

ORIGINAL ARTICLE

Knowledge, Practice, and Perception of Barriers Regarding COVID-19 among Egyptian Health care Workers

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ABSTRACT

Key words:

COVID-19, SARS-CoV-2, Knowledge, Practice, Barriers

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Background: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was characterized as the etiology for a cluster of pneumonia cases that spread rapidly, causing considerable morbidity and mortality worldwide. By April 2021, more than 2,996,791 deaths were reported globally. Proper updated infection control protocol for Coronavirus disease 2019 (COVID-19) must be provided to every health care facility. **Objectives:** To evaluate the knowledge, attitude, perception of barriers, and practices among Egyptian health care workers (HCWs) regarding COVID-19 disease. **Methodology:** A cross-sectional study using an online questionnaire through a link shared on social networking sites was conducted on 480 HCWs from different regions in Egypt. **Results:** This assessment included a sample of 480 HCWs. The total knowledge score was (19.95±2.4). Satisfactory knowledge was reported among 60%. Total attitude score was (18.1±3.7) with positive attitude being reported among 23.3%. Total practice score was (10.6±1.1) and good practice was reported among 89.2%. **Conclusion:** There were satisfactory knowledge and practice with a low positive attitude regarding COVID-19 which requires more efforts to improve precautionary measures and training programs in hospitals.

INTRODUCTION

Coronavirus disease 2019, known as COVID-19 has been declared a pandemic by the World Health Organization (WHO) on March 11, 2020. As of April 11, 2021, more than 135, 057, 587 confirmed cases have been determined, and more than 2, 919, 932 deaths attributed to COVID-19. There is still an extremely growing pandemic infectious disease¹.

SARS-CoV-2 is spread from person to person through respiratory secretions in coughs and sneezes, or by touching virus-infected surfaces or objects in proximity (within 6 feet)². The possible risk factors for serious illness and mortality were old age, smoking and associated comorbidity³.

Until now, there is no confirmed treatment against SARS-CoV-2. The most efficient intervention to stop the spread of infection in both the community and the healthcare facilities is successful infection control strategies⁴.

It is critical to create preventive protocols to give safe guidelines for HCWs and therefore reducing their work-related stress, which has been shown to affect job efficiency⁵.

In certain situations, a defensive reaction to fear about the pandemic is the need for widespread masking. But, in settings for health care. First and foremost, when

taking care for symptomatic patients with respiratory infectious diseases, a mask is an essential component of personal protective equipment (PPE) that clinicians must wear in addition to gloves, gowns, and eye protection⁶.

However, due to rising demand and supply system challenges, global shortages of masks, respirators, face shields, and gowns have led to efforts to conserve PPE through extended use or reuse, and disinfection protocols have been developed for which there is scarce scientific agreement on professional standards⁷.

Understanding health care workers' knowledge, attitudes, and practices, and their awareness of barriers and potential risk factors, helps predict expected outcomes at the national and international level.

METHODOLOGY

Study design and participants:

A cross-sectional study has been conducted between November 2020 and December 2020 where a survey was conducted through a link shared on social networking sites. A total of 480 HCWs at the frontline of COVID-19 including physicians, pharmacists, nurses, and technical staff from different hospital types in many governorates in Egypt participated in this study. Confidentiality of the research participants' identities

was maintained by making the survey anonymous and ensuring the participants' information was confidential. The submission of the answered survey was considered as consent to take part in the research study. This study was approved by the ethical committee of the Faculty of Medicine, Menoufia University.

Study tools and collection of data:

The study was carried out using a self-administered questionnaire. It was created by the authors looking up frequently asked questions on the websites of the Centers for Disease Control and Prevention (CDC), as well as WHO guidance and the Ministry of Health and Population (MOHP). Questions were written in English and were adapted to suit participants. The content and validity of the questionnaire were reviewed and evaluated by the authors and professors in microbiology, infectious diseases and public health specialties. It covered the socio-demographic characteristics, COVID-19 knowledge and practice, as well as attitudes and beliefs about barriers to COVID-19 defense among medical personnel. A pilot study was carried out on 12 HCWs, who provided their viewpoints relating to the questionnaire's visibility. The data from the pilot analysis was not included in the study's final sample. The final questionnaire was designed based on the results of the pilot study.

