

# Effect of Clustering Nursing Care on Spreading COVID-19 Infection Among Nurses: A Retrospective Study

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**Background:** The nurse's first and most important responsibility is to protect themselves from contracting or spreading COVID-19.

**Purpose:** Investigate the effect of applying clustering nursing care on spreading COVID-19 infection and fatigue level among nurses who provide nursing care for COVID-19 patients.

**Methods:** Retrospective case-control study, where cases had a COVID-19 infection in the previous six months and controls were free. Internet-based survey sent to nurses at eight hospitals.

**Findings:** A total of 100 cases and 250 controls. About 36.8% of nurses who did not apply clustering care suffered from COVID-19 infection. Meanwhile, 83.3% and 93.3% of those who clustered three and four procedures, were free of COVID-19 infection.

**Discussion:** Applying clustering for nurses' care decreases spreading of infection among nurses and decreases fatigue level related to work. Female nurses, increased fatigue, and a lack of training are all factors that may contribute to the spread of COVID-19 infection among nurses.

**Keywords:** clustering care, COVID-19 infection, nursing care, nurses

## Background

Coronavirus disease-2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). First detected in Wuhan, which is the capital of China, at the end of December 2019, the pandemic has now spread worldwide and triggered the 2019–20 coronavirus pandemic.<sup>1</sup> As of the evening of Jan 25, there were 411,749 affirmed cases of COVID-19 and 22,369 deaths in Egypt. The first case of COVID-19 in Egypt was affirmed on 14 February 2020.<sup>2</sup>

Respiratory infectious pandemics and epidemics are especially dangerous because they spread through droplets and through contact with other people. As the largest group of health professionals, nurses are the ones who work with people.<sup>3</sup> Nurses are at the frontline of the health care system response to both epidemics and pandemics. Nurses work closely with patients and are thus frequently exposed to viruses, increasing their risk of infection.<sup>4</sup> In the SARS outbreak in Taiwan, some 4 of the 70 deaths were nurses.<sup>5</sup> Early findings on COVID-19 suggest that the virus's infection rate among health-care workers may be substantially higher.<sup>6</sup>

People who work in hospitals have a higher exposure with patients and the general public including being exposed to many patients with unknown COVID-19 status.<sup>7</sup> COVID-19 being asymptomatic in some people puts HCWs at higher risk.<sup>8</sup> Among those infected, worldwide 11–29% cases were health care workers (HCW) in Indonesia.<sup>9</sup>

The nurse's first and most important responsibility is to protect themselves from contracting or spreading COVID-19. Nurses should try to cluster care as much as possible to reduce the amount of time they spend in the room and the number of times they

enter and exit it. Patients should be given a mechanism to connect with their care team that does not require them to enter the room, such as a call bell system, a room phone, or a tablet device, to help cluster care. Because patients may already feel isolated, it is critical to explain clear expectations for clustered care to them, but nurses must also safeguard themselves from unnecessary exposure.<sup>10</sup>

Clustered care is clustering several routine or nursing care events together rather than spacing them out over time. Cluster nursing care is the application of evidence-based medicine, bundling a series of independent and effective operations, care, and treatment measures, in order to reduce the infection rate in patients and health workers and to improve the clinical remedy rate. Overall, cluster nursing care can produce much better benefits than a single-factor intervention.<sup>11</sup>

Clustering care is one of several ways for better time management, and it can help nurses stay more productive by reducing fatigue.<sup>12</sup> In 2020, it will also be a priority for nurses working on COVID-19 units to prevent their exposure to the novel virus. In the COVID-19 context, nursing care provides a variety of new and unique issues. With all family and friends barred from hospitals and other facilities, the nursing staff is put under even more pressure to anticipate and meet the requirements of the patients. Nurses, on the other hand, are strong, resilient, and creative, and they should take on the issues head on. Nurses that practice clustering care organize their patient care around a set of chores that may be handled all at once, eliminating the need for several visits in and out of the patient's room.<sup>13</sup>

Furthermore, because nurses are at the interface between hospitals and the community, where there is significant transmission, combined with the fact that as essential workers they are not confined, they may also play a role in initiating or amplifying outbreaks in settings such as hospitals. Therefore, we were interested in our study about easy-to-apply method, which are cluster care and its effect in limiting the spread of infection.<sup>14–16</sup>

