



Awareness and Attitude toward Infection Control among Health Care Workers during Coronavirus Disease-19 Pandemic, Egypt

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Abstract

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BACKGROUND: Coronavirus disease (COVID)-19 emerges worldwide consideration since their first proving. The knowledge and attitude of all medical personnel play an important role in the effectiveness of infection control policies among medical institutions.

AIM: The study evaluates the knowledge of health care workers (HCWs) about infection control policies at the Egyptian institutions trying to identify the degree of their awareness to deal with such outbreak.

METHODS: A cross-sectional study was implemented in public and private hospitals sectors at Cairo, Egypt, through a structured self-administered questionnaire that was delivered to HCWs in the selected hospitals.

RESULTS: A total of 486 physicians working between university, governmental, teaching, private hospitals, and polyclinics submitted their replies. Of whom, 46.9% practiced internal medicine specialty, 35.4% were pediatricians, and only 17.7% specialized in the family medicine. Regarding the overall level of knowledge about infection control and prevention among HCWs, we found that 87.2% of participants reported presence of infection control program at their institutions and about 79% practiced these policies while only 60.5% received some training. Furthermore, we found that 64.2% of the participant did not know which infections are officially reported. There was some variation in response to causes related to the outbreak as 43.8% referred that to shortage of appropriate personnel protective equipment and only 7.4% assigned the carelessness of HCWs. Moreover, the insufficient resources to fulfill the infection control requirements were assigned as a primary factor to spread of infection (71.4%). The electronic surveillance system was believed the most efficient reporting system of infectious agents by staff (83.1%). The study revealed that there was a statistically significant difference of knowledge of infection control among medical staff according to their specialties ($p \leq 0.05$). Moreover, there was a significant trend of orientation about infection control toward the highly certificated individuals (having PhD). Furthermore, there was a potential variance between the groups of higher and lower years of experience regarding in their answers about surveillance system institutions ($p \leq 0.05$). In addition, there was variation in responses to questions related to various institutions as a higher percent of awareness of the presence of active infection control policy was found at the governmental and university hospitals ($p < 0.05$).

CONCLUSION: HCWs had reasonable knowledge about infection control and surveillance during COVID-19 outbreak and we have discovered zones of concern about infection control experience in Egypt which differ between institutions and professions and years of experience.

Introduction

Coronavirus pandemic is an ongoing outbreak of coronavirus disease (COVID)-19, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1]. Community transmission is increasing worldwide, since was first discovered in Wuhan, China, in December 2019, the WHO had announced a public health emergency event [2]. Effective infection prevention and control in health-care facilities depends on knowledge and compliance of all health-care staffs at different levels of the health organization [3]. There is an established health policy with corroborating multidisciplinary teams accountable

for preparation and formalization of infection control policies and to ensure that these designs are functioning efficiently and practiced consistently among the health care workers (HCWs) to prevent and properly control COVID-19 outbreak [4].

In the context of COVID pandemic, it appeared to be the worst strike across the world with a rising curve in developed countries in spite of advanced health systems and promoted infrastructure and designs of hospital. Hence, it is expected to be of potential threat in low- and middle-income countries with poor health system delivery [5], [6] that necessitates strict measures related to infection control policy and raising the awareness on proper hygiene and social distancing [7].

In the term of that knowledge and attitude toward infection control and prevention is imperative for halting the outbreak, few studies had investigated the levels of infection control and prevention knowledge and practices among medical and non-medical populations across the Arabian countries [8], [9] and in Africa [10] that sharing similar socioeconomic standards and demographics as well.

Accordingly, the aim of this research is to assess the awareness of HCWs regarding infection control policy and ways among medical staff and their ability to implement and apply their knowledge in real practice and to determine the degree of their preparedness to deal with such pandemic.

Methods

Study design

This study is analytical cross-sectional survey.

Study setting and population

This study was implemented among health-care providers including physicians and residents at governmental hospitals, private hospitals, and polyclinics, Egypt.

Sampling size and type

Non-random Snowball sampling was done through emails and social communication tools as Facebook groups and Whats -App. Using Epi-Info version 7 software, with anticipated frequency of awareness of 50% with 95% confidence interval and power 80%, so the least required sample size was 384. Considering dropouts rate of 41.8%, as in the study by Galesic in 2006, therefore, the sample size was estimated to be 544 participants.

Procedures of data collection

A structured self-administered anonymous questionnaire (Appendix A) was used to collect data which derived from Rabaan *et al.*, 2017 [11], in which a questionnaire-based analysis of infection prevention and control in health-care facilities in Saudi Arabia on Middle East respiratory syndrome (MERS) conducted. The questionnaire was administered in the English language and submitted through an electronic form and was distributed to the participants through emails and social communication tools as Facebook and WhatsApp.

The questionnaire including the following sections:

1. Sociodemographic characteristics: Age, sex, qualification degree, working place, and years of experience
2. Assessment of knowledge regarding COVID-19 pandemic
3. Assessment of awareness and attitude of HCWs regarding infection control programs at their institutes (13 questions) (Appendix A).

Statistical analysis

All collected questionnaires were revised for completeness and logical consistency. Pre-coded data were entered into Microsoft Office Excel program for Windows, 365. Data were transferred to the Statistical Package for the Social Sciences version 21 (SPSS-V 21) for data analysis. Quantitative variables were described as mean, SD and median and IQ while qualitative variables were expressed as number and percentage. Chi-square test was used to compare qualitative variables between groups. Fisher's exact test was used when expected cells are <5 , $p \leq 0.05$ significant and $p < 0.01$ highly significant.

Ethical consideration

The study protocol was revised and approved by ethical committees of public health department at Kasr Alainy Hospital (Number: 17, date of approval: 12/7/2020). An electronic informed consent was obtained from all participants before recruitment to the study after explaining the goals of the work. Confidentiality was guaranteed on handling the database and questionnaire forms according to revised Helsinki Deceleration of biomedical ethics (World Medical Association, 2011).

