- *Basic Research*
Assessment Risk of Nurses, Exposure to COVID 19 At Quarantine Hospital

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Abstract

Introduction: Protection of HCWs from infection is critical for resilience of the health system facing a major pandemic like COVID-19. However, despite all efforts to protect HCWs, some exposure is inevitable. Such exposure can occur at the workplace or outside the work environment in the community. **Aim:** assess risk of nurses' exposure to covid-19 at quarantine hospitals. **Methods:** A descriptive research design was conducted among all available nurses who are involved in providing care for patients infected with Corona virus in quarantine hospitals affiliated to the Ministry of Health and Population (MOHP) in Alexandria. **Tools**: Tool I: personal and socio-demographic characteristics of nurses. Tool II: WHO COVID-19 virus exposure risk assessment form for Health Care Workers (HCWs). **Results:** there was a highly statistically significant correlation between the nurses' risk of exposure and their adherence to infection control measures during interaction with Covid-19 cases and aerosol generating procedures. **Conclusion:** The vast majority of nurses in quarantine hospitals had risk of exposure to infection and more than half of them had risk of accidents exposure which nurses are facing towards the battle against COVID19 infection. **Recommendations**: establishment of infection control system in quarantine hospitals: Empower nurses are in a better position to share and disseminate experiences to reduce the cross-contamination associated with viruses such as COVID-19. In relation to nursing education; Review of pedagogical frameworks in both in theoretical classes and in clinical teaching. Recognizing nurses' research as ongoing critical role encourages and informs further collaboration and serves as a catalyst to innovation for a healthier tomorrow.

Keywords: Health Care Workers, Risk assessment, Covid-19, Protective equipment, Nurses,

1-Introduction

Coronavirus is one of the pandemics, which are outbreaks of new and re-emerging infectious diseases that afflict a huge number of people at the same time, typically resulting in significant deaths, and social and economic disruption (1).The novel Corona virus (COVID-19), which was discovered in December 2019, was declared a pandemic on March 11, 2020, and was declared as a Public Health Emergency of International Concern due to the virus's high contagiousness and mortality (2).

over 5 million people have been infected across 213 countries and territories, leading to >300000 deaths worldwide. On the frontlines of this global crisis are healthcare workers (HCWs) with the substantial task of diagnosing and treating an exponentially growing number of acutely ill patients, often having to make critical decisions under physical and psychological pressure. WHO defines health workers as 'all people engaged in actions whose primary intent is to enhance health'.7 This encompasses doctors, nurses, midwives, paramedical staff, hospital administrators and support staff and community workers, all of whom now face the occupational risk of becoming infected with COVID-19, and at worst, even death (3,4).

Healthcare workers (HCWs) are a particularly high-risk group due to their close interactions with infected persons (5). The most common causes leading to COVID-19 acquisition by health care workers (HCWs) within healthcare settings have been a lack of personal protective equipment (PPE), long-term exposure to high numbers of infected patients, inadequate infection prevention and control training, and exposure to undiagnosed COVID-19 patients (6).

Infection rates among HCWs have been reported to range from 3 to 17 percent, depending on the history and degree of contact, as well as the appearance of symptoms. It is important to understand the prevalence and risk factors for COVID-19 infection among HCWs due to the potential to transmit infection to vulnerable patients, and since a further depletion of the workforce due to infection among the HCWs can lead to critical shortages and adversely impact patient care (5).

Nurses, who make up more than half of the healthcare staff, are vital in preventing the healthcare system from collapsing due to a pandemic disaster. Unfortunately, according to State of the World's Nursing (7), the number of nurses per 10,000 populations varies from 0.6 to 196. Investing in nursing is the imperative priority to increase nursing workforce. As of the early June 2020, more than 600 nurses died from the COVID-19 pandemic due to insufficient PPE (8). Providing adequate PPE and appropriate staffing should be the highest priority and responsibility of the governments and policymakers around the world to protect nurses' safety and save people's lives (9).

The code of ethics for nurses stated that the nurse's primary commitment to the patient and they also owe the same duty to self as to others (10). These equal obligations can conflict during pandemics when nurses must continually care for critically ill infectious patients, often under extreme circumstances, including inadequate or lacking resources and an unconducive working environment (11).

Aerosols, direct contact with an infected individual, and indirect contact with a virus-contaminated surface are the main modes of transmission for this virus (12). COVID-19 has a wide spectrum of clinical manifestations, ranging from asymptomatic to severe symptoms such as pneumonia, multiple organ failure, and death. Data from several studies indicate that COVID-19 manifests clinically with common symptoms such as fever, cough, sore throat, myalgia, fatigue, shortness of breath, and sputum production (13).

COVID-19 has an extended incubation period of 2-14 days, with variable severity from asymptomatic to life threatening symptoms among different individuals (14). Infected individuals can be asymptomatic, therefore not just making the diagnosis difficult but preventing the transmission of the disease an arduous challenge (15). Protection of HCWs from infection is critical for resilience of the health system facing a major pandemic like COVID-19. However, despite all efforts to protect HCWs, some exposure is inevitable. Such exposure can occur at the workplace or outside the work environment in the community.

