Impact of Educational Program Regarding Safety Measures Guidelines on Nurses' Knowledge, Attitude and Practice toward COVID-19 Patients.

Hend A. E. Elshenawie [(1)], Heba El Sayed [(2)], Eman A. A. R. Dabou [(3)]

(1) Lecturer, Medical-Surgical Nursing, Faculty of Nursing, Alexandria University, Egypt.
(2) Lecturer, Medical-Surgical Nursing, Faculty of Nursing, Alexandria University, Egypt.
(3) Lecturer, Medical-Surgical Nursing, Faculty of Nursing, Alexandria University, Egypt.

Abstract

Nowadays, nurses should prepare themselves for pandemic events as far in advance as potentially worsening outbreak conditions. Coronavirus disease (COVID-19) is a widespread pandemic disease, especially in a health-care setting. But there are not enough researches done to control & prevent it from transmission among health-care providers. The pandemic has highlighted how protecting the healthy team is key to keeping patients safe and ensuring a functioning health system. Therefore, nurses should have sufficient knowledge and practice about pandemic events through using safety measures in dealing with COVID-19 patients to protect themselves from physical and biological hazards. **Aim:** Investigate the impact of educational programs regarding safety measures guidelines on nurses' knowledge, attitude, and practice toward COVID-19 patients. **Design:** Quasi-experimental design. **Setting:** Medical, surgical, and oncology departments at the Alexandria Main university hospital, Egypt. **Sample:** A convenience sample of 150 nurses. **Results:** There was a positive, statistically significant difference between pre & post-educational programs regarding safety measures on studied nurses' knowledge, attitude, and practice. A positive, statistically significant correlation between studied nurses' knowledge of the safety measures educational program and their attitude and practice. **Conclusion:** the educational programs regarding safety measures guidelines improved nurses' knowledge, attitude, and practice toward COVID-19 patients. **Recommendations:** Efforts should be made to enhance nurses' knowledge, attitude, and practices through periodical follow-up.

Keywords: Corna virus- knowledge-attitude. Practice –safety measures guidelines

Introduction:

At the end of 2019, coronavirus disease 2019 (COVID-19) appeared in Wuhan, China. Then, it has increased and has been announced a universal pandemic by the World Health Organisation (WHO);(2020). Until now, the infection rates continue to grow in many countries across the globe. As of April 14, 2020, 1,844,863 have proved as a case of COVID-19 in 213 countries, including 117,021 reported deaths (WHO; 2020).

Since the World health organization (WHO) confirmed coronavirus is a pandemic disease, and the number of cases steadily increased, Egypt braces for COVID- 19. (Azlan, Hamzah, Sern, Ayub & Mohamad 2020). Coronavirus disease 2019 is an evolving respiratory disease that is caused by a novel coronavirus. This disease is highly infectious through inoculation of mucous membranes through droplets including the virus and contact with droplet-contaminated surfaces of different materials and objects, which can act as live-virus reservoirs for hours to days. (Wax & Christian; 2020) (Van Doremalen et al.; 2020)

The fast and widespread COVID-19 pandemic has become a significant cause of concern for the health care profession. Owing to this novel, a lot of misunderstanding and confusion regarding the virus, mode of transmission, and the necessary precautions to prevent infection. Hens become more challenging with the enormous misinformation (Azlan, Hamzah, Sern, Ayub & Mohamad 2020).

The World Health Organization recommends droplet and contact precautions for general care, although airborne safety measures for health care providers (HCPs) doing aerosol-generating medical procedures (AGMP) in those patients. With this mode of transmission, HCPs are at the highest liability of being infected. Conversely, US Centres for Disease Control and Prevention (CDC) now recommends using respirator masks to protect HCPs providing care for suspected COVID-19 patients. (CDC; 2020).

Safety of HCPs and prevention of intra-hospital cross-infection are essential parts of pandemic response. It feels necessary for HCPs to have up-to-date knowledge about the source, spread, symptoms, and preventive measures (Nemati, Ebrahim & Nemati; 2020). Lockhart et al. (2020) mentioned that health care providers' safety and availability to work during this pandemic are crucial. The constant use of proper personal protective equipment (PPE) will guarantee the health care provider's safety. HCPs must also enhance their skillset by recognizing, simulating, and practicing the wearing and taking off their disposable and reusable equipment appropriately. (Lockhart, Naidu, Badh & Duggan; 2020).

Beyond a doubt, nurses on the frontlines make significant contributions during pandemics as a professional responsibility and serve as a binding force in the fight. Comparatively, nurses remain the group under the highest pressure among medical workers (Misra; 2020). Nurses represent one of the most at-risk populations for acquiring COVID-19. They play crucial roles in providing intensive care, working long hours, and assisting with their patients' daily living activities (Liu et al. 2020).

It is more critical to maintain the medical resources' sustainability during this pandemic by avoiding health-care workers' infection. Obviously, it is not possible to keep even a minimum standard of sustainability. Specifically, the cases have been boosted and reached the health-care system's maximal capacity (Jeon et al.; 2020).

