

The Efficacy of an Educational Intervention Regarding COVID-19 Vaccination on Nurses' Knowledge, Attitude, and Acceptance

Wessam Fathy Mohamed Gabr⁽¹⁾, Heba Ali Hamed Mohamed⁽²⁾, Rania Mohamed Gad El-Bastwese⁽³⁾
and Fatma Abdel Halim Mostafa⁽⁴⁾

(1) Lecturer of Medical-Surgical Nursing, Faculty of Nursing, Beni-Suef University, Egypt

(2,3) Lecturer of Community Health Nursing, Faculty of Nursing, Mansoura University, Egypt

(4) Lecturer of Medical- Surgical Nursing, Faculty of Nursing, Mansoura University, Egypt

(1)Email: Wesam011128@nursing.bsu.edu.eg, ORCID ID: <https://orcid.org/0000-0002-5351-4529>

(2) Email: hebaali8@mans.edu.eg

(3) Email: Raniaa@mans.edu.eg

(4) E-mail: fatmahalim@mans.edu.eg, ORCID ID: <https://orcid.org/0000-0002-0465-4066>

Abstract

The efficiency of public health initiatives focused on eradicating infectious diseases has been seriously threatened by the COVID-19 vaccination. The current study aimed to evaluate the efficacy of educational intervention regarding COVID-19 vaccination on nurses' knowledge, attitude, and acceptance. The study was conducted at medical outpatient clinics affiliated with Mansoura University Students Hospital, Mansoura, Egypt. A quasi-experimental research design was used (pre-post educational intervention). A convenient sample of 150 nurses was included in the study. The study was collected by three tools to assess demographic and occupational characteristics of nurses, medical health history and their knowledge, attitude and acceptance. The study's findings revealed that 82.7% of the studied nurses had a satisfactory total knowledge score level in the post-test compared to (4.7%) in the pre-test. The differences observed were highly statistically significant at (p value<0.001). Moreover, the total mean score of the studied nurses' acceptance significantly improved from 3.35 ± 1.73 to 6.09 ± 1.36 pre and post at a p -value <0.001. Conclusion: The application of the educational intervention showed a significant improvement in nurses' levels of knowledge, attitude, and acceptance regarding Covid-19 Vaccination. Well-structured training programs targeting all nurses in Egypt must be launched to improve their knowledge and attitude toward Covid-19 Vaccination.

Keywords: Acceptance, Attitude, COVID-19 vaccination, Educational intervention, Knowledge and Nurses

Introduction

In Wuhan, China, instances of pneumonia with an unclear origin were reported at the end of 2019. The disease was given the name COVID-19 after the novel coronavirus was found to be the pathogenic agent causing it. The virus quickly spread over the world, and classified by WHO as a pandemic in March 2020 (Gennaro et al., 2020).

Severe pneumonia, failure of kidney, and even death have all been linked to COVID-19 infections. Also fever, myalgia, a dry cough, dyspnea, and fatigue. (Abdelhafiz et al., 2020). According to various studies, COVID-19 is mainly spread by respiratory droplets during sneezing or coughing (Asadi, Bouvier, Wexler & Ristenpart, 2020).

As of March 2021, there has been 116,736,437 confirmed cases worldwide, with 2,593,285 deaths (WHO, 2021). Even though COVID-19 has peaked in the majority of European and American countries, it is still rapidly expanding over most of Africa (Olum, Chekwech, Wekha, Nassozi, & Bongomin, 2020). The high infection incidence in Africa combined with poverty, restricted access, and insufficient of health facilities (Osseni, 2020).

Healthcare specialists have been surprised by COVID-19's wide spread with variable manifestations resulting in hospitalization and death. COVID-19 has caused an unparalleled worldwide health crisis (Temsah et al., 2021). Globally, significant efforts have been made to detect new cases and rules to control viral transmission. The research intended to find medications for treatment, while many laboratories worked on developing vaccines to

prevent disease (**Sanders, Monogue, Jodlowsk & Cutrell, 2020**).