Preventive strategies focus on minimizing exposure to the COVID-19 virus through the use of PPEs, regular hand washing with soap, observing physical distancing and covering coughs and sneezes with flexed elbow or tissue (16) .Healthcare workers are strongly recommended to adhere to appropriate IPC measures in managing COVID-19 cases to minimize the risk of COVID-19 virus infection. To further protect frontline HCWs, the WHO urgently issued interim guidance to guide HCWs on IPC protocols during healthcare management of COVID-19 cases. Non-adherence to IPC protocols by HCWs in managing infectious diseases such as COVID-19 puts HCWs, patients, and communities at risk (17).

Moreover, nursing staff facing this critical situation on front lines, are directly involved in screening, treatment, and caring patients of COVID-19. The rapid increase in cases, lack of personal protective equipment (PPEs), high workload, horrifying media news, lack of specific treatment of disease and feeling unsupported are the factors which contributing to increase risk as well as mental trauma of nurse's or nursing? care providers (18). Hence, this study was conducted with the aim of assessing risk of nurses' exposure to covid-19 at quarantine hospitals.

Significance of the study:

COVID-19 in Egypt Between 14 February 2020 and 22 August 2021, there were 286,168 confirmed cases in Egypt, with 16,663 deaths; protecting HCWs remains a challenge, where shortages of adequate PPE is a daily concern. Limited testing capacity precludes early identification and isolation of cases, leading to unnecessary occupational exposure for HCWs, particularly since a high number of patients with COVID-19 remain asymptomatic. In a vicious cycle, shortages of HCWs may compel staff to continue working for days on end, even under fatigue or when symptoms manifest, further increasing the risk of transmission (19).

Unmitigated, rising infection and mortality rates in HCWs will paralyse a country's response to COVID-19, and it is bound to have a significant, long-term impact on healthcare delivery, particularly in health systems already grappling with workforce shortage due to lack of trained personnel, skilled labour migration (20,21). Nurses, who account for more than half of the healthcare workforce, are critical to keeping the healthcare system from failing in the case of a pandemic. So, the study seeks to assess risk of nurses' exposure to covid-19 at quarantine hospitals.

Aim of study: Current study aims to assess risk of nurses' exposure to covid-19 at quarantine hospitals.

Research questions: what is risk of nurses' exposure to COVID-19 at quarantine hospitals?

Subjects and Methods

Research design: A descriptive research design was used to fulfill the aim of the present study. Descriptive research is a type of research that describes a population, situation, or phenomenon that is being studied (22)**.**

Setting: The present study was carried out at North Egypt quarantine hospitals affiliated to the Ministry of Health and Population (MOHP) during quarantine period. Egypt's Ministry of Health and Population announced that 21 isolation hospitals have been reinstated to treat moderate to severe COVID-19 cases, each city had a quarantine hospital; In North Egypt (The May 15 Hospital in Cairo, Agamy Hospital in Alexandria, Abu Khalifa Hospital in Ismailia, Tama al-Amdeed Hospital in Daqahlia, Faqous Hospital in Sharqiya, Qaha Hospital in Qalyubiya, Balteem Hospital in Kafr al-Sheikh, al-Bagour Hospital in Monufiya, Kafr al-Dawwar Hospital in Beheira). Three quarantine hospitals were selected by simple random method including (Agamy Hospital in Alexandria, Kafr al-Dawwar Hospital in Beheira, The May 15 Hospital in Cairo). Participants were reached through both

online advertisements on social media channels (what's up, e-mail, platform and face book) due to the infection control precaution in those hospitals.

Subjects: The subject of this study included (450 nurses) both genders aged between 20 to 60 years old were invited using snow-ball sampling method, who are available and agreed to fill the questionnaires at quarantine hospital all convenient sample comprised nurses who are involved in providing care for patients infected with Covid-19 in quarantine hospitals. The sample size of the respondents was determined via a single population proportion formula based on the following assumption: Since there is no previous study in Egypt, the maximum prevalence was used, P = 0.5, 95% confidence level, 5% margin of error, and 10% non-response rate was added and the required sample size became 450. Respondents were selected from three hospitals

The inclusion criteria: nurses who entered the negative pressure ward and provided nursing care for confirmed COVID-19 patients and providing direct care for patients in quarantine hospitals for at least 2 weeks.

Tools: a self-administered questionnaire in a Google form was employed to collect the data, **it includes two parts:**

Tool I: Personal and Scio-demographic characteristics of nurses:　This tool was developed by the researcher to obtain baseline data as; age, gender, marital status, level of education, work unit, years of experience and attendance of workshops and training programs about infection control.

Tool II: WHO COVID-19 virus exposure risk assessment form for Health Care Workers (HCWs): This tool was developed by WHO committee and was used for health care facilities with COVID 19 patients [18.] It aids in the risk assessment for HCWs after exposure to a COVID-19 patient (WHO, 2020).　It includes 5 sections with a total of 25 questions as follow:

- Section one: Nurses interactions with COVID-19 patients" information which includes 6 main closed ended questions covered the following data: date of health worker first exposure　　　　　　　　　　　　　　　　　　to　　　　　　　　　　　　　　　　confirmed COVID-19 patient, name of health care facility where patient received care, type of health care setting, City, multiple COVID-19 patients in health care facility.

