Level of Concern, Compliance and Barriers to Use Standard Precautions among Primary Health Care Providers during COVID-19 Pandemic

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Abstract

Background: COVID-19 is an emerging public health problem threatening the life of people globally, especially healthcare providers. Primary health care providers provide the first line of care in communities during health pandemics. **Aim of the study** was to assess level of concern, compliance, and barriers to use standard precautions among primary health care providers during COVID-19 pandemic. **Subjects & Methods: Research design:** Descriptive analytical design was utilized to carry out this study. **Setting:** This study was conducted at all primary health care centers at Al-Mahallah Al-Kubra city, Gharbia Governorate, Egypt. **Subjects:** A convenient sample of 350 health care providers working in the selected primary health care centers participated in the study. **Data collection tool**: A structured self-administrated questionnaire consisted of four parts; personal and work data, level of concern, compliance with infection control standard precautions, and barriers to use standard precautions. **Results** revealed that the majority of study subjects were female nurses, 73.0% and 27% of them had moderate and high level of concern regarding the COVID-19 pandemic respectively. While 54.9% of the studied healthcare providers had high compliance with standard precautions during COVID-19 pandemic. The highly perceived barriers were increased workload (59.1%), lack of sanitizer alcohol for routine hand hygiene (58.9%), and shortage of health care providers (56.9%). A statistically significant negative correlation was found between health care providers' concern score and their compliance score. Conversely, the concern score had a statistically significant moderate positive correlation with the barrier score. **Conclusion:** This study concluded that there was high level of concern among health care providers which subsequently could lead to suboptimal health care service and less effective compliance to infection control measures during the COVID-19 pandemic. **Recommendations:** Effective approaches should be followed to enhance protection of healthcare providers and minimize their concerns during the pandemic as well as primary health care centers pandemic preparedness is needed.

Keywords: COVID-19 pandemic, Concern, Compliance, Barriers, and Standard precautions.

Introduction

On 12 January 2020, the novel coronavirus was confirmed as the cause of respiratory illness among a cluster of people in Wuhan city, Hubei Province, China, which was reported to World Health Organization (WHO) on 31 December 2019. It was declared by WHO as a global pandemic on 11 March 2020 (**WHO, 2020a**). At the time of this writing, it has infected nearly 25 million cases and 800,000 deaths worldwide since the start of the outbreak (**WHO, 2020b**). The virus was confirmed to have reached Egypt on 14 February 2020. By the end of August 2020, there have been 99,115 confirmed cases of COVID-19 with 5,421 deaths, reported to

WHO (**Egyptian Ministry of Health and Population, 2020**). COVID-19 pandemic is increasing rapidly and become the most important health problem worldwide at present, it is viral pneumonia transmitted from person-to-person by close contact through the respiratory secretions in coughs or sneezes or by touching virus-contaminated surfaces or objects (**Li et al., 2020**).

As the COVID-19 pandemic progresses, health care workers are the most important resources in providing care for the patients at the combat zone against the disease. Subsequently, they become at higher risk of being infected themselves, which could pose an immense challenge for pandemic containment

and lead to the collapse of the health care systems **(Barranco & Ventura, 2020).** Prevalence of COVID-19 among health care workers was 10% with 29 % of infections occur accidentally from exposure to patients at a non COVID-19 facilities **(Alajami et al., 2020)**.

The prevention and control of such pandemic has to start from the primary care level. In fact, COVID-19 has already been the problem in the community level worldwide. The primary care centers in the community has to play pivotal role in the frontline for pandemic containment. It is no doubt that there will be a rapid increased number of patients visiting to the primary care unit when the outbreak occurs. Therefore, number of concerns are raised by health care workers in the accomplishment of their duties in relation to COVID-19 response ((**Wiwanitkit, 2020; National primary health care development agency, 2020)**. In primary health care setting, these concerns vary from mental health problems, lack of remuneration, loss of social support, lack of basic facilities as potable water and inadequate personal protective equipment as well as risk of infection of families and friends **(Ng et al., 2020)**. Thus, health care workers are at high risk central to COVID-19 pandemic response and as such required to follow established occupational safety and health procedures to avoid exposing others to risk **(WHO, 2020c).**