Results

Basic characteristics of study group

A total of 544 participants were surveyed, 58 of them were excluded for the missing data. A total of 486 physicians working between university, government, teaching, private hospitals, and polyclinics submitted replies to the questions shown in questionnaires division. The characteristics of the group in terms of age, gender, specialties, qualifications, and institution are shown in Table 1. Nearly two-thirds of the physicians were female 69.5% (338) with mean age 33.9 ± 7 years. Of whom, 46.9% practiced internal medicine specialty, 35.4% were pediatricians, and only 17.7% specialized in family medicine. More than

70% of included physicians had postgraduate degrees (39.5% master and 32.2% PHD). More than 67% practiced their specialties at university institutions (Table 1).

Table 1: Distribution of the study group according to their basic characteristics n=486 (100%)

Variables	Values
Age	
Mean±SD	33.9±7
Median (IQR)	33 (29:38)
Years of experience	
Mean±SD	33.9±7
Median (IQR)	33 (29:38)
Sex (%)	
Female	338 (69.50)
Male	148 (30.50)
Specialty (%)	
Internal medicine	228 (46.90)
Pediatric	172 (35.40)
Family medicine	86 (17.70)
Qualification (%)	
Bachelor	136 (28.00)
Master	192 (39.50)
PhD	158 (32.50)
Place of work (%)	
Private hospital	164 (33.70)
Governmental hospital	216 (44.40)
Polyclinics	98 (20.20)
University hospital	326 (67.10)
Teaching hospital	154 (31.70)

Causes, contributing factors, and surveillance systems

By analysis of medical staff responses to questions concerned with awareness regarding infection prevention and control policies and procedures. Only 60.5% received some form of training or orientation concerning infection prevention and control. Regarding their opinion about following adherence of health-care providers to infection control policies in their institutions, they reported that 50% of all staff did not show adherence and only 27% followed them. Questions related to an emerging infectious disease task force or dealing with outbreaks, 37% of the participants had approved its presence while 23.5% did not know about it. Regarding the participants' view about awareness regarding differentiation between different isolation protocols by all staff, they reported that 42% cannot discriminate and only 31.7% can. The response to the question concerning the hospitals preparation for any infections outbreaks was disagreed by 56.6% of the participants and only 25.2% approved that. Through assessment of physicians response to awareness of medical staff about surveillance system of the infectious diseases at their institutions, unfortunately, it was found that 64.2% of the participant did not know which infections are reported to Ministry of Health (MOH) and 46.1% did not know if there was turnaround time of laboratory results of the recordable infectious agents or not. About 42% and 39% of the contributors stated that the reporting systems in their hospitals were telephone communication or paper version, respectively. Concerning the physicians' opinion about effectiveness of the used surveillance tool to control infection, only 21% were concordance and 52.5% were not. There was also some variation in participants' response to

questions related to the causes of the outbreak as 43.8% referred that to shortage of proper personal protective equipment (PPE) and only 7.4% assigned the carelessness of HCWs as a reason of outbreaks. Moreover, 71.4% reported insufficient resources to fulfill the infection control requirements as a primary factor that contributed to the spread of infection in the hospital (Table 2).

Table 2: Distribution of the study group according to their knowledge regarding infection control, surveillance system, and contributing factors to outbreaks at their institutions n=486 (100%)

A – Knowledge regarding infection control at their institutions	
Q1a – Do you have an infection control program at your institution	
DK	28 (5.8)
N	34 (7)
Y	424 (87.2)
Q2a – Do you have infection control policies and guidelines in your unit?	
DK	32 (6.6)
N	68 (14)
Y	386 (79.4)
Q3a – Have you received some form of training or orientation about infection prevention and control?	
DK	6 (1.2)
N	186 (38.3)
Y	294 (60.5)
Q4a – Do you think that all staffs in your unit are following promptly infection control policies, rules, and guidelines?	
DK	108 (22.3)
N	242 (50)
Y	134 (27.7)
Q5a – At your institution, do you have an active infection control team?	
DK	56 (11.5)
N	82 (16.9)
Y	348 (71.6)
Q6a – Do you have an emerging infectious disease taskforce or dealing with outbreaks such as COVID-19?	
DK	114 (23.5)
N	192 (39.5)
Y	180 (37)
Q7a – Do you think that all staffs can differentiate between different isolation protocols such as droplets or contact?	
DK	128 (26.3)
N	204 (42)
Y	154 (31.7)
Q8a – Do you think your hospital is prepared for any infection outbreak?	
DK	88 (18.2)
N	274 (56.6)
Y	122 (25.2)
B – Knowledge of medical staff about surveillance system toward infectious diseases at their organization	
Q1b – Which infections are reported to MOH?	
Do not know	312 (64.2)
All infections (both hospital and community acquired)	140 (28.8)
All health care-associated infections	34 (7)
Q2b – In your institution, is there known turnaround time of laboratory results of the reportable infectious agents?	
DN	224 (46.1)
N	84 (17.3)
Y	178 (36.6)
Q3b – What reporting system in your hospital?	
Paper version	190 (39.1)
Electronic surveillance	92 (18.9)
Telephone communication	204 (42)
Q4b – In your opinion, what is the effective reporting system for reporting infectious agents?	
Paper version	18 (3.7)
Electronic surveillance	402 (83.1)
Telephone communication	64 (13.2)
Q5b – Do you agree that surveillance tool used in your institution is effective to prevent or control infection?	
Neither agree nor disagree	128 (26.4)
Not agree	254 (52.5)
Agree	102 (21.1)
C – Causes and contributing factors to outbreaks at hospitals	
Q1c – In your opinion, what is the cause (s) of outbreaks?	
No clear infection control policies, rules, and guidelines	66 (13.6)
Breaching infection control policies, rules, and guidelines	68 (14)
Carelessness of HCWs	36 (7.4)
Infection control infrastructures do not exist	102 (21.1)
Shortage of appropriate personnel protective equipment	212 (43.8)
Q2c – Factors that contribute to the spread of infection in the hospital	
No infection control on-call	16 (3.3)
No infection control training program	68 (14.1)
No resources to fulfill the infection control requirements and needs	344 (71.4)
Lack and shortage of staff	54 (11.2)

Data presented as number and percentage. DK: Do not know Y: Yes N: No. COVID: Coronavirus disease, HCWs: Health care workers, MOH: Ministry of Health.

