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RESEARCH ARTICLE

Nurses' Perceptions Regarding Exposure to COVID-19 Risks, and Impact of COVID-19 Outbreak on their Work and Psychosocial Health: A Cross-sectional Study

Nora H. Elneblawi¹, Rami A. Elshatarat¹, Khadega A. Elhefnawy^{1,2}, Inas A. Ebeid^{3,4}, Mohammed S. Aljohani¹, Naif S. Alzahrani¹, Abdulaziz Mofdy Almarwani⁴ and Ziad T. Saleh^{5,*}

¹Department of Medical and Surgical Nursing, College of Nursing, Taibah University, Madinah, Kingdom of Saudi Arabia

²Department of Medical-Surgical Nursing, Faculty of Nursing, Menoufia University, Menoufia, Egypt

³Department of Psychiatric and Mental Health Nursing, Faculty of Nursing, Portsaid University, Portsaid, Egypt

⁴Department of Psychiatric Nursing, College of Nursing, Taibah University, Madinah, Kingdom of Saudi Arabia

⁵Department of Clinical Nursing, School of Nursing, The University of Jordan, Amman, Jordan

Abstract:

Introduction:

Coronavirus (COVID) is a large family of RNA viruses that cause illnesses ranging from the common cold to more severe symptoms.

Objectives:

Determine nurses' perceptions in Saudi Arabia regarding their risks, measures and coping mechanisms to prevent COVID-19 infection and transmission and the significant associated factors for their anxiety.

Methods:

This is a correlational cross-sectional study. A convenience sampling method was used to recruit a total of 345 nurses. A valid and reliable questionnaire was adapted from a previous study and the generalized anxiety disorder-2 items (GAD-2) scale was used to collect the data.

Results:

The majority of the participants (75.7%) perceived that they were most likely at risk of getting COVID-19. In terms of preventative actions, 84.3% said they were avoiding crowded places, 77.4% were adhering to protocols and recommended measures, about 73.0% of participants were taking nutritional supplements and vitamins, practicing exercises, and changing out of work clothes, 54.8% were taking a shower before going home, and 53.9% were temporarily staying away from home in alternative housing to prevent having COVID-19 or transmitting the virus to their relatives. Furthermore, significant association was found between the participants' anxiety and the male gender ($r=0.1$, $p=0.04$), less nursing experience ($r=0.41$, $p=0.02$), number of children ($r=0.35$, $p=0.03$). Additionally, participants exposed to COVID-19 patients, who did not implement the measures and coping mechanisms to prevent COVID-19 were significantly associated with a high level of GAD-2.

Conclusion:

The majority of nurses perceived that they were at high risk of getting COVID-19 and were concerned that they could easily transmit COVID-19 to their relatives. As a result, many implemented preventive measures to protect themselves and prevent transmission of COVID-19 to their families and relatives. The continued attendance of health education programs about COVID-19 as well as the implementation of basic standard precautions, is essential to protect health workers and their families.

Keywords: Novel coronavirus (COVID – 19), Global pandemic, Coping mechanisms, Saudi nurses, Generalized anxiety disorder, Psychological health.

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1. INTRODUCTION

Coronavirus (COVID) is a large family of RNA viruses that cause illnesses ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). Moreover, Coronavirus may cause life-threatening diseases such as Acute Respiratory Syndrome (ARDS) [1 - 3]. In December (2019), the third pathogenic human COVID was named a novel coronavirus (COVID-19). COVID-19 was firstly discovered in Wuhan, China [4].

COVID-19 is characterized by low pathogenicity and high transmissibility when compared to SARS and MERS, which subsequently makes it more difficult to contain and control. As a result, after more than three months following the identification of the first infected human, the incidence of infection and the mortality rate were still significantly high, which made COVID-19 a great public health concern globally [5]. In Saudi Arabia, the incidences of COVID-19 infection and the mortality rate were also high [6].

Healthcare workers caring for patients with COVID-19 in particular were at high risk of exposure to the viral disease. Close contact with persons infected with COVID-19 also elevated the risk of exposure [7]. Infection prevention and control practices were essential in protecting the function of healthcare services and mitigating the impact on vulnerable populations [7, 8]. Since nurses are in close contact with hospitalized infected patients, as well as the rest of society, they may potentially play a major role in the infection transmission chain. Therefore, improving their knowledge about COVID-19 is an essential measure for the prevention of COVID-19 transmission [5]. In addition to the risk of exposure to COVID-19, nurses are more likely to be exposed to various types of physical, psychological, and social stressors which relate to working environments. Because nurses were at high risk of COVID-19 infection, some found themselves subjected to social isolation and alienation and even discrimination by others, all while facing the risk of deadly infection. Living in isolation from family members and loved ones; working in high-risk areas and providing care to infected individuals; working long shifts besides; all these factors expose nurses to work stressors which may have a detrimental effect on their psychosocial status [9, 10]. Also, the nurses during the COVID-19 pandemic faced numerous obstacles and ethical dilemmas, which negatively affected their nursing care, making appropriate clinical decisions and making correct ethical choices [11]. Moreover, a previous study showed a significant negative relationship between COVID-19 anxiety and nurses' quality of life [12]. Furthermore, a previous Egyptian study showed that COVID-19-related anxiety has negatively affected the frontline nurses' organizational commitments and the perception of their nurse managers regarding their caring behavior [13].

Outbreaks of COVID-19 cause public anxiety, panic attacks, and fear of death from people all over the world,

particularly among healthcare professionals. For example, previous studies showed high nurses' anxiety levels in China (45.5%) [14] and Germany (59.1%) [15] during COVID-19 pandemic. The feeling of anxiety among Chinese nurses was significantly correlated with their emotional exhaustion, reduced personal achievement, and burnout, particularly in those who had lack of knowledge about COVID-19, working in isolation units, working \geq three shifts weekly, and being surrounded by health care providers with confirmed or suspected diagnosis of COVID-19 [14].