Healthcare workers are more closely to adhere to infection control standard precautions when they realize the value of it as they felt motivated to follow the guidance because of fear of infecting themselves or their families, or because they felt responsible for their patients (**Houghton et al., 2020)**. These infection control standard precautions include hand and respiratory hygiene, the use of appropriate personal protective equipment (PPE) according to a risk assessment, practice safe injection, safe waste disposal management, proper linens, environmental cleaning, and sterilization of patient care-related equipment **(WHO, 2020c).**

Optimizing the compliance of healthcare workers with the proper infection prevention and control measures is vital during the infectious disease outbreak, to ensure their safety, to decrease the likelihood of getting infected or transmitting the infection to patients and others, and consequently to alleviate their psychological stress and anxiety **(Temsah et al., 2020a)**. However, there are several barriers influencing healthcare workers' ability to comply to infection prevention and control measures guidelines and reinforce fear of healthcare workers towards COVID-19 pandemic as inadequate work place safety and inadequate health facility infection prevention and control policy **(Ogolodom et al., 2020)**.

Significance of the study

During the pandemic, it is an actually hard for primary health personnel. It is the time that the data is limited, facility is usually insufficient but there is a rapidly increasing magnitude of the problem. Successful practice during the outbreak is a challenge and require good willing and professionally daily care of the patients. The quality of primary health care for managing such crisis is an important issue. It is necessary to have a good managing plan to protect the primary health care workers during the present COVID-19 pandemic crisis **(Wiwanitkit, 2020)**. Primary health care workers considered the bulk of the stakeholders in the containment and control of the community transmission of COVID-19. So, it is critical to increase studies into concerns of primary health care providers, who are the first responders in health care settings as this is fundamental towards combating the huge threat to global public health and the health care system constituted by the COVID-19 pandemic **(Garg et al., 2020)**. However, studies on health care workers' compliance with infection control measures and barriers hindering application of standard precautions in primary health settings are limited and the relationship with concerns of health care workers during the pandemic is still unclear.

Aim of the study

The aim of the current study was to assess level of concern, compliance, and barriers to use standard precautions among primary health care providers during COVID-19 pandemic.

Research questions

- What is the level of concern of primary health care providers during COVID-19 pandemic?

- What is the level of primary health care providers' compliance with standard precautions during the pandemic?

- What are the barriers hindering primary health care providers to use standard precautions during the pandemic?

- Are there associations among primary health care providers' level of concern, compliance, and barriers to use standard precautions during the pandemic?

Subjects and Methods

Design: Descriptive analytical design was utilized for conducting this study.

Setting: The study was conducted in all (six) primary health care centers at Al-Mahallah Al- Kubra city, the large industrial and agricultural city, in Gharbia Governorate, Egypt. These centers were namely health centers first, fourth and fifth from health administration one. While, health center second, third and sixth were affiliated to health administration two.

Subjects and sampling: A convenient sample of 350 health care providers working in primary health care centers in Al-Mahallah Al- Kubra city, Gharbia Governorate during data collection time and accepted to participate in the study. Also they are directly contacted with clients during the pandemic as nurses, physicians, technicians, and pharmacists.

Tool of data collection: A structured self-administrated questionnaire consisted of the following four parts;

Part one: personal and work data: It composed of items regarding health care providers' characteristics as age, sex, qualification, job title, and years of experience. It also included questions about previous training in standard precautions, and preparation of their health centers for the pandemic as

presence of isolation rooms, availability of resources, and guidelines protocol during the pandemic.

Part two: Level of concern scale: This scale was modified and translated by the researchers guided by **Abolfotouh et al (2017)**. It was used to assess level of concern of healthcare workers' regarding COVID-19 pandemic. It was a Likert-type scale with four responses ranging from "strongly disagree" to "strongly agree". The scale was consisted of 31 items classified into five distinct domains;

- **Self-satisfaction** (7 items) i.e " I feel unsafe working at my workplace"

- **Social status** (6 items) i.e "I feel I will transmit COVID-19 to my family members"

- **Workplace-related** (8 items) for example "I feel that my institution didn't support me during the COVID-19 crisis".