A designed questionnaire included four parts;

- Socio-demographic characteristics, for instance, age, gender and place of current job.
- Knowledge questionnaire about COVID-19 which involves twelve questions about general COVID-19 information, the mode of transmission and COVID 19 screening. Most questions were responded with yes, no, or don't know.
- Attitude and barriers against protective measures towards COVID-19 in a clinical setting and it involves thirteen items to evaluate health care workers' attitudes and perceptions of infection control barriers. Most of the questions were answered as agree, disagree or undecided for each barrier.
- Infection control practices were implemented to defend against COVID-19 in the participants' clinical setting. Precautionary measures taken by participants after the pandemic of COVID-19 (Before patient arrival), (in the waiting room) and (in the examination room or operating room).

Statistical Analysis:

Results were statistically analyzed by SPSS version 23 (SPSS Inc. Released 2015. Version 23.0 of IBM SPSS statistics for windows, version 23.0, Armonk,

NY: IBM Corp). Qualitative data was expressed in: Number (No), percentage (%), while quantitative data was expressed as mean (\bar{x}), standard deviation (SD). The Unpaired t test was used for comparison of two means of normally distributed data, while the Chi-square test was used to study association between qualitative variables. A p-value was considered significant if < 0.05 .

RESULTS

A cross-sectional test was carried out on 480 participants; most of them aged 30-40 years old (50.8%), distributed as 27.5% males and 72.5% females. The demographic data of the participants as shown in table 1.

Table 1: Demographic data of the participants

| Demographic data | Participants (No.= 480) | |
|----------------------------|-------------------------|------|
| | No | % |
| Age (in years): | | |
| ≤ 30 | 100 | 20.8 |
| >30-40 | 244 | 50.8 |
| >40 | 136 | 28.4 |
| Sex: | | |
| Male | 132 | 27.5 |
| Female | 348 | 72.5 |
| Occupation: | | |
| Physician | 252 | 52.5 |
| Nurse | 160 | 33.3 |
| Medical employee | 68 | 14.2 |
| Working place: | | |
| Governmental health sector | 328 | 68.3 |
| Private sector | 48 | 10.0 |
| Both | 104 | 21.7 |

Most of participants (70.8%) received a scientific course on COVID-19. Regarding clinical features of COVID-19; 88.3% of participants said that incubation period was 2-14 days and could be disseminated by droplet route (92.5%), while 72 participants (15%) reported that blood transfusion was a common mode of transmission. The majority of study participants (86.7%) oriented that asymptomatic SARS-CoV-2 infection can also be transmitted and Health Ministry's hotline for reporting new cases was 105 (61.7%). The participants' knowledge of COVID-19 is assessed as seen in table 2.

Table 2: Knowledge of the participants about COVID-19 (N=480):

