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Epidemiological Features, Extent of Reinfection with COVID-19 Virus and Coping Strategies among Nurses in Tertiary care hospitals

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ABSTRACT

Background: Today, Coronavirus diseases 2019 impose an important occupational risk to health care workers (HWs). Until now, globally several thousand of HWs especially nurses have been infected with severe acute respiratory syndrome coronavirus. **Aim:** to identify the epidemiological features, coping strategies of infection and investigate the extent of reinfection with COVID- 19 virus among nurses working in tertiary care hospitals. **Subjects and Method:** -Study design: In this study, a descriptive cross-sectional research design was used. Study settings: The study was carried out in Tanta University hospitals, El-Gharbeya Governorate. **Tools of data collection:** - Two tools were used for data collection: A structured questionnaire sheet, and coping strategies questionnaire. **Results:** there were statistically significant relations between all items of socio-demographic criteria of the studied nurses and occurrence of COVID-19 reinfection where P<0.001 except their residence, marital status, and department items. **Conclusion:** The present study revealed that seminars/workshops with periodic refreshment in service training should be regularly organized in tertiary care hospitals and health care centers for nurses in order to equip them with adequate knowledge on how to care with Covid19 patients. **Recommendations:** Nurses must be equipped with adequate needed personal protective equipment and materials used in managing COVID 19 cases.

Keywords: Coronavirus Diseases, Health Care Workers, & Epidemiological Features

Introduction

The pandemic of Coronavirus disease 19 has impacted negatively on health systems all over the world. September 2020, about one billion persons had been infected with SARS CoV2 (the disease-causing virus) and about one million persons had died in 213 countries. COVID-19 presents throughout a spectrum of symptoms (Sherwal et al, 2020). According to Disease Control and Prevention Center (CDC) (2021) about 80percente of people infected with coronavirus disease are asymptomatic or have minor flu symptoms, which can be managed at home or in isolation facilities to prevent the virus from spreading. About15 percent have severe manifestation and require hospitalization.

The elderly and persons with chronic diseases are more likely to have negative results. The last 10–15% have slight to excessive signs, and want institutional care. The aged and people with chronic diseases are at higher risk of developing adverse outcomes (Hadaway et al, 2020). According to World Health organization (WHO) (2020), droplet infection is the most important method of virus transmission for Coronavirus disease.

Health professionals are one of the most vulnerable groups to SARS-CoV2 infection due to their frequent exposure to high-contagious situations. Thousands of front-line physicians and health-care professionals have died as a result of COVID-19

problems, with the majority of deaths occurring in low- and middle-income nations (WHO, 2020).

Nurses who are cared with COVID-19 patients possibly experience health challenges. The unknown or unsure medical institution environment with COVID-19 patients might also additionally worsen and put nurses under stress during combating the virus. Psychological support should be applied by medical institutions and organizations' administration to meet the desire of those vulnerable groups of nurses.

Therefore coping strategies are needed to lessen their pressure and burnout. Therefore, the aim of this research was to identify the epidemiological features, coping strategies of infection and investigate the extent of reinfection with the COVID 19 virus amongst nurses working in Tanta University hospitals (Sun et al, 2020).

The prevalence of reoccurring infectious situations because of monophasic organisms capable of developing immunity, or as a minimum transitory, has encouraged researchers to bear in mind words different from reinfection. In case of COVID-19 infection, the idea of reactivation of a latent infection or relapse has been considered; however, there is no evidence that infection remains latent in the organism. The presence of non-replicative viral traces up to six weeks after the onset of manifestation is what remain (Garduño Orbe et al., 2021).

After a referral from primary and secondary care providers, tertiary care hospitals provide specialized medical care over an extended period of time that includes advanced and complex procedures and treatments performed by medical specialists in a large hospital by medical specialists after a referral from primary and secondary care providers.