- Section two: Nurses activities performed for COVID-19 patients in health care facility which includes 5 main closed ended questions) which includes the following data: did you provide direct care to a confirmed COVID-19 patient?, did you have face-to-face contact (within 1 meter) with a confirmed COVID-19 patient in a health care facility?, were you

present when any aerosol-generating procedures were performed on the patient?, did you have direct contact with the environment where the confirmedCOVID-19 patient was cared for?, were you involved in health care interaction(s) (paid or unpaid) in another health care facility during the period above? If the nurse responds 'Yes' to any of the Questions 4A – 4D the nurse should be considered as being exposed to COVID-19 virus

- Section three: Adherence to IPC procedures during health care interactions which include (7 closed ended questions). which included data about: Previous exposure to confirmed cases with Covid-19, presence of multiple cases with Covid-19, provide direct care to a confirmed case with Covid-19, face-to-face contact within one meter with a confirmed case, present when any aerosol generating procedure done to a confirmed case, present when any aerosol generating procedure done, involved in health care interactions in other health care facilities. The total scores of nurses' answer were summed up, then converted into percent scores as follows; always, as recommended' means more than 95% of the time; 'most of the time' means 50% or more but not 100%; 'occasionally' means 20% to under 50% and 'rarely' means less than 20%

- **Section four**: Adherence to IPC measures when performing aerosol-generating procedures which include (6 closed ended questions). Which covers the following data; During interaction with a case with Covid-19, wear; (single use gloves, medical mask, face shield, disposable gown), Remove, replace PPE according to protocol, Perform hand hygiene before, after touch patients, Perform hand hygiene before, after touch patients, Perform hand hygiene on exposure to body fluids, after touch patient's surroundings, Perform decontamination after touch surroundings. The total scores of nurses' answer were summed up, then converted into percent scores as follows; always, as recommended' means more than 95% of the time; 'most of the time' means 50% or more but not 100%; 'occasionally' means 20% to under 50% and 'rarely' means less than 20% .

- **Section five:** Accidents with biological material that includes (1 closed ended question) as: During a health care interaction with a COVID-19 patient, did you have any type of accident with body fluid/respiratory secretions.

Method:

- An approval from the Ethical Research Committee, Faculty of Nursing, and Alexandria University was obtained.

- An official letter from the Faculty of Nursing was directed to the Directorate of MOHP in Alexandria to obtain their approval to carry out the study at selected hospitals in Alexandria after explaining the aim of the study

- Directors of the selected hospitals were met to explain the purpose of the study and the time for starting of the study in order to facilitate data collection.

- Tool one was developed in Arabic language by researchers after reviewing recent related literature. Tool two was translated into Arabic language by researchers.

- **Tools Validity**: All tools were submitted to five experts in the field of Community Health Nursing and Medical Surgical Nursing for content and face validity and the necessary modifications were incorporated accordingly.

- **The reliability** of tools was tested by means of Cronbach's Alpha and the tools were reliable. The internal consistency reliability result was 0.89.

- A **pilot study** was initially carried out prior to the actual data collection phase on 10% of the sample size to check clarity, feasibility and applicability of tools and identifying obstacles that may be encountered during the data collection process, and to determine the time needed to fill in the assessment tools, accordingly, the required modifications were done.

-The questionnaire was translated into Arabic (local language) and reviewed by experts in. The responses were backtranslated into English for rechecking of meanings and concepts. The completeness and accuracy of the collected data were checked daily by the researchers. Nurses who were respond online informed on how to complete and sent the questionnaire. Researchers regularly sent a remark to respondents so that they had filled and returned the questionnaire. The researcher reviewed the returned questionnaires for completeness and consistency of the data. Data collection started at July 20[th,] 2020 and ended at May 30th, 2021 (during quarantine period).

Ethical considerations:

A written informed consent from nurses to participate in the study was obtained before data collection and after explanation of the aim of the study.

Privacy of the study participants was asserted.

Confidentiality of the collected data was assured.

Participants' voluntary participation and their right to withdraw from the study at any time were emphasized.

Statistical analysis:

Data were processed and analyzed using PC with statistical package for social science (SPSS ver. 20). Cronbach's alpha reliability test was used to measure the reliability of all tools. Numbers and percentages from total were used to describe and summarize the demographic data. Comparisons within and between studied participants was carried out using **Chi-Square (χ^2)**, and the level of significance decided for this study was P equal to or less than 0.05.

8.Results:

Table (1): This table shows that less than half of the sample (46.2%) were among the age group of (20 - >30 years old) and one third (33.8%) of them among the age group of (30->40 years old). The highest percent of nurses (66.2%) were females, and more than half (51.6%) of them were married. Slightly more than half (50.9%) of them had Bachelor degree of Nursing and around two-fifths (42.2%, 40.9%) of the studied participants were working in the intensive care unit and had less than 5 years of experience respectively. Moreover, it is clear that the majority (80.9%) of nurses were reported that they receiving previous training on infection control during COVID 19. Also, among that one half (50%) were received the training for one time.