- **Infection-control-related** (5 items) for example "I am not confident with the current infection control measures"**.**

- **Government-related** (5 items) for example "I feel the government should restrict travel from\ to areas of the disease".

The scoring system: Responses were scored 0 (strongly disagree), 1 (disagree), 2 (agree), and 3 (strongly agree). The sum of the scores were calculated and the respondents who scored up to or above 68 points were categorized as those with high level of concern about COVID-19 pandemic. The respondents who scored 23 –<68 points were categorized as those with moderate concern level. While the score of 0–22 points was categorized as low level of concern.

Part three: Compliance with infection control standard precautions

Compliance of health care workers, to apply infection control standard precautions at work, was assessed using 14 items adapted from the previous studies of **Akagbo et al (2017)** and **Amanya et al (2020)**. Items were checked on 5-point likert scale from "Never" to "Always". These items were related to

infection control standard precautions suggested by WHO which comprise hand and respiratory hygiene, the use of personal protective equipment, safe waste disposal, environmental cleaning, and disinfection and sterilization of equipment.

The scoring system: Items responses were scored as 0 (Never), 1(Rarely), 2 (Sometimes), 3 (Usually), and 4 (Always), with higher scores indicating higher compliance with standard precautions. Scores were categorized into three levels**;** low compliance (range of 0–30 points), moderate compliance (31–<60 points), and high compliance (with ≥60points).

Part four: Barriers to use infection control standard precautions

It was developed by the researchers guided by the studies of **Akagbo et al (2017)** and **Ahmed et al (2017)** to identify the barriers hindering compliance to use infection control measures. It consists of 16 likert-type items ranging from "Never" to "Always". It included barriers related to facility such as "lack of guidelines for health care workers to apply standards," "failure of the health facility to participate in infection control programs" and "unavailability of Personal Protective Equipment ", barriers related to health care workers such as "workload," "shortage of staff," and "lack of time" and barriers related to patients such as "wearing personal protective equipment may cause fear in patients".

The scoring system:

The items were scores as 0 (Never), 1(Rarely), 2 (Sometimes), 3 (Usually), and 4 (Always). The participants were considered to have a high perception of the barriers if the total score obtained was up to or above 64 points, a moderate perception if the total score was ranged from 33 to 64 points, and low barrier perception if the total score was range from o to 32 points.

Content validity and reliability of the tool

For testing face and content validity of the study tool, three experts in community health nursing and medicine revised it and some modifications were done according to

their opinions. The reliability of the tools was tested by Cronbach's Alpha as follow:

Scale	No. of items	Cronbach's Alpha
Level of concern	31	0.92
Compliance	14	0.91
Barriers	16	0.91

Pilot study

A pilot study was done on 35 healthcare providers (10% of the sample) to estimate the reliability of tool parameters by Cronbach's Alpha. Also, it was done to test the applicability of tool, the arrangement of items, and clarity of questions and to estimate the time needed for each questionnaire. They were excluded from the sample.

Administrative and ethical considerations

The study was approved by the Ethical Committee of the Faculty of Nursing, Zagazig University. Official permission was taken from the directors of each primary health care center. Informed consent was taken from every subject participated in the study after explanation of the purpose and nature of the study. They were notified that they could withdraw at any stage of the research. Also, they were assured that the information would be confidential and used for scientific research purposes only.

Filed of work

During the pandemic, all health workers were not available during the week, they were shifting to decrease the load of work force, according to the instructions of Ministry of Health and Population, and so the researchers contact directorates and head nurses of centers to determine the list of staff available in every day. In the beginning, the researchers met the participants, introduced themselves and explained to them the study aim, procedures and their rights. Owing to health care providers were very busy, the researchers distributed the self-administrated questionnaires for all healthcare providers who were available in the center and accepted to participate in the study. Once done, the questionnaire was collected by the researcher to verify its completeness. Each participant took about 20-30 minutes to fill the questionnaire. The researchers visited the selected settings two days per week for every

center from 9.00 AM to 1.00 PM. The process of data collection was carried out in the period from the beginning of April 2020 to the end of June 2020.

