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EXPOSURE TO SARS-COV2 AMONG HEALTHCARE WORKERS IN IRAQ 2020-2021

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ABSTRACT

Background: Severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2) imposed a major burden on the healthcare systems worldwide. Healthcare workers have a higher risk to acquire the severe acute respiratory syndrome Coronavirus 2 and further spread it to the community. Severe acute respiratory syndrome Coronavirus 2 is still rapidly spreading in Iraq. The aim of the study was to estimate the prevalence of severe acute respiratory syndrome Coronavirus 2 infection among healthcare workers in Iraq and to further gain knowledge regarding the protective health behaviors adapted by the healthcare workers and the severity of their symptoms. **Methods:** a cross-sectional study was carried out using online based questionnaires. A total of 304 Healthcare workers were asked voluntarily to fill completely anonymous questionnaires through various social media (Facebook, Instagram, WhatsApp) Data were collected between 15th of Feb. to the 28th of May 2021. **Results:** Out of the total 304, 260 healthcare workers responded to the survey, the mean age was 32.06 years, the females proportion was 57.3%. Out of the 260 participants, 133 (51.2%) reported that they had a confirmed COVID-19 infection. Presenting during an aerosol generating procedure and providing direct care to suspected or confirmed COVID-19 patients were associated with higher rate to acquire the infection as 69.8 % of those who presented during an aerosolizing procedure and 57.8% of those workers who provided direct care for confirmed or suspected patients reported they had a positive infection. Mal hand hygiene practice was significantly associated with higher rate of infection as 80% of those who didn't practice good hand hygiene were tested positive for the novel virus. Among the 133 HCWs who had a positive test 113 (85%) had a mild to moderate infection, 14 (10.5%) required hospital admission, 16 (12%) required oxygen therapy. **Conclusion:** A moderate to high level of infection of severe acute respiratory syndrome Coronavirus 2 among healthcare workers in Iraq.

KEYWORDS:

INTRODUCTION

The novel Coronavirus was first recognized in late December 2019 as a cluster of mysterious pneumonia that first appeared in Wuhan, Hubei Province in China.[1] The pathogen was isolated and identified as severe acute respiratory syndrome 2 (SARS-CoV-2).[2]

The World Health Organization (WHO) used the term COVID 19, an acronym for Corona Virus Disease 2019, to describe the novel virus.[3]

The novel coronavirus demonstrated a very rapid transmission across the world and imposed a global threat.[4]

By March 11th the novel coronavirus was already established in more than 114 countries with more than 118,000 cases killing more than 4000 people which had led the WHO to announce it as a global Pandemic.[5]

COVID-19 displayed a wide range of symptoms; from mild/ asymptomatic to serious illness and death. Dry cough, fever, and dyspnea were all common presentation.[6]

The severity of the disease seems to increase with age (especially after the age of 80) and the existence of related morbidities such as chronic respiratory illnesses, coronary diseases, diabetes mellitus, and oncological

conditions.[7] the clinical image of COVID-19-related death includes respiratory failure, septic shock, and/or multiple organ failure.

The route of transmission is thought to be directly via respiratory droplets (particles > 5-10 micrometer in diameter) emitted through coughing or sneezing.[2] Indirectly as a result of interaction with infected inanimate objects, which is known as fomite transmission.[8] In aerosol generating procedures, airborne transmission of SARS-CoV-2 has also been reported. SARS-CoV-2 was recently found in stool specimens of affected individuals, suggesting the capability of SARS-CoV-2 to proliferate inside the digestive system and the possibility of a fecal–oral route of transmission.[8]

Healthcare workers (HCWs) are at the forefront of the battle against the coronavirus disease pandemic of 2019 (COVID-19).[9] Owing to their direct contact with highly infectious patients, as well as susceptibility to undiagnosed or subclinical infectious cases, healthcare providers may be at an elevated risk of SARS-CoV-2 transmission.[10] As studies showed that around 14% of cases reported to the WHO are health care workers, the proportion can be as high as 35% in certain places.[11]

