

ORIGINAL ARTICLE

Knowledge, perception of risk of disease, and infection prevention and control practices among healthcare workers and support staff toward COVID-19 in an Ethiopian referral hospital: a cross-sectional survey

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Abstract

Coronavirus disease 2019 (COVID-19) is a pandemic affecting over 106 million and killing over 2.3 million people. Inadequate knowledge of the disease coupled with scarce or improper use of infection prevention and control (IPC) measures by healthcare workers (HCWs) and support staff may be contributing to the rapid spread of infection. This survey aims to assess knowledge, risk perception, and precaution practices of HCWs and support staff toward COVID-19 under resource-constrained circumstances at a major referral hospital in Ethiopia. An institution-based survey was conducted in April 2020 using 422 subjects selected by stratified random sampling. A five-section survey instrument was distributed, and the collected responses were cleaned and entered into Epi data (v3.1) and exported to SPSS (v.26) for further statistical analysis. The survey found that about 58% of the HCWs and support staff in the hospital appear to have adequate awareness and perceive COVID-19 to be a high-risk disease. Seven out of 10 subjects practice some form of IPC measures. However, the knowledge among allied HCWs and support staff appears to be inadequate. Gender, occupation, and years in service correlated with the level of awareness. Of those surveyed, 78% were concerned about the lack of personal protective equipment and perceived public transportation to be a high-risk factor for the transmission of infection. Additional campaigns may be necessary to reinforce existing knowledge of HCWs, but more emphasis should be geared toward educating allied HCWs and support staff.

Keywords: COVID-19; pandemic; survey; knowledge; occupational exposure; Ethiopia

To access the supplementary file, please visit the article landing page

Received: 20 August 2020; Revised: 9 February 2021; Accepted: 15 February 2021; Published: 4 June 2021

Coronaviruses are respiratory viruses that are known to cause illness ranging from the common cold to severe acute respiratory syndrome (1). The transmission is mainly by respiratory droplets and direct and indirect contacts. Airborne transmission other than that by aerosol generating procedures and feco-oral transmission routes are yet to be confirmed. Most coronaviruses infect animals and the transmission from bats to humans might have occurred after mutation via an intermediate host(s), but as yet there is no definitive host identified for coronavirus disease 2019 (COVID-19). Severe acute respiratory syndrome (SARS) in 2002 killed 800 people (case fatality rate [CFR] of 10%), and in 2012, Middle East respiratory syndrome (MERS) killed 860 people (CFR of 40%) (2). Recently, a novel coronavirus was isolated from the lower respiratory tract of patients who were suffering from pneumonia in Wuhan, Hubei

Province, China. The World Health Organization (WHO) declared COVID-19 as a public health emergency of international concern on January 30, 2020, and then later on March 11, 2020, as a pandemic (3, 4). As of February 08, 2021, there are more than 106 million confirmed cases with more than 2.3 million deaths globally. Out of the confirmed cases, more than 3.6 million cases are in the African continent. The first reported case in Ethiopia was on March 12, 2020, and since then, the confirmed cases reached 136,365 (January 29, 2021) with 2,087 fatalities. This number may be an underestimation of the cases in Ethiopia because testing is limited (5).

In the absence of effective antiviral treatment or vaccine, prevention is the key to control the spread (2). Healthcare workers (HCWs) are at increased risk of acquiring COVID-19 at workplace, especially in resource-limited countries (6). On September 2, the WHO

Pan American Regional Office in Washington, DC, reported that 570,000 HCWs were infected and 2,500 patients were dead due to COVID-19 (7). In one case study, nearly 29% of the affected patients were HCWs, and hospitals were the presumed place of exposure. Some died of complications and many more were quarantined after exposure to a suspected or confirmed case of COVID-19 (8). The high contagion, asymptomatic persons or atypical presentation, inadequate and delayed testing of suspected cases, improper use or inadequate supply of personal protective equipment (PPE), and other preventive measures against coronavirus increase the likelihood of HCWs being infected (6, 9, 10). In developing countries, infection of HCWs would significantly undermine the fragile healthcare system by stretching an already thin workforce. Besides, the possibility of catching the virus and spreading it to vulnerable family members such as the elderly could affect the overall willingness of HCWs to work during an outbreak. Recognizing this as a concern, the WHO and the US Centers for Disease Prevention and Control (CDC) have prepared manuals with recommendations and started providing free online training. The confirmed cases in Ethiopia are increasing and so is the risk to frontline HCWs and their families.