Knowledge, attitudes, and practices (KAP) affect the nurses' adherence to infection control measures towards COVID-19. However, KAP plays a vital role in deciding a nurses' willingness to acknowledge the behavioral change processes from health authorities. Evaluating the KAP related to COVID-19 among the nurses would help provide better insight to address poor knowledge about the disease and develop educational programs that may be needed to change misunderstandings about the virus, mode of transmission, and preventive measures. Previous researches have supported that, for example, and not as a limitation (Modi et al., 2020) mentioned that health-care professionals in Indian need frequent educational interventions and training programs on infection control practices. Saqlain et al. (2020) emphasized that the government must launch well-structured training programs to target all HCPs to improve their existing knowledge. Besides, they recommended continuous PPE provision and training on proper infection control measures are substantial and severe. Giao et al. (2020) mentioned that great efforts through educational campaigns that target HCPs and the broader population beyond borders are immediately needed. Maleki et al. (2020) in Uganda recommended continued professional education among HCPs to enhance knowledge to encourage positive proactive and therapeutic practices and follow-up researches involving all types of hospitals across the country.

Therefore, there is an urgency to develop educational and training programs on infection control practice for health care providers (HCPs), especially nurses. Thus, this study aimed to measure the effect of safety measures guidelines on nurses' attitude and knowledge on practice among Patients with COVID-19.

Aim of the study:

The current study aimed to investigate the impact of educational program regarding safety measures guidelines on nurses' knowledge, attitude, and practice toward COVID-19 patients.

Research hypothesis:

The research hypothesis was as follows:

Nurses who received educational program regarding safety measures guidelines toward COVID-19 patients will show a higher score of knowledge, attitude, and practice after intervention than before.

Nurses who received educational program regarding safety measures guidelines toward

COVID-19 patients will apply safety measures in caring patients with the coronavirus.

Nurses who received educational program regarding safety measures guidelines toward COVID-19 patients will have a positive attitude toward caring COVID-19 patients.

Significance:

Although hospitals have taken unparalleled and stringent protective measures against COVID-19 infection to avoid its spread, Thousands of nurses are infected with COVID-19, and they have lost their lives worldwide.

Several studies identified how to control infection in clinical settings found that the lack of health team knowledge about the virus, mode of transmission, and the safety measures. Also, it should be followed in practicing with COVID-19 patients who positively affect their health. It is essential to reduce the incidence of COVID-19 and promote safety for health team workers (Riou J, Althaus CL, 2020). Several studies indicated that lack of knowledge, attitude, and skills is one of the main barriers to implementing safety measures guidelines in nursing practice. Therefore, it should maintain appropriate safe staffing levels within health-care facilities to protect nurses from infection, improve their mental health, and protect them from physical and biological hazards. Nurses should increase their knowledge and competence in dealing with COVID-19 about safety measures in hospitals for nurse safety and connect their safety policies to existing patient safety policies.

The more significant part of the studies suggested that the educational involvement could enhance nurses' knowledge in decreasing the incidence rates. Therefore, the current study will provide evidence for conducting studies to improve nurses' knowledge, attitude, and practice regarding safety measures guidelines toward COVID-19 patients.

Material and methods:

I- Research design:

The researchers utilized a quasi-experimental design. The current study used a single group pre-test and post-test educational intervention design.

II- Setting:

The researchers conducted the study at the Emergency departments (medical, surgical), medical departments, oncology departments, surgery departments at the Main University Hospital of Alexandria, Egypt. The total number of working nurses in the settings mentioned above was 400 nurses who provided direct contact.

III- Subjects:

A convenient sample of 150 nurses was applied regardless of their age, qualifications, or years of experience. They were distributed on the three working shifts.

The researcher used the "Raosoft sample size calculator software program" to calculate the proportional sample size (Sample Size Calculator by Roasoft, Inc,2014). The accepted margin of error at 5%, the response distribution is 50%, confidence level at 95% and population size is 300 nurses, and the minimum sample size is 150

Organizational design and ethical consideration:

The researcher obtained official permission from the Director of Alexandria Main university hospital and the department heads. Verbal consent was obtained from each nurse to participate in the study after clarifying the aim of the research and study's procedures. The researchers informed them that the study's participation is voluntary and have the right to withdraw from the study at any time, without giving any reason and that their responses would be held confidentially.

IV- Tools: The researchers utilized the following tools:

Tool I: The questionnaire sheet was divided into two major parts:

Part I: Nurses socio-demographic characteristics the researchers developed it after extensive reviewing of related literature based on Attari et al. ;(2017); Alkhalidi & Jamshed ;(2019) to assess nurses' personal data, which was composed of seven closed-ended questions, including sex, age, marital status, level of education, job title, years of experience in the unit.

Part II: The self-reported questionnaire sheet for nurses, which consisted of four sections

Section 1: The researchers developed it after extensive literature review (CDC; 2020) to assess nurses' knowledge about COVID-19. This part included 17 items on the mode of transmission, symptoms, treatment, risk groups, isolation, control, and prevention.

Section 2: The researchers developed it after reviewing related literature (CDC2020) (Liu et al. 2020) to assess nurses participants' attitudes toward COVID-19 & safety measures used in the caring patient using a four-point Likert scale. Twenty-six statements were asked to state the respondents' level of agreement, from "disagree," "undecided," "agree," or "strongly agree."