There are multiple factors that contributed to the increased risk to the health care workers that were manifested during the first wave of the pandemic when they had to face long work hours, fatigue, tremendous psychological stress, lack of sufficient experience to deal with the emerging virus and shortage of the personal protective equipment due to their high open market demand. However, the greatest risk of getting the infection might be from their colleagues and dealing with patients in their early stage of unsuspected infections when the viral loads are too high.[12]

Nevertheless organizational issues had also a great impact the wellbeing of the healthcare team, such as overcrowding of health units, as well as a shortage of hospital beds and care supplies, like mechanical respirators.[7]

It is unclear if HCWs' clinical features and outcomes vary from those of the general public, given that recurrent virus exposure could result in a higher SARS-CoV-2 viral load and, as a result, poorer clinical outcomes.[10]

HCWs like anyone else are prone to both the illness itself and to rumors and inaccurate information that inevitably raise their anxiety level.[13]

There is a growing need and emphasis on protecting health care professionals worldwide by providing training, addressing exhaustion, and countering the psychosocial impact due to the high burden.[14]

All levels of hazard protection should be used to avoid SARS-CoV-2 transmission to health care providers, including administrative controls, engineering controls, and providing personal protective equipment.[15]

There is limited data about the burden of SARS-CoV-2 among HCWs in Iraq, and whether the infection control programs performed by the government are effective or not in preventing the spread of nosocomial infection among HCWs, Therefore this study was carried out.

OBJECTIVES

The study aims to determine the prevalence of COVID-19 among healthcare workers in Iraq, examine the factors influencing their exposure to the virus, and assess the severity of COVID-19 cases within this group.

SUBJECTS AND METHODS

Study Design and Setting

A descriptive cross-sectional study employing a convenience sampling approach was conducted. The case definition of COVID-19 adhered to the World Health Organization (WHO) criteria published in 2020, which defines a confirmed case as “a person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms.”

Data Collection

Healthcare workers (HCWs), including physicians, dentists, pharmacists, laboratory analysts, and other medical staff, were invited to participate voluntarily through an anonymous web-based questionnaire designed using Google Forms. The survey link was distributed via email and social media platforms (Facebook, Instagram, and WhatsApp). The questionnaire was adapted, with minor modifications, from the WHO instrument titled “Health workers exposure risk assessment and management in the context of COVID-19 virus.”

The severity of infection was classified based on the WHO severity definitions issued in January 2021. The final survey comprised 19 items designed to capture key sociodemographic, occupational, and clinical information related to HCWs, including age, gender, professional role, clinical setting, medical specialty, and exposure characteristics. Participants were asked whether they had provided care for suspected or confirmed COVID-19 cases, been within one meter of a confirmed patient, or tested positive for COVID-19 during the pandemic. Additional questions addressed symptomatology, hospitalization, oxygen therapy, type of diagnostic testing, participation in aerosol-generating procedures, frequency and nature of personal protective equipment (PPE) use, hand hygiene practices, type of face mask used, and co-occupancy with colleagues in the 14 days preceding infection. Respondents also reported their average daily working hours in direct contact with suspected or confirmed COVID-19 patients. Data collection was conducted from February to May 2021.

Inclusion Criteria

Eligible participants included healthcare workers of varying ages, socioeconomic levels, job titles, and medical specialties employed in healthcare facilities across Iraq. This encompassed physicians, dentists, pharmacists, laboratory analysts, and other medical staff actively engaged in patient care.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 25. Descriptive statistics were used to summarize the data, with continuous variables expressed as means, standard deviations, and ranges, and categorical variables presented as frequencies and percentages. The Chi-square test was applied to evaluate associations between provisional diagnoses and specific variables; Fisher's exact test was employed when expected frequencies were below five. A two-tailed p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Participation in the study was entirely voluntary. Anonymity and confidentiality of participants were strictly maintained throughout the research process. Informed consent was obtained electronically; participants were required to confirm consent on the survey's welcome page before proceeding to the questionnaire.