Vaccination is widely recognized in the scientific community as a critical step in dealing with the epidemic. Vaccination saves about 2–3 million lives each year (**Fakonti, Kyprianidou, Toumbis & Giannakou, 2021**). The development of a vaccine against the virus can be seen as a defining moment in the attempt to stop the spread of the epidemic and restore normalcy to daily life. At least seven distinct vaccines have been disseminated internationally over three platforms as of February 18, 2021 (**WHO, 2021**).

More than 40 novel vaccines are currently in clinical testing, and some of them, like the Pfizer BioNTech and Moderna vaccines, have received FDA Emergency Use Authorization (EUA) and are being used in multiple countries. However, coverage rate is a crucial factor in determining vaccination success (**Forni & Mantovan, 2021**). The composition, storage requirements, and effectiveness of these vaccinations vary (70.4 percent -95 percent). There have been no major side effects associated with the vaccinations (**Ferbeyre & Vispo, 2020**).

Egypt got the primary vaccine of Sinopharm Chinese. Egypt's immunization program was launched in January, with medical teams initially stationed at quarantine, followed by medical staffs, and the establishment of website for registration of high-risk populations to obtain immunization. Late in January, Egypt got the second batch of AstraZeneca vaccines under the COVID19 Vaccines Global Access (COVAX) Facility (**WHO, 2021**).

Health care providers (HCPs) are more likely to become sick since they operate in a setting where they are exposed to potentially infected people. COVID-19 has claimed the lives of many HCPs around the world (**Gebreselassie et al., 2021**). Nursing is considered the first-line of defense in the prevention and caring of any disease including COVID-19 (**WHO, 2020**). Nurses have been identified as a priority target group for COVID-19 vaccines because they are still on the front lines of the fight against the new virus, even if it means risking their lives (**Nguyen et al., 2020**).

Due to the unpredictable nature of the COVID-19 vaccination, various perspectives, directions, and attitudes have evolved. Due to these differences, governments and public health experts are faced with challenges. The WHO has ranked vaccine fear as global health challenges. Vaccine reluctance is viewed as a hurdle to achieving herd immunity in the struggle to contain this global pandemic (**WHO, 2021**). "Vaccine hesitation" is the term for the delay in accepting or the refusal despite the vaccination availability. Hesitancy was influenced by comfort, convenience, the vaccine trust or provider, complacency, and challenges with access factors (**Sallam, 2021**).

Misinformation and untruths concerning the COVID-19 vaccinations spread and were often debated on social media even before the announcement of a successful immunization. Many vaccines contain mRNA genetic material, according to some, who argue that this can change human DNA. Furthermore, concerns regarding the COVID-19 vaccinations' long-term effects and quick development have apparently surfaced among medical specialists as well (**Mohamed et al., 2021**).

Vaccinating more than 82 percent of the population is critical for achieving the necessary herd immunity to terminate the pandemic. This requires vaccine acceptance and low hesitancy level (**Sanche et al., 2020 and Shekhar, et al., 2021**). The research on the vaccination acceptability among health teams is currently limited. Few studies conducted among health teams, only a low numbers are accepting COVID-19 vaccine. In China, nurses' refusal to undergo COVID-19 vaccine was also documented in surveys (**Fakonti et al., 2021**).

The public's attitude regarding vaccines was ambiguous and influenced by a variety of circumstances, making herd immunity difficult to achieve. Health teams will be critical to the success of vaccination among the public (**Li et al., 2021**). Also are a source of vaccine information that can help people follow vaccination recommendations more closely. As a result, healthcare staff' responsibility in advising patients and communities, as well as role modelling behavior, becomes increasingly vital. Meanwhile, most health professionals are

wary of the COVID 19 vaccine because they are concerned about its safety, which they believe evolved in a short amount of time (Alle & Oumer 2021).

Community health nurses and medical surgical nurses are advocates, caregivers, and educators. Nurses assist people in making educated decisions and provide crucial nursing care when they are at their most vulnerable (Gordon et al., 2021). If nurses have a better understanding of the COVID-19 vaccine, they can use their personal experience to teach their relatives and friends, patients they will serve once they leave the hospital, and the public about the necessity of getting the vaccine. To overcome barriers and ensure optimal immunization coverage, it is critical to understand the nurse's knowledge, attitudes, and acceptance of COVID-19 vaccination.