Statistical analysis

All data were collected, tabulated, and statistically analyzed using SPSS 20.0 for windows (SPSS Inc., Chicago, IL, USA 2011). Quantitative data were expressed as the mean ± SD & median (range), and qualitative data were expressed as absolute frequencies (number) & relative frequencies (percentage). The students'-test was used to compare two groups of normally distributed variables. F (ANOVA) test was used to compare between more than two groups of normally distributed variables. If a p-value significant, post hoc was used to detect significance between every two groups. Percent of categorical variables were compared using the Chi-square test. Spearman's rank correlation coefficient was calculated to assess the relationship between various study variables, (+) sign indicate direct correlation & (-) sign indicate inverse correlation, also values near to 1 indicate strong correlation & values near 0 indicate a weak correlation. All tests were two-sided. P-value ≤ 0.05 was considered statistically significant (S), and p-value > 0.05 was considered statistically insignificant (NS). Logistic regression is used to describe data and to explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval, or ratio-level independent variables.

Results

Table 1 shows that the total sample was 350 health care providers whose age ranged between 22 and 59 years with Mean±SD of 36.1±8.8 years, and the majority of them (77.4%) were females. Regarding educational qualifications, 45.4% of the studied health care providers had a bachelor's degree as their highest level of education and had a mean work experience of 13. 8±9. 4 years. As for specialty, the highest proportion of participants were nurses (47.4%), followed by pharmacists (21.4%), technicians (18.3%), and doctors (12.9%).

Table 2 reveals that the highest concern domain was that of self- satisfaction domain (mean 14.4±3.9), followed by workplace-related domain (mean 13.7±4.4). On the other hand, the lowest one was that of infection control-related domain (mean 9±3.4).

As displayed in **Table 3,** 88.9% of primary health care providers had direct contact with patients, and 78.9% of them reported that there was an infection control program in their health centers. Of all participants, 74.3% had attended training courses in infection control and 77.1 % were more enthusiastic to apply infection control measures after COVID-19 pandemic, and only 38.9% reported that their health centers had guidelines for the care of COVID 19 patients. Concerning preparedness of the health centers, the table shows that only 18.0 % of HCPs had reported that their health centers were prepared for COVID 19 pandemic, and 2.6 % of health centers used for isolation of COVID 19 patients.

Table 4 shows that the studied health care providers reported that they were more compliant as "always and usually" with hand washing before and after contacting patients (93.1%), covering the nose and mouth when sneezing and coughing (92.0 %), and disposal of wastes continuously in a safe manner (90.6%). On the other hand, 68.3 % of health care providers reported that they were rarely or never worn an N95 mask when contacting patients.

Table 5 reveals that the most commonly reported barriers as "always and usually" were increased workload (59.1%), lack of sanitizer alcohol for routine hand hygiene (58.9%), and shortage of health care providers (56.9%). On the other hand, the least frequently reported barriers were those of failure of the health facility to participate in infection control programs (27.7%), insufficient information about the transmission routes of COVID 19 (28.6%), and lack of instructions on standard precautions in the health center (29.2%).

Figure 1 illustrates that 73.1% of the studied primary health care providers had a moderate level of concern about COVID 19 pandemic. Also, the figure illustrates that almost 55.0 % of the studied health care

providers had high compliance with standard precautions, whereas 78% of them had moderate barriers to use standard precautions during COVID 19 pandemic.

Table 6 points a statistically significant negative correlation between health care providers' concern score and their compliance score (r= -0.31). Conversely, the concern score had a statistically significant moderate positive

correlation with the barrier score (r= 0.53).

Table 7 indicates that barrier score and gender were the statistically significant positive predictors of high concern scores. On the other hand, the compliance score was the only negative predictor of high concern score. As evident from the odds ratio, females were 2.5 times more likely to have higher concerns about COVID-19 than males.

Table (1): Socio-demographic characteristics of the studied primary health care providers (n=350).

Parameters	N	%
Sex		
Males	79	22.6
Females	271	77.4
Age		
< 35	170	48.6
≥ 35	180	51.4
Mean ±SD		36.1±8.8
Range		22-59
Experience per years		
≤10years	174	49.7
>10years	176	50.3
Mean ±SD		13.8±9.4
Range		1-39
Social status		
Married	319	91.1
Single	31	8.9
Education		
Diploma	94	26.9
Technical institute	92	26.3
Bachelors	159	45.4
Master degree	5	1.4
Specialty		
Doctors	45	12.9
Nurses	166	47.4
Technical	64	18.3
Pharmacist	75	21.4

Table (2): Concern domains of primary healthcare providers regarding COVID-19 pandemic (n=350).