Awareness and attitude responses according to the specialties

The study revealed that there was a statistically significant difference ($p \leq 0.05$) among medical staff according to their specialties regarding their knowledge of infection control at their institutions, where 93% of family medicine medical staff reported having infection control program at their institutions. Nearly 87.2% of pediatric medical staff reported having infection control policies and guidance at their units, whereas 7.9% of internal medicine medical staff stated that they do not know ($p < 0.001$), while 42.1% and 43.1% of internal medicine

and pediatric medical staff, respectively, stated that they did not receive any training of infection prevention and control. About 44.2% of family medicine medical staff stated that staff at their units following rules and policies of infection control, while 62.8% of internal medicine medical staff stated "no" and 26.7% of pediatric medical staff stated that they "don't know" ($p < 0.001$). Majority of the participants have infection control teams at their units, 23.4% of medical staff did not know about the emerging infectious diseases task force. While 42% of medical staff Stated their non-capability to differentiate between different isolation strategies. The Majority (56.3%) stated unpreparedness to face the outbreak (Table 3).

Table 3: Distribution of the study group by their specialties according to their knowledge regarding infection control, surveillance system, and contributing factors to outbreaks at their institutions n=486 (100%)

Questions	Internal medicine n (%)	Pediatric n (%)	Family medicine n (%)	p-value
A Questions Knowledge regarding infection control				
Q1a – Do you have an infection control program at your institution?				
DK	20 (8.8)	4 (2.3)	4 (4.7)	0.021
N	18 (7.9)	14 (8.1)	2 (2.3)	
Y	190 (83.3)	154 (89.5)	80 (93)	
Q2a – Do you have infection control policies and guidelines in your unit?				
DK	18 (7.9)	8 (4.7)	6 (7)	<0.001
N	48 (21.1)	14 (8.1)	6 (7)	
Y	162 (71.1)	150 (87.2)	74 (86)	
Q3a – Have you received some form of training or orientation about infection prevention and control?				
DK	2 (0.9)	4 (2.3)	0 (0)	<0.001
N	96 (42.1)	74 (43)	16 (18.6)	
Y	130 (57)	94 (54.7)	70 (81.4)	
Q4a – Do you think that all staffs in your unit are following promptly infection control policies, rules, and guidelines?				
DK	42 (18.6)	46 (26.7)	20 (23.3)	<0.001
N	142 (62.8)	72 (41.9)	28 (32.6)	
Y	42 (18.6)	54 (31.4)	38 (44.2)	
Q5a – At your institution, do you have an active infection control team?				
DK	30 (13.2)	18 (10.5)	8 (9.3)	0.033
N	34 (14.9)	40 (23.3)	8 (9.3)	
Y	164 (71.9)	114 (66.3)	70 (81.4)	
Q6a – Do you have an emerging infectious disease taskforce or dealing with outbreaks such as COVID-19?				
DK	56 (24.6)	44 (25.6)	14 (16.3)	<0.001
N	110 (48.2)	70 (40.7)	12 (14)	
Y	62 (27.2)	58 (33.7)	60 (69.8)	
Q7a – Do you think that all staffs can differentiate between different isolation protocols such as droplets or contact?				
DK	68 (29.8)	36 (20.9)	24 (27.9)	0.071
N	98 (43)	68 (39.5)	38 (44.2)	
Y	62 (27.2)	68 (39.5)	24 (27.9)	
Q8a – Do you think your hospital is prepared for any infection outbreak?				
DK	48 (21.2)	32 (18.6)	8 (9.3)	0.006
N	126 (55.8)	104 (60.5)	44 (51.2)	
Y	52 (23)	36 (20.9)	34 (39.5)	
B – Knowledge regarding surveillance system toward infectious diseases				
Q1b – Is your hospital is enrolled in national surveillance system?				
DK	104 (45.6)	64 (37.2)	30 (34.9)	0.03
N	58 (25.4)	50 (29.1)	16 (18.6)	
Y	66 (28.9)	58 (33.7)	40 (46.5)	
Q2b – Do you have a list of reportable infectious agents available in your hospital?				
DK	64 (28.1)	56 (32.6)	28 (32.6)	0.005
N	108 (47.4)	64 (37.2)	22 (25.6)	
Y	56 (24.6)	52 (30.2)	36 (41.9)	
Q3b – Which infections are reported to MOH?				
DK	154 (67.5)	106 (61.6)	52 (60.5)	0.011
All infections (both hospital and community acquired)	58 (25.4)	60 (34.9)	22 (25.6)	
All health care-associated infections	16 (7)	6 (3.5)	12 (14)	
Q4b – In your institution, is there known turnaround time of laboratory results of the reportable infectious agents?				
DK	126 (55.3)	62 (36)	36 (41.9)	<0.001
N	42 (18.4)	26 (15.1)	16 (18.6)	
Y	60 (26.3)	84 (48.8)	34 (39.5)	
Q5b – What reporting system in your hospital?				
Paper version	80 (35.1)	76 (44.2)	34 (39.5)	0.1
Electronic surveillance	54 (23.7)	26 (15.1)	12 (14)	
Telephone communication	94 (41.2)	70 (40.7)	40 (46.5)	
Q6b – In your opinion, what is the effective reporting system for reporting infectious agents?				
Paper version	8 (3.5)	8 (4.7)	2 (2.3)	<0.001
Electronic surveillance	192 (85)	126 (73.3)	84 (97.7)	
Telephone communication	26 (11.5)	38 (22.1)	0 (0)	
Q7b – Do you agree that surveillance tool used in your institution is effective to prevent or control infection?				
Neither agree nor disagree	80 (35.4)	32 (18.6)	16 (18.6)	<0.001
Not agree	112 (49.6)	94 (54.7)	48 (55.8)	
Agree	34 (15)	46 (26.7)	22 (25.6)	
C – Causes and contributing factors to outbreaks at hospitals				
Q1c – In your opinion what is the causes of outbreaks?				
No clear infection control policies, rules, and guidelines	34 (15)	26 (15.1)	6 (7)	0.063
Breaching infection control policies, rules, and guidelines	34 (15)	24 (14)	10 (11.6)	
Carelessness of HCWs	18 (8)	12 (7)	6 (7)	
Infection control infrastructures do not exist	56 (24.8)	24 (14)	22 (25.6)	
Shortage of appropriate personnel protective equipment	84 (37.2)	86 (50)	42 (48.8)	
Q2c – Factors that contribute to the spread of infection in the hospital				
No infection control on-call	4 (1.8)	12 (7)	0 (0)	<0.001
No infection control training program	40 (17.9)	24 (14)	4 (4.7)	
No resources to fulfill the infection control requirements and needs	162 (72.3)	108 (62.8)	74 (86)	
Lack and shortage of staff	18 (8)	28 (16.3)	8 (9.3)	

Data presented as number and percentage. DK: Do not know Y: Yes, N: No. COVID: Coronavirus disease, HCWs: Health care workers, MOH: Ministry of Health.