Most studies conducted on COVID-19 focus on the clinical characteristics and epidemiology of the disease and not on its relation to HCWs. There is an urgent need to evaluate and improve the level of awareness of HCWs. Thus, we aim to explore knowledge, perception of risk, and the infection prevention and control (IPC) practices of HCWs and support staff against COVID-19 in a tertiary teaching hospital in Ethiopia. The findings of this survey are expected to identify strengths and weaknesses of the current IPC practices in the survey hospital, increase awareness of policy makers and national programs about preventive measures, serve as a baseline study, and supplement other studies on the subject of COVID-19 to galvanize the effort to control the spread of the disease.

Materials and methods

Study design

The survey was conducted at St. Paul's Hospital Millennium Medical College (SPHMMC) in Addis Ababa, which is the second-largest multi-specialty tertiary care teaching hospital in Ethiopia. The hospital has been giving medical services for more than 50 years with an emphasis on the underserved population. There are about 800 students and more than 3,031 medical staff (11). The cross-sectional survey was conducted from March 30 to May 2020. Participants were drawn from all healthcare professionals and support staff actively working in the hospital for at least 6 months. Workers on personal, sick, or maternity leave were excluded.

Sample size determination and sampling technique

Sample size was calculated based on a prior presumption that the proportion (P) of HCWs and support staff with adequate knowledge on COVID-19 would be about 50% with the desired precision of $d = 0.05$. The sample size was determined using the single population proportion formula and adding nonresponse rate of 10%. Using stratified random sampling, 422 subjects were included in the survey. The variables assessed were risk perception, self-reported IPC practices, and knowledge about COVID-19.

Data collection and scoring

Data were collected using a self-administered semi-structured questionnaire that was prepared after a thorough literature review on COVID-19. The scope and structure of the questionnaire are included in the Supplement. We tried to objectively assess the knowledge of HCWs about the disease using structured questions focusing on COVID-19 etiology, symptoms, transmission, and treatment. Each response was recorded as 'yes' or 'no' and transformed into scores ranging from 0 to 28. Knowledge scores for individuals were calculated and summed up to give the total knowledge score. The risk perception and self-reported practice statements were scored on a 5-point Likert scale, from 1 to 5 (strongly agree 5, agree 4, neutral 3, disagree 2, and strongly disagree 1). To calculate the overall risk perception, responses were scored on a 0–12 range with a score >9 (80%) considered as high-risk perception. The results of each practice related question were summed up to give a score of 0–35. Testing of the questionnaire was carried out in 21 (5%) randomly selected HCWs and support staff from their respective departments. Following input, the questionnaire was distributed to the study population. Both paper-based and online Google forms-based questionnaires were used to collect data. Participants were given sufficient time to read, comprehend, and answer all the questions; and information about the survey was provided to address any question.

Data processing and analysis

The processing began by checking the gathered data for accuracy and completeness. Each completed questionnaire was assigned a unique code and entered into Epi Info version 3.5.1 (CDC, Atlanta, GA, USA) and exported to SPSS version 26 (IBM, Armonk, NY, USA) for further analysis. Results are presented as frequency distributions, cross-tabulations, and graphs. Continuous variables are presented as mean and standard deviation (SD), and categorical variables are presented as frequency and percentages. The chi-square test was used to evaluate the level of association. Statistical significance was established at a P -value of <0.05 . Operational definitions and

cut-off points used in this survey are provided in the Supplement.

Ethical clearance

Clearance was obtained from the Institutional Research and Ethics Review Committee (IRB) of the SPHMMC. Participation of the HCWs in the study was voluntary.

Results

Socio-demography

With a response rate at 100%, 422 study subjects participated in the survey of whom 339 were HCWs and 83 were

support staff (Table 1 and Supplementary Material). The gender composition was 47% male and 53% female with an overall average age of 27.6 years. More than half of them have served in the hospital for at least 2 years. About 74% were using public transport (taxi and bus) to travel to and from work, and most were living with their nuclear family.