Concern domains	High		Moderate		Low		Mean ± SD	Range
	N	%	N	%	N	%		
Self-satisfaction domain	23	9.1	308	88.0	10	2.9	14.4±3.9	4-21
Social status-related domain	22	6.3	285	81.4	43	12.3	10.4±3.6	0-18
Workplace-related domain	6	1.7	297	84.9	47	13.4	13.7±4.4	3-24
Infection control-related domain	34	9.7	246	70.3	70	20.0	9±3.4	1-15
Government-related domain	97	27.7	243	69.4	10	2.9	9.8±2.1	3-12

Table (3): Infection control measures as reported by the studied primary healthcare providers (n. 350)

| Parameters	Yes		No	
	N	%	N	%
Direct contact with patients	311	88.9	39	11.1
The presence of an infection control program	276	78.9	74	21.1
Attending training courses in infection control	260	74.3	90	25.7
Health center had guidelines for care of COVID-19 patients	136	38.9	214	61.1
Health providers after COVID-19 pandemic became more enthusiastic to apply infection control measures	270	77.1	80	22.9
Health center prepared for COVID-19 pandemic	63	18.0	287	82.0
Health center used for isolation of COVID-19 patients	9	2.6	341	97.4

Table (4): Primary health care providers' compliance with standard precautions during COVID-19 pandemic (n=350).

Items	Always / usually		sometimes		Never/rare	
	N	%	N	%	N	%
Washing hands before and after contacting patients	326	93.1	23	6.6	1	.3
Wearing a surgical mask during contacting patients	214	61.1	59	16.9	77	22.0
Wearing an N95 mask during contact with patients	96	27.4	15	4.3	239	68.3
Use PPE to avoid direct contact with a patient with COVID 19	229	65.4	77	22.0	44	12.6
Use good hand hygiene protocols	307	87.7	41	11.7	2	.6
Clean and disinfect of surfaces and equipment after patient discharge	296	84.6	41	11.7	13	3.7
Dispose of waste in a continuous and safe manner	317	90.6	27	7.7	6	1.7
Wear gloves when touching patients	241	68.9	62	17.7	47	13.4
Wear eye protection when dealing with patients	96	27.4	63	18.0	191	54.6
Wear apron when touching or examining patients	97	27.7	43	12.3	210	60.0
Not touch eyes, mouth, or nose after touching or interacting with patients	281	80.3	49	14.0	20	5.7
Covering the nose and mouth when sneezing and coughing	322	92.0	26	7.4	2	.6
Reducing the number of sick people or companions inside the rooms when examining or touching the patient	301	86.0	45	12.9	4	1.1
Perform any examination or procedure for the patient in a well-ventilated room	277	79.1	65	18.6	8	2.3

Table (5): Barriers to use standard precautions as reported by primary health providers during COVID-19 pandemic (n.350).

Items	Always /usually		Sometimes		Rare/Never	
	n.	%	n.	%	n.	%
Interference with the ability to provide care	141	40.3	121	34.6	88	25.1
Exposure to infection is unexpected	136	38.9	68	19.4	146	41.7
Lack of time to comply with infection control standard precautions	190	54.3	111	31.7	49	14.0
Uncomfortable personal protective equipment	177	50.6	71	20.3	102	29.1
Wearing personal protective equipment may cause fear in patients	111	31.7	169	48.3	70	20.0
Unavailability of Personal Protective Equipment	178	50.9	129	36.9	43	12.2
Infection control standard precautions is time consuming	177	50.6	100	28.6	73	20.8
The workplace is crowded with patients	153	43.7	133	38.0	64	18.3
Shortage of health care providers	199	56.9	102	29.1	49	14.0
Increased workload	207	59.1	70	20.0	73	20.9
Failure of the health facility to participate in infection control programs	97	27.7	79	22.6	174	49.7
The lack of instructions on standard precautions in the health center	102	29.2	75	21.4	173	49.4
Lack of awareness about standard precautions in the healthcare environment	127	36.3	84	24.0	139	39.7
Insufficient hand-washing tools	122	34.9	78	22.2	150	42.9
Lack of sanitizer alcohol for routine hand hygiene	206	58.9	70	20.0	74	21.1
Insufficient information about the transmission routes of COVID 19	100	28.6	81	23.1	169	48.3

