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Awareness, Practices and Barriers Related To Infection Prevention and Control among Physicians during The First Wave of COVID-19 Pandemic

Rasha Saad Hussein[1]; Shimaa Ahmed Abdel-Salam[2]; Asmaa Fathy Gebrel[3]; Wafaa Mohamed Hussein[1]

[1]Department of Community, Environmental and Occupational medicine, Faculty of Medicine, Ain Shams University, Cairo, Egypt
[2]Department of Medical Microbiology and Immunology, Faculty of Medicine, Ain Shams University, Cairo, Egypt
[3]Department of Family Medicine, Faculty of Medicine, Misr University for Science & Technology

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ABSTRACT

Background: Healthcare workers (HCWs) are at an increased risk of Coronavirus disease (COVID-19) transmission. Despite the development of several vaccines, inequitable distribution and vaccine hesitancy impact their role in protecting HCWs. Adherence to Infection Prevention and Control (IPC) practice remains a cornerstone in preventing disease spread in health facilities and in communities. **Objectives:** The study aims to measure knowledge and practices of physicians in relation to COVID-19 infection prevention and control. It also aimed to identify perceived barriers facing IPC practice. **Method:** In this cross-sectional study, we used an online survey to collect data from physicians working in a university hospital in Cairo throughout June-July, 2020. The survey included 12 items for knowledge, 8 items for practice and 6 items for perceived barriers. Scores for knowledge and practice of IPC were calculated and transformed into percent scores. **Results:** Three hundred and eighteen (318) physicians responded to the survey. The mean knowledge percent score was 57.1±15.9. Participants knew the least about facemasks and gloves protectiveness. The mean percent score for IPC practice was 78.8±12.2. Less than a quarter of physicians "always" used N95 mask during all patient care procedures or did a seal test when donning one. Overcrowded emergency departments, improper work place design, shortage in IPC supplies and insufficient training were the main barriers to IPC practice cited by almost 90% of the study participants. **Conclusion:** Physicians in our study had average IPC Knowledge score compared to other studies. Continuous IPC training can largely improve IPC knowledge and practice among physicians.

INTRODUCTION

A global pandemic of Coronavirus disease (COVID-19) was declared in March 2020. Ever since, the pandemic has resulted in more than 246 million confirmed cases, including nearly 5 million deaths worldwide by the end of October 2021.[1] Frontline Healthcare Workers (HCWs) are at an increased risk of acquiring COVID-19 infection during close contact with cases in overcrowded health facilities or with frequent exposure to contaminated environment. The results of a prospective cohort study revealed that HCWs had a

Corresponding Author: Rasha Saad Hussein, [1]Department of Community, Environmental and Occupational medicine, Faculty of Medicine, Ain Shams University, Cairo, Egypt Email: tartourm@yahoo.com. DOI: 10.21608/ejcm.2021.102360.1190

twelvefold increased risk of contracting COVID-19 infection compared to the general population.[2]

Recently, a breakthrough has been achieved in developing vaccines against COCID-19. Several vaccines have been approved by the World Health Organization (WHO) for emergency use and millions of doses have been administered worldwide. [3] However, equitable access to vaccines especially in developing countries remains a challenge.[4] It is estimated that only 3% of the population in Egypt had received at least one dose of the vaccine and 0.7% were fully vaccinated by mid-June 2021.[5] Although healthcare workers were prioritized for COVID-19 vaccination, vaccine hesitancy slowed down the progress towards full vaccination coverage of all healthcare workers.[6,7]

Given these challenges, adherence to infection control practices remains a cornerstone in protecting healthcare workers from acquiring COVID-19 infection in healthcare settings. Adherence to infection prevention and control measures (IPC) was especially crucial during the early days of COVID-19 pandemic, when treatment protocols and vaccines were still under development. The primary preventive measures recommended by WHO include: hand hygiene, respiratory hygiene, wearing personal protective equipment (PPE) and maintaining a distance of at least 1 metre from others.[8,9]

Several studies have explored knowledge, attitudes, and practices of healthcare workers towards COVID-19 preventive measures. IPC knowledge levels ranged between average to very good. [10–15] Previous studies have also shown variability in adherence to IPC practices among HCWs. [16–19] Multiple studies have found a correlation between IPC knowledge and practice.[20–22]

Our study aimed to measure knowledge about IPC guidelines related to COVID-19 among physicians in a university hospitals in Egypt. It also aimed to measure their adherence to IPC practices and to identify the perceived barriers affecting their adherence to IPC practice.