RESULTS

Socio-demographic characteristics

A total of 304 healthcare workers (HCWs) were invited to participate in an E-survey, achieving a response rate of 85.5% with 260 participants responding. The participants' ages ranged from 20 to 77 years, with a mean age of 32.06 years (SD ± 16.20). More than half (51.5%) were under 30 years old, and 57.3% were female, yielding a male-to-female ratio of 0.7:1. The majority of participants (86.2%) resided in Baghdad, and 43.5% were doctors, with medical specialties accounting for 50.7% of the respondents.

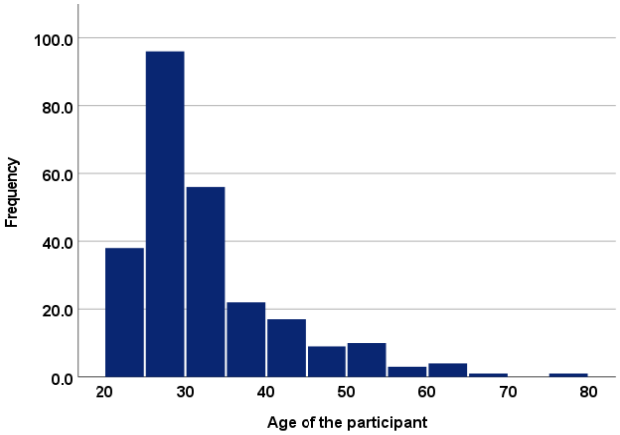

Figure 1: Simple histogram of the age of the participants.

Table 1: Characteristics distribution of the studied participants.

Variable	No. (n= 260)	Percentage (%)
Gender		
Male	111	42.7
Female	149	57.3
Province		
Baghdad	224	86.2
Others	36	23.8
Role in HCF		
Doctor	113	43.5
Dentist	33	12.7
Pharmacist	84	32.3
Laboratory Analyst	11	4.2
Others	19	7.3
Specialty		
Medical Branches	132	50.7
Surgical Branches	106	40.8
Others	22	8.5

Certain information of COVID-19

In a study of healthcare workers, 51.2% reported having COVID-19, with 85% experiencing mild to moderate

symptoms. Additionally, 10.5% were hospitalized and 12% needed oxygen therapy. Notably, 47.4% of infected individuals had shared rooms with colleagues prior to infection. The PCR test was the most common diagnostic method, used by 65.4% of participants. Fatigue was the most prevalent symptom, reported by 88.7%, followed by headache and fever at 78.2%, with 14.3% remaining asymptomatic.

Table 2: Distribution of the study participants by certain information of COVID-19.

Variable	No. (n= 260)	Percentage (%)
COVID-19 Test		
Positive	133	51.2
Negative	127	48.8
Severity of COVID-19		**n= 133**
Mild to Moderate	113	85.0
Severe to Critical	20	15.0
Hospitalization		
Yes	14	10.5
No	119	89.5
O2 Therapy		
Yes	16	12.0
No	117	88.0
Shared Room With Colleagues		
Yes	63	47.4
No	70	52.6
Types of COVID-19 test		
PCR	170	65.4
Rapid Test	88	33.8
Other	17	6.5