| Knowledge about COVID-19 | | | | |
|---|-----|------|---|----------|
| | No | % | No | % |
| -Having a scientific course on Covid-19 | | | | |
| Yes | 340 | 70.8 | | |
| No | 140 | 29.2 | | |
| -Incubation period of Covid-19 | | | | |
| 0-1 days | 4 | 0.8 | | |
| 2-14 days | 424 | 88.3 | | |
| 15-28 days | 40 | 8.3 | | |
| I don't know | 12 | 2.5 | | |
| -COVID-19 mode of spread by droplet route | | | | |
| Yes | 444 | 92.5 | | |
| No | 20 | 4.2 | | |
| I don't know | 16 | 3.3 | | |
| -Blood transfusion is a common mode of transmission for COVID-19 | | | | |
| Yes | 72 | 15.0 | | |
| No | 360 | 75.0 | | |
| I don't know | 48 | 10.0 | | |
| -Asymptomatic COVID-19 infection can be transmitted | | | | |
| Yes | 416 | 86.7 | | |
| No | 48 | 10.0 | | |
| I don't know | 16 | 3.3 | | |
| -Health Ministry's hotline for reporting cases | | | | |
| 105 | 296 | 61.7 | | |
| 115 | 20 | 4.2 | | |
| 150 | 24 | 5.0 | | |
| I don't know | 140 | 29.1 | | |
| | | | - Smoking is a risk-factor for COVID-19 severity | |
| | | | Yes | 344 71.7 |
| | | | No | 96 20.0 |
| | | | I don't know | 40 8.3 |
| | | | -High risky groups | |
| | | | Young children | 8 1.7 |
| | | | Old people | 460 95.8 |
| | | | I don't know | 12 2.5 |
| | | | -Headache and fatigue are symptoms of covid-19 | |
| | | | Yes | 440 91.7 |
| | | | No | 32 6.7 |
| | | | I don't know | 8 1.6 |
| | | | -COVID-19 is more severe than the flu | |
| | | | Yes | 460 95.8 |
| | | | No | 8 1.7 |
| | | | I don't know | 12 2.5 |
| | | | -COVID-19 survives on surfaces for any period | |
| | | | Yes | 376 78.3 |
| | | | No | 72 15.0 |
| | | | I don't know | 32 6.7 |
| | | | -Safe distance to limit spreads of COVID-19 are: | |
| | | | 3 feet | 128 26.7 |
| | | | 5 feet | 128 26.7 |
| | | | 6 feet | 160 33.3 |
| | | | I don't know | 64 13.3 |

On studying the attitude with regard to COVID-19, 56.7% of the participants believed that wearing two surgical masks was more effective in protection against COVID-19. Temperature screening alone wasn't effective for diagnosing COVID-19 infection (80%), knowledge about infection control strategies wasn't available (50%), training in practice of infection control wasn't appropriate (51.6%), policy and procedures of infection control practice were absent (40.8%), HCWs have not adhered to these policy and procedures (52.5%), infection control supplies weren't sufficient (68.3%), hand hygiene after patient contact, wearing mask while contacting with patient, avoiding

overcrowding in hospital and decreasing clinical workloads were protective (54.2%, 69.2%, 75.8% and 75.8%, respectively) and proper disinfection of environmental surfaces wasn't protective (44.2%). Practice towards COVID-19 was evaluated; results revealed that 39.2% had COVID-19 symptoms, 59.2% had work activities as usual, 50.8% Spaced out consultations to avoid overcrowding in the waiting room and 45% Checked body temperature & excluded those above 37.5 °C. The attitude and practice of the healthcare workers participants towards COVID-19 were summarized as shown in table 3.

Table 3: Attitude and practice of the healthcare workers participants towards COVID-19

