVID-19 patient in a health care facility?	267 (64.5)	137 (33.1)	10 (2.4)
Did you have direct contact with the environment where the confirmed COVID-19 patient was cared for bed, linen, medical equipment, bathroom, etc.?	325 (78.5)	87 (21.0)	2 (0.5)
Were you present when any aerosol-generating procedures were performed on the patient?	209 (50.5)	176 (42.5)	28 (6.8)

**Table 3: Adherence to IPC procedures during health care interactions**

<b>Questions</b>	<b>Compliant</b>	<b>Non-compliant</b>
During a health care interaction with a COVID-19 patient, did you use single-use gloves?	370 (89.4)	44 (10.6)
During a health care interaction with a COVID-19 patient, did you use an N95 mask (or equivalent respirator)?	374 (90.3)	40 (9.7)
During a health care interaction with a COVID-19 patient, did you use a face shield or goggles/protective glasses?	187 (45.1)	227 (54.8)
During a health care interaction with a COVID-19 patient, did you use a disposable gown?	186 (44.9)	228 (55)
During a health care interaction with the COVID-19 patient, did you remove and replace your PPE according to a protocol (e.g., when medical mask became wet, disposed of the wet PPE in the waste bin, performed hand hygiene, etc.)?	292 (70.6)	122 (29.5)
During a health care interaction with the COVID-19 patient, did you perform hand hygiene before and after touching the COVID-19 patient (whether you were wearing gloves)?	292 (70.5)	122 (29.4)
During a health care interaction with the COVID-19 patient, did you perform hand hygiene before and after any clean or aseptic procedure was performed (e.g., while inserting a peripheral vascular catheter, urinary catheter, intubation, etc.)?	307 (74.1)	107 (25.8)
During a health care interaction with the COVID-19 patient, did you perform hand hygiene after exposure to body fluid?	326 (78.8)	88 (21.3)
During a health care interaction with the COVID-19 patient, did you perform hand hygiene after touching the patient's surroundings (bed, door handle, etc.), regardless of whether you were wearing gloves?	339 (81.9)	75 (18.1)
During a health care interaction with the COVID-19 patient, were high-touch surfaces decontaminated frequently (at least three times daily)?	300 (72.5)	114 (27.6)

**Table 4: Adherence to IPC measures when performing aerosol-generating procedures**

Questions	Frequency (%)	
	Compliant	Non-compliant
During aerosol-generating procedures on a COVID-19 patient, did you wear single-use gloves?	340 (82.1)	74 (17.8)
During aerosol-generating procedures on a COVID-19 patient, did you wear an N95 mask (or equivalent respirator?)	328 (79.3)	86 (20.7)
During aerosol-generating procedures on a COVID-19 patient, did you wear a face shield or goggles/protective glasses?	227 (54.8)	178 (45.1)
During aerosol-generating procedures on a COVID-19 patient, did you wear a disposable gown?	236 (56.2)	178 (43.7)
During aerosol-generating procedures on the COVID-19 patient, did you remove and replace your PPE according to a protocol (e.g., when medical mask became wet, disposed of the wet PPE in the waste bin, performed hand Hygiene, etc.)?	304 (73.6)	110 (26.6)
During aerosol-generating procedures on the COVID-19 patient, did you perform hand hygiene before and after touching the COVID-19 patient, regardless of whether you were wearing gloves?	368 (88.9)	46 (11.1)
During aerosol-generating procedures on the COVID-19 patient, did you perform hand hygiene before and after any clean or aseptic procedure was performed?	371 (89.6)	43 (10.4)
During aerosol-generating procedures on the COVID-19 patient, did you perform hand hygiene after exposure to body fluid?	321 (77.5)	93 (22.5)
During aerosol-generating procedures on the COVID-19 patient, did you perform hand hygiene after touching the patient's surroundings (bed, door handle, etc.), regardless of whether you were wearing gloves?	358 (86.5)	34 (13.5)
During aerosol-generating procedures on the COVID-19 patient, were high-touch surfaces decontaminated frequently (at least three times daily)?	313 (75.6)	101 (24.4)

Aerosol-generating procedures include tracheal intubation, nebulizer treatment, open airway suctioning, sputum collection, tracheotomy, bronchoscopy, cardiopulmonary resuscitation (CPR), etc.)

**Table 5. Association of demographic variables with IPC adherence**

Variables	IPC adherence during health care interactions		IPC adherence to aerosol-generating procedures	
	Mean rank	p-value	Mean rank	p-value
<b>Gender</b>				
Male	213.97	0.211	212.85	0.301
Female	199.17		200.62	
<b>Age (years)</b>				
≤ 25	208.45	0.739	85	0.918
26-35	212.00		252	
36-45	195.25		59	
36-45	183.79		14	
> 55	167.50		410	
<b>Marital status</b>				
Married	209.12	0.819	212.64	0.469
Unmarried	206.39		203.99	
<b>Residence</b>				
Rural	225.36	0.095	196.40	0.299
Urban	202.11		210.85	
<b>Experience</b>				
< 1 year	207.63	0.020	200.57	0.156
1-5 years	226.32		222.09	
6-10 years	185.62		196.95	
> 10 years	185.22		187.48	
<b>Education</b>				
Matriculation	260.93	0.009	261.60	0.004
Higher school education	242.04		249.71	
Diploma	179.58		178.38	
Graduation	185.40		186.19	
Masters/specialization	260.93		261.60	
<b>Medical staff</b>				
Medical doctor	221.15	<0.001	230.80	<0.001
Nurse	228.73		210.58	
Pharmacist	217.95		236.86	
Physical/respiratory therapist	225.10		182.35	
Laboratory personnel	59.17		108.14	
Ward servant/cleaner	312.60		285.94	
Others staff	199.85		252.85	
<b>Hospital ownership</b>				
Public	208.80	0.497	210.46	0.123

Private	195.31		179.81	
<b>Hospital type</b>				
Tertiary care	206.90	0.895	206.21	0.778
Secondary care	208.49		209.63	
<b>City</b>				
Lahore	212.28	0.726	216.97	0.478
Sahiwal	212.36		209.51	
Faisalabad	196.28		193.27	
Bahawalpur	202.46		200.01	
<b>Availability of IPC facilities</b>				
<b>Experienced an interruption in water supply</b>				
Yes	208.22	0.946	216.11	0.420
No	207.28		204.90	
<b>Sufficiency of PPEs</b>				
Yes	198.39	0.143	198.77	0.161
No	215.61		215.27	
<b>Availability of IPC team</b>				
Yes	216.25	0.073	208.37	0.859
No	194.81		206.24	
<b>Training on IPC</b>				
Yes	209.36	0.789	204.96	0.714
No	206.17		209.32	