The authors of this study reviewed the available literature to find related clinical researches about KSA based nurses' perception and experiences during their efforts to prevent and manage COVID-19. Unfortunately, however, we found limited information and a scarcity of previous studies in Saudi Arabia discussing this essential health issue faced by this crucial category of healthcare professionals and addressing the objectives of this study. The database search revealed previous international literature that discussed nurses' and other health professionals' perceptions, practices, and coping mechanisms for preventing previous respiratory infectious diseases such as SARS and MERS. However, yet again, unfortunately, there were no related study that discussed the Saudi nurses' perceptions and coping mechanisms to prevent previous respiratory infectious diseases.

1.1. Review of Literature

Before May 2020, the complete clinical picture regarding COVID-19 was not entirely clear. Reported clinical manifestations of COVID-19 have ranged from very mild (including some individuals with no reported symptoms) to severe symptoms, including illness that leading to hospitalization and death. While most of the clinical information so far suggests that the majority of COVID-19 illnesses were mild. Based on the American Centre for Disease Prevention and Control (CDC) Morbidity & Mortality Weekly Report, the results showed that about 80% of deaths among COVID-19 patients in the United States (U.S.) were among adults 65 years or older, and the severity of disease with the highest percentage of severe complications was among people 85 years or older [7].

Alongside the patients with COVID-19 disease symptoms, who comprised the main cause for transmission of COVID-19 disease, recent observations have also suggested that asymptomatic COVID-19 patients and those in the incubation period of the disease were also carriers of the disease. However, when COVID-19 was first discovered, it remained to be proven whether the infected patients with COVID-19 in the recovery phase were a potential source of transmission of the disease or not [16]. These epidemiological characteristics of COVID-19 made the control of COVID-19 extremely challenging. Moreover, the added difficulty of identifying and quarantining those at high risk of transmitting the virus early on contributed to the rapid acceleration of COVID-19 infection across communities.

At the time of conducting this study, there were no specific therapeutics or vaccines fully developed for COVID-19. The primary goal of public health measures was to inhibit the

* Address correspondence to this author at the Department of Clinical Nursing, School of Nursing, The University of Jordan, Amman, Jordan 11942; Tel: +962785358313; Fax: +96265300244; E-mails: zyad.saleh2@ju.edu.jo, Ziad.Saleh@ju.edu.jo

epidemic and decelerate the rate of infection. Several public health measures were implemented to prevent the person-to-person spread of the disease by means of isolation and quarantine. Isolation of patients was particularly effective in interrupting the transmission of viral diseases [17]. On January 30, 2020, the World Health Organization (WHO) announced that the COVID-19 outbreak had constituted a public health emergency and international concern [16].

The findings of previous clinical research showed that heavy nursing workloads adversely affected patient safety. Furthermore, they negatively affected nursing job satisfaction and consequently contributed to high turnover in the nursing profession. Moreover, excessive workload was a contributing factor to increased medical errors. Nurses experiencing stress and burnout may not be able to perform efficiently or effectively. The resulting suboptimal performance negatively affected patient care and decreased safety [18, 19].

1.2. Study Objectives

The specific objectives of this study are to determine: 1) the perceptions taken by nurses working in Saudi Arabia, regarding the risks of exposure to COVID-19. 2) Participants' measures and coping mechanisms to prevent the infection of COVID-19. 3) The impact of COVID-19 transmission on participants' work and personal lives. 4) Participants' opinion about receiving COVID-19 vaccine in the future (within 12 months). 5) Participants' generalized anxiety disorder level, and 6) The significant associated factors for the participants' generalized anxiety disorder.

2. MATERIALS AND METHODS

2.1. Study Design

A correlational cross-sectional study was conducted to determine the participants' perceptions regarding their exposure to COVID-19 and the impact of the outbreak on their work and personal lives.

2.2. Sample and Setting

A convenience sampling method was used to recruit a total of 345 nurses to address the objectives of this study. The inclusion criteria for participation in this study were for bedside nurses to be registered in the two largest cities of Saudi Arabia's Western Region (Medina and Jeddah), who were full time workers at hospital departments (including emergency department, medical-surgical department and critical care units) that provide diagnostic and therapeutic procedures to patients who were diagnosed with, or suspected to have COVID-19 disease, who were directly caring for patients with COVID-19 disease, and who were able to understand the English language. During COVID-19 pandemic, only the major government hospitals in the cities of Medina and Jeddah were assigned to provide care for patients with COVID-19. Therefore, the sample of this study was recruited from these major hospitals, which include: Ohud Hospital (Medina city) and King Fahad Hospital (Jeddah city). The study was conducted prior to the development of the COVID-19 vaccine, therefore, all participants were yet to be the recipients of the

COVID-19 vaccine.

2.3. Study Sample Size

The software program G-POWER was used to identify the effective sample size. Power analysis for Spearman's correlation test was conducted using a power of 95%, an alpha of 0.05, a medium effect size, 0.30, and two tailed tests. The power analysis for Spearman's correlation test revealed the required sufficient sample size as being 320 participants [20].

2.4. Data Collection Procedure

Two authors of this study met the eligible nurses in person in their workplace settings. Each of the authors visited the selected departments/settings at different work-shifts (morning and night shifts) to meet a large number of the eligible participants. Thereafter, the researchers explained the purpose of the study to the eligible nurses and invited them to complete an online self-administered questionnaire, which was designed by the authors, and hosted digitally using Google Forms. The participants, who decided to partake in the study, were asked to their contact details (email or WhatsApp number) which were used to send them a hyper-link to the online survey. The authors also provided the eligible nurses who accepted to participate in the study with a flyer containing a QR code link which could easily be scanned by nurses' smart phones to access and fill-in the survey. Further to this, the authors sent the link of the online survey by email and WhatsApp to nursing managers in the selected settings for them to distribute the link to nurses in their departments.

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A total of 400 candidates were invited (by the authors or *via* head-nurses of selected departments) to participate in this study by using the above-mentioned methods. To prevent gaps in the collected data, all questions were set to require in the form (using the Google Forms settings), making submissions only possible once all questions had been answered. A total of 345 completed surveys were submitted to the authors of this study. In order to avoid unwanted or fraudulent data as well as duplicate submissions, all participants were required to submit their forms using their official Ministry of Health email address. This ensured that each submission contributing to the data of the study was from a unique email address of a verified professional.