METHOD

A Cross-sectional study was implemented at a university hospital in Cairo, Egypt. Participants were invited to fill an online survey between the first of June till the 30th of July, 2020. We used a convenience sampling method targeting physicians from all seniority levels and specialties. During the study period, most of the physicians from all specialties worked either in the emergency department or in COVID-19 isolation wards . The sample size was calculated using power analysis for sample size software (PASS version 11). We have reviewed results from previous relevant studies, and we have calculated the sample size based on a mean correct answer rate regarding COVID-19 related knowledge of 80.4%[23] and good practices of 94.3% [8] with a margin of error =0.05 and at 95% confidence level. A sample size of 250 physicians was needed. By the end of the designated study duration, 318 physicians responded to the survey.

We used an anonymous online survey to collect responses. The survey questions were derived from the "CDC guidance for COVID-19" and "WHO guidance for infection prevention and control". [23,24] Face validity for the survey items was assessed by three specialists in microbiology, infection control and epidemiology. The survey was pilot tested on 10 physicians before starting the data collection; to investigate clarity and comprehension of the questions.

To ensure access to the maximum number of physicians, we communicated with one physician at each clinical department and asked him/her to share the link with colleagues through his/ her department's social media groups.

The survey consisted of four sections: The first section included socio-demographic characters as age, gender, seniority level and specialty. The second section was composed of 12 items to test knowledge of COVID-19 modes of transmission and IPC precautions. Each correct answer was awarded 1 point with a maximum score of 12 points. A participant's score was divided by 12 and multiplied by 100 to yield a percent score. The third section consisted of eight items on adherence to standard precautions during care of COVID-19 cases. A 3-category scale was used "Rarely, Sometimes and Always"; scored from 1 to 3 with a maximum score of 27 points. A participant's practice score was divided by 27 and multiplied by 100 to give a percent score. The fourth section addressed perceived barriers facing physicians in adherence to infection control practice guidelines. This section included six yes/no questions adapted from Salman et al., 2020 study.[8]

Table 1: The proportion of participants giving correct responses to the 12 knowledge items

Item	N	%
Hand hygiene reduces the risk of infection	317	99.7
COVID-19 is transmitted through infectious droplets	310	97.5
Keeping 1-1.5 meters reduces the risk of infection	310	97.5
Contacts of COVID-19 cases must be quarantined for 14 days	275	86.5
Facemasks reduce the risk of COVID-19 transmission	243	76.4
Correct PPE Doffing steps	172	54.1
Correct PPE donning steps	171	53.8
Isolation in negative pressure room is not mandatory	86	27.0
PPE set is not the same for all producers done to COVID-19 cases	66	20.8
A COVID-19 case without fever can transmit the infection.	26	8.2
Gloves do not provide full protection against COVID-19 transmission	19	6.0
Different forms of facemasks do not provide the same degree of protection	12	3.8
Total Knowledge score (mean ± SD) *6.85 +1.91*		
Total Knowledge percent score (mean ± SD) *57.1±15.9*		

sd: standard deviation, ppe: personal protective equipment

Data analysis: We used IBM SPSS for Windows, version 25.0 for data analysis. Means, standard deviations (SD) and ranges were used to summarize numerical variables. Numbers and percentages were used to describe categorical variables. Independent t-test was used to compare mean scores between two groups. ANOVA test was used to compare mean scores in more than two groups. Pearson Correlation was used to examine the association between knowledge and practice scores. Statistical significance level was considered at a p value ≤ 0.05.

RESULTS

Three hundred and eighteen (318) physicians responded to the survey. The age of the participants ranged between 24 and 53 years with a mean± standard deviation of 30.18±6.07 years. Most participants were females 193 (60.7%). Duration of work experience ranged between 0 and 30 years with a mean ± SD of 5.23±5.09 years. The distribution of specialties and seniority levels of the respondents was balanced. The sample included nearly equal proportions of interns, residents and specialists comprising 29.6%, 28.3% and 29.2% of the sample respectively. Consultants constituted a relatively smaller proportion (12.9%) of the sample. Regarding specialties distribution, the sample consisted of nearly equal proportions of interns (non-specialized), surgeons and internal medicine physicians comprising 29.6%, 24.5% and 27.0% of the study sample respectively. Obstetricians and paediatricians represented 10.1% and 8.8% of the sample respectively. Nearly half of the respondents (52.5%) had attended training on infection control in the past.

The overall mean percent score for IPC knowledge in our sample was 57.1±15.9. The role of hand hygiene was correctly identified by 99.7% of the respondents, but only 3.6% of the respondents knew that the various forms of facemasks do not provide the same degree of protection. Table (1) shows the percentage of participants who responded correctly to each knowledge item; arranged in descending order.

The mean percent score for IPC practice was78.8±12.2. Most of the respondents indicated they always disposed safely of personal protective equipment. Only 20.8% of the respondents always did a seal test for N95 mask when donning one. Figure (1) shows the percentage of physicians who "Always" performed each of the eight IPC practices.