Fatigue among nurses can be exacerbated with increased numbers of shifts worked without a day off, increase routine workload and working more than four consecutive 12-hour shifts is associated with excessive fatigue and longer recovery times. So, clustering routine care, rest breaks, napping, exercise, bright lights, and pharmacologic measures may be used to provide temporary relief from the symptoms of fatigue during the work shift.<sup>17</sup>

There are limited published studies on COVID-19 prevention measures focusing on clustering nursing care, especially in Egypt. The purpose of our study is to assess the effect of applying clustering nursing care on spreading COVID-19 infection among nurses who provide nursing care for COVID-19 patients.

## Research Questions

Q1: What is the effect of applying clustering nursing care on the spread of COVID-19 infection among nurses?

Q2: Is there a relation between clustering nursing care and fatigue level among nurses?

Q3: What are the factors affecting on the spread of COVID-19 infection among nurses?

## Methods

### Research Design

A retrospective case-control study was used. The study was conducted at eight tertiary referral centers in different regions of Egypt, which provide care for COVID-19 patients at the governorate level.

**Participants:** The size of the sample was computed with a confidence rate of 95%, power 0.8, the odds ratio was 11.24,<sup>18</sup> and the expected proportion in controls was 0.01. Ten percent of the non-response rate was added, and the minimum sample size per group was 97 nurses. We invited 420 nurses from previous mentioned setting who we had way to connection by convenience sample of respondents who provide care for patients with COVID-19, received 350 responses; 100 of them reported infected with COVID-19 on the other hand “case”, 250 of them stated that they were non infected “control” during the previous 6 months from June 1st, 2021, to November 30th, 2021.

### Tools of Data Collection

It was intended to measure the prevalence of COVID-19, fatigue level, and clustering care.

Characteristics of nurses included age, gender, education level, years of experience, marital status, residence, training courses, COVID-19 infection in the last six months related to their work, applying clustering care, and number of procedures clustering.

The Indonesian edition of the Japan Industrial Fatigue Research Committee (JIFRC) scale was adapted from Tarwaka (2010)<sup>19</sup> and consists of 30 question items. In general, this questionnaire consisted of 3 parts, the first ten questions revealed “drowsiness and dullness”, the second ten questions revealed “difficulty in concentration” and the third ten questions reveal “projection of physical disintegration”, the questionnaire used five Likert scales with the answer options consisting of (1) never, (2) sometimes, (3) being felt regularly, (4) often experienced, (5) always experienced. Total scores obtained by summing all scores per item, then categorized into 4: 1) scores 30–52=“low” work fatigue; 2) scores 53–75=“medium” work fatigue; 3) scores 76–98=“high” work fatigue; 4) scores 99–120=“very high” work fatigue.

## Pilot Study

A pilot study was conducted on a group of 20 nurses (10%). It was conducted prior to data collection to assess the feasibility and duration of data collection. No modification was carried out; therefore, the participants in the pilot were included in the study.

Study framework: We communicate via e-mail and various social media services with nurses who provide nursing care for COVID-19 patients. We obtained verbal consent to join the study after explaining the purpose of the study and its tools. The data was collected using Google Forms and distributed to the participants via Facebook and WhatsApp. The researchers sent the link to the nurses in order to collect the data, and all of the responses were compiled into an online spreadsheet. The survey’s first section greets participants and instructs them to complete all of the questions. We received 350 responses; 100 of them reported being infected with COVID-19. On the other hand, 250 of them stated that they were not infected during the previous 6 months from June 1st, 2021, to November 30th, 2021.

## Ethical Consideration

Consent was obtained from each nurse before participation. The purpose of the study was explained in written words in the introduction part of the survey. In addition, participants who agreed to participate in the study were assured that all information obtained would be kept confidential. They were notified that they had the right to withdraw from the study at any time. We contacted the author of the fatigue tool to obtain approval to use it. We comply with the study with the Declaration of Helsinki.