In the first section of the online questionnaire contained an explanation cover page about the study, as well as a written consent form. Clarification of the nature, purpose, and specific objectives of the study and the inclusion criteria were documented for the eligible participants in this explanation cover page. Moreover, the participants were informed that their participation was entirely voluntary and that their personal information would be anonymous and confidential. All willing participants in the study were asked to confirm their agreement to participate and were informed that submission of the survey was considered written consent. The data collection window was between May 2020 and October 2020, prior to the distribution of the COVID-19 vaccinations in Saudi Arabia.

2.5. Data Measurement/Instruments

A structured questionnaire was used to assess the participants' perceptions regarding their level of risk due to exposure to COVID-19. Participants were also asked about the measures and coping mechanisms they employed to prevent COVID-19 infection or transmission, as well as the impact of COVID-19 transmission on their personal and professional lives. This questionnaire was adapted from a previous study [21]. The original instrument was used to investigate healthcare workers' perceptions of risk and preventive measures for SARS. To use the original instrument (English version), a permission letter was obtained from the corresponding author of the previous study [21]. The validity and reliability of the original instrument are documented in the study held at the time [21]. Thereafter, the researchers of this study modified the original instrument to render it relevant to the COVID-19 transmission and applicable to the context of Saudi Arabia.

Generalized anxiety disorder-2 items (GAD-2) scale was used to identify the anxiety among the participants [22]. GAD-2 is a very brief screening scale for assessing generalized anxiety disorder. The scale has also been used in several clinical research studies to screen three other common anxiety disorders, including panic disorder, social anxiety disorder, and posttraumatic stress disorder. The validity and reliability of the original English version of the GAD-2 scale were documented [22, 23]. The participants in this study were required to answer two items in this survey: "Over the last 2 weeks, how often have you been bothered by the following problems?": 1) "Feeling nervous, anxious or on edge" and 2) "Not being able to stop or control worrying". The two questions were answered *via* 'multiple choice' options which were as follows: (0=not at all), (1=several days), (2=more than half days), and (3=nearly every day). The total score of GAD-2 scale ranges from 0 (no anxiety) to 6 (severe anxiety). Using a cut-off of 3 (out of 6) for GAD-2 has been documented in previous studies to have very good sensitivity (86%) and specificity (83%) for diagnosing the GAD [22, 23].

2.6. Ethical Considerations and Institutional Review Board Approval

Prior to conducting this study, official Institute of Review Board (IRB) permission was obtained from the ethical research committee at College of Nursing, Taibah University, Saudi Arabia, (approval number: Nursing-2020-014). Moreover, official permission was obtained from the Clinical Health Research Committee of the North Western region of Ministry of Health (via Medina city branch) in order to recruit and facilitate collecting data from the nurses at the selected departments in the governmental hospitals. The participants were informed that their participation in this study would be entirely voluntary, their personal information would be anonymous and confidential, and they could stop completing the survey at any time or not submit the online survey if they refused to participate in the study.

2.7. Pilot Study

The authors of this study and two expert clinical health

researchers checked the validity, clarity, and feasibility of the instruments that were used in this study. English language editors checked and verified the clarity, structure and grammar of the instrument. Moreover, a pilot study was conducted by recruiting 30 nurses from the selected hospitals to verify the reliability and clarity of the online survey used in this study. The findings of the pilot study showed very good internal consistency and reliability (Cronbach's $\alpha=0.87$). Moreover, the clarity of the questionnaire and ease of participation *via* the online Google Form were noted. Data collected from the pilot participants was excluded from the final statistical analysis of the current study.

2.8. Statistical Analysis

For data analysis, the Statistical Package for the Social Sciences (SPSS) software program was used. Frequency and descriptive statistics were used to describe the participants' socio-demographic data and work characteristics. Spearman's correlation analysis was used to determine the association between the participants' GAD and the following factors: demographical and work characteristics, participants' exposure to patients with COVID-19 diagnosis, participants' perception regarding their exposure to COVID-19 and risk to contract COVID-19, impact of the COVID-19 transmission on personal life and work, and participants' measures and coping mechanisms to prevent transmission of COVID-19. Participants' perceptions of variables (regarding the risks of COVID-19 disease), which may increase GAD rating, were gauged via multiple choice responses: "1=strongly disagree", "2=disagree", "3=not sure disagree/ agree", "4= agree", and "5=strongly agree". While, participants' perceptions of variables regarding the risks of COVID-19 disease and their measures and coping mechanisms to prevent the transmission of COVID-19 variables that may reduce the participants' GAD level (for example "I am confident my employer will look after my medical needs if I were to fall ill with COVID-19") were reversed coded to "5=strongly disagree", "4=disagree", "3=not sure disagree/ agree", "2= agree", and "1=strongly agree". These variables (with reversed coded responses) were identified by adding a star (*) at end of the sentences in tables of results. Also, Spearman's correlation analysis was used to identify any relationship between the preventive measures taken by participants and coping mechanisms to reduce the risk of COVID-19 infection to themselves, their friends and families. A p value of < 0.05 will be used to be a statistical significant test. After running these correlation tests, only the significant associated factors were reported in correlation table.

3. RESULTS

3.1. Sample Characteristics

The response rate for participating in this study was high (86.3%) with 345 candidates participating in the questionnaire out of a total of 400 invitations. The majority of the participants were females (67.0%), married (65.2%), Saudis (45.2%), over 30 years old (62.6%), living with their families in a house/apartment (65.2%), and had more than 10 years experiences as a staff nurse. Most participants (30.4%) worked in Intensive Care Units (ICUs) (Table 1).

3.2. Participants' Exposure to Patients Diagnosed with COVID-19

The majority of the participants (61.8%) were directly exposed to or gave care to between one to five patients with COVID-19. Moreover, most participants (66.9%) were exposed daily to COVID-19 patients (Table 2).