| Attitude towards COVID-19 | N=480 | | Practice towards COVID-19 | N=480 | |
|---|-------|------|---|-------|------|
| | No | % | | No | % |
| Do you think wearing two surgical masks is more effective in protection against COVID19? | | | Have you ever had symptoms of COVID-19? | | |
| Yes | 272 | 56.7 | Yes | 188 | 39.2 |
| No | 208 | 43.3 | Confirmed COVID-19 | 40 | 8.3 |
| Do you think temperature screening alone is effective for diagnosing covid-19 infection? | | | Confirmed & hospitalized | 8 | 1.7 |
| Yes | 96 | 20.0 | No | 244 | 50.8 |
| No | 384 | 80.0 | What have you done regarding work or activity during COVID-19? | | |
| Are you sure about avoiding COVID infection at work? | | | Stopped all activities | 48 | 10.0 |
| Enough confident | 72 | 15.0 | Limited to emergencies | 148 | 30.8 |
| A little confident | 196 | 40.8 | Work as usual | 284 | 59.2 |
| No confident | 212 | 44.2 | Precautions applied before patient arrival: | | |
| Do you think knowledge about infection control measures is available? | | | Spaced out consultations to avoid overcrowding | 244 | 50.8 |
| Agree | 152 | 31.7 | Checking body temperature & exclude those above 37.5 °C. | 216 | 45.0 |
| Disagree | 240 | 50.0 | In geriatric patients, interventions are postponed. | 116 | 24.2 |
| Neutral (undecided) | 88 | 18.3 | Sort phone | 79 | 16.5 |
| Do you think training in infection control practice is appropriate? | | | Nothing | 71 | 14.8 |
| Agree | 116 | 24.2 | Precautions applied in the waiting room: | | |
| Disagree | 248 | 51.6 | The patient was instructed to put on a mask. | 362 | 75.4 |
| Neutral | 116 | 24.2 | Space (at least one meter) | 270 | 56.3 |
| Do you think policy of infection control practice are present? | | | Ventilation on a regular basis | 231 | 48.1 |
| Agree | 168 | 35.0 | Check patient's body temperature | 211 | 44.0 |
| Disagree | 196 | 40.8 | Disinfection many times a day | 241 | 50.2 |
| Neutral | 116 | 24.2 | Storage of items outside the room | 143 | 29.8 |
| Is there adherence of HCWs to this policy? | | | Withdrawal of books | 132 | 27.5 |
| Agree | 132 | 27.5 | Consider the current condition on enrollment | 124 | 25.8 |
| Disagree | 252 | 52.5 | Hand washing | 133 | 27.7 |
| Neutral | 96 | 20.0 | Nothing | 22 | 4.6 |
| Do you think infection control supplies are sufficient? | | | Precautions in the examination or operating room: | | |
| Agree | 104 | 21.7 | Surface disinfection with 0.5% sodium hypochlorite | 148 | 30.8 |
| Disagree | 328 | 68.3 | Surface disinfection with 70% ethyl alcohol | 212 | 44.2 |
| Neutral | 48 | 10.0 | Surface disinfection with a standard disinfectant | 136 | 28.3 |
| Do you think hand hygiene after contact with patients is protective? | | | Disinfection of devices and removal of disposable ones | 232 | 48.3 |
| Agree | 260 | 54.2 | Hand washing before and after each procedure | 288 | 60.0 |
| Disagree | 156 | 32.5 | Ventilation for adequate time after each patient | 200 | 41.7 |
| Neutral | 64 | 13.3 | None | 56 | 11.7 |
| Do you think that wearing mask while contacting with patient is protective? | | | PPE and devices used during work: | | |
| Agree | 332 | 69.2 | Disposable gloves | 216 | 45.0 |
| Disagree | 108 | 22.5 | Sterile disposable gloves | 92 | 19.2 |
| Neutral | 40 | 8.3 | Disposable gown | 192 | 40.0 |
| Do you think that proper disinfection of environmental surfaces is protective? | | | Sterile microfiber disposable | 96 | 20.0 |
| Agree | 188 | 39.2 | N95 mask | 152 | 31.7 |
| Disagree | 212 | 44.2 | Surgical mask | 328 | 68.3 |
| Neutral | 80 | 16.7 | Safety glasses | 136 | 28.3 |
| Do you think that avoiding overcrowding in hospital is protective? | | | FFP2 or FFP3 facial filters | 56 | 11.7 |
| Agree | 364 | 75.8 | Water-repellent, non-woven | 72 | 15.0 |
| Disagree | 96 | 20.0 | Disposable headset | 104 | 21.7 |
| Neutral | 20 | 4.2 | None | 16 | 3.3 |
| Do you think that decreasing clinical workloads is protective? | | | | | |
| Agree | 364 | 75.8 | | | |
| Disagree | 52 | 10.8 | | | |
| Neutral | 64 | 13.3 | | | |

Total knowledge score was (19.95±2.4) and satisfactory knowledge was reported among 60%. Total attitude score was (18.1±3.7) with positive attitude

being reported among 23.3%. Total practice score was (10.6±1.1) and good practice was reported among 89.2% (fig 1).