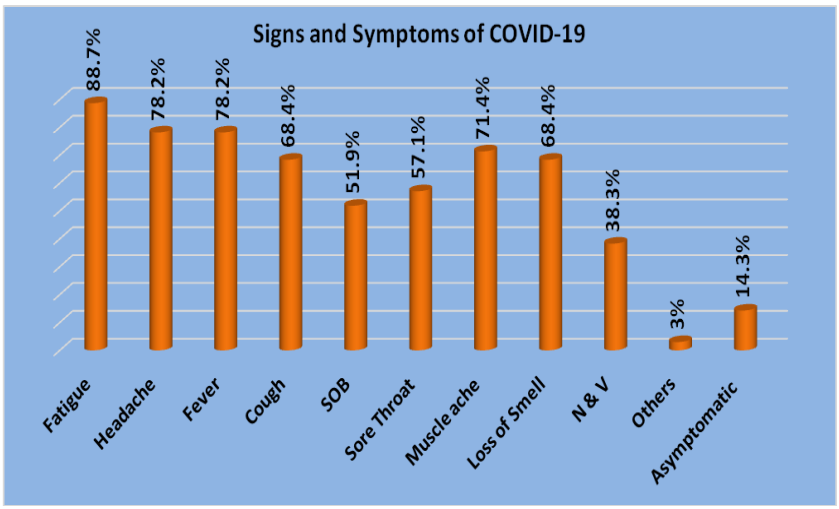

Figure 2: Distribution of the study participants by signs and symptoms of COVID-19.

Exposure to COVID-19

In a study of healthcare workers, it was found that 20.4% were present during aerosol-generating procedures, while 79.2% cared for confirmed or suspected COVID-19 patients. Notably, 82.3% reported contact with confirmed cases, and 33.1% spent 6 to 12 hours with these patients. Regarding personal protective equipment, 38.8% used it consistently, 39.3% most of the time, while 10% did not use it at all. Additionally, 90% washed their hands before and after patient contact, and the primary masks used were medical masks (63.5%) and N95 or KN95 masks (35%).

Table 3: Distribution of the study participants by exposure to COVID-19 and protective health behaviors.

Variable	No. (n= 260)	Percentage (%)
Present During Aerosol Procedure		
Yes	53	20.4
No	207	79.6
Provide Care For COVID-19 Cases		
Yes	206	79.2

No	54	20.8
Close Contact With COVID-19 Cases		
Yes	214	82.3
No	46	17.7
Time With COVID-19 Cases (hrs.)		
Non	75	28.8
≤ 5	77	29.6
6 - 12	86	33.1
> 12	22	8.5
PPE Use		
All The Time	101	38.8
Most of The Time	102	39.3
Half of The Time	31	11.9
Never	26	10.0
Hand Hygiene		
Yes	234	90.0
No	26	10.0
Medical Mask		
Yes	165	63.5
No	95	36.5
N95 or KN95 Mask		
Yes	91	35.0
No	169	65.0
FFP1 Mask		
Yes	9	3.5
No	251	96.5
FFP2 Mask		
Yes	10	3.8
No	150	96.2
Other Masks		
Yes	4	1.5
No	256	98.5

There was a statistically significant association between COVID-19 infection and the specialty of healthcare workers (HCWs), with a higher proportion of infections among those in surgical specialties (63.2%, P=0.004). No significant associations were found regarding age (P=0.648), gender (P=0.491), residence (P=0.983), or role in healthcare facilities (P=0.056).

Table 4: Distribution of the study participants by COVID-19 infection and socio-demographic characteristics.

Socio-demographic Data	COVID-19 Test		Total (%) n= 260	P - Value
	Positive (%) n= 133	Negative (%) n= 127		
Age (Years)				
< 30	66 (49.3)	68 (50.7)	134 (51.5)	**0.648**
30 - 50	47 (55.3)	38 (44.7)	85 (32.7)	
> 50	20 (48.8)	21 (51.2)	41 (15.8)	
Gender				
Male	60 (54.1)	51 (45.9)	111 (42.7)	**0.419**
Female	73 (49.0)	76 (51.0)	149 (57.3)	
Province				
Baghdad	110 (49.1)	114 (50.9)	224 (83)	**0.983**
Others	23 (50.0)	23 (50.0)	46 (17)	
Role in HCF				
Doctor	61 (54.0)	52 (46.0)	113 (43.5)	**0.056**
Dentist	16 (48.5)	17 (51.5)	33 (12.7)	
Pharmacist	37 (44.0)	47 (56.0)	84 (32.3)	
Laboratory Analyst	10 (90.9)	1 (9.0)	11 (4.2)	
Other	9 (47.4)	10 (52.6)	19 (7.3)	