Table (2): It was found that, less than half (46.9 %) of nurses reported that they previously exposed to confirmed Covid-19 cases and around two-thirds 68.4% of them were reported presence of multiple Covid-19 cases at quarantine hospitals. It is also apparent from the table that the vast majority (92.0%) of nurses was providing direct care and have a face-to-face contact within one meter with confirmed Covid-19 cases.

Additionally, majority (87.6%) of nurses reported that they were present when any aerosol generating procedure done to confirmed Covid-19 cases. Those who were involved in health care interactions in other health care facilities and have direct contact with the patient's environment constituted (91.3%,34.4%) respectively.

Table (3): shows distribution of Nurses according to their Adherence to Infection Control Measures during Health Care Interaction: This table illustrated that, nearly all (99.6%) of nurses reported that they wear PPE and more than half (58.9%) of them always wear single use gloves. Those who always wear medical mask, face shield and disposable gown constituted (72.4%, 44.2%, 54.9%) respectively. Moreover, it can be noticed from the table that, less than half (46.7%) of the nurses mentioned that they always removing and replacing PPE according to protocol. Those who always perform hand hygiene before and after touching the patients and any procedure represented (47.3%, 47.8%) respectively. Additionally, more than two fifth (47.8 %, 42.4%) of the nurses stated that they always

performing hand hygiene on exposure to body fluids and after touching patient's surroundings. Those who were most of times perform decontamination after touching the surroundings constituted (42.9%).

Table (4): illustrated distribution of nurses according to their adherence to infection control measures during aerosol generating procedure: This table portrayed that, all (100%) of them reported that they wear PPE during their interaction with Covid-19 cases. Those who were reported that they always wear single use gloves, N95 mask, face shield, disposable gown, and water proof apron during their interaction with Covid-19 cases constituted (60.0 %, 52.2%, 40.7%, 57.1 %, and 42.9 % respectively). Whereas, less than half (48.0 %) of them mentioned that they always remove and replace PPE according to protocol. It could be also observed from the table that, slightly more than half (50.2% and 50.7%) of the nurses stated that they always perform hand hygiene before and after touching the patients and any procedure. In addition, slightly less than half of them (49.8%) reported that they always perform hand hygiene after touching the patient's surroundings. Similarly, less than half (47.1%) of them always perform decontamination after touching the surroundings.

Table (5): This table illustrated that, more than half (52.4%) of the nurses were mentioned that they have accidents during patients- interaction. More than one third of them (38.1 %) reported that they were exposed to splash of body fluids into broken skin, and more than one quarter (26.7 %) of them were exposed to Splash of body fluids into the mouth /nose. Those who exposed to Splash of body fluids into the eye and Sharp puncture injury constituted (19.7% and 15.5% respectively).

Table (6): shows distribution of nurses according to the presence of risk of exposure to infection or accidents COVID 19 and adherence to infection control measures: It was noticed that, the vast majority (96.4 %) had risk of exposure to infection and more than half (52.4%) of them had risk of accidents. High level of adherence to infection control measures during interaction with Covid-19 cases and during aerosol generating procedure were reported by (52.7 and 49.3 %) of the nurses respectively, while low level were experienced by only 6.2%.

Table (7): This table shows the relationship between the nurses' risk of exposure and their socio-demographic data. No statistically significant difference was found between the nurses' risk of exposure to confirmed Covid-19 cases and their age, gender, marital status and previous training on infection control during Covid-19 where p= 0.484, 0.067, 0.668, 0.493 respectively. Additionally, the same table illustrates that a highly statistical significance relationship between the nurses' risk of exposure and their level of education, work unit, years of experience and the number of trainings on infection control during Covid-19 where p= 0.006*, 0.036*, 0.004*, 0.008* respectively.

Table (8): This table illustrates the relationship between the nurses' risk of exposure and their adherence to infection control practices. It was obvious that there was a highly statistically significant difference between the nurses' risk of exposure and their adherence to infection control measures during interaction with Covid-19 cases and aerosol generating procedure where P= 0.003*, 0.029* respectively.

Table (1): Frequency and Percentage Distribution of Nurses' Socio-demographic Characteristics.

Items		Total (n=450)	
		No.	%
Age (years)	20-	208	46.2
	30-	152	33.8
	40-	68	15.1
	≥50	22	4.9
Gender	Male	152	33.8
	Female	298	66.2
Marital status	Single	188	41.8
	Married	232	51.6
	Divorced	6	1.3
	Widowed	24	5.3
Level of education	Secondary School of Nursing	64	14.2
	Technical Institute of Nursing	125	27.8
	Bachelor degree of Nursing	229	50.9
	Post University education	32	7.1
Work unit	Inpatient	127	28.2
	Intensive care unit	190	42.2
	Emergency department	100	22.2
	Outpatient clinic	33	7.3
Years of experience	<5	184	40.9
	5-	98	21.8
	10-	84	18.7
	15-	54	12.0
	≥50	30	6.7
Previous training on infection control during COVID 19	No	86	19.1
	Yes	364	80.9
Number of trainings on infection control during COVID 19		N= 364	
	Once	182	50.0
	Twice	116	31.9
	Three times	26	7.1
	Four times and more	40	11.0

Table (2): Frequency and Percentage Distribution of Nurses' Exposure to COVID 19 Infection