Knowledge and source of information of the participants

All participants stated to have heard about COVID-19, and 66% (278) of them had the opportunity to attend formal training sessions/lectures about COVID-19 at some point. About 69% of the participants thought that they

Table 1. Socio-demography of HCWs and support staff at SPHMMC

Characteristics	Category	Number	%	
Age (years)	18–29	291	69	
	30–39	89	21	
	40–49	12	3	
	Total	391	100	
Sex	Male	199	47	
	Female	223	53	
	Total	422	100	
Marital status	Single	283	67	
	Married	130	31	
	Divorced/widow	9	2	
	Total	422	100	
Transportation	Public transport	309	74	
	Self-driving	33	8	
	Walk	77	18	
	Total	419	100	
Home living circumstances	Alone	99	26	
	With parents	64	17	
	With family	164	42	
	With friends	60	15	
	Total	387	100	
Profession	Doctor (medical doctors and interns)	116	31	
	Pharmacist	13	3	
	Radiologist	10	2	
	Nurse and midwives	188	45	
	Medical Lab	17	4	
	Anesthesia/anesthesiology	5	1	
	Guards	19	4	
	Porters	22	5	
	Cleaners	42	10	
	Total	422	100	
	Educational level of support staff	Elementary school	36	43
		Secondary school	32	39
		Tertiary school	15	18
Total		83	100	

HCWs, healthcare workers; SPHMMC, St. Paul's Hospital Millennium Medical College.

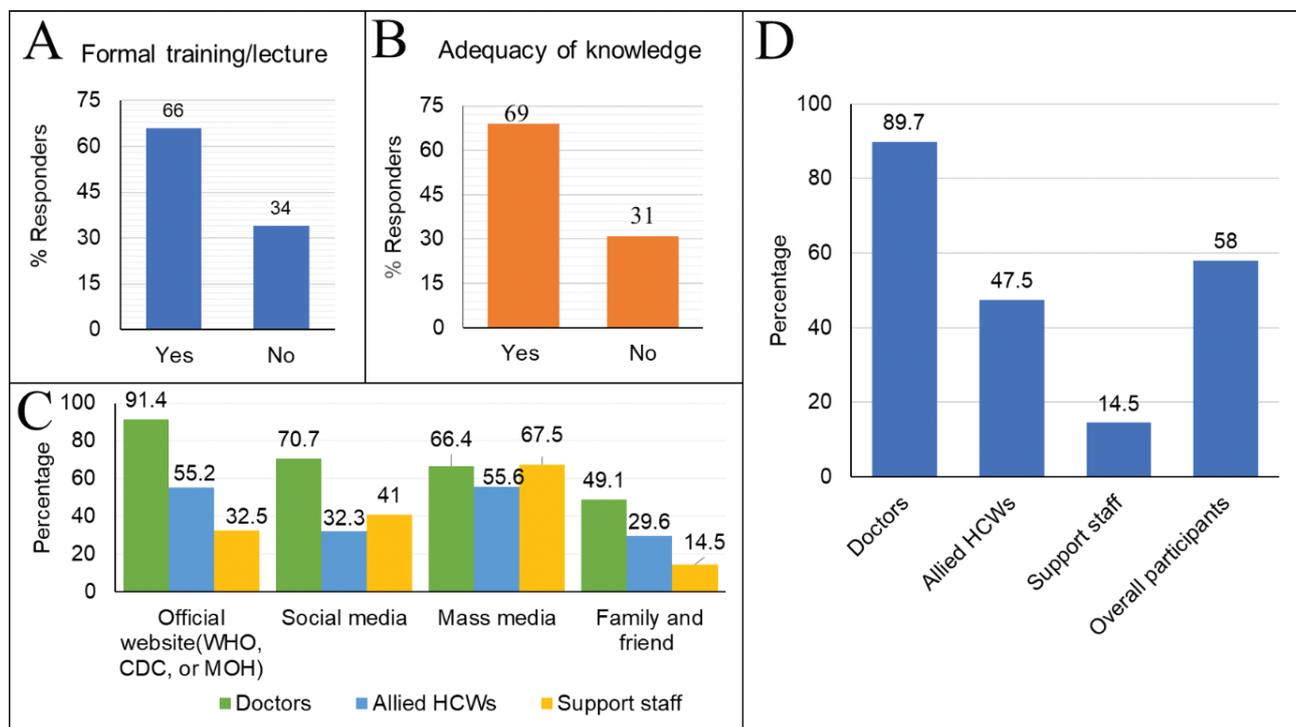


Fig. 1. Knowledge and sources of COVID-19 information among participants. (a) Formal training about COVID-19. (b) Adequacy of knowledge (self-assessment) among HCWs and support staff. (c) Sources of information about COVID-19. (d) Percentage of HCWs and support staff with adequate knowledge (score > 80%).

had sufficient information about COVID-19 and its prevention (Fig. 1a and b). As shown in Fig. 1c, doctors self-reported using official websites (WHO, CDC, or Ethiopian Federal Ministry of Health [FMOH]) as their main source of information followed by social and mass media. Allied HCWs used official websites and mass media equally as the main source. However, the support staff was getting COVID-19-related information primarily from mass media and social media.