Community health nurse provides direct health care at all levels, through her work in tertiary care hospitals, Maternal and child health care centers and other community settings. Community health nurse play a vital role in preventing and controlling or even slowing the spread of COVID 19 in any health care setting (Singhal etal, 2020).

Significance of the study

Understanding COVID-19 infection among nurses and the extent of reinfection is key element not only for describing epidemiological features for infection, but also for preventing and applied control measures at a health care facility and national level (Alwahaibi et al, 2020; Shukla, 2020). So; the aim of the present research was to identify the epidemiological features, coping strategies of infection and investigate the extent of reinfection with COVID 19 virus among nurses working in Tanta University hospitals.

Aim of the research

To identify the epidemiological features, coping strategies of infection and investigate the extent of reinfection with COVID 19 virus among nurses working in tertiary care hospitals.

Subjects and Method

Research design, setting, and timing

A descriptive cross sectional study was conducted in Tanta University hospitals, El-Gharbia Governorate, at Middle delta; Egypt. These include: Medical hospitals, Surgical Hospitals, and diagnostic departments. The period of the study was four months (from 1st January through April 2021).

Research Subjects

The study included all nurses (179 nurses) who were previously diagnosed with COVID19 diseases once or more and back to work. **Inclusion criteria:** nurses previously diagnosed with COVID19, back to

their work, free from any influenza manifestations, willing to participate in the research.

Tools of data collection:

The data of this research was collected by direct interview with nurses previously infected with COVID19 using questionnaires predesigned by the researchers based on literature review. The questionnaires including the following tools:

Tool (1): consists of two parts:

Part 1: socio demographic and work data related to nurses: age, sex, marital status, level of education, residence, income, number of the family and rooms, work department, years of experience, workshop training about infection control.

Part (2): clinico-epidemiological profile of COVID-19 of the affected nurses (Shukla, 2020). It was included; presence of chronic diseases, previous pregnancy during an attack, presence of reinfection, manifestations of each COVID19 attack, methods of diagnosis, isolation type, complications in every attack, duration between first and final attack and etc.

Tool (2): Coping strategies questionnaire: (Zhang, Y et al, 2020; Al-Sagarat, 2017). This part containing fifteen items of coping strategies developed by the researcher in Arabic language based on recent related literatures; to assess confronting the nurse to the professional pressure after exposure to COVID-19 attack. It is scored on 4-points, Likert-type scale: 1 = never; 2= sometimes; 3= often and 4= all the time. These scores were summed up and classified as; a wide range of coping strategies: 65%-100% and less than 65% act need to cope more for preventing stress.

The questionnaire was written first in English and translated to Arabic language. Content validity of the questionnaire was tested by 5 experts in the field of community health nursing and public health. Reliability of tools was measured using Cronbach's Alpha test. Tool II reliability was 0.873. A pilot study was conducted before the actual work to ascertain the clarity and applicability of the study tools and to identify obstacles that might be faced during data collection. The pilot study was conducted on 18 nurses (not included at the final analysis) and relevant modifications were performed before actual data collection.

Statistical Analysis:

The final collected data were organized, tabulated, presented, and analysed by using SPSS (Statistical Package for the Social Sciences software) version 22.0 for Windows. Categorical data were presented as frequencies and percentages and numerical data were presented as mean and standard deviation. Chi-square test and odds ratio were used as first order analysis followed by Binary logistic regression for independent factors that had significant associations The level of significance adopted was $P<0.05\%$ with 95% confidence interval to identify significant predictors of reinfections and complications of COVID-19 among the studied nurses.

Ethical Considerations:

Permissions from the college and hospital authorities were obtained from the Ethical Committee of Faculty of Medicine, Tanta University. At a beginning of the interview, every nurse was told about the aim and importance of the research and informed consent was obtained. The obtained Participants' information was kept confidential. All authors have no potential conflicts of interest.