Section 3: This is the final section of part II to assess the respondents' practices. It comprised sixteen questions related to practices and performance regarding the safety measures performed to protect themselves from infection transmission. It included; working in crowded areas, avoiding cultural manners like shaking hands, coughing, and nose-blowing. Other behaviors such as hand washing before and after doing any procedures, wearing the mask, face shield, and goggles, wearing a sterile gown, wearing sterile gloves, changes the sterile gloves between patients, use of disinfection, sanitizers. Isolated all equipment used for patients with COVID-19 isolate patients with COVID-19**,** isolated rooms, wearing special uniforms during caring with COVID-19 patients, and practicing social distancing.

Scoring system

The total scores of knowledge, attitude, and practice were 100 points for each domain. Each correct answer was assigned a score of one, and the wrong answer was given zero, and the total scores were converted into a percent score. According to the following criteria, the overall knowledge score was categorized into three-level: if the total score was ≥ ٧1%, it was considered a high level. If the score was between 51 to ٧0 %, it was deemed moderate level and low level if it was ≤ 50 %.

Educational program regarding safety measures guidelines development:

The education program included an illustrated Arabic brochure about safety measures guidelines for nurses regarding COVID-19 protection and care. The researchers adapted the program after reviewing the literature and related research studies and based on the safety measures guidelines of CDC (2019) as the benchmark for all COVID-19 patients care guidance, and provided protocols for best practices as regards the prevention and monitoring of COVID-19 patients before, during, and after hospitalization. It includes the following: definition of COVID-19, factors that can determine transmission risk of COVID-19, guidelines (Centers for Disease Control and Prevention (CDC), 2019) as regards the safety measures used in prevention and monitoring of COVID-19, protective measures to prevent transmission of it and role of the nurse in decreasing the risk for COVID-19 and how to protect themselves and others form the infection.

Validity and ratability

The data collection tools' content validity was examined by five experts affiliated to the Faculty of Nursing, Alexandria University at the medical-surgical Nursing Department. The experts examined it for content coverage, clarity, relevance, applicability.

Reliability: The reliability of the developed tools was tested using Cronbach's alpha test (0.88).

Pilot study

The pilot study was conducted on 10% of nurses (four nurses) regarding the study's clarity and applicability. No modifications were done. The pilot study sample was excluded from the whole study sample.

Methods:

Four Phases were conducted during this study: assessment, planning, implementation, and evaluation. Data collection was done pre-and post- educational guidelines. Data collection started from May 2020 to August 2020.

The developed data collection tools (The self-reported questionnaire) were translated from English to Arabic. The Arabic form was distributed to five experts in the medical-surgical

nursing department at the nursing faculty for content validity and to ensure the meaning of the content. Based on experts' opinion, some modifications were done, and then the final forms were developed .the questionnaires were conducted in the Arabic language.

Assessment phase: It aimed to assess the characteristics of participated nurses and nurse's knowledge, attitude & practice toward safety measures for COVID-19 by using the prepared self-administered questionnaire (pre-test).

Planning and preparatory phase:

Depend on the assessment phase, the researcher developed the content and media of the visual materials guidelines. Guidelines were revised by five medical surgical nursing department expertise at the nursing faculty for content validity. Based on the opinion of experts, the researchers made some modifications to formulate the final forms.

Implementation phase:

This phase included the educational sessions: the researcher delivered it to all participants, based on CDC and national guidelines for safety measures. They had the following: Lectures were conducted over 30 to 45 minutes/day for three consecutive days per week over five weeks, to approach all participants in all work shifts. The sessions included the theoretical material about COVID-19, mode of transmission, measures used in prevention and monitoring of COVID-19, protective measures to prevent COVID-19 transmission, and the nurse's role in decreasing the risk for transmission of COVID-19 and How to protect themselves & others from the transmission of infections. The educational materials included videos, posters, brochure, demonstration models, and PowerPoint presentations

Evaluation phase:

This phase was asserted the impact of the educational program regarding safety measures guidelines on nurses 'knowledge, attitude, and practice toward COVID-19 patients in order to compare between the results of pre and post educational guidelines to determine the level of improvement in nurses' knowledge and attitude regarding using the same questionnaire of phase I (post-test) and assessing the practice of the participants using the same method of phase I. The evaluation phase was also emphasized approximating the educational guidelines' effect on their practice among patients undergoing COVID-19 that was assessed immediately after ending the program and at two months after implementing the educational program safety measures guidelines for follow-up.

Statistical analysis:

After data collection, it was coded and transformed into a specially designed format suitable for computer feeding. It was analyzed using IBM SPSS software package version 20.0. Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of the distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation. A 5 % level of significance was chosen where $p \leq 0.05$ was considered significant.

The used tests were

1- **Marginal Homogeneity Test:** Used to analyze the significance between the different stages
2- **Student t-test:** For normally distributed quantitative variables, to compare between two studied groups.
3- **F-test (ANOVA):** For normally distributed quantitative variables, to compare between more than two groups
4- **ANOVA with repeated measures:** For normally distributed quantitative variables, to compare between more than two periods or stages, and Post Hoc test (Bonferroni adjusted) for pairwise comparisons
5- **Pearson coefficient:** To correlate between two normally distributed quantitative variables
6- **Friedman test:** For abnormally distributed quantitative variables, to compare between more than two periods or stages and **Post Hoc Test** (**Dunn**'s**)** for pairwise comparisons

Results:

Table1: illustrated that more than two-thirds (80.7%) of studied nurses were in the age group of 20 to less than 30 years, .and half of the studied nurses are female. Moreover, more than half of the studied nurses (60.7%) were staff, and only 8% were head nurses. In the specialty area,

62% of the studied nurses worked in oncology, while less than a quartet (8%) were work in surgery. More than half of the studied nurses (74%) had five years of experience concerning years of experience. As regards the level of educations, less than half of the studied nurses (44.7%) had graduated from the Technical Institute of nursing and less than a quarter of the studied nurses (23.3%) had diploma degree, &(31.3) of them had a bachelor degree.