## Statistical Analysis

The collected data was coded and entered into the Statistical Package for Social Sciences (SPSS) (SPSS Inc; version 24; IBM Corp., Armonk, NY, USA). After completing entry, the data was explored to detect any errors. Then, it was analyzed by the same program for presenting frequency tables with percentages. Qualitative data were presented as a number and percent. Furthermore, quantitative data were described as mean or standard deviation, as appropriate. In multiple linear regression, numerous explanatory variables are used to predict the outcome of a response variable. The Chi-square probability distribution is particularly useful in analyzing categorical variables. A *t*-test is a type of inferential statistic used to determine if there is a significant difference between the means of two groups. Pearson Correlation coefficients are used to measure the strength of the linear relationship between two variables. Analysis of Variance (ANOVA/ *F*-test) is a statistical formula used to compare variances across the means (or average) of different groups. The results were considered statistically significant at  $P \leq 0.05$  and highly significant at  $P < 0.01^{**}$ . The tools were evaluated for their reliability by using Cronbach’s alpha coefficient test in the SPSS program version 24 by a statistician. The internal consistency reliability (Cronbach’s) of the predesigned questionnaire appeared to be good (Cronbach’s = 0.867).

## Findings

Regarding characteristics of studied nurses, the present table detects three hundred and fifty nurses responded to the questionnaire; the mean age of the infected group was  $32.10 \pm 4.76$ , whereas that of the noninfected group was  $32.29 \pm 3.79$  years, with no significant difference at  $p$  value  $>0.05$ . Also, 85% and 72.8% of the participants in the infected group and noninfected group were female, respectively, with a slight significant difference between the studied groups. In addition, 24% and 25.2% of studied nurses had experience ranging from 5 to  $<10$  years in the infected group and noninfected group, respectively, with no significant difference between the studied groups. About 79% of nurses in the infected group did not attend training courses, whereas 71.2% of nurses in the noninfected group attended training courses about caring for COVID-19 patients, with a highly

significant difference at  $p$  value  $<0.01^{**}$ . Furthermore, there was no relation between education level, residence, marital status, and years of experience with the incidence of infection at  $p$  value  $>0.05$ . See more in [Table 1](#).

Regarding nurses' fatigue level related applied clustering nursing care, the current figure revealed that 25.6% and 47% of nurses who did not apply clustering care reported having very high fatigue levels and high fatigue levels, respectively. And 60.3% of nurses who applied clustering for only two procedures had moderate fatigue levels. Meanwhile, 39.6% of nurses who applied clustering for three procedures had low fatigue and 66.7% of those who clustered four procedures had low fatigue. See more in [Figure 1](#).

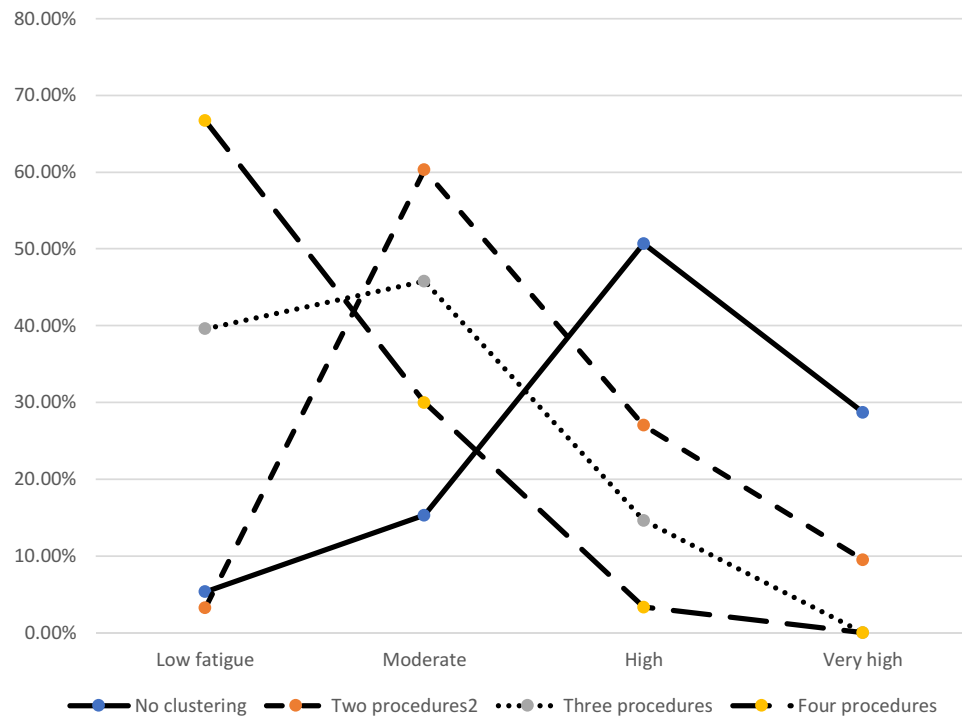
According to nurses' COVID-19 infection prevalence related applied clustering nursing care, the current figure stated that 36.8% of nurses did not apply clustering care suffered from COVID-19 infection, only 20.6% of nurses who clustered two procedures suffered from COVID-19. Meanwhile, 83.3% and 93.3% of them who clustered three procedures and four procedures were free from COVID-19 infection, [Figure 2](#).