3.3. Participants' Perceptions Regarding Exposure and Risk of COVID-19 Infection

The majority of the participants perceived that they were most likely at risk of contracting COVID-19 from close contact with infected patients (75.7%) or through close contact with colleagues exposed to COVID-19 patients (65.2%). Regarding the risk of contracting COVID-19, most of the participants believed that their jobs put them at great risk of exposure to COVID-19 (73.0%). Over half said they were afraid of falling ill with COVID-19 (56.5%) and that their families believed that they were at high risk of getting COVID-19 (66.1%). Moreover, about two-thirds of the participants believed that the people closest to them (e.g. spouses/partners, family members, and friends) were: at high risk of getting COVID-19 because of their job (60.9%), worried for their health (66.1%), and worried they themselves might get infected through interaction with the participants (60.0%). Most participants were concerned about passing COVID-19 to their family members (65.2%), close friends (55.7%), and work colleagues (55.7%). When the participants were asked about the impact of COVID-19 transmission on their personal and professional lives, most participants said they were afraid of telling their families about the risk that they were exposed to in the workplace (54.8%).

Roughly half of all participants felt appreciated by their hospital/clinic/employer (51.3%), the society at large (55.7%). Over half of the participants felt that there was adequate staff at their workplace to handle the different demands (56.5%),

however, they felt more stressed at work (51.3%) (Table 3).

3.4. Measures and Coping Mechanisms to Prevent the Transmission of COVID-19

Regarding the measures and coping mechanisms that had been used by the participants to prevent the spread of COVID-19 to themselves and others, most of the participants said that they were: getting information as much as possible about COVID-19 (81.7%), taking nutritional supplements, and vitamins (73.0%), adhering to protocols and recommended measures (77.4%), trying not to think too much about the risks (65.2%), keeping their mind positive and convincing themselves that they won't contract COVID-19 (73.9%), avoiding crowded places (84.3%), avoiding colleagues who may be exposed to COVID-19 (68.7%), or practicing exercises regularly (73.0%). Most participants were changing out of work clothes before going home (73.0%), showering before going home (54.8%), or temporarily staying away from home altogether, in alternative housing (53.9%) to prevent passing COVID-19 to their families or others (Table 4).

3.5. Participants' Opinions about Receiving COVID-19 Vaccine in the Future

The majority of the participants (67.0%) strongly agreed or agreed that a COVID-19 vaccine would protect them from COVID-19 infection in the future. However, most participants (44.9%) also strongly agreed or agreed that receiving a vaccine in the future would put them at high risk for contracting other secondary diseases (such as CVD, stroke, respiratory problems), as a resultant complication of a COVID-19 vaccine. Accordingly, most of the participants (42.3%) strongly disagreed or disagreed that they would be willing to receive a COVID-19 vaccine in the future (in the case that it would be offered voluntarily) (Table 4).

Table 1. Demographics and work data.

Demographic Data	n (%)
Gender	
Male	114 (33.0%)
Female	231 (67.0%)
Age (year)	
20 – 24	45 (13.04%)
25 – 29	84 (24.35%)
30-34	183 (53.0%)
> 35	33 (9.6%)
Marital status	
Single	99 (28.7%)
Married	225 (65.2%)
Divorced	21 (6.1%)
Nationality	
Saudi	156 (45.2%)
Indian	42 (12.2%)
Filipino	36(10.4%)
Egyptian	78 (22.6%)
Jordanian	24 (7.0%)
Other	9 (2.6%)

(Table 1) contd....

Demographic Data	n (%)
The number of children the participants have	
0	123 (35.7%)
1	42 (12.2%)
2	90 (26.1%)
3	48 (13.9%)
> 4	41 (11.9%)
Staying (where the participant is living)	
With my family in house/apartment	225 (65.2%)
In a hotel	12 (3.5%)
Alone in a rental room/apartment	78 (22.6%)
Hospital housing	30 (8.7%)
Nursing job experience	
1 – 5	12 (9.6%)
6–10	72 (20.9%)
>10	171 (49.5%)
The participants were working at these area/department	
Surgical ward/department	69 (20.0%)
Medical ward/department	60 (17.4%)
Intensive care unit	105 (30.4%)
Emergency department	75 (21.7%)
Other departments	36 (10.4)

Table 2. Participants' exposure to patients with COVID-19 diagnosis.

Participants' Exposure to Patients with COVID-19 Diagnosis	n (%)
Over the last 2 weeks, the number of COVID 19 patients that the participants personally had exposure to or take care for	
1-4 patients	213 (61.7%)
5-9 patients	69 (20.0%)
10-14 patients	45 (13.1%)
> 15 patients	18 (5.2%)
Over the last 2 weeks, How often the participants were exposed or took care for COVID-19 patients	
Daily	231 (66.9%)
Few times a week	72 (20.9%)
Rarely	42 (12.2%)

Table 3. Participants' perception regarding the risks of COVID-19 disease.

Participants' Perception Regarding Exposure and the Risk to have COVID-19 Disease	Strongly Disagree/ Disagree n (%)	Not sure Disagree/ Agree n (%)	Agree/ Strongly Agree n (%)
At my place of work, I am most likely at risk of getting COVID-19 from:			
Close contact with COVID-19 patients	42 (12.2%)	42 (12.2%)	261 (75.7%)
The air that I breathe	90 (26.1%)	138 (40.0%)	117 (33.9%)
Close contact with colleagues exposed to COVID-19 patients	42 (12.2%)	78 (22.6%)	225 (65.2%)
With regard to the risk of contracting COVID-19 myself:			
I feel that my job puts me at great risk of exposure to COVID-19	45 (13.0%)	48 (13.9%)	252 (73.0%)
I am afraid of falling ill with COVID-19	69 (20.0%)	81 (23.5%)	195 (56.5%)
I have little control over whether I get infected or not	102(29.6%)	135(39.1%)	108 (31.3%)
I accept the risk of getting COVID 19 as part of my job *	99(28.7%)	102(29.6%)	144(41.7%)
I am looking for another job or considering resigning because of the risk	246(71.3%)	69(20%)	30 (8.7%)
I am confident my employer will look after my medical needs if I were to fall ill with COVID-19 *	75 (21.7%)	126 (36.5%)	144 (41.7%)
My family believes that I have a high risk of getting COVID-19	42 (12.2%)	75 (21.7%)	228 (66.1%)

(Table 3) contd....