Table (1): Distribution of COVID-19 epidemiological profile among the studied nurses

Variable	Total =179 No	%
Age/years:		
20-	**45**	**25.1**
30-	**49**	**27.4**
40-	**47**	**26.3**
50-58	**38**	**21.2**
Mean ±SD	**38.91± 9.95**	
Range	**22-58**	
Sex		
Male	**60**	**33.5**
Female	**119**	**66.5**
Residence		
Urban	**82**	**45.8**
Rural	**97**	**54.2**
Marital status:		
Single	**39**	**21.8**
Ever married	**140**	**78.2**
Income		
Enough	**44**	**24.6**
Not enough	**135**	**75.4**
Education level :		
Nursing secondary school	**83**	**46.4**
Nursing technical institute	**53**	**29.0**
Nursing college/postgraduate	**43**	**24.0**
Presence of chronic diseases		
-yes	**70**	**39.1**
-no	**109**	**60.9**
Types of chronic diseases suffered from it nurses	**33**	**18.4**
- hyper tension	**17**	**9.5**
- diabetes	**20**	**11.2**
- hypertension and diabetes		
Department :		
Medical/ ICU	**118**	**65.9**
surgical	**28**	**15.6**
diagnostic	**33**	**18.5**
Presence of reinfection:		
No	**78**	**43.6**
Yes	**101**	**56.4**
Frequency of attacks:		
One	**78**	**43.6**
Two	**28**	**15.6**
Three	**70**	**19.1**
Four	**3**	**1.7**
Duration between first and final attack		
No	**78**	**43.6**
One month	**8**	**4.5**
2-3 months	**44**	**24.6**
5-6 months	**49**	**27.5**
Duration from onset until remission manifestation of last attack	**70**	**(39.1%)**
7 - 14days	**62**	**(34.6%)**
15 -29 days	**47**	**(26.3%)**
30- 45 days		

Table (2): Distribution of the clinical profile of COVID-19 among the studied nurse.

Variable	1st attack No= 179		2nd attack no=101		Third attack N0=73		4th attack No=3	
	No	%	No	%	No	%	No	%
Manifestations: Fever and chills	179	100	101	100	73	100	3	100
Sore throat	174	97.2	0	0	65	89.0	3	100
Cough	169	94.4	96	95.04	73	100	3	100
Runny nose	169	94.4	96	95.04	0	0	0	0
headache	87	48.6	96	95.04	43	59	3	100
Fatigue	153	85.5	96	95.04	65	89.0	3	100
Dyspnea (shortness of breath)	156	87.2	96	95.04	65	89.0	3	100
Myalgia and arthralgia	153	85.5	101	100	65	89.0	3	100
loss of taste and smell	110	61.5	77	76.2	68	93.2	3	100
GIT manifestations (vomiting &diarrhea)	156	87.2	96	95.04	65	89.0	3	100
Method of diagnosis:								
CT on chest only	18	10.1	0	0.0	0	0.0	0	0.0
Lab investigation only	54	30.2	0	0.0	0	0.0	0	0.0
X- ray on chest	37	20.7	0	0.0	4	2.2	0	0.0
CT and Lab investigation	70	39.1	88	87.1	13	17.8	3	100
Nose or throat swab	0	0	13	12.9	56	76.7	0	0.0
Presence of complications after the attack	119	66.5	61	60.4	44	60.3	3	100
Complications: Muscle atrophy	100	55.9	59	58.4	0	0.0	3	100
Chest complications with pain	119	66.5	61	60.4	44	60.3	0	0.0
Lung clots	76	42.5	56	55.5	0	0.0	0	0.0
Impaired in concentration	0	0.0	0	0.0	33	45.2	3	100
Insomnia after COVID 19	0	0.0	0	0.0	42	57.5	3	100
Depression and stress	0	0.0	0	0.0	23	31.5	3	100
Skin rash after COVID 19	0	0.0	0	0.0	0	0.0	3	100
Type of isolation: At home	99	55.3	82	81.2	12	16.4	0	0.0
At hospital	80	44.7	19	18.8	61	83.6	3	100
Ensure of being negative before back to work -yes	68	38.0	39	38.6	43	58.9	3	100