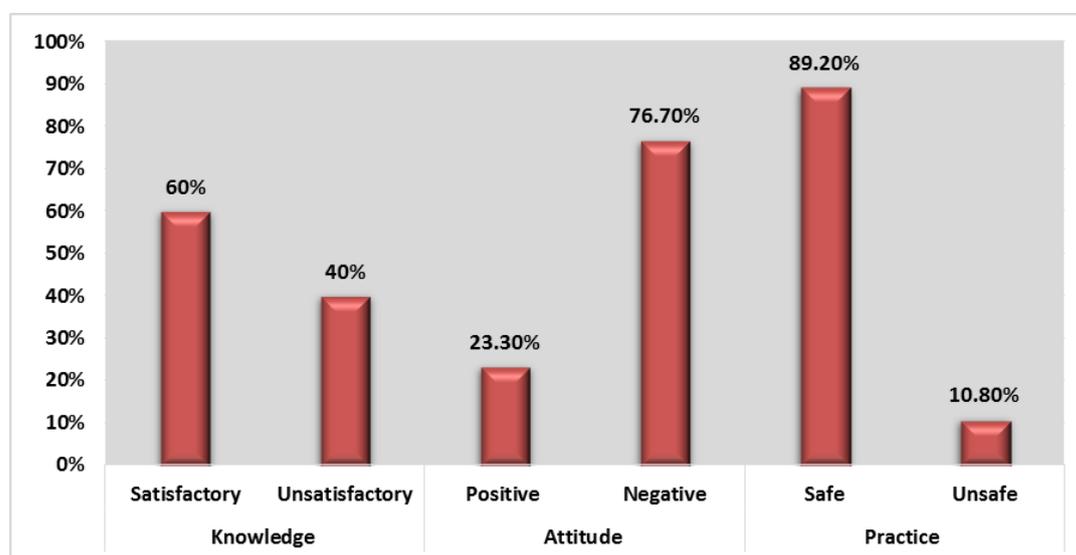


Fig 1: Knowledge, attitude, and practice among the studied healthcare workers

Knowledge and practice scores were significantly higher among females (20.3±2.2 and 10.6±1.1, respectively) than males (19.1±2.7 and 10.3±1.1, respectively), ($P < 0.001$ and 0.002, respectively), additionally, age groups > 40 years showed significantly

higher knowledge and practice scores than those < 40 years old ($P=0.009$ and 0.019, respectively). Unsatisfactory knowledge was greater among males (60.6%) and para-medical personnel (45.6%) (table 4).

Table 4. Distribution of Knowledge, attitude, and practice score regarding sex, age, occupation.

| | | Sex | | | | P-value | Age | | | | P-value | Occupation | | | | P-value |
|-----------|----------------|----------|------|----------|------|---------|------------|------|------------|------|---------|------------|------|--------------|------|---------|
| | | Male | | Female | | | < 40 years | | > 40 years | | | Physician | | Para-medical | | |
| | | no | % | no | % | | no | % | no | % | | no | % | no | % | |
| Knowledge | Score | 19.1±2.7 | | 20.3±2.2 | | <0.001* | 19.8±2.5 | | 20.4±2.1 | | 0.009* | 20.1±2.5 | | 19.8±2.4 | | 0.127 |
| | Unsatisfactory | 80 | 60.6 | 112 | 32.2 | <0.001* | 140 | 40.7 | 52 | 38.2 | 0.620 | 88 | 34.9 | 104 | 45.6 | 0.017* |
| | Satisfactory | 52 | 39.4 | 236 | 67.8 | | 204 | 59.3 | 84 | 61.8 | | 164 | 65.1 | 124 | 54.4 | |
| Attitude | Score | 18.3±4.2 | | 18.1±3.5 | | 0.478 | 17.9±3.9 | | 18.6±3.2 | | 0.051 | 18.1±3.2 | | 18.1±4.2 | | 0.938 |
| | Negative | 96 | 72.7 | 272 | 78.2 | 0.209 | 268 | 77.9 | 100 | 73.5 | 0.307 | 192 | 76.2 | 176 | 77.2 | 0.695 |
| | Positive | 36 | 27.3 | 76 | 21.8 | | 76 | 22.1 | 36 | 26.5 | | 60 | 23.8 | 52 | 22.8 | |
| Practice | Score | 10.3±1.1 | | 10.6±1.1 | | 0.002* | 10.5±1.2 | | 10.7±0.8 | | 0.019* | 10.6±0.9 | | 10.5±1.3 | | 0.146 |
| | Unsafe | 16 | 12.1 | 36 | 10.3 | 0.576 | 40 | 11.6 | 12 | 8.8 | 0.373 | 32 | 12.7 | 20 | 8.8 | 0.167 |
| | Safe | 116 | 87.9 | 312 | 89.7 | | 304 | 88.4 | 124 | 91.2 | | 220 | 87.3 | 208 | 91.2 | |