Participants' Perception Regarding Exposure and the Risk to have COVID-19 Disease	Strongly Disagree/ Disagree n (%)	Not sure Disagree/ Agree n (%)	Agree/ Strongly Agree n (%)
If I were to get COVID-19 I believe that my chances of survival are poor	174 (50.4%)	120 (34.8%)	51 (14.8%)
With regard to the risk of COVID-19 among those closest to me (spouse/partner, family members, friends etc):			
People close to me are at high risk of getting COVID-19 because of my job	54 (15.7%)	81 (23.5%)	210 (60.9%)
People close to me are worried for my health	45 (13.0%)	72 (20.9%)	228 (66.1%)
People close to me are worried they might get infected through me	51 (14.8%)	87 (25.2%)	207 (60.0%)
I am most concerned about passing COVID-19 to:			
My family members	54 (15.7%)	66 (19.1%)	225 (65.2%)
Close friends	69 (20.0%)	84 (24.3%)	192 (55.7%)
Work colleagues	63 (18.3%)	90 (26.1%)	192 (55.7%)
Others	96 (27.8%)	96 (27.8%)	153 (44.3%)
Impact of the COVID 19 transmission on personal life and work			
I have been afraid of telling my family about the risk I am exposed to at workplace	108 (31.3%)	48 (13.9%)	189 (54.8%)
People avoid me because of my job	108 (31.3%)	108 (31.3%)	129 (37.4%)
People avoid my family members because of my job	129 (37.4%)	126 (36.5%)	90 (26.1%)
I feel appreciated by the hospital/clinic/my employer	75 (21.7%)	93 (27.0%)	177 (51.3%)
I feel appreciated by society	39 (11.3%)	114 (33.0%)	192 (55.7%)
There are adequate staff at my workplace to handle the different demands	66 (19.1%)	99 (28.7%)	180 (52.2%)
There is more conflict among colleagues at work	108 (31.3%)	126 (36.5%)	111 (32.2%)
I feel more stressed at work	90 (26.1%)	78 (22.6%)	177 (51.3%)
I have an increase in workload	96 (27.8%)	99 (28.7%)	150 (43.5%)
I have to work overtime	144 (41.7%)	114 (33%)	84 (24.3%)

3.6. Participants' Anxiety Status and Controlling Actions for Stressful Life Events

Over one-third of the participants said that they were bothered by “feeling nervous, anxious or on edge” with experiencing these feelings for several days (38.8%), and for more than half the days (31.5%), over the last 2 weeks. Moreover, about 11% were bothered by “feeling nervous, anxious or on edge” nearly every day over the last 2 weeks. Moreover, the participants said that they were bothered by “not being able to stop or control worrying” for more than half the days (31.5%), several days (26.2%), nearly every day (18.6%) over the last two weeks. Using a cut-off point of (3 out of 6) for GAD-2 scale, more than half of the participants (56.5%) were classified to have generalized anxiety disorder. During stressful life events, most of the participants (53.9%) were taking the following actions nearly every day: avoid letting themselves get upset when they think about it or reminded of it (53.9%), and tried to remove it from their memory (42.6%) to avoid getting stressed (Table 5).

3.7. Significant Associated Factors for Participants' Generalized Anxiety Disorder

Spearman's correlation analyses showed a very weak

significant correlation between participants' anxiety level (GAD) and the male gender ($r=0.1, p=0.04$). Also, there was data to suggest moderate significant correlation between participants' anxiety level (GAD) and nursing experience ($r=0.41, p=0.02$), and number of children that the participants have ($r=0.35, p=0.03$). Also, moderate significant correlation was found between participants' anxiety level and participants' perception regarding the risks of COVID-19 variables including participants' worries about the risk of transmit the COVID-19 to those people closest them ($r=0.53, p=0.02$), participants' concern about passing COVID-19 to those people closest to them ($r=0.51, p=0.02$), and the impact of COVID-19 transmission on the participants' personal life and work ($r=0.68, p=0.01$). Moreover, moderate significant correlation between participants' anxiety level and participants' measures and coping mechanisms to prevent the transmission of COVID-19 variables including participants' coping mechanisms with the risk of getting COVID-19 ($r=0.47, p=0.02$), and participants' measures for preventing me from passing COVID-19 to others ($r=0.38, p=0.04$). Moreover, the correlation test showed strong significant correlation between participants' anxiety level (generalized anxiety disorder) and participants' exposure to patients with COVID-19 diagnosis variables (Table 6).

Table 4. Participants' measures and coping mechanisms to prevent transmission of COVID-19.

Measures and Coping Mechanisms to Prevent Transmission of COVID-19	Strongly Disagree/ Disagree n (%)	Not sure Disagree/ Agree n (%)	Agree/ Strongly Agree n (%)
I have personally coped with the COVID 19 situation by:			

(Table 4) contd....