Table (1): Number and percentage distribution of studied nurses as regards their socio-demographic data

Variable	No. (n=150)	%
Age (years)		
20 > 30 years	121	80.7
30 > 40 years	29	19.3
Sex		
Female	77	51.3
Male	73	48.7
Job Title		
Staff nurse	91	60.7
Technical nurse	47	31.3
Head nurse	12	8.0
Area of specialization		
Medical	45	30.0
Surgical	12	8.0
Oncology/ Vascular	93	62.0
Experience in years		
1-5	111	74.0
6-10	31	20.7
11-15	6	4.0
16 years and above	2	1.3
Level of education		
Nursing diploma	35	23.3
Technical nursing institute graduate	67	44.7
Bachelor's degree	47	31.3
Master's degree	1	0.7
Marital status		
Single	89	59.3
Married	55	36.7
Divorced	6	4.0

Table 2: Illustrated the total score of Nurses Knowledge, attitude & practice pre, post, and during follow up period after implementing safety measures guidelines regarding care for patients with COVID-19 as regards knowledge that the total score of the nurses who had satisfactory knowledge about safety measures in the pre-implementation phase was (63.03 ± 9.45) while studied nurses had improvement in their knowledge score immediately and at two months after guideline implementation with positive statistical significance difference (p = <0.001).

Regarding attitude, the results noted that there was a highly statistically significant improvement in studied nurses' attitudes toward safety measures in caring for patients with COVID-19 immediately and after two months of implementation (p = <0.001).

Regarding practice, the results noted that there was a highly statistically significant improvement in studied nurses' practice toward safety measures using in caring patients with COVID-19 immediately and after two months of implementation (p = <0.001).

Table (2): Total score of Nurses Knowledge, attitude & practice of studied nurses as regards safety measures guidelines in caring patients with COVID-19 through intervention phases (n = 150)

Variable	Pre	Immediate Post	After 2 months Follow up	F	p
Knowledge					
Total Score					
Min. – Max.	39.0 – 76.0	53.0 – 76.0	53.0 – 76.0		
Mean ± SD.	63.03 ± 9.45	66.80 ± 7.33	70.19 ± 8.22		
% Score				41.480*	<0.001*
Min. – Max.	35.09 – 100.0	59.65 – 100.0	59.65 – 100.0		
Mean ± SD.	77.24 ± 16.58	83.86 ± 12.85	89.81 ± 14.42		
p_0		<0.001*	<0.001*		
Attitude					
Total Score					
Min. – Max.	50.0 – 120.0	88.0 – 120.0	88.0 – 120.0		
Mean ± SD.	93.43 ± 13.56	111.7 ± 13.02	109.8 ± 13.47		
% Score				119.774*	<0.001*
Min. – Max.	22.22 – 100.0	64.44 – 100.0	64.44 – 100.0		
Mean ± SD.	70.47 ± 15.07	90.79 ± 14.47	88.69 ± 14.96		
p_0		<0.001*	<0.001*		
Practice					
Total Score					
Min. – Max.	30.0 – 60.0	45.0 – 60.0	45.0 – 60.0		
Mean ± SD.	54.27 ± 8.31	58.43 ± 2.93	58.11 ± 3.77		
% Score				31.144*	<0.001*
Min. – Max.	33.33 – 100.0	66.67 – 100.0	66.67 – 100.0		
Mean ± SD.	87.27 ± 18.47	96.50 ± 6.51	95.81 ± 8.38		
p_0		<0.001*	<0.001*		

F: F test (ANOVA) with repeated measures, Sig. bet. periods was done using **Post Hoc Test Bonferroni**

p_0: p-value for comparing between **pre** periods and **each other periods**

*: Statistically significant at $p \leq 0.05$

Table3: Illustrate the effect of educational program on studied nurses Knowledge, attitude & practice regards safety measures guidelines in caring patients with COVID-19 through implementation phases.

Regarding knowledge, the results revealed that the majority (67.3 %) of studied nurses had a high scoring satisfactory knowledge (71-100 %) on using safety measures in caring for patients with COVID-19 pre & immediately after implementation of guidelines. The percentage of studied nurses who have highly scoring knowledge was slightly declined after two months of implementing guidelines. On the other hand, the results showed a significant improvement in the total level of nurses' knowledge regarding safety measures compared with before, immediate, and after 2months of implementation of teaching guidelines (p = 0.009, 0.029), respectively.

Concern attitude, the results noticed that in the pre-implementation phase, 48.7 % of studied nurses have moderate scoring (51-70 %) attitude on using safety measures in caring patients with COVID-19. While most (74.0 %) of studied nurses have high positive scoring (71-100 %) in their attitude, immediate but highly scoring knowledge slightly declined among studied nurses70.7 % after two months of implementation teaching guidelines. On the other hand, the results showed a significant improvement in nurses' attitude regarding safety measures compared with before, immediate and after 2months of implementing teaching guidelines (p = <0.001).