Figure (1): Total of the studied primary health care providers' level of concern, compliance and barriers to use standard precautions during COVID-19 pandemic (n=350)
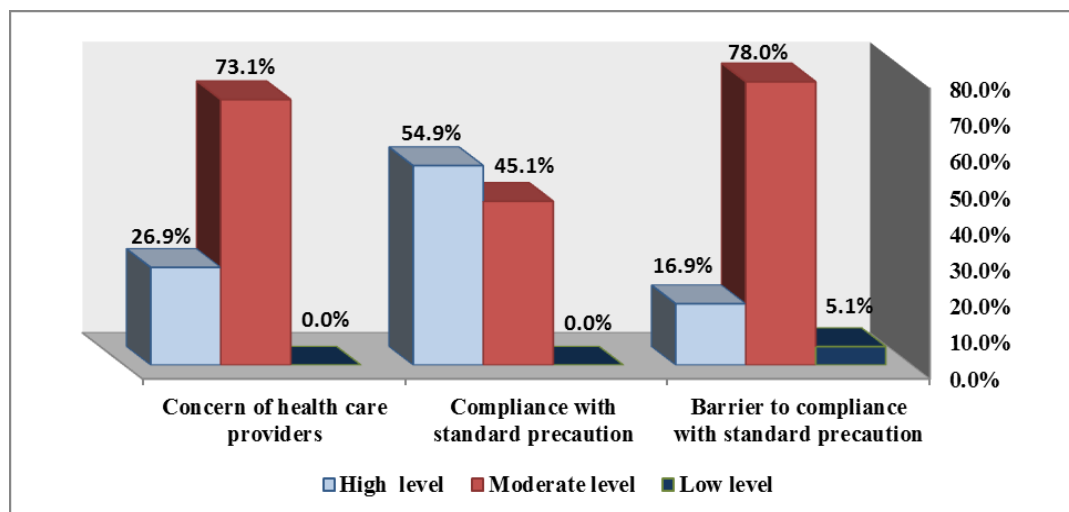
Table (6): Correlation of concern score with compliance and barriers to use standard precautions among primary health care providers during COVID-19 pandemic (n=350).

Parameters	Concern score	
	(r)	p
Compliance	-0.31	<0.001
Barrier	0.53	<0.001

Table (7): Logistic regression for predictor variables of concern among primary health care providers during COVID-19 pandemic (n. 350).

Variables	β	Test of sig	p-value	Odds ratio
Barrier score	.089	44.1	0.0001	1.08
Compliance score	-.053	12.8	0.0001	0.95
Sex (females)	1.07	6.5	0.011	2.5

Discussion

COVID-19 was a novel and immense outbreak arising in Egypt, to the best of our knowledge, this is the first study to assess the level of concern, compliance, and barriers to use standard precautions among primary health care providers during COVID-19 pandemic in Egypt.

Part I: The level of concern of health care providers during the pandemic

The present study results demonstrated that all health care providers had moderate and high level of concern regarding the COVID-19 pandemic. This relatively high concern could be attributed to novelty of such global critical situation, lack of their confidence in safety and support from the health system, also afraid from the transmission of infection to contacts or family members and disturbance of social relationships. Similarly, Saudi Arabian study of **Abolfotouh et al (2020)**, found that more than one fourth (27.9%) of healthcare workers had a high level of concern, and 48.5% of them had a moderate concern regarding COVID-19 outbreak.

As for concern domains, the highest score was that of self-satisfaction domain. This outcome might be explained by that health providers felt anxious, unsafe and at risk for getting COVID-19 at work. This fear could be due to that they are afraid of transmitting infection to their families as well as there is no vaccine or specific coronavirus treatment and unavailability of facilities. These findings are similar to other studies conducted in Saudi Arabia, Egypt, and Nigeria (**Abolfotouh et al**

(2020); **Alsubaie et al (2019); Ogolodom et al (2020))**.