Measures and Coping Mechanisms to Prevent Transmission of COVID-19	Strongly Disagree/ Disagree n (%)	Not sure Disagree/ Agree n (%)	Agree/ Strongly Agree n (%)
Learning as much as I can about COVID 19	27 (7.8%)	36 (10.4%)	282 (81.7%)
Taking nutritional supplements, vitamins or tonics	48 (13.9%)	45 (13.0%)	252 (73.0%)
Adhering to protocols and recommended measures	30 (8.7%)	48 (13.9%)	267 (77.4%)
Trying not to think too much about the risks	45 (13.0%)	75 (21.7%)	225 (65.2%)
Keeping my mind positive and convincing myself that I won't develop COVID 19	36 (10.4%)	54 (15.7%)	255 (73.9%)
Avoiding crowded places	30 (8.7%)	24 (7.0%)	291 (84.3%)
Avoiding colleagues who may be exposed	36 (10.4%)	72 (20.9%)	237 (68.7%)
Exercising regularly	45 (13.0%)	48 (13.9%)	252 (73.0%)
The following measures are used in preventing me from passing COVID 19 to others			
Changing out of work clothes before going home	45 (13.0%)	48 (13.9%)	252 (73.0%)
Showering before going home	72 (20.9%)	84 (24.3%)	189 (54.8%)
Temporarily staying away from home in alternative housing	75 (21.7%)	84 (24.3%)	186 (53.9%)
Participants' opinion about receiving COVID-19 vaccine in the future (within 12 months)			
In your opinion, receiving COVID-19 in the future will protect me from getting COVID-19 disease	38 (11.01%)	76 (22.03%)	231 (67.0%)
In your opinion, receiving COVID-19 vaccine in the future will put at high risk for having other secondary diseases (e.g: CVD, stroke, respiratory problems), as a complication of COVID-19 vaccine	78 (22.6%)	112 (32.5%)	155 (44.9%)
Participants' agreement regarding the willingness to receive COVID-19 vaccine in the future (in case if it is voluntary)	146 (42.3%)	85 (24.6%)	114 (33.1%)

Table 5. Participants' anxiety status and controlling actions for stressful life events.

Participants' Anxiety Status and Controlling Stressful Life Events	Not at all (0) n (%)	Several Days (+1) n (%)	More than Half the days (+2) n (%)	Nearly Every Day (+3) n (%)
Generalized Anxiety Disorder-2 scale (GAD-2): Over the last 2 weeks, how often have you been bothered by the following problems?	-	-	-	-
Feeling nervous, anxious or on edge	65 (19.0%)	133 (38.8%)	108 (31.5%)	37 (10.8%)
Not being able to stop or control worrying	75 (21.9%)	90 (26.2%)	114 (33.0%)	64 (18.6%)
During stressful life events, how often do you make the following actions?	-	-	-	-
I avoid letting myself get upset when I think about it or am reminded of it	22 (6.4%)	34 (9.9%)	103 (29.9%)	186 (53.9%)
I try to remove it from my memory	45 (13.0%)	59 (17.1%)	94 (27.3%)	147 (42.6%)
Anxiety status	n (%)	-	-	-
(Generalized anxiety disorder [GAD-2] ≥ 3) (GAD-2 total score is ranged between 0 and 6)	195 (56.5%)	-	-	-

Table 6. Significant associated factors for participants' generalized anxiety disorder.

Associated Factors	Generalized Anxiety Disorder-2 (GAD-2)	
	Correlation (r)	p value
Demographics and work variables		
Gender (male)	0.10	0.04
Nursing job experience	- 0.41	0.02
The number of children that the participants have	0.35	0.03
Participants' exposure to patients with COVID-19 diagnosis variables		
Over the last 2 weeks, number of COVID-19 patients that the participants personally had exposure to or take care for	0.83	< 0.01
Over the last 2 weeks, How often the participants were exposed or took care of COVID-19 patients	0.77	< 0.01
Participants' perception regarding the risks of COVID-19 disease variables		

(Table 6) contd....

Associated Factors	Generalized Anxiety Disorder-2 (GAD-2)	
At the place of work, the participants perceived that he/she were most likely at risk of getting COVID-19	0.39	0.04
Participants' perception regarding the worries of those people closest to him/her about the risk of transmitting COVID-19 to them	0.53	0.02
Participants' concern about passing COVID-19 to those people closest to him/her	0.51	0.02
Impact of the COVID-19 transmission on the participants' personal life and work	0.68	0.01
Participants' measures and coping mechanisms to prevent transmission of COVID-19 variables		
Participants' coping mechanisms with the risk of getting COVID-19	0.47	0.02
Participants' measures for preventing me from passing COVID-19 to others	0.38	0.04

4. DISCUSSION

This study was conducted to assess nurses' perceptions regarding COVID-19 risk and their exposure to COVID-19. To the authors' knowledge, this is a unique study in Saudi Arabia conducted to assess nurses' coping mechanisms to prevent COVID-19, the impact of COVID-19 transmission on their work and personal lives, and the associated factors for nurses' generalized anxiety disorder.

In spite of the high risk involved, the nurses in this study, as well as nurses all over the world, made great efforts to deal with COVID-19 transmission, while caring for patients infected by the virus during the pandemic. The majority of nurses in this study reported that they were exposed to COVID-19 daily because of their work. Similarly, in a previous study conducted in Saudi Arabia, the authors reported that nurses faced a high risk of COVID-19 infection during their work during the COVID-19 transmission [24]. Moreover, a previous study conducted on Irish nurses involved in planning for, and giving care during the influenza pandemic, found that the nurses were the staff most at risk of exposure among all healthcare professionals during the influenza pandemic [25].

In spite of the high risk of COVID-19 infection, nearly half of all nurses accepted these risks as a part of their job, which demonstrates their dedication as healthcare professionals. Only (8.7%) of the nurses in this study reported that they were considering resigning from their nursing job because of the risk of COVID-19. Similarly, the findings of previous studies, which were conducted in Singapore and Ireland, showed that healthcare workers accepted the risk of infection during an influenza pandemic as a part of their work, and only (15%) expressed willingness to leave their job during the previous influenza transmission [25, 26]. Inversely, a recent study conducted in the Philippines, assessing COVID-19 anxiety among nurses, found that only (20.3%) of health professionals reported their readiness to care COVID-19 patients [27].