Regarding model linear regression, this model explains 48% of the variation in prevalence of COVID-19 among nurses detected through  $R^2$  value 0.489. Also, it was explained that applied clustering care and attending training courses about COVID-19 had a negative effect of  $-0.226$  and  $-0.567$  on spreading infection among nurses at a  $p$  value  $<0.01^{**}$ . Increased fatigue level and female nurses, on the other hand, had positive effects on infection spread among nurses with 0.123 and 0.288 at  $p$  value  $0.01^{**}$ , respectively, [Table 2](#).

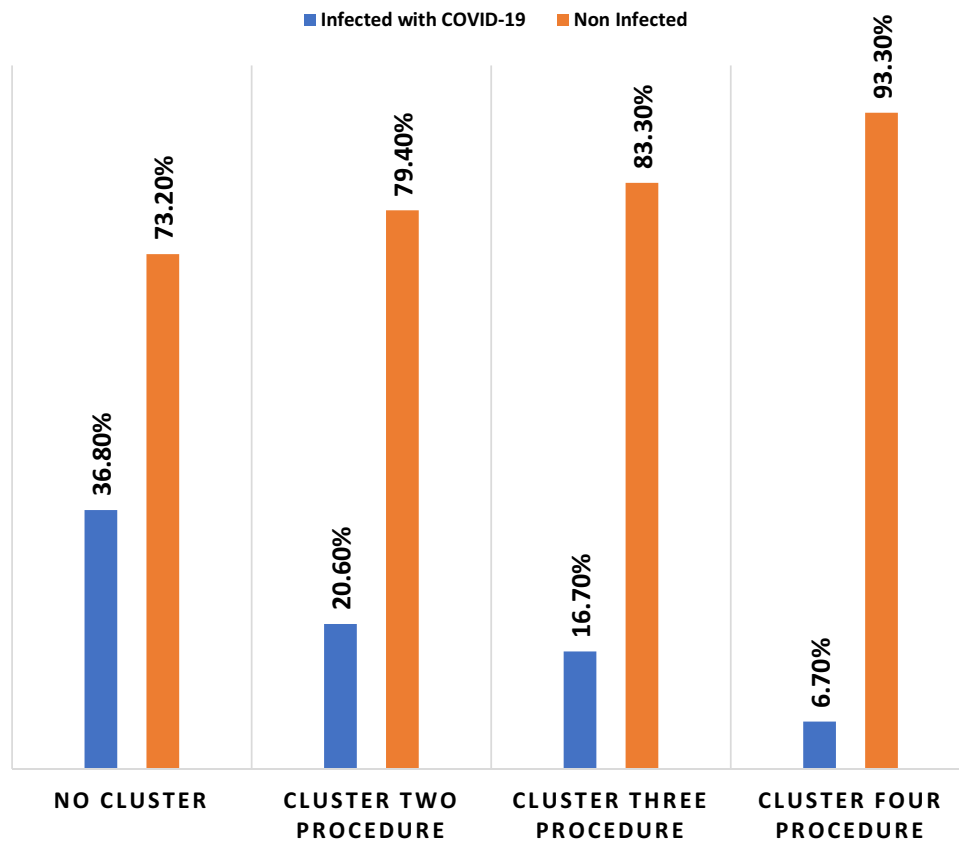
**Table 1** Distribution of Studied Nurses Related to Their Characteristics