Specialty				
Medical Branches	58 (43.9)	74 (56.1)	132 (50.8)	**0.004**
Surgical Branches	67 (63.2)	39 (36.8)	106 (40.8)	
Others	8 (36.4)	14 (63.6)	22 (8.5)	

Healthcare workers showed a higher COVID-19 positivity rate during aerosolizing procedures (69.8%, P=0.002) and while caring for COVID-19 patients (57.8%, P=0.001). Factors such as close contact with confirmed cases (57.5%, P=0.001) and spending over 12 hours with COVID-19 patients (63.6%, P=0.01) were associated with increased positivity rates. Additionally, those who failed to wash hands before and after contact (80.8%, P=0.001) and those not wearing masks (61.1%, P=0.015) exhibited a higher incidence of positive tests, while other protective measures did not have significant correlations (P > 0.05) with infections.

Table 5: Distribution of the study participants by COVID-19 infection and exposure status.

Exposure to COVID-19	COVID-19 Test		Total (%) n= 260	P - Value
	Positive (%) n= 133	Negative (%) n= 127		
Present During Aerosolizing Procedure				
Yes	37 (69.8)	16 (30.2)	53 (20.4)	**0.002**
No	96 (46.4)	111 (53.6)	207 (79.6)	
Provide Care For COVID-19 Cases				
Yes	119 (57.8)	87 (42.2)	206 (79.2)	**0.001**
No	14 (25.9)	40 (74.1)	54 (20.8)	
Close Contact With COVID-19 Cases				
Yes	123 (57.5)	91 (42.5)	214 (82.3)	**0.001**
No	10 (21.7)	36 (78.3)	46 (17.7)	
Time With COVID-19 Cases (hrs.)				
Non	30 (40.0)	45 (60.0)	75 (28.8)	**0.010**
≤ 5	35 (45.5)	42 (54.5)	77 (29.6)	
6 - 12	54 (62.8)	32 (37.2)	86 (33.1)	
> 12	14 (63.6)	8 (36.4)	22 (8.5)	
PPE Use				
All The Time	42 (41.6)	59 (58.4)	101 (38.8)	**0.056**
Most of The Time	49 (48)	53 (52)	102 (39.3)	
Half of The Time	20 (64.5)	11 (35.5)	31 (11.9)	
Never	22 (84.6)	4 (15.4)	26 (10.0)	
Hand Hygiene				
Yes	112 (47.9)	122 (52.1)	234 (90)	**0.001**
No	21 (80.8)	5 (19.2)	26 (10)	
Medical Mask				
Yes	75 (45.5)	90 (54.5)	165 (63.5)	**0.015**
No	58 (61.1)	37 (38.9)	95 (36.5)	
N95 or KN95 Mask				
Yes	84 (49.7)	85 (50.3)	169 (65)	**0.524**
No	49 (53.8)	42 (46.2)	91 (35)	
FFP1 Mask				
Yes	2 (22.2)	7 (77.8)	9 (3.5)	**0.077**
No	131 (52.2)	120 (47.8)	251 (96.5)	
FFP2 Mask				
Yes	4 (40)	6 (60)	10 (3.8)	**0.471**
No	129 (51.6)	121 (48.4)	250 (96.2)	

DISCUSSION

HCWs are the frontline of response to COVID-19. They are at high risk of acquiring the disease and subsequently, exposing patients and others to infection. This study revealed that 51.2% of HCWs in Iraq were infected with SARS-CoV-2. The observed figure is much more than the observed in the U.K (24.4%),[16] the US (13.7%),[17] Spain (9.3%)[18] and Greece (1-2%),[19] In Nicaragua; a developing country in the Latin America, the prevalence was found to be relatively higher, as one study had demonstrated that (30.35%) of the HCWs were tested positive for COVID-19.[20]

The high percentage of infection among HCWs in Iraq might be attributed to multiple factors including the fact that Iraqi healthcare system was devastated by wars, conflicts, and social unrest. Published articles documented the deterioration of health system in Iraq.[21]