*: significant

DISCUSSION

This cross-sectional research was carried out at the start and during the peak of the second wave of the COVID-19 pandemic. The participants were physicians, nurses, and other health care providers at 52.5%, 33.3% and 14.2%, respectively. In comparison to other studies

performed in China⁸ and Pakistan⁹ where the highest percentage of HCWs were nurses (70.9%) and pharmacists (46.65%), respectively.

The present findings revealed that HCWs had a satisfactory degree of knowledge (60%). These results are similar to what has been mentioned in other studies conducted among HCWs by Bhagavathula et al.¹⁰ as the degree of knowledge was 61% and another research

done by Nemati et al.¹¹, in which the degree of knowledge was 56.5 percent. However, our results are lower than those mentioned in other studies conducted by Abdelhafiz et al.¹², Olum et al.¹³, and Huynh et al.⁸ as the knowledge correct answer rates were 80.4%, 82.4%, and 88.4%, respectively.

In our study, COVID-19 knowledge has been shown to be significantly correlated with age groups above 40. According to the findings of many studies, people above the age of forty have a higher degree of knowledge^{14,15}. In contrast to previous research that has linked a higher degree of knowledge to people under the age of 40^{12,16}. Others have shown no correlation between both knowledge and age^{17,18}.

Knowledge scores were higher among females in the present study. This does not agree with another study done in Yemen, which reported that females were less prepared to confront COVID-19 than males in their country¹⁹.

In our study, 92.5% of participants accepted that the virus spreads through air droplets. This result is similar to that has been mentioned in another research done in Egypt¹², where 95.9% of the subjects gave the same answer. But it differs from a study done in Pakistan²⁰, where only 70.5% of the subjects gave similar answer.

Regarding risk groups of COVID-19 severity, 95.8% in our survey reported that old age is the most affected age group. This is higher than a study conducted in Bangladesh²¹ with a percentage of 86.1%. Only 33.3% of our study participants answered that 6 feet was a safe distance to keep it from spreading. This is lower than the Saudi Arabian study²² where 50.62% gave correct answers. Moreover, only 61.7% of HCWs in the present study know that the Health Ministry's hotline for reporting COVID 19 cases is 105. This suggests that the website of the Ministry of Health should be updated to enable HCWs to use this platform for all health-related issues.

Novel's study²³ documented inadequate awareness of asymptomatic infections. Nevertheless, certain COVID-19 patients are asymptomatic, but sometimes they can also spread the pathogen to the others²⁴. More than 86% of the HCW participants in our sample study were convinced that asymptomatic COVID-19 infection can be transmitted to others. This agrees with the Egyptian study¹² where 81.8% of the subjects gave the same answer.

The incubation time of Covid-19 is 2-14 days, according to 88.3 percent of the study participants in our sample. This is consistent with findings from research in Pakistan²⁰ where 90.4% of the study participants gave the same answer. Although, it differs from another Egyptian study²⁵, where only 77.6% of the subjects gave the same answer.

Our participants (78.3%) reported that SARS-CoV-2 may survive on surfaces for any period which was comparable to that mentioned in a research done in

Yemen¹⁹ as 85.4% of the study participants responded with the same answer.

The total attitude score towards COVID-19 was (18.1±3.7), with 23.3% reporting a positive attitude, which is comparable to another study done in Egypt where the score recorded 13.7 ± 2.1 ²⁵. This could be attributed to the participants' health-care settings which may be of various types. This score is less than another study carried in a Saudi Arabian in which 28.23 was the mean score²².