Table (2) shows the association between knowledge score and characters of the study participants. Younger participants (≤30 years) have shown a significantly higher knowledge score. Male participants and physicians who received infection control training in the past have also shown better knowledge scores. A significantly higher IPC practice score was associated with attending previous IPC training (Table 2).

Figure (2) shows the means and standard deviations of knowledge and practice percent scores compared across seniority levels and specialties. Mean knowledge score was lowest among interns (52.9±15.8) and highest among consultants

Table 2: Comparing IPC knowledge and practice scores by characters of the study participants

		Knowledge percent score			Practices percent score		
		Mean	±SD	P value	Mean	±SD	P value
Age	≤30	58.7	15.3	0.018*†	78.59	12.30	0.73
	>30	54.2	16.6		79.07	11.98	
Gender	Female	54.7	15.2	0.001*†	78.41	11.62	0.53
	Male	60.7	16.2		79.29	13.00	
Years of experience	0-5	59.2	15.6	0.034*‡	79.81	11.78	0.14
	>5-10	54.7	15.9		78.11	12.32	
	>10	54.4	16.1		76.91	12.81	
IPC training	No	53.5	15.2	<0.001*†	77.04	10.99	0.01*
	Yes	60.3	15.8		80.31	12.99	

(*) Statistical significance, (†) Independent t test was used, (‡) ANOVA test was used, SD: standard deviation

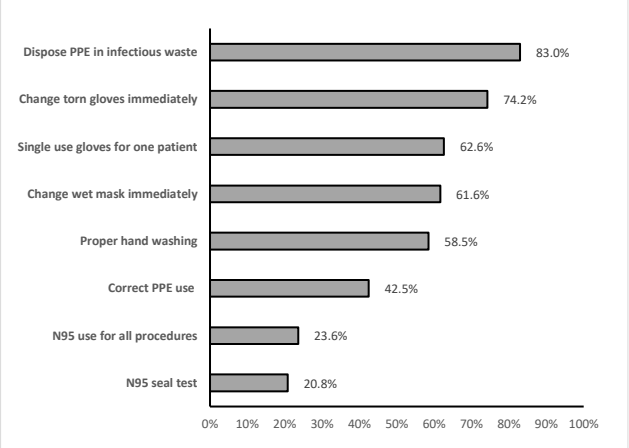

Figure 1: Percentage of physicians who reported "always" performing each of the eight IPC items in the practice scale (N=318).

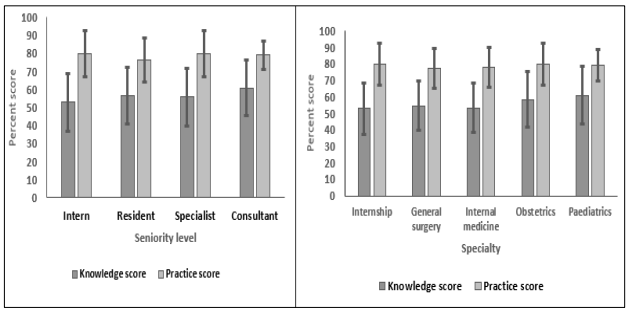

Figure 2: Error bars showing means and standard deviations of knowledge and practice scores across seniority levels and specialties

(60.9±15.6) with p=0.027. Across specialties, the mean knowledge scores were highest among paediatricians (61.0±17.6) and lowest among interns with p=0.008. Practice scores have shown insignificant variation across seniority levels and specialties. Practice scores ranged between 76.2±12.3 among residents and 80.1±12.8 among interns (p=0.12). Across specialties, practice scores were lowest among general surgeons (77.5±12.0) and highest among interns (p=0.61).

Generally, we found that IPC practice percent scores were always higher than knowledge percent scores across all groups. On the other hand, we found a moderate correlation between practice and knowledge scores in our sample population (Pearson Correlation =0.445, P value <0.001).

Figure (3) shows the barriers to IPC practice reported by the participants. Overcrowded emergency departments and poorly designed small workspaces were reported by 286 (90%) of the respondents.

DISCUSSION

Our survey was conducted during the first wave of COVID-19 pandemic, when IPC measure assumed a great importance in protecting HCWs in the absence of vaccines or approved prophylactic drugs. The study aimed to measure knowledge and practices of physicians in relation to COVID-19 infection prevention and control. Participants in the study had average knowledge about COVID-19 dynamics and IPC measures. Better knowledge scores were associated with younger age (≤30 years), male gender and having received past IPC training. Interns had the least knowledge scores compared to specialized physicians. Knowledge was moderately correlated with practice scores; however, practice scores were consistently higher than knowledge scores in all groups. Also practice scores did not vary significantly across specialties or seniority levels. The IPC knowledge score in our study had a mean of 57.1±15.9. Similar

knowledge levels were reported by studies in some countries in the region.[10,11] However, knowledge scores have reportedly crossed 80% in studies from other African and Asian countries.[12–15] Variation in knowledge levels may be attributed to different