Long working hours was significantly associated with acquiring SARS-CoV-2 infection among HCWs; this is consistent with the results of a study that took place in Wuhan, China which stated that prolonged working hours (more than 10 hours / day) is highly associated with increased risk of COVID-19 infection. Other studies in China and Ethiopia to access the risk factors of acquiring the COVID-19 infection had also yielded same results.[22,23] Indeed, prolonged working hours can have a tremendous effect on the well-being of the HCWs, as stress, fatigue, lack of sleep as well as having daily meals that lack essential nutrients can weaken the immune system and making it prone to diseases,. The long working hours in Iraq might be explained by defects in the administration and the lack of a logic epidemiological sense by the HCWs as they merge their shift duties in order to get longer periods of rest and might work for both private and public sectors simultaneously. HCWs being infected with SARS-CoV-2 act as a source of infection, transmitting the virus to their contacts (patients, colleagues and family).

The negligence of hand hygiene was significantly associated with the developing of SARS-CoV-2 infection, 10% of HCWs didn't practice hand hygiene before and after touching the patient or any aseptic procedure, 80% of them reported that they were infected with COVID-19. These results indicate that the transmission of the virus can occur indirectly through contaminated hands that carry viral residuals after either contact with patients or fomites. Other researches published in China and the UK also support these findings.[22,24]

Another interesting association with COVID-19 infection in HCWs was the fact that HCWs who were presented during aerosolizing procedures were more likely to be infected with SARS-CoV-2. As 69.8 % of those who were presented during an aerosolizing generating procedure (e.g. tracheal intubation, BiPAP, nebulization etc...) also reported they had been tested positive for COVID-19 infection. This may highlight airborne transmission as another possible route of infection. There are cases reports suggesting that airborne transmission may be occurring and it has been shown that SARS-CoV-2 can survive in aerosols for ≥3 h (with a similar reduction in titer as occurs with SARS-CoV-1).[25][26][27] This is consistent with other two studies that took place in Canada to investigate the risk of SARS corona virus transmission(64).[28] Therefore, a strict PPE use is necessary during these procedures as well as the continuous disinfection of surfaces and the appliance of engineering designs for infection control like appropriate ventilation and the use of air filters.

It was found that front line HCWs who provided direct care for suspected or confirmed COVID-19 patients, and those who were in close contact (within 1 meter) with a confirmed COVID-19 patient were more likely to be infected with SARS-CoV-2. As results had shown (57.8%) of those who provided direct care for suspected or confirmed COVID-19 patients, were tested positive for the infection. This finding is in contrast with studies conducted in Portugal and Qatar.[29,30] In Portugal the results showed that front-line HCWs were less likely to be infected with SARS-CoV-2 than non-front line HCWs emphasizing on the possibility that the source of infection was from their colleagues.[29]

In Qatar also it was found that the infection rate was much higher for those who weren't working directly with COVID-19 patients as PPE use was less stringent in these settings.[30] The high percentage of infection among front-line HCWs in Iraq may be due to the lack of mandatory training courses regarding the latest updated protocols for infection control and prevention issued by the World Health Organization (WHO) and the Center of Disease Control and Prevention (CDC) for the proper use and disposal of PPE.

Our study has multiple limitations, it's a cross sectional study with limited number of participants, so results can't be generalized and further studies with larger sample size should be carried out, the other limitation is the fact that most participants were either physicians or pharmacists, while the numbers of lab technicians and other paramedic groups were limited, no nurses were included in this study.

CONCLUSIONS

Moderate to high level of SARS-CoV-2 infection among HCWs was observed. Long working hours and negligence of PPE (gowns, masks, gloves, etc.) were associated with increased infection level. The HCWs who directly took care of COVID-19 patients and those who were at close proximity with a confirmed COVID-19 patient had a higher probability to get infected with the virus. Improper hand hygiene practice, the presence during an aerosolizing generating procedure, also contributed to the increased the risk to get the infection.

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