As summarized in Fig. 1d, doctors received the highest score with nearly 90% of them having adequate knowledge about COVID-19 (score > 22 out of 28 or 80%). Based on their responses, about 48% of the allied HCWs appeared to have adequate knowledge, and support staff scored the lowest with 14.5%. Overall, about 58% of the participants had knowledge surpassing the 80% adequacy threshold. The mean knowledge score for HCWs and support staff was about 82 and 60%, respectively.

Further granular detail of knowledge of HCWs was assessed and summarized in Table 2. Nine out of 10 doctors and 61% of the allied HCWs said that SARS-CoV-2 is the cause of COVID-19 but only 36% of the support staff answered this question correctly. About 82% of doctors identified the origin of SARS-CoV-2 to be bats, while 48.4 and 59% of the allied HCWs and support staff, respectively, said the same about the origin. Doctors, allied HCWs, and support staff identified fever (99.1,

86.5, 66.3%) and cough (98.3, 70.9, 69.9%) as the most common symptoms that COVID-19 patients might manifest. The majority of the participants identified droplets and contact to be known modes of transmission, and over 50% of doctors believed that feco-oral transmission is possible. Nine out of 10 doctors and 80% of the allied HCWs understood that asymptomatic transmission is a possibility, while only 23% of the support staff knew about asymptomatic transmission.

Perception of risk

The overwhelming majority of HCWs was fearful of acquiring COVID-19 at the workplace (Table 3). Over 97% of physicians, 91% of allied HCWs, and 88% of support staff said they likely or very likely expected to be infected in hospital at some point, and more than 80% of the workers were concerned that they may transmit the virus to family members. The perception about the fatality from COVID-19 varied among respondents with the majority of hospital support staff perceiving COVID-19 to be highly fatal (86%). At least 80% of physicians responded that there is a good chance of surviving this disease if infected. Overall, the perceived risk and the ability to recover from COVID-19 appeared to be associated with the degree of involvement in patient care and the level of training of the professional. Over 58% (244) of

Table 2. Knowledge about COVID-19 in HCWs and support staff (n = 422)

Questions		Doctors (n = 116)		Allied HCWs (223)		Support staff (n = 83)	
		Number	%	Number	%	Number	%
Cause of COVID-19	SARS-CoV-2	106	91.4	135	60.5	30	36.1
Presumed origin of COVID-19	Bats	95	81.9	108	48.4	49	59
	Snakes	1	0.9	13	5.8	3	3.6
	Fish	2	1.7	9	4	1	1.2
	Unknown	18	15.5	90	40.4	26	31.3
Symptoms	Headache	98	84.5	126	56.8	51	61.4
	Fever	115	99.1	193	86.5	55	66.3
	Cough	114	98.3	158	70.9	58	69.9
	Sore throat	101	87.1	123	55.2	48	57.8
	Shortness of breath	86	74.1	152	68.2	61	73.5
Transmission	Droplet	79	68.1	211	94.6	75	90.4
	Contact	112	96.6	197	88.3	76	91.6
	Feco-oral	65	56	68	30.5	17	20.5
Asymptomatic transmission		108	93.1	177	79.4	19	22.9
Necessity of preventive measures in young adults		111	95.7	197	88.3	58	69.9
Complications	Pneumonia	110	94.8	144	64.6	30	36.1
	Respiratory failure	112	96.6	175	78.5	47	56.6
	Death	108	93.2	139	62.3	52	62.7
Prevention	Hand hygiene	116	100	221	99.1	72	86.7
	Covering nose and mouth when coughing/sneezing	116	100	219	98.2	33	39.8
	Avoiding sick contacts	108	93.1	221	95.1	33	39.8
	Having well-cooked meat and eggs	99	85.3	203	91	17	20.5
Exposure risk	Patient examination	116	100	204	91.5	66	79.5
	Laboratory sample collection	110	94.8	127	57	28	33.7
	Radiologic imaging	109	94	97	43.5	22	26.5
	Drug dispensing	109	94	101	45.3	17	20.5

HWCs, healthcare workers.

the HCWs and support staff perceived COVID-19 to be a high-risk disease.