Table (3): Association and estimated risk of Socio-demographic factors and occurrence of reinfection

Variable	Presence of reinfection		Absence of reinfection		Test of significance P value	Odds Ratio (OR)
	No =101	% (56.4%)	No =78	% (43.6%)		
Age /year						
50-58	28	73.7	10	26.3	X^2= 5.845	OR =2.608
22-57	73	51.8	68	48.2	P= 0.016*	(95%CI; 1.179 - 5.77)
Sex:						
Female	74	62.2	45	37.8	X^2= 4.721	OR =2.01
Male	27	45.0	33	55.0	P= 0.037*	(95%CI; 1.071 - 3.771)
Residence						
Urban	41	50.0	41	50.0	X^2= 2.54	OR=0.617
Rural	60	61.9	87	38.1	P= 0.111	(95%CI; 0.340 - 1.119
Marital status						
Single	20	51.3	19	48.7	X^2= 0.536	OR=0.767
Ever married	81	57.9	59	42.1	P= 0.464	(95%CI; 0.376 - 1.562
Income						
Not enough	86	63.7	49	36.3	X^2=	OR=3.393
Enough	15	34.1	29	65.9	11.835 P= 0.001*	(95%CI; 1.659 - 6.938)
Family size						
≤ 5	74	64.9	40	35.1	X^2= 9.198	OR=2.604
> 5	27	41.5	38	58.5	P= 0.002*	(95%CI; 1.393 - 4.867
Education level						
- Nursing secondary school	61	73.5	22	26.5	X^2=	OR=3.882
- others	40	41.7	56	58.3	18.339 P<0.001*	(95%CI; 2.059 - 7.319)
Presence of Chronic diseases						
- Yes	49	73.1	18	26.9	X^2= 12.16	OR=3.141
- No	52	46.4	60	53.6	P<0.001*	(95%CI; 1.631 - 6.05)
Department:						
Medical /ICU	66	55.9	52	44.1	X^2= 0.339	OR=0.943
Surgical/Diagnostic	35	53.6	26	46.4	P= 0.844	(95%CI; 0.505 - 1.760
Working duration/years						
≥10 years	64	65.3	34	34.7	X^2= 6.948	OR=2.238
< 10 years	37	45.7	44	54.3	P= 0.008*	(95%CI; 1.224 - 4.093)
Previous training on infection control:						
- Absent	41	54.7	34	45.3	X^2= 0.162	OR=0.884
- Present	60	57.7	44	42.3	P= 0.687	(95%CI; 0.486 - 1.609

Table (4): Binary logistic regression for reinfection factors of the studied nurses

Reinfection factors of studied nurses	Wald	p	Adjusted odds ratio (AOR)	95%CI Lower	Upper
Age (40-58 years)	3.098	0.078	0.286	0.071	1.153
Female sex	1.621	0.203	1.619	0.077	3.398
Not enough income	13.457	<0.001*	5.768	2.262	14.709
Family size (≤ 5)	1.971	0.160	0.488	0.179	1.329
Educational level (-Nursing secondary school)	9.985	0.002*	4.516	1.739	11.730
Duration of work as a nurse/years (≥ 10 years)	1.326	0.249	2.069	0.600	7.132
Presence of chronic disease	5.400	0.020*	2.825	1.177	6.782

Table (5): Association and estimated risk of Socio-demographic factors and occurrence of complications due to COVID-19