Relation practice, the results revealed that more than half (69.3%) percentage of total studied nurses who have a high score in practice (71-100%) on using safety measures in caring patients with COVID-19 pre-implementation of guidelines. The percentage of studied nurses who have high scores in practice was 98.0% immediately after implementation guidelines, but after 2months during the follow up the percentage of the follow-up percentage declined slightly to 94.0%. On the other hand, the results showed significant improvement in nurses' practice regarding safety measures compared with before, immediate, and after two months of implementing teaching guidelines(p= <0.001).

Table (3): Effect of educational program on studied nurses Knowledge, attitude & practice regards safety measures guidelines in caring patients with COVID-19 through intervention phases (n = 150)

Variable	Pre		Immediate Post		Follow up (after2 months)	
	No.	%	No.	%	No.	%
Knowledge						
Low (≤50%)	16	10.7	0	0.0	0	0.0
Moderate (51-70%)	33	22.0	38	25.3	42	28.0
High (71-100%)	101	67.3	112	74.7	108	72.0
$^{MH}p_0$			0.009*		0.029*	
Attitude						
Low (≤50%)	9	6.0	0	0.0	0	0.0
Moderate (51-70%)	73	48.7	39	26.0	44	29.3
High (71-100%)	68	45.3	111	74.0	106	70.7
$^{MH}p_0$			<0.001*		<0.001*	
Practice						
Low (≤50%)	7	4.7	0	0.0	0	0.0
Moderate (51-70%)	39	26.0	3	2.0	9	6.0
High (71-100%)	104	69.3	147	98.0	141	94.0
$^{MH}p_0$			<0.001*		<0.001*	

MH: Marginal Homogeneity Test

p_0: p value for comparing between **pre** periods and **each other periods**

*: Statistically significant at $p \leq 0.05$

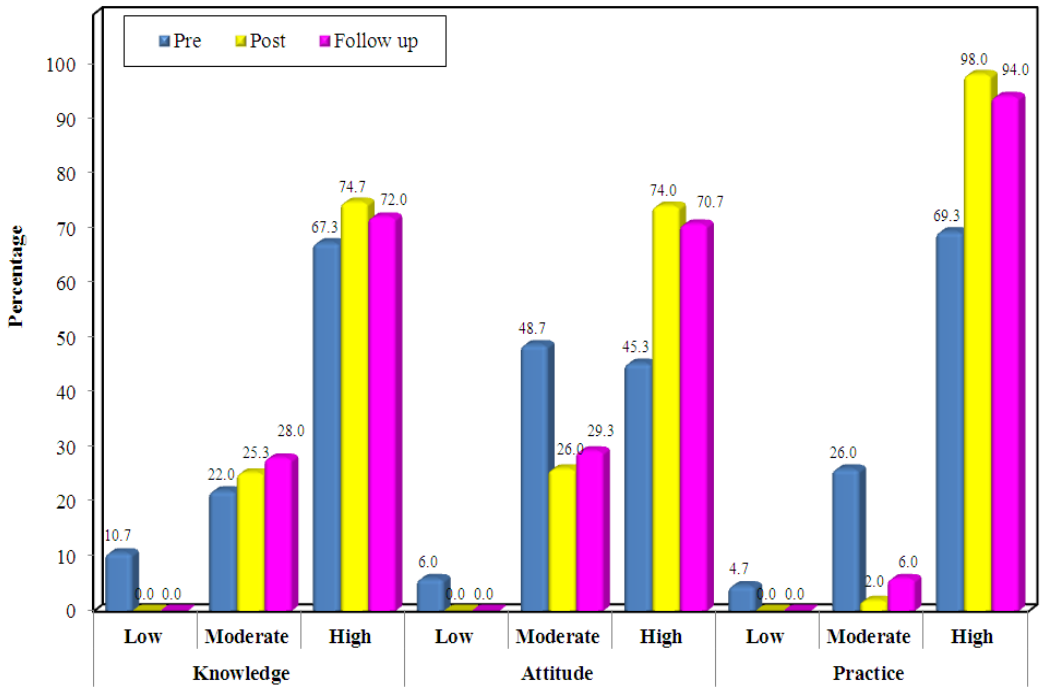

Fig (1): Level of knowledge, attitude & perceived practice of studied nurses as regards safety measures guidelines in caring patients with COVID-19 through intervention phases (n = 150)

Table 4: showed the correlation between knowledge, attitude & practice of studied nurses regarding safety measures guidelines in caring patients with COVID-19 post-implementation phase after two months passed. The results revealed (r = 0.682 P= < 0.001*). Moreover, there was a positive correlation between studied nurses' knowledge toward the safety measures guidelines and their practice (r = 0.173 P=0.035*).

Concerning attitude, the results noticed a positive correlation between studied nurses' attitude toward the safety measures guidelines in caring for patients with COVID-19 and their practice (r = 0.375 p= < 0.001*).

Table (4): Correlation between Knowledge, attitude & practice of studied nurses as regards safety measures guidelines in caring patients with COVID-19 post-implementation phases

Variable		Nurses Knowledge	Nurses Attitude	Nurses Practice
Nurses Knowledge	**r**		0.682*	0.173*
	p		<0.001*	0.035*
Nurses Attitude	**r**			0.375*
	p			<0.001*

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$

Table 5: Illustrated the correlation between overall knowledge, attitude & practice of studied nurses regarding safety measures guidelines in caring patients with COVID-19 with their socio-demographic characteristics through intervention phases.