Part II: Health care providers' compliance to standard precautions during the pandemic

Regarding infection control measures, the current study revealed significant changes concerning infection-control issues during the pandemic such as the presence of infection control programs and staff training, also the health providers in PHC settings became more enthusiastic to apply infection control measures after emerging of COVID-19 pandemic. This could be explained by the fact that the disease is highly transmissible and health care providers were afraid of getting infected and transmit it to their families and loved ones. This comes are in accordance with **Abdel Wahed et al (2020)** in Egypt, who found that health care workers were more respectful to infection control measures during the pandemic than before. On Contrary, **Elhadi et al (2020)** in Libya, found that less than 7 % of both physicians and nurses had taken courses or training on COVID-19 prevention and control.

The present study found that more than fifty percent of the health care providers reported that their health centers had no guidelines for the care of COVID-19 patients and the majority of them did not have either isolating rooms or preparation for COVID-19 pandemic. Similarly, **Elhadi et al (2020)** found that 18% of healthcare workers reported the presence of an isolation room and protocol and only about 13% of them felt that health facilities were prepared for the COVID-19 outbreak. On contrary, Saudi Arabian study of

Al Ghobain et al (2017) demonstrated that more than half of the hospital staff had attended infection control training, and they reported that their hospitals had infection control program and enough staff to deal with Middle East Respiratory Syndrome (MERS) outbreak and the hospitals have the plan to handle with the outbreak. The probable reason for the contrary of our findings with other studies might be due to that this study was conducted in primary health care centers.

Concerning compliance with standard precautions, the present study results demonstrated that all the studied health care providers had a high and moderate compliance level with standard precautions during COVID-19 pandemic. This relative higher self-reported compliance, reflecting awareness of health care providers regarding the seriousness of disease outbreaks in general and COVID-19 specifically, and the only way to protect themselves against it is by adherence to strict infection control standard precautions. This finding is consistent with the studies of **Amanya et al (2020)** in Uganda; **Abdel Wahed et al (2020)**; and **Refeai et al. (2020)** in Egypt. This consistency among studies, regardless of the setting could be due to the importance of health care workers' adherence to infection control measures to combat such a worldwide pandemic.

In this study, the majority of health care providers reported that they were more compliant with hand washing hygiene before and after contacting with patients, and they cover their nose and mouth when sneezing and coughing. This finding is reflecting the necessity of strict adherence to good hand and respiratory hygiene in the prevention and control of infections especially in COVID-19 pandemic era. This is consistent with the relatively high overall compliance for hand hygiene in the Chinese study of **Zhou et al (2020)**. Also, the study of **Raghavan et al (2020)** in Afghanistan, found that the great majority of health care workers follow the hygiene practices, including hand washing regularly with soap/water and covering mouth and nose with a clean cloth while coughing or sneezing. On contrary to these findings, **Papagiannis et al (2020)** in Greece found that although 941% of the health care workers knew

that SARS-CoV-2 transmission could be reduced with hand washing, only 1 in 4 health care practitioners washed their hands after touching the patient and surroundings.

On the other hand, the current study found that more than half of the studied healthcare providers rarely or never worn an N95 mask when contacting with patients. This might be due to the unavailability of N95 mask in primary health centers and N95 masking used mainly during aerosol-generating procedures, so that the priority was given to COVID-19 responders in special isolation hospitals. This is supported by **Raghavan et al (2020)** who found that studied health care workers reported that N95 masks are not available in all the markets, they are expensive and thus out of reach for common people and finally, it is good to use when someone is infected rather than everyone.

Part IV: The barriers hindering health care providers' compliance with standard precautions

The present study revealed that more than three-quarters of health care providers had a moderate barrier level and the most commonly perceived barriers were increased workload, lack of sanitizer alcohol for routine hand hygiene, and shortage of healthcare providers. This might be attributed to that the current unprecedented pandemic lead to overwhelming demand for protective supplies and equipment needed for infection prevention and control practices, additional cleaning and disinfection, and long working hours. As well as perceived shortage of health care workers in primary health care centers may result from an increased need for health services, inequitable distribution of health care workers, migration and too few such workers being trained. These findings are consistent with the studies of **Houghton et al (2020)** ; **Refeai et al (2020)** ; **Loftus et al (2019) ; Assefa et al (2020)** in Ethiopia ; and **Nkomazana et al (2015)** .