Variable	Presence of complications		Absence of complications		Test of significance P value	Odds Ratio
	No =115	% (64.2%)	No =64	% (35.8%)		
Age /year						
40-58	67	78.8	18	21.2	X^2=	OR= 3.567
22-39	48	51.1	46	48.9	14.974 P< 0.001*	(95%CI; 1.846-6.895)
Sex:						
Female	76	63.9	43	36.1	X^2= 0.022	OR=0.952
Male	39	65.0	21	35.0	P=0.881	(95%CI;0.497-1.821)
Residence						
Urban	60	73.2	22	26.8	X^2= 5.247	OR= 2.083
Rural	55	56.7	42	43.3	P= 0.022*	(95%CI; 1.107-3.92)
Marital status						
Single	22	56.4	17	43.6	X^2= 1.333	OR=0.654
Ever married	93	66.4	47	33.6	P= 0.248	(95%CI;0.317-1.348)
Income						
-Not enough	97	71.9	38	28.1	X^2=	OR=3.687
- Enough	18	40.9	26	59.1	12.832 P= 0.001*	(95%CI;1.816-7.488)
Family size						
≤ 5	78	68.4	36	31.6	X^2= 2.383	OR=1.640
> 5	37	56.9	28	43.1	P= 0.123	(95%CI;0.873-3.079)
Education level						
- Nursing secondary school	51	61.4	32	38.6	X^2= 0.528	OR=0.797
- Others	64	66.7	32	33.3	P=0.467	(95%CI;0.432-1.471)
Presence of Chronic diseases	54	80.6	13	19.4	X^2=	OR=3.473
- yes	61	54.5	51	45.5	12.463 P<0.001*	(95%CI;1.706-7.068)
- no						
Department						
Medical/ICU	84	71.2	34	28.8	X^2= 7.262	OR= 2.391
Surgical / diagnostic	31	50.8	30	49.2	P= 0.007*	(95%CI; 1.26-4.538)
Duration of experience/years						
≥10	72	73.5	26	26.5	X^2= 8.021	OR= 2.447
< 10	43	53.1	38	46.9	P=0.005*	(95%CI; 1.309-4.575)
Previous training on infection control:						OR=0.729
- absent	45	60.0	30	40.0	X^2= 1.013	(95%CI;0.393-1.351)
- present	70	67.3	34	32.7	P= 0.314	

Table (6): Binary logistic regression for factors associated with complications of the studied nurses

Factors associated with reinfection of studied nurses	Wald	p	Adjusted odds ratio (AOR)	95%CI Lower	Upper
Age (40-58 years)	6.575	0.010*	4.809	1.448	15.973
Not enough income	5.928	0.015*	2.702	1.214	6.015
Urban residence	6.233	0.013*	2.534	1.221	5.258

Duration of work as a nurse ≥ 10 years	2.290	0.130	0.404	0.125	1.306
Presence of chronic disease	3.324	0.068	2.239	0.941	5.325
Medical /ICU department	4.065	0.044*	2.154	1.022	4.543

Table (7): Coping strategies adopted by the studied nurses after COVID 19 infection exposure

Variable	Degree of the coping strategy			
	Never	Rare	Almost	All the time
Q1**: making plans for myself**.	8(4.5%)	47 (26.3%)	58 (32.4%)	66(36.9%)
Q2: having confidence to do the job well.	0(0.0%)	21(11.7%)	70 (39.1%)	88(49.2%)
Q3: Knowing that there are those who care about me.	0(0.0%)	35 (19.6%)	67 (37.4%)	77 (43.0%)
Q4: discussing with friend problems as they arise at work	4(2.2%)	25(14.0%)	88(49.2%)	62 (34.6%)
Q5: having a steady life that is kept separate from work life.	4(2.2%)	31 (17.3%)	74(41.3%)	70 (39.1%)
Q6: when necessary ;Draw upon my knowledge and experience	0(0.0%)	41 (22.9%)	48(26.8%)	90(50.3%)
Q7: commitment to praying and getting closure to God	14(7.8%)	22 (12.3%)	58 (32.4%)	85(47.5%)
Q8: Through having team supervision	9 (5.0%)	25 (14.0%)	56(31.3%)	89(49.7%)
Q9: Reminding myself that others trust in me	0 (0.0%)	53 (29.6%)	60 (33.5%)	66 (36.9%)
Q10: By believing in and feeling good about myself	5(2.8%)	65(36.3%)	47(263%)	62 (34.6%)
Q11:Through having support from my manager	10(5.6%)	69 (38.5%)	50(27.9%)	50(27.9%)
Q12: By making a concerted effort to keep myself relaxed and in control.	15 (19.9%)	49 (27.4%)	53 (29.6%)	62 (34.6%)
Q13:Through sleeping restfully	5 (2.8%)	19(10.6%)	59(33.0%)	96(53.6%)
Q14:By searching for a positive side to every problem.	8(11.8%)	19(10.6%)	64 (35.8%)	88(49.2%)
Q15: through hopes and entertainment outside the house	4 (2.2%)	23(12.8%)	79 (44.1%)	73(40.8%)
	Had a wide range of coping strategies		**Need to cope more for preventing stress**	
Degree of accommodating preventive coping strategies	153	85.5%	26	14.5%