Regarding awareness of HCWs concerning surveillance systems toward infectious diseases at their institutions (Table 3), the study revealed that 46.5% of family medicine staff stated that their hospital is enrolled in the national surveillance system, while 29.1% and 45.6% of pediatric and internal medicine staff stated "No & Don't know," respectively. In addition, 97.7% of family medicine staff stated electronic surveillance, while 22.1% of pediatric staff stated telephone surveillance. Most of the respondents denied the effectiveness of surveillance tools in their institutes. On the other side, there was no statistical difference of significance regarding the response of staff by specialties to their opinion concerning the causes of outbreaks at their hospitals.

The study revealed that the absence of resources to fulfill the infection control requirements and needs is a main contributing factor to spread of infection in hospital ($p < 0.001$), otherwise, there was no statistical difference regarding the response of staff by their specialties to their opinion concerning the causes of outbreaks at their hospitals ($p = 0.063$).

Awareness and knowledge responses according to the qualification's certifications

The study revealed that there was a statistically significant difference with $p \leq 0.05$ among medical staff according to qualifications regarding their knowledge of infection control at their institutions (Table 4). The trend of orientation for infection control is toward the highly certificated individuals (having PhD). On the other hand, there was no statistically significant difference with $p = 0.172$ and $p = 0.212$ in response of staff to questions related to receiving training concerning infection control and promptly following infection control policies, respectively. The study revealed that there was variation in response among medical staff according to their qualifications regarding their knowledge of surveillance systems toward infectious diseases at their institutions (Table 4). There was a statistical difference of significant with $p < 0.001$ among staff in response to which infections are reported to MOH. Furthermore, there was a statistical difference of significant with $p = 0.002$ and 0.001 in response of staff if there was known turnaround time of laboratory results of reported infectious agents? and What reporting system in their hospital? respectively. The study also revealed statistical differences of significance with $p = 0.008$ and <0.001 in response of staff to what is the effective reporting system for reporting infectious agents? and If they agree that surveillance tools used in your institution are effective to prevent and control infections, respectively. On the other hand, there was no statistical difference of significant with $p = 0.149$ and 0.054 in response of staff if their hospital is enrolled in the national surveillance system and if they have a list of reportable infectious agents available in their hospital,

respectively. The study revealed statistical differences of significance among staff by their qualification according to their response to causes of outbreaks at their hospitals with $p = 0.048$. Furthermore, there was a statistical difference of significance among staff in response to factors contributing to spread of infections at their hospitals with $p < 0.001$ (Table 4).

Awareness and knowledge responses according to the years of experience

The study revealed a significant statistical difference among staff by years of experience concerning their knowledge regarding infection control at their institutions (Table 5). In response whether they have an infection control program and guidelines, the study also revealed a statistical difference of significance with $p < 0.032$ in response of staff if they think all staffs in their unit are following promptly infection control policies. The response of staff if they have an active infection control team at their institution was a statistical difference of significant with $p < 0.001$. The study also revealed a statistical difference of significance with $p = 0.002$ in response of staff if they have an emerging infectious disease task force or dealing with outbreaks such as COVID-19. There was a statistical difference of significance with $p < 0.001$ in response of staff if they think that their hospital is prepared for any infection outbreak. On the other hand, there was no statistical difference of significance with $p = 0.292$ and $p = 0.094$ in response of staff if they received some form of training or orientation about infection prevention and control and if they think that all staffs can differentiate between isolation protocol as droplet or contact, respectively.

The study revealed statistical difference of significance among the groups of higher and lower years of experience in response to questions regarding surveillance system toward infectious diseases at their institutions concerning awareness of the presence of surveillance tool used in their institutions, if it is effective to prevent or control infection, reporting path tool $p < 0.05$ (Table 5).

Responses according to the types of hospital sectors

There was variation in responses among participants to questions according to the type of their institutions (Table 6). Response to question if there is an infection control program at their institution or not, the study revealed that there was statistical difference of significance regarding awareness of the presence of active infection control policy at the governmental and university hospitals with $p < 0.05$. There was also significant variation in responses to the question if the institution had an emerging infectious diseases task force with ($P = 0.003$). Majority of the health workers in governmental (76.5%), university (58.7%), and teaching

Table 4: Distribution of the study group by qualification according to their knowledge regarding infection control, surveillance system, and contributing factors to outbreaks at their institutions n=486 (100%)