The practice of preventive measures against COVID-19

The majority of HCWs and support staff reported practicing IPC measures. As depicted in Fig. 2a, nearly 90% of HCWs and 80% of support staff agreed or strongly agreed that they avoided shaking hands and large-group gatherings. Similarly, 86% of the respondents covered their noses when coughing or sneezing, and 89% of the respondents washed their hands after exposure to respiratory secretions. Over 54% of the respondents used public transport to and from the hospital and considered this a high-risk factor. Of the respondents, 78% (313) agreed or strongly agreed that there was inadequate PPE available at their current workplace, while 16% (66) felt that the PPE available to them was adequate. In regard to practicing the WHO's 5 Moments for Hand Hygiene, 76% of the HCWs reported that they performed handwashing at all five

moments, while 82 and 87% of the HCWs practiced washing before and after touching a patient, respectively (Fig. 2b). The overall practice of preventive measures against COVID-19 was assessed by asking seven Likert scale questions (Fig. 2c). With the arbitrary score of ≥ 26 (75%) considered as good, 74% (311) of the participants scored 75% or more in the self-reported practice of precautionary measures.

The role of respondents' attributes to knowledge, risk perception, and the practice of preventive measures

Table 4 shows that people with more years in healthcare service tended to practice IPC measures more frequently (P -value 0.019). A statistically significant association was observed between occupation or gender and knowledge about COVID-19. It is counterintuitive that factors such as training about COVID-19 neither improved the understanding about the disease ($P = 0.645$) nor improved the practice of IPC measures ($P = 0.608$). Similarly, living

Table 3. Perceived risk of COVID-19 in SPHMMC HCWs and support staff (n = 422)

Questions		Doctors		Allied HCWs		Support staff	
		#Respondent	%	#Respondents	%	#Respondents	%
How likely do you think it is that you might become infected with COVID-19 in the near future at your workplace?	Not likely	3	2.6	20	9.1	10	12
	Likely	30	25.9	80	36.4	24	28.9
	Very likely	83	71.6	120	54.9	49	59
	Total	116		220		83	
How likely do you think that people in your family and friends might become infected with COVID-19 in the near future if you are infected?	Not likely	5	4.3	32	15	7	9
	Likely	43	37.1	73	34.3	25	32.1
	Very likely	68	58.6	108	50.7	46	59
	Total	116		213		78	
How likely do you think it is to get COVID-19 in general?	Not likely	0	0	31	14.4	18	23.4
	Likely	66	56.9	87	40.5	16	20.8
	Very likely	50	43.1	97	45.1	43	55.8
	Total	116		215		77	
If anyone gets COVID-19, there is no possibility of survival.	Not likely	93	80.2	118	54.1	11	13.8
	Likely	15	12.9	69	31.7	42	52.5
	Very likely	8	6.9	31	14.2	27	33.8
	Total	116		218		80	
Total score	High risk perception	82	71	117	57	45	38
	Low risk perception	34	29	88	43	27	62

HCWs, healthcare workers; SPHMMC, St. Paul's Hospital Millennium Medical College.