Table (1): illustrates distribution of COVID-19 epidemiological profile among the studied nurses. The table showed that the current study included 179 nurses, their mean age was 38.91± 9.95, two thirds of them (66.5%) were females, and more than half of them 54.2% were from rural residents. More than three fourths (78.2%) were ever married, 46.4% had secondary technical nursing education and the income of 75.4% was not enough. About two thirds (65.4%) belonged to medical and ICU departments. Of the studied nurses 78 (43.6%) were infected with one attack, 28 (15.6%) with two attacks, 73 (19.1%) with three attacks and 3 (1.7%) with four attacks of COVID-19. The least duration between first and final attack was one month; 8 (4.5%) and the longest duration was 5-6 months; 49(27.5%).

Table (2): presents distribution of the clinical profile of COVID-19 among the studied nurse. The table reported that all mentioned clinical manifestations were emphasized at all attacks except for headache complained by 48.6% and loss of taste and smell by 61.5% of affected nurses at the first attack but the percentage increased at the following attacks (76.2%, 93.2%, and 100% respectively). Sore throat was absent at the second attack and runny nose disappeared at the third and fourth attacks. Regarding methods of diagnosis: CT and lab investigations were the main methods used in all attacks except for the third attack where more than three quarters (76.7%) of the studied nurses used nose and throat swab for PCR investigation for diagnoses. Complications occurred after all attacks with varying percentages but it occurred in all of those affected by the fourth attack. While the main complications were muscle atrophy, chest complications and pain and lung clots (pulmonary emboli) at the first and second attack, neurologic complications (impaired concentrations, insomnia, depression, and stress) were manifested at the third attack. Skin rash appeared after all cases of 4th attack. As regards site of isolation; more than half of the studied nurses(55.3%)isolated at home at the first attacks and the majority of them (81.2%) isolated at home in the 2 nd attack and the reverse at the 3rd and

4th attacks where the vast majority isolated at hospital (83.6% and100% respectively).

Table (3): reveals association and estimated risk of socio-demographic factors and occurrence of reinfection. It pointed that there was significant association between the occurrence of reinfection among the studied nurses and 50-58 age group (p=0.016, OR= 2.608), female sex (p=0.037, OR=2.01), not enough income (p=0.001, OR=3.393), <5 family size (p=0.002, OR=2.604), Nursing secondary school level of education (p<0.001, OR==3.882), presence of chronic disease (p<0.001, OR=3.141,) and working duration ≥ 10 years (p=0.008, OR=2.238). On the other hand, the association between reinfection and residence, marital status, department and previous training workshops on infection control were not significant.

Table (4): illustrates Binary logistic regression for reinfection factors of the studied nurses. It pointed that not enough income ((P<0.001, AOR=5.768, 95% CI=2.262-14.709), nursing secondary school education (p=0.002, AOR=4.516, 95% CI= 1.739-11.73,), and presence of chronic disease (p= 0.02, AOR=2.825, 95% CI=1.177-6.782) were significant predictors of reinfection.