Questions	Qualification			p-value
	Bachelor, n (%)	Master, n (%)	PhD, n (%)	
A – Knowledge regarding infection control				
Q1a – Do you have an infection control program at your institution?				
DK	14 (10.3)	10 (5.2)	4 (2.5)	<0.001
N	16 (11.8)	16 (8.3)	2 (1.3)	
Y	106 (77.9)	166 (86.5)	152 (96.2)	
Q2a – Do you have infection control policies and guidelines in your unit?				
DK	16 (11.8)	14 (7.3)	2 (1.3)	<0.001
N	32 (23.5)	28 (14.6)	8 (5.1)	
Y	88 (64.7)	150 (78.1)	148 (93.7)	
Q3a – Have you received some form of training or orientation about infection prevention and control?				
DK	2 (1.5)	4 (2.1)	0 (0)	0.172
N	60 (44.1)	66 (34.4)	60 (38)	
Y	74 (54.4)	122 (63.5)	98 (62)	
Q4a – Do you think that all staffs in your unit are following promptly infection control policies, rules, and guidelines?				
DK	26 (19.1)	52 (27.1)	30 (19.2)	0.212
N	76 (55.9)	86 (44.8)	80 (51.3)	
Y	34 (25)	54 (28.1)	46 (29.5)	
Q5a – At your institution, do you have an active infection control team?				
DK	34 (25)	18 (9.4)	4 (2.5)	<0.001
N	14 (10.3)	60 (31.3)	8 (5.1)	
Y	88 (64.7)	114 (59.4)	146 (92.4)	
Q6a – Do you have an emerging infectious disease taskforce or dealing with outbreaks such as COVID-19?				
DK	30 (22.1)	46 (24)	38 (24.1)	<0.001
N	74 (54.4)	84 (43.8)	34 (21.5)	
Y	32 (23.5)	62 (32.3)	86 (54.4)	
Q7a – Do you think that all staff can differentiate between different isolation protocols such as droplets or contact?				
DK	40 (29.4)	38 (19.8)	50 (31.6)	0.001
N	48 (35.3)	80 (41.7)	76 (48.1)	
Y	48 (35.3)	74 (38.5)	32 (20.3)	
Q8a – Do you think your hospital is prepared for any infection outbreak?				
DK	14 (10.3)	36 (18.8)	38 (24.4)	<0.001
N	98 (72.1)	114 (59.4)	62 (39.7)	
Y	24 (17.6)	42 (21.9)	56 (35.9)	
B – Knowledge regarding surveillance system toward infectious diseases				
Q1b – Is your hospital is enrolled in national surveillance system?				
DK	64 (47.1)	68 (35.4)	66 (41.8)	0.149
N	32 (23.5)	58 (30.2)	34 (21.5)	
Y	40 (29.4)	66 (34.4)	58 (36.7)	
Q2b – Do you have a list of reportable infectious agents available in your hospital?				
DK	48 (35.3)	44 (22.9)	56 (35.4)	0.054
N	54 (39.7)	82 (42.7)	58 (36.7)	
Y	34 (25)	66 (34.4)	44 (27.8)	
Q3b – Which infections are reported to MOH?				
DK	104 (76.5)	112 (58.3)	96 (60.8)	<0.001
All infections (both hospital and community acquired)	32 (23.5)	66 (34.4)	42 (26.6)	
All health care-associated infections	0 (0)	14 (7.3)	20 (12.7)	
Q4b – In your institution, is there known turnaround time of laboratory results of the reportable infectious agents?				
DK	74 (54.4)	74 (38.5)	76 (48.1)	0.002
N	24 (17.6)	44 (22.9)	16 (10.1)	
Y	38 (27.9)	74 (38.5)	66 (41.8)	
Q5b – What reporting system in your hospital?				
Paper version	60 (44.1)	58 (30.2)	72 (45.6)	0.001
Electronic surveillance	16 (11.8)	40 (20.8)	36 (22.8)	
Telephone communication	60 (44.1)	94 (49)	50 (31.6)	
Q6b – In your opinion, what is the effective reporting system for reporting infectious agents?				
Paper version	4 (2.9)	12 (6.3)	2 (1.3)	0.008
Electronic surveillance	108 (79.4)	152 (79.2)	142 (91)	
Telephone communication	24 (17.6)	28 (14.6)	12 (7.7)	
Q7b – Do you agree that surveillance tool used in your institution is effective to prevent or control infection?				
Neither agree nor disagree	36 (26.5)	42 (21.9)	50 (32.1)	<0.001
Not agree	86 (63.2)	94 (49)	74 (47.4)	
Agree	14 (10.3)	56 (29.2)	32 (20.5)	
C – Causes and contributing factors to outbreaks at hospitals				
Q1c – In your opinion, what are the causes of outbreaks?				
No clear infection control policies, rules, and guidelines	16 (11.8)	36 (18.8)	14 (9)	0.048
Breaching infection control policies, rules, and guidelines	20 (14.7)	20 (10.4)	28 (17.9)	
Carelessness of HCWs	6 (4.4)	20 (10.4)	10 (6.4)	
Infection control infrastructures do not exist	30 (22.1)	36 (18.8)	36 (23.1)	
Shortage of appropriate personnel protective equipment	64 (47.1)	80 (41.7)	68 (43.6)	
Q2c – Factors that contribute to the spread of infection in the hospital				
No infection control on-call	4 (3)	12 (6.3)	0 (0)	0.001
No infection control training program	24 (17.9)	24 (12.5)	20 (12.8)	
No resources to fulfill the infection control requirements and needs	100 (74.6)	126 (65.6)	118 (75.6)	
Lack and shortage of staff	6 (4.5)	30 (15.6)	18 (11.5)	

Data presented as number and percentage. DK: Do not know Y: Yes N: No. COVID: Coronavirus disease, HCWs: Health care workers, MOH: Ministry of Health.

hospitals (85.7%) stated that their institutions were not well ready to face outbreaks ($p = 0.001$). Majority of the participants did not know which type of infection reported to MOH ($p = 0.007$).

Regarding the response to question if the staff can differentiate between different isolation protocols such as droplets or contact, the response

was significantly more likely to respond “No or don’t know” ($p = 0.012$). Paper version of surveillance is the reporting system in governmental and university hospitals ($p = 0.034$), however, as expected the most recommended effective reporting system to be is electronic version. More than half of the participants did not agree that surveillance tools used in their institution

Table 5: Distribution of the study group by years of experience according to their knowledge regarding infection control, surveillance system, and contributing factors to outbreaks at their institutions n=486 (100%)