Items		Total (n=450)	
		No.	%
Previous exposure to confirmed cases with Covid-19	No	239	53.1
	Yes	211	46.9
Presence of multiple cases with Covid-19	No	72	16.0
	Yes	308	68.4
	Don't know	70	15.6
Provide direct care to a confirmed case with Covid-19	No	36	8.0
	Yes	414	92.0
Have a face-to-face contact within one meter with a confirmed case with Covid-19	No	36	8.0
	Yes	414	92.0
Present when any aerosol generating procedure done to a confirmed case with Covid-19	No	56	12.4
	Yes	394	87.6
Direct contact with the patient's environment	No	39	8.7
	Yes	411	91.3
Involved in health care interactions in other health care facilities	No	295	65.6
	Yes	155	34.4

Table (3): Frequency and percentage Distribution of Nurses' Adherence to Infection Control Measures during Health Care Interaction:

Items		Total (n=450)	
		No.	%
During interaction with a case with Covid-19, wear PPE	No	2	0.4
	Yes	448	99.6
During interaction with a case with Covid-19, wear single use gloves	Rarely	6	1.3
	Occasionally	8	1.8
	Most times	171	38.0
	Always	265	58.9
During interaction with a case with Covid-19, wear medical mask	Rarely	2	0.4
	Occasionally	20	4.4
	Most times	102	22.7
	Always	326	72.4
During interaction with a case with Covid-19, wear face shield or goggles/protective glasses	Rarely	28	6.2
	Occasionally	59	13.1
	Most times	164	36.4
	Always	199	44.2
During interaction with a case with Covid -19, wear disposable gown	Rarely	14	3.1
	Occasionally	32	7.1
	Most times	157	34.9
	Always	247	54.9
During interaction with a case with Covid -19, wear waterproof apron	Rarely	14	3.1
	Occasionally	32	7.1
	Most times	157	34.9
	Always	247	54.9
Remove, replace PPE according to protocol	Rarely	16	3.6
	Occasionally	78	17.3
	Most times	146	32.4
	Always	210	46.7
Perform hand hygiene before, after touch patients	Rarely	14	3.1
	Occasionally	50	11.1
	Most times	173	38.4
	Always	213	47.3
Perform hand hygiene before and after any clean or aseptic procedure	Rarely	12	2.7
	Occasionally	42	9.3
	Most times	181	40.2
	Always	215	47.8
Perform hand hygiene on exposure to body fluids	Rarely	18	4.0
	Occasionally	52	11.6
	Most times	165	36.7
	Always	215	47.8
Perform hand hygiene after touch patient's surroundings	Rarely	20	4.4
	Occasionally	64	14.2
	Most times	175	38.9
	Always	191	42.4
Perform decontamination after touch surroundings	Rarely	14	3.1
	Occasionally	66	14.7
	Most times	193	42.9
	Always	177	39.3

Table (4): Frequency and percentage Distribution of Nurses' Adherence to Infection Control Measures during Aerosol Generating Procedure:

Items		Total (n=450)	
		No.	%
During interaction with a Covid-19 case, wear PPE	No	0	0.0
	Yes	450	100.0
During interaction with a Covid-19 case, wear single use gloves	Rarely	4	0.9
	Occasionally	10	2.2
	Most times	166	36.9
	Always	270	60.0
During interaction with a Covid-19 case, wear N95 mask	Rarely	22	4.9
	Occasionally	34	7.6
	Most times	159	35.3
	Always	235	52.2
During interaction with a Covid-19 case, wear face shield	Rarely	34	7.6
	Occasionally	94	20.9
	Most times	139	30.9
	Always	183	40.7
During interaction with a Covid-19 case, wear disposable gown	Rarely	14	3.1
	Occasionally	36	8.0
	Most times	143	31.8
	Always	257	57.1
During interaction with a Covid-19 case, wear water proof apron	Rarely	46	10.2
	Occasionally	79	17.6
	Most times	132	29.3
	Always	193	42.9
Remove, replace PPE according to protocol	Rarely	10	2.2
	Occasionally	84	18.7
	Most times	140	31.1
	Always	216	48.0
Perform hand hygiene before, after touch patients	Rarely	8	1.8
	Occasionally	68	15.1
	Most times	148	32.9
	Always	226	50.2
Perform hand hygiene before, after any procedure	Rarely	8	1.8
	Occasionally	64	14.2
	Most times	150	33.3
	Always	228	50.7
Perform hand hygiene after touch patient's surroundings	Rarely	8	1.8
	Occasionally	72	16.0
	Most times	146	32.4
	Always	224	49.8
Perform decontamination after touch surroundings	Rarely	6	1.3
	Occasionally	76	16.9
	Most times	156	34.7
	Always	212	47.1

Table (5): Frequency and percentage Distribution of Nurses according to the Accident Occurred during Interaction with Patients:

Items		Total (n=450)	
		No.	%
Have accidents during patients- interaction	No	214	47.6
	Yes	236	52.4
Accidents occurred		N= 236	
	Sharp puncture injury	37	15.7
	Splash of body fluids into the eye	46	19.5
	Splash of body fluids into the mouth /nose	63	26.7
	Splash of body fluids into broken skin	90	38.1