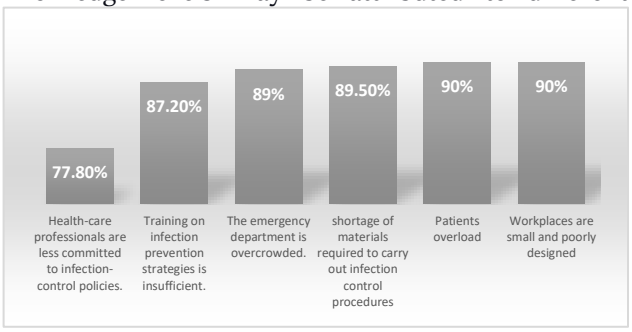

Figure 3: Infection control perceived barriers among the study group (N=318)

samples characteristics. Also, different studies used different measurement scales. In our study, more than 95% of the respondents correctly identified the role of hand hygiene and physical distancing in reducing infection risk. High knowledge of the role of hand hygiene was also reported by studies from India and Saudi Arabia.[25,26] Proper knowledge of the role of keeping physical distance was reported by studies from Egypt and Iran.[27,28]

In our study, participants below 30 years of age had significantly better knowledge. Several studies have similarly reported better knowledge scores in the younger age groups.[12,13,29] However, this was not a consistent finding since some studies have shown higher knowledge levels among older participants, [16,30] while other studies found no association between age and knowledge levels.[31,32]

In our study, the years of work experience and IPC knowledge were inversely related. Higher knowledge was observed among participants working for five years or less. This group happens to be the youngest as well. In contrast to our findings, studies from Saudi Arabia and Nigeria have shown significantly better knowledge among healthcare workers who have been working for over 10 years.[16,33] A study in Pakistan has shown an association between practice and years of work experience, but could not show an effect of work duration on knowledge.[34] Younger physicians are usually more involved in everyday clinical practice and they probably receive more frequent IPC training or information compared to more senior physicians. Younger physicians may also have better skills using technology with better access to the vast online sources on COVID-19 and IPC. However, we have observed a paradox at the two extreme ends of experience. When we compared knowledge across seniority levels, consultants have shown significantly better knowledge compared to interns. This observation should be interpreted with caution since the number of consultants was relatively small (12.9% of the sample).

The overall mean IPC practice score in our study (78.76±12.17) was relatively good. A Saudi Arabian study has reported good practice levels in around 88% of the participants.[16] In our study, correct hand hygiene was done "Always" by more than half of the participants (58.5%). A study in Brazil has reported an even lower adherence (46.25%) to hand hygiene in critical care units.[17] Less than half of our study participants reported correctly used PPE "Always" and less than a quarter of them "Always" wore N95 during all patient care procedures. Varying performance levels of PPE use were found in other studies. A study done in Pakistan labelled only 35.2% of workers as good at wearing masks. [19] Another Saudi study has shown that over 70% of HCWs wore facemasks. [18] Shortage in PPE supplies including N95 respirators has been a worldwide challenge during the early days of the pandemic.[35] Supply shortage could have negatively affected HCWs' practice of PPE use. In our study, IPC practice scores were significantly higher among participants who had previous IPC training. This is consistent with several studies that showed a positive association between IPC knowledge and practice.[20–22] We have found a moderate positive correlation between knowledge and practice sores. However, practice scores were always higher than knowledge scores, and they did not differ significantly by specialty or seniority level. We did not collect information about the date of last training, but it is likely that knowledge levels decline over time following training [36], while it seems that practices performed daily can be maintained at satisfactory levels.

Nearly 90% of respondents to our survey perceived overcrowding at the emergency rooms and limited supply of infection control materials as barriers to infection control practice. These barriers were similarly reported by other studies in Egypt, Pakistan and Nigeria. [12,34,37]

Study Limitations

We used a convenience sample of physicians who accepted to fill the online survey in one hospital. This may limit the generalizability of the study results to different settings.

CONCLUSION AND RECOMMENDATIONS:

Overall, we found average IPC Knowledge and good practice levels among physicians. Poorly designed small workspaces, cases overload, limited supplies of IPC materials and insufficient IPC training were the main barriers to IPC practice. We recommend continuous IPC training to improve IPC knowledge and skill retention among physicians. Hospitals may need to arrange extra ER space to reduce over crowdedness such as field hospitals, especially during the peaks of transmission. Hospitals need to adjust the estimates of IPC supplies needed throughout the various stages of the pandemic, since shortage and stock out can have a negative impact on IPC practice.

Ethical considerations

The study protocol was approved by a research ethical committee at the University where the study was conducted. The survey was anonymous to ensure confidentiality.

Disclosure statement

The authors announce that they do not have competing interests.

Data Availability Statement

The data sets that were created and examined during the current study are available on request from the corresponding author

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