Questions	Years of experience		p-value
	≤8 n (%)	More than 8 n (%)	
Do you have an infection control program at your institution			
Do not know	22 (9)	6 (2.5)	<0.001
No	24 (9.8)	10 (4.1)	
Yes	198 (81.1)	226 (93.4)	
Do you have infection control policies and guidelines in your unit?			
Do not know	26 (10.7)	6 (2.5)	<0.001
No	46 (18.9)	22 (9.1)	
Yes	172 (70.5)	214 (88.4)	
Have you received some form of training or orientation about infection prevention and control?			
Do not know	6 (2.5)	0 (0)	0.027
No	98 (40.2)	88 (36.4)	
Yes	140 (57.4)	154 (63.6)	
Do you think that all staff in your unit are following promptly infection control policies, rules, and guidelines			
Do not know	62 (25.4)	46 (19.2)	0.002
No	132 (54.1)	110 (45.8)	
Yes	50 (20.5)	84 (35)	
At your institution, do you have an active infection control team?			
Do not know	42 (17.2)	14 (5.8)	<0.001
No	46 (18.9)	36 (14.9)	
Yes	156 (63.9)	192 (79.3)	
Do you have an emerging infectious disease taskforce or dealing with outbreaks such as COVID-19?			
Do not know	58 (23.8)	56 (23.1)	<0.001
No	116 (47.5)	76 (31.4)	
Yes	70 (28.7)	110 (45.5)	
Do you think that all staff can differentiate between different isolation protocols such as droplets or contact?			
Do not know	66 (27)	62 (25.6)	0.267
No	94 (38.5)	110 (45.5)	
Yes	84 (34.4)	70 (28.9)	
Do you think your hospital is prepared for any infection outbreak?			
Do not know	44 (18)	44 (18.3)	<0.001
No	160 (65.6)	114 (47.5)	
Yes	40 (16.4)	82 (34.2)	
Is your hospital is enrolled in national surveillance system			
Do not know	104 (42.6)	94 (38.8)	0.696
No	60 (24.6)	64 (26.4)	
Yes	80 (32.8)	84 (34.7)	
Do you have a list of reportable infectious agents available in your hospital			
Do not know	72 (29.5)	76 (31.4)	0.867
No	100 (41)	94 (38.8)	
Yes	72 (29.5)	72 (29.8)	
Which infections are reported to MOH?			
Do not know	168 (68.9)	144 (59.5)	<0.001
All infections (both hospital and community acquired)	72 (29.5)	68 (28.1)	
All health care-associated infections	4 (1.6)	30 (12.4)	
In your institution, is there known turnaround time of laboratory results of the reportable infectious agents?			
Do not know	114 (46.7)	110 (45.5)	0.796
No	44 (18)	40 (16.5)	
Yes	86 (35.2)	92 (38)	
What reporting system in your hospital			
Paper version	82 (33.6)	108 (44.6)	<0.001
Electronic surveillance	36 (14.8)	56 (23.1)	
Telephone communication	126 (51.6)	78 (32.2)	
In your opinion, what is the effective reporting system for reporting infectious agents:			
Paper version	8 (3.3)	10 (4.2)	0.109
Electronic surveillance	196 (80.3)	206 (85.8)	
Telephone communication	40 (16.4)	24 (10)	
Do you agree that surveillance tool used in your institution is effective to prevent or control infection			
Neither agree nor disagree	54 (22.1)	74 (30.8)	<0.001
Not agree	152 (62.3)	102 (42.5)	
Agree	38 (15.6)	64 (26.7)	
In your opinion what are the causes of outbreaks			
No clear infection control policies, rules, and guidelines	36 (14.8)	30 (12.5)	0.873
Breaching infection control policies, rules, and guidelines	36 (14.8)	32 (13.3)	
Carelessness of HCWs	16 (6.6)	20 (8.3)	
Infection control infrastructures do not exist	50 (20.5)	52 (21.7)	
Shortage of appropriate personnel protective equipment	106 (43.4)	106 (44.2)	
Factors that contribute to the spread of infection in the hospital			
No infection control on-call	16 (6.6)	0 (0)	<0.001
No infection control training program	36 (14.9)	32 (13.3)	
No resources to fulfill the infection control requirements and needs	174 (71.9)	170 (70.8)	
Lack and shortage of staff	16 (6.6)	38 (15.8)	

Data presented as number and percentage. DK: Do not know Y: Yes; N: No. COVID: Coronavirus disease, HCWs: Health care workers, MOH: Ministry of Health.

are effective to prevent or control infection ($p = 0.022$). The study revealed that the most common cause of outbreaks was shortage of right PPE across all three institution types ($p = 0.002$).

The top-cited identifiable factor that contributed to the spread of infection in the hospitals was absence of resources to fulfill the infection control requirements and needs ($p = 0.001$).

Table 6: Distribution of the study group according to place of work regarding their knowledge concerning infection control, surveillance system, and contributing factors to outbreaks at their institutions