	N	%	N	%	
	Infected group		Non infected group		
Age:					
22 - <32	58	58	152	60.8	<i>T</i> test 0.355
32 - <42	33	33	65	26	
42 - 52	9	9	33	13.2	
Mean $\pm$ SD	32.10 $\pm$ 4.76		32.29 $\pm$ 3.79		
Gender:					
Male	15	15	68	27.2	Chi-square $<0.05^*$
Female	85	85	182	72.8	
Education level:					
Diploma of nursing	20	20	47	18.8	Chi-square  $>0.05$
Technical health institute	60	60	148	59.2	
Bachelor of nursing	17	17	45	18	
Postgraduate	3	3	10	4	
Years of experience:					
1 - <5	9	9	25	10	<i>T</i> test  $>0.05$
5 - <10	24	24	63	25.2	
10 - 15	45	45	105	42	
>15 year	22	22	57	22.8	
Marital status:					
Married	72	72	170	68	Chi-square $>0.05$
Unmarried	28	28	80	32	
Residence:					
Near to hospital	14	14	60	24	Chi-square $>0.05$
Away from hospital	86	86	190	76	
Training course related care of COVID-19 patients:					
Yes	21	21	178	71.2	Chi-square $^{**}<0.001$
No	79	79	72	28.8	

**Note:** \*Significant  $<0.05$ ;  $^{**}$ high significant  $<0.01$ .



**Figure 1** Distribution of nurses' fatigue level related applied clustering nursing care.



**Figure 2** Distribution of nurses' COVID-19 infection prevalence related applied clustering nursing care.

**Table 2** Model Linear Regression for Spreading COVID-19 Infection Among Nurses

Coefficients <sup>a</sup>					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.498	0.133		18.836	<0.001
Cluster care (yes)	−0.226	0.062	−0.225	−3.646	<0.001
Fatigue level	0.123	0.033	0.233	3.689	<0.001
Gender (female)	0.288	0.074	0.234	3.879	<0.001
Training program (yes)	−0.567	0.061	−0.566	−9.308	<0.001
a. Dependent Variable: Prevalence of COVID-19 among nurses					
b. Predictors: (Constant), training, cluster, GENDER, Fatigue level					
<b>Model Summary</b>					
R <sup>2</sup>	F		Sig. F Change		
0.489	46.630		<0.001		

**Table 3** Correlation Between Studied Variables

	Fatigue Level
Cluster care	r. −0.584 p <0.001**
Number of procedures clustering	r. −0.700 p <0.001**

**Note:** \*\*High significant <0.01.

According to the correlation between fatigue level and applied clustering care, there was a high negative correlation between fatigue level and clustering care at p value <0.01 and the number of procedures clustered had a high negative correlation with fatigue level at p value <0.01\*\* (Table 3).

## Discussion

Our study was conducted on 350 nurses who provided direct care for COVID-19 patients at ward and intensive care units at eight tertiary referral governmental hospitals in different geographic areas of Egypt in the previous six months. One hundred of them reported being exposed to COVID-19 infection who considered themselves in the case group, and 250 nurses reported being free from infection who considered themselves in the control group. We conducted a retrospective case/control study which aimed to assess the effect of applying clustering nursing care on the spread of COVID-19 infection and fatigue level among nurses who provide nursing care for COVID-19 patients.

The findings of our study indicated that more than one-third of nurses who did not apply clustering care suffered from COVID-19 infection. One-fifth of nurses who clustered two procedures suffered from COVID-19. Meanwhile, the vast majority of those who clustered three and four procedures were free of COVID-19 infection. Applied clustering care while providing nursing care for COVID-19 patients and attended training courses about caring for COVID-19 patients lead to decrease the spread of infection among nurses through decreasing direct contact with patients and decreasing times of exposure to the infection. Moreover, the vast majority (83.3%) and (93.3%) of those who clustered three procedures and four procedures were free from COVID-19 infection. In addition, female nurses and the increasing level of fatigue among nurses, unfortunately, increase their chances of getting infected. These results may be attributed to

physical fatigue, which gradually begins to affect focus and makes them more prone to mistakes, such as forgetting to wear personal protective barriers, which exposes them to infection more. At p values greater than 0.05, age, experience, education level, and place of residence had no effect on the spread of infection among nurses.