In relation to knowledge, there was a positive correlation between total nurses' knowledge and their data immediately after guideline implementation regarding their age, job title, area of specialty, year of experience, and level of education (p=0.002,0.015, 0.014, 0.012, 0.002) respectively. After two months of the implementation, there was a positive correlation between total nurses' knowledge and personal data age, job title, and education level (0.012, 0.008, and 0.007).

Regards total attitude, the results revealed that there was a positive correlation between total nurses' attitude and their personal data immediately after and two months after guideline implementation concerning their age, job title, area of specialization, the experience of years, and level education (p=*(<0.001, 0.010, 0.004, 0.003, 0.005) respectively.

Finally, regarding overall practice, there was total nurses' practice and their personal data immediately & 2 months after guideline implementation with their age, job title, area of speciation, and educational level (p= <0.001, < 0.001, 0.003, 0.002), respectively. However, there was no significant correlation between total nurses, knowledge, attitude & practice, and sex in all implementation phases (P=0.186, 0.455, 0.348).

Table (5): Correlation between overall knowledge, attitude & practice of studied nurses as regards safety measures guidelines in caring patients with COVID-19 with their socio-demographic characteristics through intervention phases

Variable	Overall knowledge			Overall attitude			Overall practice		
	Pre	Post	Follow up after2months	Pre	Post	Follow up after 2months	Pre	Post	Follow up after 2months
Age (years)									
20 >30 years	76.24 ± 16.31	88.88 ± 14.46	86.05 ± 13.42	69.70 ± 13.94	89.15 ± 15.10	86.85 ± 15.58	87.40 ± 19.06	95.74 ± 7.01	94.88 ± 9.07
30 > 40 years	81.43 ± 17.31	96.31 ± 10.11	91.23 ± 8.58	73.72 ± 19.02	97.66 ± 8.74	96.36 ± 8.69	86.74 ± 16.03	99.69 ± 1.29	99.69 ± 1.29
t (p)	1.522 (0.130)	3.241* (0.002*)	2.579* (0.012*)	1.071 (0.291)	4.006* (<0.001*)	4.430* (<0.001*)	0.172 (0.864)	5.805* (<0.001*)	5.612* (<0.001*
Sex									
Male	77.99 ± 15.90	91.57 ± 13.31	88.40 ± 12.03	70.81 ± 15.52	91.37 ± 14.31	89.58 ± 14.59	86.20 ± 19.14	96.22 ± 6.80	95.18 ± 9.29
Female	76.45 ± 17.34	88.99 ± 14.68	85.63 ± 13.44	70.12 ± 14.68	90.18 ± 14.71	87.75 ± 15.39	88.40 ± 17.78	96.80 ± 6.22	96.47 ± 7.29
t (p)	0.568 (0.571)	1.127 (0.262)	1.329 (0.186)	0.278 (0.781)	0.501 (0.617)	0.749 (0.455)	0.727 (0.468)	0.548 (0.584)	0.941 (0.348)
Job Title									
Staff nurse	78.99 ± 15.08	91.88 ± 13.35	88.36 ± 12.21	72.53 ± 15.02	93.39 ± 13.02	91.64 ± 13.24	91.06 ± 16.40	99.15 ± 2.12	99.15 ± 2.12
Technical nurse	76.11 ± 17.65	90.03 ± 13.94	87.27 ± 12.67	68.01 ± 14.76	87.71 ± 15.41	84.52 ± 16.36	81.99 ± 18.69	92.48 ± 8.66	91.21 ± 10.71
Head nurse	68.42 ± 21.03	79.53 ± 15.45	76.32 ± 13.37	64.54 ± 14.83	83.15 ± 17.22	82.69 ± 17.16	79.26 ± 25.45	92.22 ± 8.76	88.52 ± 13.92
F (p)	2.355 (0.099)	4.319* (0.015*)	4.973* (0.008*)	2.450 (0.090)	4.406* (0.014*)	4.792* (0.010*)	5.257* (0.006*)	25.259* (<0.001*	24.914* (<0.001*
Area of specialization									
Medical	81.72 ± 16.13	95.36 ± 10.55	90.72 ± 9.73	72.22 ± 14.87	96.25 ± 10.58	94.74 ± 10.94	90.96 ± 14.09	99.21 ± 2.28	99.21 ± 2.28
Surgical	87.57 ± 6.58	88.60 ± 15.95	85.67 ± 13.95	72.04 ± 23.03	91.30 ± 14.91	87.04 ± 15.51	77.04 ± 15.38	98.15 ± 4.11	96.48 ± 9.59
Oncology/ Vascular	73.74 ± 16.71	88.10 ± 14.71	85.46 ± 13.64	69.43 ± 13.99	88.09 ± 15.40	85.97 ± 15.84	86.81 ± 20.21	94.98 ± 7.61	94.07 ± 9.56
F (p)	6.490* (0.002*)	4.364* (0.014*)	2.715 (0.070)	0.589 (0.556)	5.093* (0.007*)	5.613* (0.004*)	2.840 (0.062)	7.396* (0.001*)	6.138* (0.003*)
Experience in years									
1-5	76.28 ± 16.84	87.96 ± 14.64	85.38 ± 13.70	70.43 ± 14.40	88.16 ± 15.41	85.83 ± 15.91	87.29 ± 18.89	95.40 ± 7.21	2.97 ± 0.16
6-10	81.15 ± 15.48	96.26 ± 10.35	90.83 ± 8.60	70.72 ± 17.53	97.85 ± 8.32	96.34 ± 8.09	87.38 ± 17.92	99.57 ± 1.45	3.0 ± 0.0
11-15	75.44 ± 6.33	100.0 ± 0.0	95.32 ± 4.05	83.70 ± 18.60	100.0 ± 0.0	97.78 ± 1.92	98.52 ± 2.57	100.0 ± 0.0	3.0 ± 0.0
16-20	66.08 ± 22.83	100.0 ± 0.0	97.66 ± 4.05	62.22 ± 10.60	100.0 ± 0.0	98.89 ± 1.92	88.15 ± 18.64	100.0 ± 0.0	3.0 ± 0.0
20 years and above	89.47 ± 12.41	100.0 ± 0.0	92.98 ± 0.0	61.67 ± 0.79	100.0 ± 0.0	100.0 ± 0.0	66.67 ± 0.0	100.0 ± 0.0	3.0 ± 0.0
F (p)	1.152 (0.335)	3.338* (0.012*)	2.160 (0.076)	0.975 (0.423)	3.845* (0.005*)	4.307* (0.003*)	0.900 (0.466)	3.291* (0.013*)	0.262 (0.902)
Level of education									
Nursing diploma	77.14 ± 14.12	85.11 ± 16.10	83.01 ± 15.10	67.59 ± 15.40	86.95 ± 16.08	85.30 ± 16.54	84.13 ± 21.51	92.89 ± 9.24	92.76 ± 9.57
Technical nursing institute graduate	77.51 ± 16.71	88.85 ± 14.60	85.55 ± 13.01	71.77 ± 15.22	88.46 ± 15.44	86.0 ± 15.79	87.46 ± 18.28	96.32 ± 6.12	94.83 ± 9.74
Bachelor's degree	76.86 ± 18.48	96.08 ± 8.86	92.09 ± 8.62	70.95 ± 14.74	96.78 ± 9.35	94.80 ± 10.25	89.79 ± 16.12	99.39 ± 1.29	99.39 ± 1.29
Master's degree	80.70 ± 0.0	100.0 ± 0.0	92.98 ± 0.0	62.22 ± 0.0	100.0 ± 0.0	100.0 ± 0.0	66.67 ± 0.0	100.0 ± 0.0	100.0 ± 0.0
F (p)	0.029 (0.993)	5.049* (0.002*)	4.248* (0.007*)	0.706 (0.550)	4.524* (0.005*)	4.403* (0.005*)	1.048 (0.373)	7.695* (<0.001*)	5.195* (0.002*)