Fifteen percentage of our participants had enough confidence regarding COVID 19 infection avoidance at work. This is compared to another research in which only 5.9% were not scared of contracting disease during work²⁶.

In our study, 51.6% claimed that training in practice of infection control wasn't appropriate, 40.8% answered that policy of infection control were absent, 52.5% claimed that HCWs weren't adhered to these policies. This is in parallel with Nigerian study in which 46.2% of participants reported that training on infection control for this disease was inadequate²⁷. But this is different from a study in which 6.1% did not have a program of infection control at their organization²⁸.

Regarding patients' overcrowding in hospitals, it was identified as a perceived barrier by 75.8% of our HCWs participants. The same barrier has been reported in Ethiopia²⁹ at a percentage of (66.12%). On the other hand, overcrowding in hospitals was considered as an obstacle by less than 5% of HCWs in a Libyan study³⁰.

The lack of infection control supplies in hospitals was identified as a barrier by 68.3% of our HCWs participants. This agrees with a research that has been conducted in Ethiopia²⁹ with percentages of (52.5%). In contrast, according to a Libyan survey³⁰, only 16.30 percent of participants believe that PPE deficiencies are a perceived limitation.

A satisfactory practice was reported at 89.2%. This result was consistent with a research done in Saudi Arabia, where 87.9% of HCWs reported using safe infection-control practices¹⁴.

Despite reports globally indicating a reduction in routine medical care for other illnesses with the onset of COVID 19, 59.2% of participants continue to work as usual for other illnesses³¹.

The most cautious factors taken prior to the arrival of the patients in the current research, were spaced out consultations to avoid overcrowding in the waiting room and excluding those above 37.5 °C at 50.8% and 45.0% from our participants respectively. These data were similar to a Chinese study, which revealed 59.6% of HCWs participants monitor body temperature as preventive practice against COVID 19³². This is opposed to one study³³, which found that measuring fever was practically ineffective for evaluating the risk of SARS-CoV-2 infection.

Using a mask for the patient and keeping at minimum one meter between patients were mentioned by 75.4% and 56.3% of our HCWs participants, respectively. while, in an Ethiopian study, 29.9% of participants maintained social distancing by staying 2 meters away from others³⁴. Hand washing was reported by 60% in our research study. This is significantly lower than a study, which found that 74% of subjects always wash their hands before and after communicating patients³⁵.

According to our findings, surgical masks were used by 68.3 percent of HCWs and N95 masks were used by 31.7 percent of HCWs. At the present time, we don't have conclusive data on the effectiveness of surgical masks versus respirators used in the healthcare settings for SARS-CoV-2³⁶. When performing aerosol generation procedures, HCWs interacting with COVID-19 patients should wear surgical masks with eye safety and N95³⁷. This agrees with the findings of a Bangladeshi study in which surgical masks and N95 masks were used by, respectively, 87.8% and 71% of participants³⁸. Also, 70.1 percent of HCWs through Iran³⁹ wear the mask during work. Furthermore, 45.0% and 19.2% of our subjects use disposable and sterile gloves in their health care centers, respectively, comparable to a survey conducted in Italy⁴⁰, where disposable gloves were reported by 90.10% and sterile gloves by just 5.79%.

CONCLUSION

Satisfactory knowledge and safe systems of practice towards COVID-19, along with a low positive attitude, were revealed, which necessitates further efforts to enhance hospital precautionary measures and training programs. Overcrowding in hospitals, increased clinical workloads and insufficient infection control supplies were all shown as obstacles to controlling the SARS-CoV-2 pandemic. This should prompt us to establish new health-care settings while also reconsidering the number of HCWs working in the existing ones. Also, to increase infection control supplies.

- The authors declare that they have no financial or non-financial conflicts of interest related to the work done in the manuscript.
- Each author listed in the manuscript has seen and approved the submission of this version of the manuscript and takes full responsibility for it.
- This article has not been published anywhere and is not currently under consideration by another journal or a publisher.

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