Table (6): Frequency and percentage Distribution of Nurses according to the Presence of Risk of Exposure to Infection or Accidents COVID 19 and Adherence to Infection Control Measures:

Items		Total (n=450)	
		No.	%
Risk of exposure	No	16	3.6
	Yes	434	96.4
Risk of accidents	No	214	47.6
	Yes	236	52.4
Adherence to infection control measures during interaction	Low	28	6.2
	Fair	185	41.1
	High	237	52.7
Adherence to infection control measures during aerosol generating procedure	Low	28	6.2
	Fair	200	44.4
	High	222	49.3

Table (7): The Relationship between Nurses' Risk of Exposure and their Socio-demographic data:

Items	Risk of Exposure				Total (n=450)		Test of Significance
	No (N= 16)		Yes (N= 434)				
	No.	%	No.	%	No.	%	
Age (years)							
20-	6	2.9	202	97.1	208	46.2	X2 = 2.451 P = 0.484
30-	8	5.3	144	94.7	152	33.8	
40-	2	2.9	66	97.1	68	15.1	
≥50	0	0.0	22	100.0	22	4.9	
Gender							
Male	2	1.3	150	98.7	152	33.8	X2 = 3.358 P = 0.067
Female	14	4.7	284	95.3	298	66.2	
Marital status							
Single	6	3.2	182	96.8	188	41.8	X2 = 1.564 P = 0.668
Married	10	4.3	222	95.7	232	51.6	
Divorced	0	0.0	6	100.0	6	1.3	
Widowed	0	0.0	24	100.0	24	5.3	
Level of education							
Secondary School of Nursing	2	3.1	62	96.9	64	14.2	X2 = 12.548 P = 0.006*
Technical Institute of Nursing	0	0.0	125	100.0	125	27.8	
Bachelor degree of Nursing	10	4.4	219	95.6	229	50.9	
Post University education	4	12.5	28	87.5	32	7.1	
Work unit							
Inpatient	2	1.6	125	98.4	127	28.2	X2 = 8.518 P = 0.036*
Intensive care unit	6	3.2	184	96.8	190	42.2	
Emergency department	8	8.0	92	92.0	100	22.2	
Outpatient clinic	0	0.0	33	100.0	33	7.3	
Years of experience							
<5	6	3.3	178	96.7	184	40.9	X2 = 15.223 P = 0.004*
5-	0	0.0	98	100.0	98	21.8	
10-	8	9.5	76	90.5	84	18.7	
15-	0	0.0	54	100.0	54	12.0	
≥50	2	6.7	28	93.3	30	6.7	
Previous training on infection control during COVID 19							
No	2	2.3	84	97.7	86	19.1	X2 = 0.469 P = 0.493
Yes	14	3.8	350	96.2	364	80.9	
Number of trainings on infection control during COVID 19	N=14		N=350		N= 364		
Once	4	2.2	178	97.8	182	50.0	X2 = 19.019 P = 0.008*
Twice	4	3.4	112	96.6	116	31.9	
Three times	4	15.4	22	84.6	26	7.1	
Four times and more	2	5.0	38	95.0	40	11.0	

Table (8): The Relationship Nurses' Risk of Exposure and their Adherence to Infection Control Practices:

Items	Risk of Exposure				Total (n=450)		Test of Significance
	No (N= 16)		Yes (N= 434)				
	No.	%	No.	%	No.	%	
Adherence to infection control measures during interaction							
Low	2	7.1	26	92.9	28	6.2	$X^2 = 11.693$
Fair	0	0.0	185	100.0	185	41.1	$P = 0.003*$
High	14	5.9	223	94.1	237	52.7	
Adherence to infection control measures during aerosol generating procedure							
Low	2	7.1	26	92.9	28	6.2	$X^2 = 7.075$
Fair	2	1.0	198	99.0	200	44.4	$P = 0.029*$
High	12	5.4	210	94.6	222	49.3	

9-Discussion

The burden to fight with Corona Virus Disease-19 (COVID-19) pandemic has lied to frontline health care workers that are putting themselves at a higher risk in the battle against the disease. The study focused on analysis Assessment risk of nurses' exposure to COVID 19 at quarantine hospitals in Egypt.

Findings from this study suggest; less than half of nurses had previous exposure to confirmed cases with COVID 19; while Most of nurses were providing care of multiple cases with COVID-19 in their quarantine hospital, and were providing direct care to a confirmed case with COVID-19; On the other hand, they had a face-to-face contact within one meter with a confirmed case with COVID-19, and they Presented when any aerosol generating procedure done to a confirmed case with COVID-19. Most nurses had direct contact with the patient's environment, and near two thirds were not involved in health care interactions in other health care facilities. As such finding, nurses work quarantine hospitals might have the possibility of being infected with COVID-19 and should have satisfactory knowledge about all features of the disease such as established prevention strategies, proposed treatment, diagnosis, and clinical manifestation, and risk exposure to COVID-19. To the authors` knowledge, this is the first study in Egypt that assessed the exposure health risk of COVID19 among nurses. Besides, there are also very limited studies regarding the exposure risk of COVID-19 among nurses' work at quarantine hospitals globally. The International Council of Nursing (8) reported that an average of 10% of all confirmed cases of COVID-19 infections are among HCWs, with a range of 1% to 32%.