Questions	Place of work			p-value
	Governmental hospital, n=102 n (%)	University hospital, n=152 n (%)	Teaching hospital, n=14 n (%)	
Do you have an infection control program at your institution				
Do not know	4 (3.9)	16 (10.5)	0 (0)	0.074
No	14 (13.7)	10 (6.6)	2 (14.3)	
Yes	84 (82.4)	126 (82.9)	12 (85.7)	
Do you have infection control policies and guidelines in your unit				
Do not know	4 (3.9)	14 (9.2)	0 (0)	0.009
No	8 (7.8)	32 (21.1)	4 (28.6)	
Yes	90 (88.2)	106 (69.7)	10 (71.4)	
Have you received some form of training or orientation about infection prevention and control?				
Do not know	0 (0)	2 (1.3)	0 (0)	0.137
No	36 (35.3)	64 (42.1)	2 (14.3)	
Yes	66 (64.7)	86 (56.6)	12 (85.7)	
Do you think that all staffs in your unit are following promptly infection control policies, rules, and guidelines				
Do not know	22 (21.6)	34 (22.7)	2 (14.3)	0.965
No	50 (49)	74 (49.3)	8 (57.1)	
Yes	30 (29.4)	42 (28)	4 (28.6)	
At your institution do you have an active infection control team				
Do not know	8 (7.8)	22 (14.5)	0 (0)	<0.001
No	28 (27.5)	12 (7.9)	6 (42.9)	
Yes	66 (64.7)	118 (77.6)	8 (57.1)	
Do you have an emerging infectious disease taskforce or dealing with outbreaks such as COVID-19?				
Do not know	28 (27.5)	32 (21.1)	4 (28.6)	0.003
No	52 (51)	54 (35.5)	8 (57.1)	
Yes	22 (21.6)	66 (43.4)	2 (14.3)	
Do you think your hospital is prepared for any infection outbreak				
Do not know	4 (3.9)	32 (21.3)	0 (0)	0.001
No	78 (76.5)	88 (58.7)	12 (85.7)	
Yes	20 (19.6)	30 (20)	2 (14.3)	
Is your hospital is enrolled in national surveillance system				
Do not know	36 (35.3)	70 (46.1)	6 (42.9)	0.566
No	32 (31.4)	38 (25)	4 (28.6)	
Yes	34 (33.3)	44 (28.9)	4 (28.6)	
Do you have a list of reportable infectious agents available in your hospital				
Do not know	28 (27.5)	52 (34.2)	4 (28.6)	0.209
No	42 (41.2)	72 (47.4)	6 (42.9)	
Yes	32 (31.4)	28 (18.4)	4 (28.6)	
Which infections are reported to MOH?				
Do not know	66 (64.7)	112 (73.7)	6 (42.9)	0.007
All infections (both hospital and community acquired)	34 (33.3)	30 (19.7)	8 (57.1)	
All health care-associated infections	2 (2)	10 (6.6)	0 (0)	
In your institution, is there known turnaround time of laboratory results of the reportable infectious agents?				
Do not know	44 (43.1)	74 (48.7)	2 (14.3)	0.038
No	28 (27.5)	26 (17.1)	6 (42.9)	
Yes	30 (29.4)	52 (34.2)	6 (42.9)	
Do you think that all staff can differentiate between different isolation protocols such as droplets or contact?				
Do not know	18 (17.6)	56 (36.8)	6 (42.9)	0.012
No	56 (54.9)	62 (40.8)	4 (28.6)	
Yes	28 (27.5)	34 (22.4)	4 (28.6)	
What reporting system in your hospital				
Paper version	48 (47.1)	58 (38.2)	10 (71.4)	0.034
Electronic surveillance	22 (21.6)	26 (17.1)	0 (0)	
Telephone communication	32 (31.4)	68 (44.7)	4 (28.6)	
In your opinion, what is the effective reporting system for reporting infectious agents:				
Paper version	8 (7.8)	2 (1.3)	0 (0)	0.001
Electronic surveillance	82 (80.4)	134 (89.3)	8 (57.1)	
Telephone communication	12 (11.8)	14 (9.3)	6 (42.9)	
Do you agree that surveillance tool used in your institution is effective to prevent or control infection				
Neither agree nor disagree	16 (15.7)	42 (28)	4 (28.6)	0.022
Not agree	56 (54.9)	80 (53.3)	10 (71.4)	
Agree	30 (29.4)	28 (18.7)	0 (0)	
In your opinion what are the causes of outbreaks				
No clear infection control policies, rules, and guidelines	24 (23.5)	16 (10.7)	6 (42.9)	0.002
Breaching infection control policies, rules, and guidelines	2 (2)	14 (9.3)	0 (0)	
Carelessness of HCWs	10 (9.8)	8 (5.3)	2 (14.3)	
Infection control infrastructures do not exist	16 (15.7)	36 (24)	2 (14.3)	
Shortage of appropriate personnel protective equipment	50 (49)	76 (50.7)	4 (28.6)	
Factors that contribute to the spread of infection in the hospital				
No infection control on-call	0 (0)	2 (1.3)	2 (14.3)	0.001
No infection control training program	12 (11.8)	24 (16)	4 (28.6)	
No resources to fulfill the infection control requirements and needs	70 (68.6)	116 (77.3)	8 (57.1)	
Lack and shortage of staff	20 (19.6)	8 (5.3)	0 (0)	

Data presented as number and percentage. DK: Do not know Y: Yes; N: No. COVID: Coronavirus disease, HCWs: Health care workers, MOH: Ministry of Health.

Discussion

The current study pointed out considerable concern on infection control policies among physicians in different health organizations in Egypt which differ among various specialties, qualification credentials, and experience extent. The study objective was to assess

awareness of medical doctors to infection prevention and control in health care institutions in Egypt during a pandemic of COVID-19.

The respondents comprise various health institutions including government (44%) and private hospitals and polyclinics. Low resources of basic infection control settings like hand hygiene materials and use of personal protective equipment (PEE),

over-crowdedness, sanitation measures, and uncertainty of infection prevention policy by health worker staff and more likely the health service receiver are the main causes of dispersion of any infectious disease [12], [13].

Overall, the level of knowledge about infection control and prevention among the health workers in this study was satisfactory. Of 60.5% had reported awareness about infection control policies and guidelines, this is along with a previous report assessing knowledge, attitude, and perception in both Nigeria and Egypt that revealed that most participants (62%) had considerable knowledge; nevertheless, Chinese and Iranian reports showed higher scores of knowledge during COVID-19 [14], [15].

Like most of the world countries, we face a great challenge against the new worldwide pandemic of COVID-19, this global outbreak that is caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), resulting in a wide spectrum of symptoms associated with a high risk of case fatality [14]. In addition, this outbreak has a potential burden on medical, social, psychological settings across the world, threatening mainly healthcare workers especially front-line individuals [15]. The matter necessitates an efficient, effective well-organized collaborative strategy to face that dreadful disease.

Responses in the present study suggested relatively high levels of certainty among physicians regarding infection control at a personal and institutional level while there is less grasp of the surveillance and reporting system standards. Most of the respondents recommended electronic surveillance, yet most actual reporting of infectious diseases all over health institutes occurs through the telephone communication followed by paper tools. Half of the participants did not agree that the available reporting system in their institutions is efficient in the prevention of the disease. This is contradicting what concluded by a similar Arabian study that observed a relatively unpredictable uncertainty about infection prevention programs' knowledge and surveillance standards in response to the MERS outbreaks [11]. This disparity in findings may be attributed to the different experiences of physicians and the study population that included various nationalities, other health workers rather than physicians.

At the national and health facility level, many factors affect the spread of any infectious disease including organism-related factors as pathogenicity and virulence, personal immune state, or health facilities related factors as global supply shortages of PPE like wearing a surgical mask, and a gown, gloves, face shield, goggles, and/or visors or lack of clear infection control strategies. Furthermore, it may be due to breaking the infection control rules or exhausted infrastructure [16].