Table (5): shows association and estimated risk of socio-demographic factors and occurrence of complications due to COVID-19. It pointed that there was signification association between occurrence of complications and 40-58 years age group (p<0.001,OR=3.567), urban residence(p=022, OR=2.083) not enough income(p <0.001, OR=3.687), presence of chronic disease(p<0.001, OR=3.473), Medical/ICU departments (p=0.007,OR=2.391) and duration of working as a nurse (p=0.005, OR=2.447).

Table (6): reveals Binary logistic regression for factors associated with complications of the studied nurses. It revealed that 40-58 age group (p=0.01, AOR=4.809, 95% CI= 1.448-15.973), not enough income (p=0.015, AOR=2.702, 95% CI= 1.214-6.015), urban residence (p=0.013, AOR=2,534, 95% CI=1.221-5.258) and belonging to medical and ICU departments (p=0.044, AOR=2.154, 95% CI= 1.022-4.543) were the significant predictors of complications occurrence.

Table (7): represents coping strategies adopted by the studied nurses after COVID 19 infection exposure. It revealed that the majority (85.5%) of affected nurses had a wide range of coping strategies and only 14.5% need to cope with more strategies for preventing stress. Also, the table shows that the top six common strategies were: actively learning professional knowledge and experience effectively; engaging in health-promoting activities; working with team group and supervisor; having confidence in own abilities to work effectively and adjusting the attitude; facing problem positively and praying and closure to God.

Discussion

The pandemic of Coronavirus disease 19 provided pressure on the health care worker (HWs) due to increase infection rates in almost countries. Health care facilities must assign responsibilities for high Coronavirus disease 19 risk departments. Nurses applied a vital aspect in the clinical care of patients, making sure that adequate infection prevention and control measures are applied in health care facilities. Nurses are the first line of infection control because they provide direct health care at all levels and maintain connections between individuals' families, communities, and the rest of the health care system (Who, 2020; Mhango, 2020).

Inadequate knowledge, lack of personal protective equipment, negative beliefs can affected behaviors

among nurses and lead to delayed diagnosis, poor infection control practice, spread and re infection of disease (Wahed, 2020). So the aim of the present research was to identify the epidemiological features, coping strategies of infection and investigate the extent of reinfection with COVID-19 virus amongst nurses working in Tanta University hospitals.

Regarding manifestations related to COVID-19 post exposure, the current research illustrated that the entire studied sample reported that the most common presenting manifestations experienced throughout the first attack were fever, sore throat followed by dry cough and runny nose followed by dyspnea, fatigue myalgia and arthralgia. This finding contradicts the study conducted by İkıışık et al. (2021) who studied Socio demographic and manifestation of corona virus reinfection among healthcare workers in turkey and found that most frequent symptoms were tired (65.2%), pain in head following with 60.8% and high temperature in 47.8% and pain in throat in 47.8% (İkıışık, 2021).

The frequency of symptoms at the present study was different with the research conducted by Manjiyil I et al. (2021) who studied clinic epidemiological profile and outcome of corona virus positive health care workers in a tertiary care center in south India microbiology section and found that common symptoms were fever (67.2%), myalgia (40.4%) and headache (39.6%). Around 21.3% of subjects remained asymptomatic (Manjiyil, 2021).

The current study illustrated that CT and lab investigations were the main methods used in all attacks except in the third attack more than three quarters of the studied nurses used nose and throat swab for PCR investigation for diagnoses. This finding was not similar to that documented at a study conducted by İkıışık et al., (2021) who reported that some people were tested despite having no symptoms, most likely as a result of contact with high-risk individuals or irregular institutional examinations. From the perspective of researchers; it is important for estimating the population level of reinfections, testing of asymptomatic persons is important (İkıışık, 2021).