The published data and reports very often did not include the details on the age group of the cases, ethnicity, nor the underlying clinical conditions and settings (community or hospital settings) where HCWs have contracted the virus. It is also challenging to obtain the

data on HCW infections and deaths with a breakdown by occupation (Huang et al., 2020) (24) stated that, despite intense training, it is not uncommon for nurses to not be fully aware of their exposure while caring for patients, especially when they feel stressed or exhausted.

Evidence from the current study illustrated that a high rate of nurses` adherence to infection control measures during health care interaction with cases of COVID-19 infections; including wearing PPE, wearing single use gloves, wearing medical mask, wearing disposable gown. However; there were inadequate nurses` adherence to infection control measures during wearing face shield; Remove, replace PPE according to protocol, and Perform hand hygiene. The vast differences in nurses' adherence infection control measures may be due to the time the studies were conducted, as the likelihood of being infected with COVID-19 was higher among health care workers, load of the COVID-19 cases at quarantine hospitals, availability of equipment and not all nurses had training programs on COVID-19.

Similarly, (Albeladi et al 2021) [25] were conducted a study in Saudi Arabia to evaluate the level of adherence to preventive measures against COVID-19, they were found that 49% of health care workers participants were adherent to COVID-19 preventive measures. However, (Powell et al., 2020) [26] found on a study among healthcare workers in Tanzanian outpatient facilities concluded that infection control measures compliance was inadequate; Besides, a study in China was done by (Lai et al., 2020) [27] who reported that an improvement in IPC behaviors of healthcare workers during the COVID-19 outbreak.

In relation to nurses` adherence to infection control measures during aerosol generating procedure; the participants nurses adhere to hand hygiene and PPE usage. Perhaps, our findings may be an indication of infection prevention and control efforts to combat the spread of COVID-19 in quarantine hospitals, as recommended by the guidance on preparing workplaces for COVID19 infection. Particularly, this finding due to nurse's proper handwashing practice and they knew it impotence in prevention infectious diseases. Hands should be washed with water and soap for about 40–60 seconds; and PPE usage, they applied by integrating the information based on the degree of the spreading risk of this virus in different areas of health facilities. This results was in line with a previous study was done by (Tran et al., 2012) [28] who suggested that some procedures potentially capable of generating aerosols have been associated with increased risk of SARS transmission to HCWs, where they found showed that HCWs performing or being exposed to a tracheal intubation procedure had a higher risk of disease transmission compared with unexposed HCWs ; there was overwhelmingly high compliance with IPC protocols during AGPs by healthcare workers due to aerosol-generating procedures are high-risk procedures that are associated with an increased risk of SARS-CoV-2 transmission to healthcare workers. . Similarly, The Central for Disease Control and Prevention (CDC., 2020) [14] declared that

the risk for exposure of nurses providing direct health care for patients with COVID-19 increase when preforming or attending aerosol procedures (e.g. intubation, extubating, CPR, nebulizer, and bronchoscopy) without using proper PPE, along with poor adherence to infection control measures. Risk for exposure has been identified as nurses providing direct health care for patients with COVID-19 (e.g., physical examinations, nursing care, specimen collection) and when performing or attending aerosol-generating procedures (e.g., intubation, extubating, induction of sputum, cardiopulmonary resuscitation, bronchoscopy) without using proper personal protective equipment (PPE), along with poor adherence to infection control and prevention (ICP) practices associated with COVID-19 (CDC, 2020) [14].

The current study reported that more than half participant nurses had accidents during COVID-19 patients' interactions, more than half of participants nurses exposed to splash of body fluids into broken skin, mouth, or nose. Thus, this finding stress adequate supply and proper use of personal protective equipment, which are of the greatest role in preventing COVID-19 infection among nurses; As part of standard precautions, any procedure that can be expected to generate splashes or sprays of infectious material should be performed using appropriate barriers to protect the nurse; e.g., a face shield that provides reliable protection from splashes. As suggested in the study by (Feldman et al, 2020) [29] who reported that droplet sprays and aerosols can be deposited on uncovered sites such as skin on the face and neck; however, SARS-CoV-2 is not able to initiate infection at those sites. Infective material may be deposited into the susceptible tissues of the eyes, nose, or mouth via mechanisms such as hand transfer (self-inoculation).

This finding underscores the importance of maintaining consistent adherence to hand hygiene, including after removal of PPE. A study done by (Loibner., 2019) [30] who reported that when nurses wear personal protective equipment (PPE), they usually take 4–6 working hours without a break. This is very critical to nurses' well-being, since longer hours wearing PPE can cause fatigue, stress, and exhaustion, making healthcare providers prone to causing medical errors.