These results are supported by the study conducted by Qiong & Hui, 2016<sup>11</sup> who assessed the value of clinical cluster nursing in the prevention of multidrug resistant [MDR] infections in patients and stated that cluster nursing care effectively prevents MDR infections in ICU patients with severe encephalopathy and reduces the mortality rate, thus having excellent clinical significance. Also, Deitrick et al, 2020<sup>10</sup> stated that nursing care should focus on limiting the exposure and spread of the virus. Additionally, cohort with Bryant et al, 2004<sup>20</sup> stated that healthcare workers experiencing fatigue can jeopardize their own health and safety, such as increasing their susceptibility to infectious diseases. Furthermore, SCIE, 2022<sup>21</sup> reported that staying outside where possible, and letting fresh air in when indoors helps decrease the spread of infection. Hasan et al, 2021<sup>22</sup> conduct a model for the problem of clustering patient care in healthcare facilities so as to minimize infection spread. Stone et al, 2004<sup>23</sup> detected that staffing patterns and nurses' working conditions are risk factors for healthcare-associated infections as well as occupational injuries and infections. Meanwhile, inconsistent with the study performed by Atnafie et al, 2021<sup>24</sup> who reported that age between 25 and 34 years (AOR = 0.20), age between 35 and 44 years (AOR = 0.13), family size of >6 (AOR = 3.77), and work experience of 21–30 years (AOR = 0.01) were the protective factors against COVID-19. Meanwhile, Rodriguez-Lopez et al, 2021<sup>18</sup> detected those men (AdjOR 4.13, 95% CI 1.70–10.05) and nurses (AdjOR 11.24, 95% CI 1.05–119.63) were identified as risk factors for infection among health workers.

Furthermore, according to nurses' fatigue levels related to applied clustering nursing care, one-quarter and nearly half of nurses who did not apply clustering care reported having very high fatigue levels and high fatigue levels, respectively. And less than two-thirds of nurses who applied clustering for only two procedures had moderate fatigue levels. Meanwhile, more than one-third of nurses who applied clustering for three procedures and about two-thirds of those who clustered four procedures had low fatigue. Besides, there was a high negative correlation between applied clustering nursing care and the number of procedures clustered at one time with fatigue level at p value <0.01\*\*.

These findings are consistent with Arielle Cratsenberg et al, 2015<sup>25</sup> reported that nurses' tasks such as vital signs, toileting, medication administration, and phlebotomy can be completed together to avoid the frequency of nighttime sleep interruptions for patients and allow rest time for nurses. Wang et al, 2020<sup>26</sup> showed that long working hours, exhaustion, and stigma are additional factors that place nurses at high risk for exposure to COVID-19. Also, Zou et al, 2021<sup>27</sup> reported that there was a positive correlation between daily working hours and the degree of fatigue among HCWs. Moreover, González-Gil et al, 2021<sup>28</sup> reported that heavy workloads, high patient-nurse ratios, and lack of rest are causing exhaustion among nurses. Alvarez et al, 2020<sup>29</sup> informed us that long work hours and high workload, exposure to the virus, and frequent and close contact with patients infected with COVID-19 could lead to exhaustion and fatigue. As well as Zhan et al, 2020<sup>30</sup> reported that average daily working hours had a significantly positive correlation with nurses' fatigue. Jiang et al, 2018<sup>31</sup> demonstrated that HCW fatigue increases the risk of patient care errors and employee injuries.

## Conclusion

This study highlights the benefits of clustering nursing care. By using clustering for routine nursing care for COVID-19 patients, nurses are less likely to catch an infection and will be less fatigued at work. Female nurses, increased fatigue, and a lack of training are all factors that may contribute to the spread of COVID-19 infection among nurses.

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The authors report no conflicts of interest in this work.

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