Significance of the study:

The COVID-19 outbreak is extremely dangerous to human health. There have been 179,407 confirmed cases in Egypt as of February 2021, with 10,443 deaths. The high transmissibility, asymptomatic, large numbers of patients with modest symptoms, and super-spreading episodes may all contribute to the rapid spread (WHOa, 2021).

Everyone, regardless of age, must lead healthy lifestyles and advance wellbeing in order to achieve sustainable development. The health of millions of people had greatly improved before the outbreak. To address the growing health issues, more work is needed. The exceptional and quick progress of COVID-19 vaccines provides "great optimism" that the terrible epidemic can be stopped, but everyone must be reached "as quickly as possible" globally (United Nations, 2021).

In Egypt, few studies have looked at COVID-19 vaccination acceptance among potential HCWs. Medical students were included in two trials, and both found vaccine acceptability to be lower than in Western countries but greater than in African countries. To date, there have been few published reports on HCWs' uptake of COVID-19 vaccinations (Saied et al., 2021). Therefore, the researchers conducted this study to evaluate the efficacy of educational intervention regarding Covid-19

vaccination on nurses' knowledge, attitude, and acceptance.

Aim of the study:

This study aimed to evaluate the efficacy of educational intervention regarding COVID-19 vaccination on nurses' knowledge, attitude, and acceptance.

Research hypotheses:

1. The level of knowledge among nurses regarding COVID-19 vaccination will be improved after applying the educational intervention.
2. The attitude of nurses regarding COVID-19 vaccination will be improved after applying the educational intervention.
3. The percentage of nurses who are willing to receive the COVID-19 vaccine will be increased after applying the educational intervention.

Subjects and methods:

Research design

A quasi-experimental one-group pre-post test design was utilized. A quasi-experimental design is an empirical study as it estimates the causal impact of an intervention on its target population (Gopalan, Rosinger & Ahn, 2020).

Setting

This study was conducted at medical outpatient clinics affiliated with Mansoura University Students Hospital, Mansoura, Egypt. It includes 12 outpatient clinics on the second floor at the medical services complex building and 18 medical clinics at the university faculties. These clinics provide both curative and preventive health services to Mansoura University students.

Sampling

A convenient sample of 150 nurses who were working in the previously mentioned setting and accepted to participate in the study was selected at the time of the study.

Tools of data collection:

Three tools were used for data collection.

Tool I: Self-administered Structured Questionnaire.

It was developed by the researcher after reviewing the relevant literature and compromised of three parts:

Part one: Demographic and occupational characteristics of nurses, such as age, sex, educational level, residence, years of experience, and attendance at workshops or training programs concerning COVID-19 vaccination.

Part Two: Medical health history of the nurses such as previous COVID-19 infection and the presence of medical problems.

Part Three: Nurses' level of knowledge about the COVID-19 vaccination. It was developed by the researchers based on related literature by **UNICEF, (2021)** and **WHO, (2021)**. This part was classified into (16) main categories, that covered multiple-choice questions related to COVID-19 vaccination which included; the definition and advantages of the COVID-19 vaccine; the most widely available COVID-19 vaccines, and their routes of administration, efficacy, and mechanism of action; the storage temperature of each vaccine; possible side effects following the COVID-19 vaccination; steps for receiving the COVID-19 vaccine; categories for eligible and non-eligible recipients; and the preventive measures to be followed after the COVID-19 vaccination.

The scoring system

The scoring system was determined; the correct answer was marked (1) and an incorrect answer or didn't know was marked (zero). The total scores ranged from (0-67 marks) Mean and SD were used to determine the difference in knowledge scores. According to **Elhadi et al., (2021)** cut-off score for adequate knowledge, the total knowledge score was categorized into two levels:

Unsatisfactory < 75 % of the total score.

Satisfactory ≥ 75% of the total score.

Tool II: Nurses' Attitude Self-Administered Scale:

This scale was adopted from **Kumari et al, (2021)** to assess nurses' attitudes toward COVID-19 vaccination. This tool consisted of sixteen statements requiring a response on a five-point Likert- scale with five continuums. The scale included nurses' opinions related to certain factors that motivated them and might be responsible for their decision to take the vaccine such as safety, efficacy, availability of vaccine free of cost, and health care professional recommendation. In addition, the scale included statements about several vaccine concerns that create doubt in nurses' minds to get the vaccine.