The findings of this study reflected that nurses were feeling worried and fear of passing infection to people close to them. Similarly, a previous study, which was conducted during a MERS-CoV transmission in Jeddah (Saudi Arabia), showed that the healthcare workers expressed their worries about passing the infection to their families and others [28]. Fear of infection not only the affected nurses themselves, but also their families and those close to them. The majority of the nurses in this study reported worries for friends and family and concern for their health. Half of the nurses were afraid of telling their families about the risk of COVID-19 that they were exposed to

during daily work. Moreover, their worry not only affected the nurses' personal life, but about three-quarters of them felt stigmatized as others in their lives avoided them (including family) due to their profession. Therefore, all of these aspects and stressors negatively affected the participants' personal lives and increased their feelings of anxiety. The findings of this study were consistent with previous studies, which were conducted during previous infectious respiratory disorders, including the SARS pandemic in Singapore and the MERS-CoV transmission in Jeddah (Saudi Arabia). Whereas, the healthcare workers reported the worries of their families regarding their health and the risks of having the infection. The healthcare workers in these studies were also confused by stressors faced during their duties and worries about exposing their family members and close relatives to infection. For example, a previous study showed that about one-third of healthcare workers (31%) said that "people avoid my family members because of my job". Some also reported that taxi drivers refused to take them to their workplaces [21, 28].

The results of this study showed that the participants were feeling fear of passing the COVID-19 infection to their families and others. Correlation analyses show significant positive association between the participants who used preventive measures and coping mechanisms to reduce the risk of infection, and participants' perception of the risk that their families and friends would be exposed to COVID-19 and the participants' feeling of anxiety to transmit COVID-19 to their family and friends. Moreover, more than half of them stayed away from their homes in alternative housing as a measure to prevent transmitting COVID-19 to their families, and two-thirds of them changed out of their work clothes (scrubs) before going to their houses as a coping strategy during the COVID-19 pandemic. Similarly, in a previous study that was conducted in Saudi Arabia to assess coping strategies during the MERS-CoV transmission, healthcare workers said that they kept their usual clothes separated in the departments' cabinets and they used disposable scrubs provided by the hospital to minimize the passing of infection to others. They also avoided going out in public places as a measure to decrease the transmission of MERS-CoV [28].

Only about two-thirds of the nurses in this study perceived that receiving a COVID-19 vaccine in the future would protect them from getting COVID-19. Moreover, only one-third of them showed a willingness to take a COVID-19 vaccine, and nearly half of them expected high risk of having other secondary diseases or side effect symptoms as a complication of a COVID-19 vaccine. Similarly, a study conducted in

southwestern Ethiopia, showed that only close to half of the nurses intended to accept the COVID-19 vaccine [29]. Another study conducted among nurses in Hong Kong showed that approximately two-thirds of the respondents indicated that they were likely to opt for a COVID-19 vaccine when it became available [30].

In the previous study, about half of the healthcare workers, particularly the nurses, reported several stressors in their work. These stressors and workloads were increased during the influenza epidemic. Lack of confidence in preventing transmission of infectious disease, less rest time, increased workload and fear of transmission of infection to their families and others were the major risk factors of developing anxiety during the influenza epidemic among healthcare workers [21, 28]. In this study, the majority of the nurses were feeling nervous and anxious and experiencing an inability to control their worries during the COVID-19 pandemic. Moreover, more than half of the nurses (56.5%) during COVID-19 pandemic had generalized anxiety, which is greater than the levels of anxiety (38%) recorded in the previous study among the nurses who were working in emergency and febrile outpatient clinics in Chinese hospitals, during COVID-19 pandemic [31]. Also, the GAD in this study was higher than GAD (17.36%) among Korean public health nurses who were working in public health centers during COVID-19 pandemic [32]. Moreover, in another study conducted in Saudi Arabia, the results indicated that registered nurses generally had high levels of anxiety and stress during the COVID-19 transmission [24].

Physical and psychological symptoms including loss of appetite, sleep disturbance, fatigue, and psychological distress are the major symptoms of anxiety [27]. In a study conducted during the COVID-19 transmission in the Philippines showed that 'tonic immobility' and sleep disturbances were the most pronounced symptoms of anxiety related to COVID-19 among the health staff [27]. In this study, the nurses exhibited less interest and felt down during stressful events.

The findings of this study showed that the significant associated factors for participants' generalized anxiety disorder were: the participants' number of children; being in situations of high risk of COVID-19 infection; participants' concern about passing COVID-19 to close people; and the impact of the COVID-19 transmission on the participants' personal life and work. Similarly, the findings of the previous study showed that excessive workload; fear of passing the infection to family members; the presence of children in the respondent's households; and increased death among medical staff; were all significant factors contributing to stress and anxiety among healthcare staff in Chinese hospitals [31]. Moreover, in this study, there was a negative correlation between generalized anxiety and higher experience in a nursing job. While the findings of the previous study, which were conducted in hospitals in Yunlin and Chiayi Counties (China), showed a positive correlation between nurses who were older than 40 years and had been working at their present hospital for more than 20 years and perceived higher job stress compared with the younger colleagues and less experience in their nursing field [33]. Moreover, in the previous study, the result showed no significant relationship between nursing profession

experience and COVID-19 related anxiety. A recent study showed that the most significant stressors for nurses are related to their physical working environment, i.e., workload (overtime work, frequent changeable [day/night] shifts, unsuitable work/rest regimens), and work under pressure to have tasks done in a very short time [10]. Furthermore, work-related distress associated with COVID-19 is an essential indicator of mental illness, as it can lead to anxiety and depression among healthcare workers. In addition to the increased workload, the high risk of getting infected with COVID-19 can lead to more job-related stress and strains. These stressors can affect not only the nursing staffs' physical and mental well-being, but also patients' outcomes, nurses' productivity, and healthcare services [10, 34]. Furthermore, healthcare workers are at an increased risk of infection and have the highest pressure on their work and personal lives. Therefore, during the periods of transmission of infectious diseases, including COVID-19, the implementation of infection prevention and control procedures and guidelines is very important in healthcare settings [26, 35]. Use of personal protective equipment (PPE) is also crucial to reducing transmission [36]. The provision of social and institutional support to nurses during stressful events is also crucial to help them to overcome their stress, particularly when occupational stress levels are increased during infectious disease outbreaks such as the COVID-19 pandemic [37]. In this study, the nurses received appreciation from their institutions and society. Moreover, they reported that appreciation and support were useful to decrease the distress and anxiety of nurses. These findings were consistent with the results in the previous study, where the authors reported that work flexibility, social and organizational support, and using of preventive measures to prevent infectious disorders were significantly effective strategies to decrease the level of nurses' anxiety levels and distress that related the COVID-19 pandemic.