On the other hand, the foregoing study findings revealed that the least agreed upon barriers were failure of the health facility to participate in infection control programs, insufficient information about the transmission routes of COVID 19, and lack of instructions on standard precautions in the health center.

This might be due to that Egyptian Ministry of Health and Population is implementing a health sector reform project under which infection control committees in the health centers plan of continuous in-service training to equip the heath staff with adequate and up-to-date knowledge on infection control standard precautions for better quality of care. On the contrary, **Ahmed et al (2017)** in Egypt, found that the most frequently reported barrier was lack of sufficient information about infection control standards among nurses in family health centers. The possible reason of contrary might be that the current study was conducted during COVID19 pandemic.

Part V: Relations of healthcare providers' level of concern with their compliance and barriers to use standard precautions in primary health care centers

The present study findings demonstrated a significant negative correlation indicating that a higher concern score is associated with lower compliance score. The finding was further confirmed by logistic regression analysis which demonstrated that compliance was a negative predictor of concern score. Consistently, the Saudi Arabian study of **Temsah et al (2020b)** highlighted the importance of strict infection control measures to limit health care workers' anxiety, which will result in better compliance, performance, and patient care**.** On contrary, **Brooks et al (2020)** found that healthcare workers with higher concern about the risk of infection were more likely to comply with recommended behavior, and that monitoring from superiors could improve compliance.

The current study results revealed that the barrier score statistically significant positively correlated with concern score as well as barrier score was a positive predictor of concern score. This reflected that when healthcare provider's perception of barriers increased, their concern level increased. This finding might be due to that when healthcare providers realize the actual barriers that hider their compliance with infection control standard precautions, their ability to exercise control over the situation was reduced and they became more worried and afraid of being infected. On the same line, the study of **Ogolodom et al (2020)** revealed that heath care workers had several barriers

hindering their compliance to infection prevention and control which could reinforce fear of them towards the COVID-19 pandemic. Also, the study of **Lam et al (2020)** in China and Hong Kong, revealed that inadequate provision of PPE and training on infection control, while having close contact with patients are likely to leave health care workers with higher perceived levels of risk in terms of fear and susceptibility of COVID-19.

The present study findings indicated that being a female was a significant positive predictor of high concern and females were 2.5 times more likely to have higher concern about COVID-19 pandemic than males. A possible explanation is that women tend to antedate the negative impact of the disease on one's health and the health of close family and friends, and women are the primary caregivers of their children and closures of schools and daycare centers have massively increased childcare needs, which has a particularly large impact on working mothers and consequently aggregate their fear and concern regarding the pandemic. This finding is consistent with other studies of **Broche-Pérez et al (2020)** in Cuba; **Abdel Wahed et al (2020)** ; and **Alon et al (2020)** .

So, the present study findings are important to inform Egyptian health care system about the current situation in order to establish strategies and intervention to strengthen primary health care centers to combat such global pandemic.

Conclusion

Based on the study findings, it can be concluded that there was a relatively high level of concern regarding COVID-19 pandemic among healthcare providers in primary health centers which subsequently could lead to suboptimal health care services. Also, despite unpreparedness of primary health centers and moderate barrier level perceived by the studied healthcare providers, all of them had moderate and high compliance with infection control standard precautions during the pandemic.

Recommendation

- Effective approaches should be followed to minimize primary healthcare providers' concern during the pandemic, such as

adequate training, provision of knowledge, psychological, and organizational support.

- Preparedness of primary health care centers with well-trained health care providers, standard guidelines for care of COVID-19 patients, necessary supplies, and protective equipment to provide services as required by patients while adhering to infection control standard precautions guidelines during the pandemic.

- Advocate perceived barriers to authority figure in charge in order to establish strategies to improve primary healthcare providers' compliance with infection control standard precautions during COVID-19 pandemic.

- Design a strategic plan before such future outbreaks in all primary health care settings.

- Further research to replicate the current study in different settings on larger samples to permits for generalizations.

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