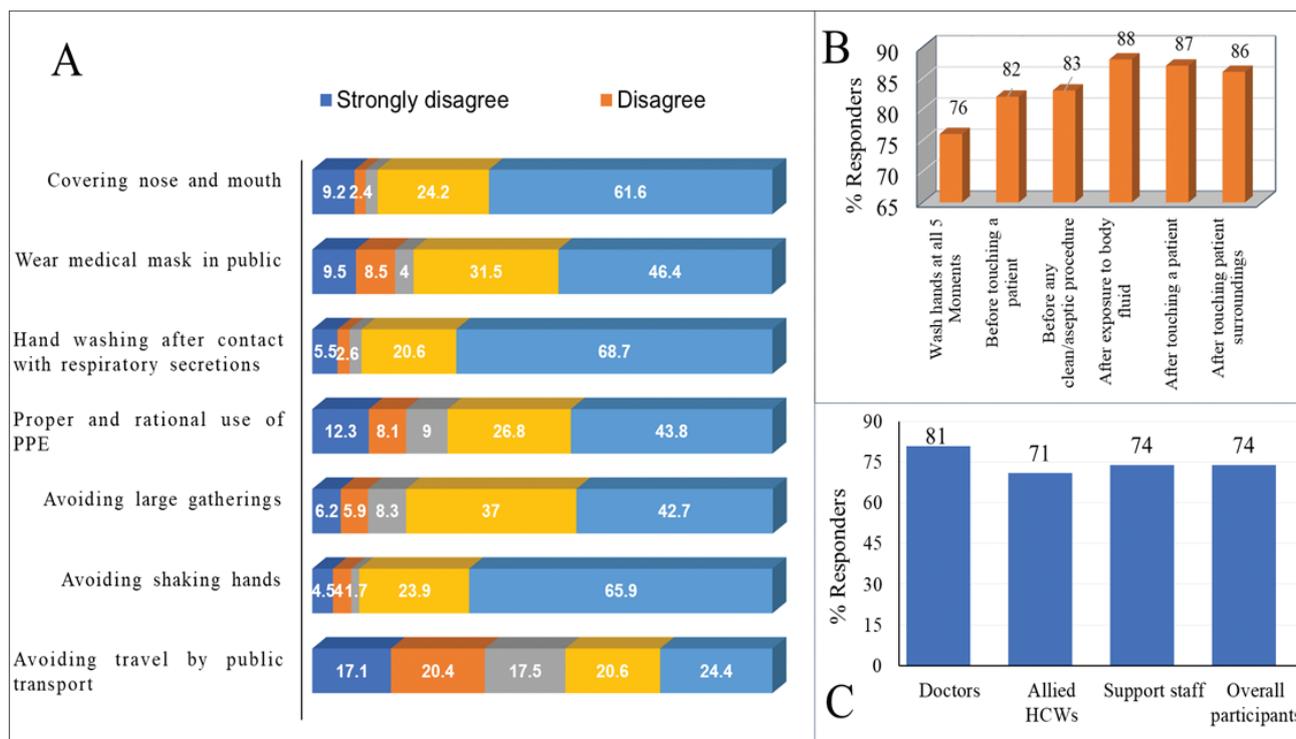


Fig. 2. Self-reported infection prevention and control practices for COVID-19. (a) Stacked bar in percentage of HCWs' and support staffs' responses to the practice questions (n = 422). (b) Percentage of HCWs' reported handwashing practices for the WHO's five moments of handwashing (n = 339). (c) The practice of preventive measures by the HCWs and support staff.

Table 4. Association between some attributes of respondents and knowledge, risk perception, and practice of preventive measures

Respondents by attribute	Knowledge		Risk perception		Practice	
	P	Cramer's V/Phi*	P	Cramer's V/Phi	P	Cramer's V/Phi
Occupation	0.000**	0.586	0.266		0.137	
Year of service	0.016**	0.170	1		0.019**	0.128
Marital status	0.404		0.577		0.897	
Gender	0.000**	0.225	0.216		0.261	
Living circumstances	0.537		0.150		0.608	
Training	0.645		0.654		0.107	

*Cramer's V/Phi values shown are only for those shown to have significant association on the chi-square test.

**The factors with significant association.

circumstances at home appear to have an insignificant effect on knowledge, perception of risk, and practice of preventive activities.

Free-text responses

One hundred and eight respondents (25%) made at least one free-text comment. The responses were predominantly about the shortage of PPE for use during hospital hours. Many respondents commented that they had to use public transport to and from the hospital in crowded buses and taxis, endangering themselves, their families, and the public. It is noteworthy that many responded that they take pride in and obtain great joy from their job and are willing to help patients. However, they also expressed frustration and pressure because of perceived 'lack of value' afforded to their well-being.

Discussion

COVID-19 is an emerging and rapidly changing pandemic with a wide-ranging impact on global healthcare systems and other aspects of human life. Both the HCWs and hospital support staff are at the forefront of the fight against COVID-19 and are affected by the disease. In the context of resource-constrained countries, the likelihood of them acquiring the disease is higher compared to the general population (6, 12, 13). This is partly due to the fact that PPE is scarcely available, and at times, the quality or effectiveness of PPE for HCWs is not necessarily at par with the transmissibility of this virus. Adequate knowledge about clinical manifestations, diagnosis, management, and established IPC measures is important in the fight to contain its spread. In this survey, we set out to evaluate the knowledge, perception of risk of the disease, and self-reported IPC practices of HCWs and support staff toward COVID-19. We found that the mean knowledge score of HCWs and support staff was about 82 and 60%, respectively. These scores are comparable to studies done elsewhere in an African hospital (82.4%) and US residents (80%) (12, 14). However, the mean score is slightly lower than among Chinese residents (90%) (15). This might be