The scoring system

A scoring system was used to quantify nurses' attitudes ranging from 1 to 5, where 5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, and 1 = strongly disagree regarding the Covid-19 vaccination. If the statement was negative, the scoring system was reversed. The Mean and SD were used to determine the difference in attitude scores.

Tool III: Nurses' Acceptance Self-Administered Scale:

This scale was adopted from **Kumari et al, (2021)** to assess nurses' acceptance of the COVID_19 vaccination. It is composed of four statements requiring a response on a three-point Likert scale with three continuums (yes, not sure, and no). The scale included items about the willingness of the nurses to take the vaccine even if they have to pay for it or even if its protection lasts for short time and whether they encourage their families to take the vaccine.

The scoring system

A scoring system was used to quantify nurses' acceptance ranging from (0 to 2, where 2 = yes, 1= not sure = and zero = no) regarding COVID-19 vaccination. The Mean and SD were used to determine the difference in acceptance scores and higher mean scores indicate high acceptance.

Validity and Reliability

Content validity was tested by a jury of 5 experts in the fields of Medical-Surgical

Nursing, and Community Health Nursing. The tools were reviewed by the experts to improve their clarity, relevance, completeness, simplicity, and applicability; only minor changes were made, and the final form was developed. Translation and the back-translation approach were employed to confirm the validity of tool I. The proposed tools' testing reliability was calculated using the Chronbach's Alpha test, which measures the tools' internal consistency. Chronbach's Alpha test for attitude and acceptance scales was determined to be 0.86.

Pilot Study

A pilot study was carried out on 10% (17) of the participant nurses before data collection to test the applicability and feasibility of the tools and make necessary modifications before conducting the main study. Nurses who were included in the pilot study were excluded from the study sample

Field Work

Data were collected within 3 months, from the first of May 2021 to the end of July 2021. It was collected throughout three phases as follows:

Phase I: Assessment phase:

The preliminary data concerning the nurses' knowledge, attitude and acceptance regarding COVID_19 vaccination was gathered during this phase after the aim of the study was clarified. The researchers collected data from nurses three days a week from 9 a.m. to 12 p.m. Approximately, 25-35 minutes were taken to complete the data collection tools.

Phase II: Implementation phase:

Based on the findings of the assessment phase, in addition to literature, the educational booklet was developed by the researchers in simple Arabic language with illustrative pictures and diagrams based on the WHO guidelines and the Egyptian Ministry of Health and Population. During this phase, nurses were divided into small groups (10 nurses/session). Each group received two educational sessions; the time allocated for each session was 45-50 minutes. The total number of groups was 15 groups, and the total time for completing the educational session was 2 hours for each group.

An explanation of the designed COVID-19 vaccination educational intervention using a PowerPoint presentation and discussion was conducted during the session.

At the beginning of each session, general and specific objectives were illustrated. During the session, each group received the same educational intervention content using the same teaching strategies and handouts. The terms used by the researchers were plain, brief, and simple. Nurses were asked questions related to the topics addressed in the session before ending to ensure that they understood the instructions and to strengthen their knowledge. The researchers re-emphasized any points that were missed or vague.

The content of the COVID-19 vaccine educational booklet included the following: the definition, advantages, the most widely available vaccines, routes of administration, efficacy, and mechanism of action; the storage temperature of each vaccine; possible side effects; steps of vaccine receiving; categories for eligible and non-eligible recipients; and the measures to be followed after the vaccination.

Phase III: Evaluation phase (post-educational intervention):

Nurses' knowledge, attitudes, and acceptance were evaluated after one month of the educational intervention. A comparison between nurses' knowledge, attitude, and acceptance scores was done pre and post the educational intervention.

Ethical Considerations

Ethical approval was granted from the responsible authorities of the Faculty of Nursing at Mansoura University and Official permission was obtained from Mansoura University Student Hospital authorities to carry out the study after providing details about the nature of the study. Before beginning the data collection process, the study's purpose was explained to the qualified nurses in order to get their informed consent. The nurses were notified that their participation in the study was completely voluntary and that they could end it whenever they wanted without facing any consequences. They were given assurances that their privacy and anonymity would be

respected. Ethics, values, culture, and beliefs were all held in high regard.