t: Student t-test p: p value for comparing between the different categories *: Statistically significant at $p \leq 0.05$

Discussion:

Nurses' knowledge and attitude are essential indicators of health care system performance. This current study revealed that most participants were in the age group between 20 to less than 30. Around half of them were females and working as staff nurses. However, more than half of them were work in the oncology and vascular department and had five years of working experience. Moreover, less than half of the participants had graduated from the Technical Institute of nursing.

Knowledge is a precondition for founding preventive ideas, creating positive attitudes, and advocating positive behaviors. Regarding knowledge, the current findings showed that the mean knowledge score of the nurses who had a satisfactory level in the pre-implementation phase was (63.03 ± 9.45). In contrast, it had improved immediately and two months after implementation of the guidelines (66.80 ± 7.33, 70.19 ± 8.22) respectively. These results reflect the effectiveness of the implementation of the guidelines. Furthermore, two-thirds of nurses had a highly satisfactory knowledge score on using safety measures in caring for patients with COVID-19 pre-implementation. However, the percentage of studied nurses who had high knowledge scores increased immediately after the implementation while it slightly declined after two months of implementation of guidelines.

Concerning the attitude of studied nurses, in the pre-implementation phase, less than half of the studied nurses had a moderate attitude score using safety measures in caring for patients with COVID-19. After implementing the guidelines, more than two-thirds had a high positive attitude, scoring immediately, but it slightly declined after two months of implementing teaching guidelines.

Additionally, knowledge and attitude do not provide anticipated consequences for the control of COVID-19 infection without acceptable practice. Regarding the nurses' practice, the results revealed that the nurses who practice using safety measures in the pre-implementation phase were (54.27 ± 8.31). Whereas studied nurses had improved in their practice immediately (58.43 ± 2.93) but after two months of implementation, it slightly decreased to became (58.11 ± 3.77). These findings explain that level of practice domains could be affected by the level of knowledge and attitude.

Besides, The results showed significant improvement in the total level of nurses' knowledge, attitudes toward attitude, and practice towards measures that can be followed to prevent the transmission of the disease compared with before, immediate, and after two months of implementing the teaching guidelines ($p = < 0.001$). These findings may be applicable because all medical health sectors, especially nurses, were looking for information about the COVID-19, transmission mode, and prevention measures during the pandemic. Besides, this highly positive attitude explains the excellent level of knowledge. However, this decline might be related to the limited number of infection control material, supplies and increasing COVID-19 patients.