partly because the survey was done at an earlier phase of the pandemic in Ethiopia or can be attributable to the limited access to information sources and IPC facilities in Ethiopia. COVID-19 is yet to be fully understood, and thus, objective evaluation of the adequacy of knowledge about the disease is a challenge. Despite the limitation, we found that about 58% of the respondents appeared to have adequate knowledge about COVID-19. This observation is in line with previous findings of a study by Olum et al. (12) among the HCWs of Makerere Hospital, Uganda, which is 69%, and with the results of a survey 58.7%, by Bhagavathula et al. in the United Arab Emirates (10). However, this score is much lower than what was reported by Huynh et al. in Vietnam, which was around 88.4% (16).

It appears there is difference in knowledge between HCWs and support staff with 90% of medical doctors commanding adequate knowledge about COVID-19, while a sizable portion of allied health workers including nurses lacked knowledge in a certain area of the disease. Moreover, only 14% of the support staff were equipped with the necessary knowledge about the disease (score \leq 80%) with the majority falling short in some key elements of prevention of COVID-19 and the lowest scores being for hospital cleaners. This might be alarming because these workers are highly vulnerable to healthcare-associated infection with consequent transmission to other HCWs and their families.

The mean perception of risk by all HCWs was around 58%, which appears to be higher than some other findings. For example, in Germany, the risk perception among the general population was about 34% (17). The difference in risk perception might be attributable to the target study subjects (hospital workers in the current survey as opposed to the general German population). Furthermore, the majority of respondents were anxious that COVID-19 is a high-risk disease for themselves (92%) or their families (86%). The anxiety of HCWs is in agreement with the results of the study in China that reported around 85% (18). In another study, 92% of HCWs in Iran were afraid

of being infected with the disease and transmitting it to their family (19). Owing to the perceived risk, the majority of surveyed HCWs in this survey (74%) reported practicing IPC measures. These measures include regular hand hygiene, social distancing, avoiding crowded places and large gatherings, wearing a facemask, covering mouth and nose while coughing or sneezing, and avoiding handshaking. Comparable studies showed IPC practices follow the same trend as in Uganda or Saudi Arabia (12, 20). In contrast, nearly 90% of HCWs in China regularly practice preventive measures (18). The will to practice preventive measures will likely be undermined by a shortage of PPE in the hospital. The majority of surveyed HCWs (78%) reported their concern for lack of PPE (facemasks, shields, and gloves). At the time of this survey, about 77% HCWs and 83% support staff regularly use a facemask. Such high regularity of use is encouraging but according to some respondents, a sizable portion of respondents was either buying the facemasks on their own or using one for a prolonged time. This is unsustainable and the risk of infection is high because of the repetitive use of the same PPE without appropriate cleaning or sterilization. Shortage of PPE is not a unique situation to the current survey site; similar observations have been reported from other low- and lower middle-income countries (13, 21, 22).

Limitations

The cross-sectional nature of the survey limits assertions about the cause and effect relationship. The data presented in this survey are self-reported and partly dependent on the participants' honesty and ability to recall. Besides, COVID-19 is very dynamic, and therefore, what held during the data collection period may not be the case at a later time. Despite these limitations, our findings provide a valuable insight into the knowledge, risk perception, and practice of preventive measures of HCWs and support staff during the survey period.

Conclusions and recommendation

It is encouraging that the majority of HCWs at the SPHMMC Hospital tried their best to equip themselves with knowledge about COVID-19. The self-reported practice of IPC measures appeared to be frequent by HCWs, particularly those in service at the hospital for a long time. However, the current survey particularly identified that allied HCWs and support staff appear to lack some fundamental knowledge about the prevention of the disease, and this might be a real concern and requires prompt intervention through additional campaigns of hands-on training, health education, and drafting of local IPC guidelines. Such campaigns would be beneficial if organized based on individual circumstances (profession, level of understanding, and gender). Furthermore, there

is a widely shared concern about the lack of PPE and separate public transportation, and this ought to be addressed as much as resources allow.

Acknowledgments

We acknowledge the HCWs and support staff of SPHMMC for actively participating in this survey and sharing their experiences. We are also grateful to the data collectors.

Conflict of interest and funding

We confirm that we declare no conflict of interest. We also did not receive funding or benefits from industry to conduct this study.

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