The findings of this study and previous studies indicate that the nurses who were taking care of patients with COVID-19 perceived high-risk exposure to infection and felt distressed from the risk of transmission of COVID-19 to their family members and relatives. These feelings negatively affected their psychosocial lives. Therefore, they used several measures and coping mechanisms to prevent transmitting COVID-19 to their families, relatives, and colleagues. The literature review found evidence to urge that healthcare settings should enforce preventive measures (such as using transmission-based precautions) and guidelines to prevent COVID-19 transmission and infection. Furthermore, continuing health educational programs and receiving all doses of COVID-19 vaccines are recommended to improve health professionals' immunity and prevent COVID-19 infection.

4.1. Research Implementation for Practice and Recommendations

Implementing the basic standard precautions (e.g., hand hygiene and wearing N95 mask and face shields or eye goggles), as well as implementing of additional measures for those healthcare workers in isolation hospitals/departments are considered the most important measures, which are needed to protect them and their families from COVID-19 infection.

Recommended standard precautions, and policies must be followed by the healthcare providers. Personal protective equipment (PPEs) must be available when caring for patients in health facilities to reduce transmission of infection, and these precautions should be part of practice for all patients at all levels, regardless of whether they have infectious diseases (including COVID-19) or not. Available literature shows that these preventive measures are essential and have significant contributions to protecting the nursing and healthcare staff from the transmission of COVID-19 infection, which also positively leads to reducing their distress and anxiety [6, 38, 39]. The World Health Organization advised healthcare workers to get enough rest between shifts and after working hours, eat healthy nutrition, stop smoking, and practice exercises in order to take care of their health, enhance their immunity and prevent COVID-19 infection. During the pandemic, due to their working conditions and high risk of having COVID-19 infection, healthcare workers are advised to communicate with their families and friends, using indirect contact methods such as the phone and social media [6, 38]. Furthermore, conducting continuing health educational programs and workshops for nursing and healthcare staff about the characteristics, preventive measurement, and treatment of COVID-19 are essential to enhance health professionals' knowledge, self-confidence, and practices for preventing the transmission of COVID-19 among healthcare workers and their families and friends. These educational programs should include the correct skills for hand hygiene and donning and removing of all PPEs, as well as provide information about the benefits of taking a COVID-19 vaccine. Implementation of such educational programs and preventive measures consequently will reduce their worries, distress, and anxiety [6, 38, 39]. Literature showed that a high frequency of nurses had moderate to severe anxiety levels during the COVID-19 pandemic, which negatively affected the nurses quality of life and nurses care on the job while increasing their level of burnout. Therefore, nursing managers must pay attention to their nursing staff's psychosocial condition and identify the related factors that may increase the anxiety level and intervene to stabilize the nursing staff. Also, the nursing managers and head-nurses should encourage the nursing staff to discuss their feelings of anxiety with their colleagues. Moreover, interventional strategies, including providing health educational programs, additional training and psychosocial counseling, conducting small groups team meetings, hiring highly qualified nurses, should be encouraged to reduce the nursing staff's anxiety and improve the team work environment [14, 32].

4.2. Research Strengths and Limitations

To the authors' knowledge, this study is the first study in Saudi Arabia that was conducted to investigate the impact of COVID-19 transmission on nurses' work and psychosocial health, the associated factors for nurses' anxiety and their coping mechanisms to prevent COVID-19. Therefore, this study will provide a baseline of information and useful data for developing clinical guidelines for nurses in Saudi Arabia and other Arab countries, for preventing respiratory infectious diseases such as COVID-19, and how to cope with similar

infectious diseases in the future.

Despite several strengths of this study, using cross-sectional design limits the studies ability to determine the effectiveness and causality of the relationship between the variables in this study. Moreover, the results of this study cannot be fully representative of all nurses in Saudi Arabia due to the natural limitations of the convenience sampling method. Further experimental and longitudinal research and recruiting nurses and other healthcare providers are suggested.

CONCLUSION

Doctors, nurses, other health professionals and administrators found themselves on the front lines, in the line of fire. Nurses and health workers were at higher risk of infection than others for countless reasons, including exposure between patients, colleagues and other factors. The findings of this study show that the majority of nurses perceived that they were at high risk of getting COVID-19, and that they could easily transmit COVID-19 to their relatives. Therefore, they implement preventive measures to protect themselves and prevent transmission of COVID-19 to their family and relatives. Implementation of basic standard precautions is essential to protect health workers and their families from infection. Moreover, stopping smoking, eating healthy diet, practicing physical activity, keeping hand hygiene are essential to improve the health professionals' immunity and help in preventing the COVID-19 infection and transmission of infection to their relatives. Attending continuing health educational programs and workshops about COVID-19 are recommended for health professionals.

AUTHORS' CONTRIBUTION

All authors conceived and designed the study, conducted research, provided research materials. RAE and ZTS analyzed and interpreted data. All authors wrote initial and final drafts of article, and provided logistic support. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

LIST OF ABBREVIATIONS

COVID	=	Coronavirus
COVID – 19	=	Novel Coronavirus
GAD-2	=	Generalized Anxiety Disorder-2items
MERS	=	Middle East Respiratory Syndrome
SARS	=	Severe Acute Respiratory Syndrome
ARDS	=	Acute Respiratory Syndrome
CDC	=	Centre for Disease Prevention and Control
WHO	=	World Health Organization
IRB	=	Institute of Review Board
ICU	=	Intensive Care Unit
PPE	=	Personal Protective Equipment

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

IRB permission was obtained from the ethical research

committee at College of Nursing, Taibah University, Saudi Arabia (approval number: Nursing-2020-014). Moreover, official permission was obtained from the Clinical Health Research Committee of the North Western region of Ministry of Health (via Medina city branch) in order to recruit the nurses at the selected settings.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request. Confidentiality and security of data and materials were ensured through all stages of the study.

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest financial or otherwise.

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