Concerning frequency of infection associated with COVID19 among the studied nurses results of the present study revealed that more than one third of the studied nurses were infected with one attack, less than one quarter of them infected with two or three attacks, and only (1.7%) of them infected with four attacks of COVID-19.

The least duration between first and final attack was one month within (4.5%) of them, and the longest duration was 5-6 months reported by (27.5%) of them. This finding was not in agreement with the study conducted by Garduño-Orbe et al. (2021) who studied SARS-CoV-2 Reinfection amongst the Healthcare Workers in Mexico: Case Report and Literature Review, who reported that reinfection with endemic human coronaviruses was discovered an average of 6 months after the initial infection, with a minimum of 50 days.

The majority of the time, these episodes are arise with less intensity and and result in lower viral titers; however, roughly 11% of cases are demonstrated to have a larger viral spread, as compared to the last infection. The second infection can then be of same or greater severity, and it is likely that this second infection is caused by a novel coronavirus species (Garduño Orbe et al., 2021).

From the researcher's point of view reinfection with COVID- 19 was excessive amongst nurses working in medical and ICU departments associated with increased number of patients among these units in addition to decrease of personal protective equipment.

Moreover, the present study found that more than one third of the studied nurses during the first and the second attack were not sure of becoming negative before returned back to work, while more than half of them in the third attack were not sure of becoming negative before returned back to work. This finding was in contrast with the study conducted by İkıışık et al. (2021) who reported that 96 percentage of the studied sample were followed as outpatients after the new PCR positive result (İkıışık, 2021).

Diabetes mellitus, hypertension, pulmonary disorders, and OTHER chronic diseases have a bad complication in individuals suffered from COVID19 virus. In this regard, the current study found that more than one third of the studied nurses suffered from chronic diseases. This result was in contrast with the research of Sherwal et al., (2020) who found that half of the studied sample had chronic illness as diabetes mellitus (20.1%) then hypertension (19.2%) (Sherwal, 2020).

According to complications post attacks of COVID 19 the current study illustrated that complications occurred after all attacks with varying percentage but it occurred in all of those affected by the fourth attack.

While the main complications were muscle atrophy, chest complications and pain and lung clots (pulmonary emboli) at the first and second attack, neurologic complications (impaired concentrations, insomnia, depression and stress) were manifested at the third attack. Skin rash appeared after all cases of 4th attack. This finding is similar to the study conducted by Sherwal et al., (2020) who reported that among systemic complications, respiratory and renal problems were the most common (Sherwal, 2020).

Mortality is higher in symptomatic cases of the studied nurses and this was clinically significant in our study as 3 nurses have died from Tanta University Hospitals. This was supported by Patel et al., (2021) who studied clinico-epidemiological profile of COVID-19 patients admitted in a tertiary care hospital in India and found that mortality was higher in symptomatic patients and this was clinically significant ($p<0.001$) (Patel, 2021).

As regard to the coping strategies followed by the studied nurses' post COVID-19 infection. The current study found that the majority of affected nurses had a wide range of coping strategies and less than one quarter of them need to cope more strategies for preventing stress.

Also, the top six common strategies were: actively learning professional knowledge and experience effectively; engaging in health-promoting activities; working with team group and supervisor; having confidence in own abilities to work effectively and adjusting the attitude; facing problem positively and praying and closure to God.

This finding was in the same line with the study conducted by Huang et al. (2020). Who studied Emotional responses and coping strategies in nurses and nursing students during COVID-19 outbreak: A comparative study , and found that most of the studied nurses used coping strategies such as problem focused coping methods that include active coping ,planning, and use of instrumental support (Huang, 2020).

Conclusion and recommendation

The present study revealed that seminars/ workshops with periodic refreshment in service training should be regularly organized in tertiary care hospitals and health care centers for nurses in order to equip them with adequate knowledge on how to care with COVID 19 patients. Nurses must be equipped with adequate needed personal protective equipment and materials used in managing COVID 19 cases.

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