The current findings are congruent with Huynh et al. (2020), who assessed the knowledge and attitude toward COVID-19, in which the result showed good knowledge. Moreover, the results are along the lines of Saqlain et al. (2020), who conducted a study in Pakistan about KAP and perceived barriers on 105 nurses out of 414 health care workers found most of them had good knowledge. Giao et al. (2020) mentioned 88.4% of participants had sufficient knowledge regarding COVID-19. Shi et al. (2020) also said that 89.51% of health-care providers had appealed good knowledge. Present findings afford confidence in health-care professionals' knowledge regarding viral symptoms, transmission mode, and preventive measures. This finding is of more significance in the current scenario.

Consequently, HCPs must be aware of all the updates and take preventative measures to prevent the infection. Zhong et al. (2020) found sufficient knowledge, and the doctors showed higher knowledge scores than nurses. Moreover, Wahed et al. (2020) assessed the knowledge, attitudes, and perception of health care providers regarding COVID‑19 at different types of hospitals in Fayoum, Egypt. They found a mean knowledge score of 18.5 ± 2.7 with an 80.4% rate, and a positive attitude

was observed among allied health professionals more than physicians. Another study conducted in Iran observed that 99% of participants had excellent knowledge of disease and transmission mode, but only 86% had sufficient knowledge (Maleki et al.; 2020). This finding appears in line with other studies performed in Pakistan, China, and Vietnam (Saqlain et al. 2020, Zhang et al.; 2020, Giao et al.; 2020). One more study in Ugandan had stated that 70% had a sufficient level of knowledge (Olum; 2020). These findings also congruent with Retnaningsih et al. (2020), who reported the factors were affecting COVID-19 transmission prevention practice are knowledge and attitude. Rabbani and Al Saigul (2020) in Saudi Arabia mentioned there were good infection control practices among the HCWs.

On the other hand, one more study performed along with nurses mentioned that 56.5% have sufficient knowledge about symptoms, way of transmission, and treatment (Nemati, Ebrahimi & Nemati; 2020). Another research from the United Arab Emirates on the health care workers' knowledge and perception of COVID-19 reported insufficient knowledge about the disease. They rationalized that might be related to the timing of surveying at the beginning of the pandemic, and they recommended urgent educational training (Bhagavathula et al.,2020). At the same time, Bhagavathula et al.,2020 stated that most HCPs positively affect COVID-19. Furthermore, Rabbani and Al Saigul (2020) in Saudi Arabia mentioned that knowledge was better among physicians than non-physicians.

Moreover, attitudes and practices were proportional between the groups. They noticed poor knowledge about the causative agent and role of antibiotics for COVID-19, but the transmission mode and prevention were good knowledge. The concerns and fears among the participants were extensive. Generally, interventions are required to enhance the knowledge and address the worries of HCW.

Additionally, the current result showed a positive, statistically significant correlation between studied nurses' knowledge of the safety measures guidelines and their attitude ($p= <0.001$). Moreover, there was a positive correlation between nurses' knowledge and their practice of the safety measures guidelines ($p= 0.035$). Furthermore, the results noticed a positive correlation between studied nurses' attitude toward the safety measures guidelines in caring for patients with COVID-19 and their practice ($p= < 0.001$). These findings explain that knowledge level could affect the participants' attitude level and behavioral practices that match Bloom's three educational activities domains, including cognitive knowledge, affective attitude, and psychomotor skills.

Additionally, there was a positive correlation between overall nurses' knowledge, attitudes, practice, and personal data immediately after guidelines implementation related to their age, job title, area of working specialty, year of experience, and education level. In contrast, there was no significant correlation between total nurses, knowledge, attitude & practice, and sex in all implementation phases ($P= 0.18, 0.455, 0.348$).

The present study finding was in agreement with Saqlain et al. (2020), who found a positive correlation between the three domains, including knowledge, attitude, and practice. Moreover, Zhang et al. (2020) mentioned that knowledge affects the practice of preventive measures and that Kamata et al. (2020) noted there is a strong relationship between knowledge and practical actions.

On the other side, Huynh et al. (2020) mentioned a negative correlation between knowledge and attitude scores ($r = - 0.21$, $P= < 0.001$). They concluded that most HCWs had good knowledge and a positive attitude and required an additional education intervention toward COVID-19. In contradicting with the current study, There was no statistically significant correlation between attitude and the socio-demographic variable (age, sex, hospital, qualification, and educational level) in Uganda's study (Olum et al. 2020). Zhang et al. (2020) mentioned sex is significantly related to the practice of preventive measures. Retnaningsih et al. (2020) found that women have a greater chance to behave better in preventing actions than men. In general, participated nurses had high knowledge about COVID-19 and a positive attitude towards

using protective measures and limiting their spread.

Conclusion:

The present study concluded that the educational program regarding safety measures guidelines helped improve the nurses' knowledge, attitude, and practice toward COVID-19 patients.

Recommendations:

Continuous educational and clinical sessions about infection control and universal percussion should be conducted to improve nurses' clinical practices and knowledge for the caring patient with COVID-19. The health care sector should run a periodical training program regarding the nursing care protocol for patients with COVID-19. Efforts should be made to improve nurses' knowledge, attitude, and practices through periodical follow-up.

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