In this study, there were some associated factors that affected nurse exposure to COVID 19 infection. There was a significant relation between nurses` level of education and the nurses' risk of exposure to COVID-19 infection. Academic programs will provide a workforce with further skills and knowledge to contribute in a direct and meaningful way. This was incongruent with result of study by (Al-Dossary et al., 2020) [31] who found that nurses with a bachelor's degree had better prevention and perception towards COVID-19 compared to other educational backgrounds. The second factor was experience; it is worth noting that expertise nurses are accountable for and oversee the provision of safe patient care, thus with greater exposure and consistent care towards COVID-19, because of

more exposure in bedside care. (Kieft et al., 2014) [32] stated that the work experience nurses have, this more opportunity to practice critically and provide quality patient care. While there was a highly significant relation between numbers of training programs provided to nurses about COVID-19 and exposure to infection. It could be safe to say that constant reinforcement of health information could lead to better awareness, and prevention. Consistently, (King et al., 2021) [33] stated that majority of nurses participated in training program about COVID-19, stated that they felt safe at work with patients and using PPE.

The current study, nurses working in intensive care unit had a statistically significant relation to exposure to COVID-19 infection. This may be due to work overload during pandemic and exposure to aerosol procedures in nursing management of COVID- 19 patients. (Castillo & Caro., 2021) [34] who studied intensive care nurses` experience during the COVID-19 pandemic, the result indicated that despite the effort of supervisors efforts to recruit more staff to ICU during pandemic, this lead that nurses had no prior experience, and falling to cope with work load; in addition of physical and psychological consequence manifested in ICU nurses.

9-Conclusion

From the findings of the present study, It was noticed that, the vast majority of nurses in quarantine hospitals had risk of exposure to infection and more than half of them had risk of accidents exposure which nurses are facing towards the battle against COVID19 infection. There was high adherence to personal protective equipment uses and aseptic practices during and after health care interactions with patients were identified and hand washing practice. There was a significant relation between nurses` level of education and the nurses' risk of exposure to COVID-19 infection. Academic programs will provide a workforce with further skills and knowledge to contribute in a direct and meaningful way strategies implemented quarantine hospitals in effective way that protect nurses from COVID-19 infection.

Recommendation

Based on the current study findings, quarantine hospitals police; that aims to ensure adequate nurses` support for counseling, psychological well-being and safety. Avoiding unnecessary contact in isolation area for minimizing cross-transmission; and establish scientific, reasonable nursing shift schedule to avoid nurses work load that lead increase risk exposure and unnecessary accidents during care of COVID-19 patients. Empower nurses are in a better position to share and disseminate experiences to reduce the cross-contamination associated with viruses such as COVID-19. In relation to nursing education; Review of pedagogical frameworks in both in theoretical classes and in clinical teaching; Improvement of multimedia: e-resources of high quality; Development of

simulation platforms for clinical skills learning and assessment. Recognizing nurses' researches as ongoing critical role encourages and informs further collaboration and serves as a catalyst to innovation for a healthier tomorrow.

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الملخص العربي

تقييم مخاطر تعرض طاقم التمريض لفيروس كرونا المستجد بمستشفيات الحجر الصحى

المقدمة: تُعد حماية العاملين في مجال الرعاية الصحية من العدوى أمرًا بالغ الأهمية ، على الرغم من كل الجهود المبذولة لحماية العاملين في مجال الرعاية الصحية ، فإن بعض التعرض أمر لا مفر منه. حيث يمكن أن يحدث هذا التعرض في مكان العمل أو خارج بيئة العمل في المجتمع.

الهدف من الدراسة: تقييم مخاطر تعرض طاقم التمريض لفيروس كرونا المستجد بمستشفيات الحجر الصحى

منهجية البحث: تم إجراء تصميم بحث وصفي بين جميع الممرضات المتوفرين والمشاركين في تقديم الرعاية للمصابين بفيروس كورونا في مستشفيات الحجر الصحي التابعة لوزارة الصحة والسكان بالإسكندرية.

تم إستخدام أداتان لتجميع البيانات: ١

لأداة الأولى: استبيان تقييم مقدم الرعاية الصحية. **الأداة الثانية:** نموذج منظمة الصحة العالمية لتقييم مخاطر التعرض لفيروس كرونا المستجد للعاملين في مجال الرعاية الصحية .**النتائج:** لقد أسفرت نتائج البحث عن وجود فروق ذات دلالة إحصائية عالية بين مخاطر تعرض الممرضات للتعرض والتزامهم بتدابير مكافحة العدوى أثناء التفاعل مع المرضي المصابين بفيروس كورونا المستجد.

الخلاصة: كانت الغالبية العظمى من الممرضات في مستشفيات الحجر الصحي معرضين لخطر الإصابة بالعدوى وأكثر من نصفهم معرضون لخطر التعرض للحوادث التي يواجهها الممرضون في المعركة ضد عدوى فيروس كورونا المستجد فى مستشفيات العزل.

التوصيات: إنشاء نظام مكافحة العدوى في مستشفيات الحجر الصحي: تمكين الممرضات في وضع أفضل لمشاركة ونشر الخبرات للحد من التلوث المتبادل المرتبط بالفيروسات مثل فيروس كورونا المستجد . فيما يتعلق بتعليم التمريض ؛ مراجعة الأطر التربوية في كل من الفصول النظرية والتدريس السريري. إن الاعتراف بأبحاث الممرضات على أنها دور حاسم مستمر يشجع ويعلم المزيد من التعاون ويعمل كمحفز للابتكار من أجل غد أكثر صحة.