In the current study, the most cited cause of outbreaks was mainly due to shortage of appropriate

PPE and mostly the lack of resources to fulfill infection control needs is attributing factor of infection spread in the hospitals' settings and these are inconsistent with what reported previously during MERSA in Saudi Arabia where poor infrastructure facilities and understaffed hospitals with inattentiveness of health workers [11].

There was evidence of variability between different medical professions, institution types. Increasing the COVID-19 cases among the HCWs across either developed or developing countries reflecting the gaps of infection control policies in health institutes where strict actions are imperative. In the context of the COVID-19 outbreak [17], [18], the WHO recommends measures related to HCWs through ensuring adequate supplies of PPE, adherence to infection control and prevention policies, and procedures for all aspects of health care, establishing a surveillance process for acute respiratory infections potentially caused by COVID-19 virus [19], [20].

In the term of years of experience, there was a significant variation in response to questions related to the knowledge of whether there is an infection control policy in their institution also a significant difference in response to the questions concerning receiving, availability, and accessibility of infection control program in different health institutions with high uncertainty in those with fewer years of experience this was mainly expected as "don't know" answers among the physician with below 8 years of experience, this is along with a previous survey done in Saudi Arabia which is considered like our society sharing for somehow the same sociodemographic characteristics [11].

Being a fact, HCWs in private hospitals are more satisfied with infection control policy as well as more aware about infection control and prevention guidelines with superior resources than those in governmental health sectors [21], [22], yet in the study, we compare the governmental, teaching, and university hospitals only and discard the private and polyclinic sector due to the overlap of places work as well as these places of work were the only working hospitals during the curfew. On questions relating to readiness and competence of the institution, it was found that most of the physicians across governmental, university, and teaching hospitals declared unpreparedness of their institutions for the COVID outbreak. And mostly, they did not know which type of infection was reported to MOH. With respect to contributing factors of infection spread and surveillance systems, the participants were more likely to deny the effectiveness of the reporting system in their institutions and also stated that the absence of resources to fulfill the infection control requirements and needs was the most cited cause of infection spread. Moreover, a significant difference across institution types on whether staff can differentiate between different isolation protocols such as droplet or contact. Hence, effective programs for staff training seem to be urgently obliged. Moreover, this is along with Rabaan *et al.* study [11].

It is worth noting some limitations of our study. First, this survey did not provide the identification of the participating institutions specifically. Second the inability of the study to evaluate the grading of awareness and the level of carelessness. Third regarding the institutions types data analysis we could not evaluate private sectors in such comparison due to the overlap of the places of work of medical staff.

Conclusion

Surveillance and infection control measures are critical to a global public health response. This self-reported questionnaire of HCWs in Egypt had shown reasonable knowledge about infection control and surveillance during the COVID-19 outbreak, yet promotes self-reported infection control behaviors, which may result from the higher workload and lack of resources. The preparedness system including the human resources and PPE storage in the hospitals should be improved to combat the emergent infection flow.

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Appendix A

- We thank you for giving us part of your valuable time to contribute to this scientific research and help in identifying infection control in hospitals during the Covid 19 pandemic.
 - Please do not write your name. The data of this form is confidential and will not be used for purposes other than scientific research
- Age in years
- 1) Sex
1. Male 2. Female
- 2) Qualification
1. Bachelor
2. Master
3. Md degree
- 3) Working place (more than one answer accepted)
1. Private hospital
2. Governmental hospital
3. Polyclinics
4. University hospital
5. Teaching hospital
- 4) Years of experience
- 5) Source of COVID-19 information
1. Television
2. Social media
3. Websites of hospital/Health Ministry
- 6) Do you have an infection control program at your institution?
1. Yes 2. No 3. Don't know
- 7) Do you have infection control policies and guidelines in your unit?
1. Yes 2. No 3. Don't know
- 8) Have you received some form of training or orientation about infection prevention and control for example Provide information on the selection and use of PPE in healthcare settings and Practice how to safely remove PPE
1. Yes 2. No 3. Don't know
- 9) Do you think that all staff in your unit are following promptly infection control policies, rules, and guidelines?
1. Yes agree 2. Don't know 3. No, did not agree
- 10) At your institution, do you have an active infection control team?
1. Yes 2. No 3. Don't know
- 11) Do you have an emerging infectious disease taskforce or dealing with outbreaks such as Covid 19?
1. Yes 2. No 3. Don't know
- 12) Do you think your hospital is prepared for any infection outbreak?
1. Yes agree 2. Don't know 3. No, did not agree
- 13) Is your hospital is enrolled in national surveillance system
1. Yes 2. No 3. Don't know
- 14) Do you have a list of reportable infectious agents available in your unit and accessible to all staff?
1. Yes 2. No 3. Don't know
- 15) Which infections are reported to MOH (ministry of health)?
1. All healthcare associated infections
2. All infections (both hospital and community acquired)
3. Don't know
- 16) In your institution, is there known turnaround time of laboratory results of the reportable infectious agents?
1. Yes 2. No 3. Don't know
- 17) Do you think that all staff can differentiate between different isolation protocols such as droplets or contact?
1. Yes 2. No 3. Don't know

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- 18) what reporting system in your hospital
1. Electronic surveillance
 2. Paper version
 3. Telephone communication
- 19) In your opinion, what is the effective reporting system for reporting infectious agents:
1. Electronic surveillance system
 2. Paper version
 3. Telephone communication
- 20) Do you agree that surveillance tool used in your institution is effective to prevent or control infection
1. Yes agree 2. Don't know 3. No, did not agree
- 21) In your opinion, what is the cause(s) of outbreaks?
- 22) Factors that contribute to the spread of infection in the hospital:
1. Breaching infection control policies, rules, and guidelines
 2. No clear infection control policies, rules, and guidelines
 3. Carelessness of healthcare workers
 4. Shortage of appropriate personnel protective equipment
 5. Infection control infrastructures do not exist
1. Lack and shortage of staff
 2. No infection control training program
 3. No resources to fulfill the infection control requirements and needs
 4. No infection control on-call