Statistical analysis of the data:

Version 20.0 of the IBM SPSS program was used to analyze the data. The demographic details and information sources of the participants were shown in terms of quantity and percentage. The distribution's normality was confirmed using the Kolmogorov-Smirnov test. Quantitative data were represented as range (minimum and maximum), mean, standard deviation, and median. At a level of significance of 5%, the significance of the obtained results was determined. were dispersed weirdly. For categorical data, the Chi-square test was employed to compare distinct groups. When more than 20% of the cells have an expected count of less than 5, adjust for chi-square using Fisher's Exact or Monte Carlo methods. The McNemar test was used to gauge each stage's significance. The Wilcoxon signed ranks test was used to compare two time periods and evaluate quantitative data with an anomalous distribution. The relationship between two numerical variables with odd distributions was evaluated using the Spearman coefficient. The significance level was determined at $P < 0.05$.

Results

Table (1) clarified that the mean age of the studied sample in years was 29.97 ± 7.13 and 100% were females. 40% of the studied sample has a bachelor's degree in nursing, their mean years of experience was 7.84 ± 5.36 , and 96.7% didn't attend any courses about the COVID-19 vaccines.

Table (2) illustrated that 9.3% of studied nurses had bronchial asthma and 50% of the

studied nurses were exposed previously to COVID-19 infection.

Table (3) showed the total mean score of nurses' COVID-19 vaccination knowledge increased significantly from 24.58 ± 9.15 pre-intervention to 52.55 ± 5.49 post-intervention. There were highly statistically significant differences in total and subtotal mean scores of nurses' knowledge between pretest and post-intervention at $p < 0.001$.

Figure (1) portrayed the effect of the educational intervention on total knowledge score levels among the studied nurses. 82.7% of the studied nurses had a satisfactory total knowledge score level in the post-test compared to (4.7%) in the pre-test. The differences observed were highly statistically significant at (p value < 0.001).

Table (4) showed that the total mean score of nurses' attitude significantly improved from 35.69 ± 5.42 to 56.65 ± 5.90 pre and post-application of the educational intervention at a p -value < 0.001 .

Table (5) displayed that the total mean score of the nurses' acceptance significantly improved from 3.35 ± 1.73 to 6.09 ± 1.36 pre and post-application of the educational intervention at a p -value < 0.001 .

Table (6) revealed that there was a statistical relation between nurses' residence and their knowledge level at post-test ($P < 0.05$) while, no statistically significant differences were found between demographic characteristics, including gender, age, qualifications, attending training courses, and nurses' total knowledge score levels pre and post intervention, where ($P > 0.05$).

Table (1): Frequency distribution of demographic & occupational characteristics for the studied nurses (n= 150)

Items	N	%
Gender		
▪ Female	150	100
Age (years)		
▪ <25	40	26.7
▪ 25-<35	72	48
▪ 35-<45	32	21.3
▪ ≥45	6	4
Mean ± SD	29.97 ± 7.13	
Residence		
▪ Urban	98	65.3
▪ Rural	52	37.7
Qualifications		
▪ Diploma in nursing	58	38.7
▪ Technical nurse	32	21.3
▪ Bachelor's degree in nursing	60	40
Years of experience		
▪ <10	56	37.3
▪ 10-<15	74	49.3
▪ ≥15	20	13.3
Mean ± SD	7.84 ± 5.36	
Attending training courses about Covid-19 Vaccines		
▪ Yes	5	3.3
▪ No	145	96.7

Table (2): Distribution of the Studied Nurses according to their Health History (n=150).

Item	n	%
Health problems		
▪ Hypertension	10	6.7
▪ Diabetes Mellitus	9	6
▪ Immunological diseases	4	2.7
▪ Bronchial asthma	14	9.3
Previous Covid 19 infection exposure		
▪ Yes	75	50
▪ No	43	28.7
▪ Not sure	32	21.3

Table (3): Mean differences of Studied nurses knowledge scores pre and post-intervention application

Nurses' knowledge	Pre intervention	Post intervention	Z	P. Value
	Mean \pm SD	Mean \pm SD		
Definition of vaccine	0.74 \pm 0.44	0.93 \pm 0.10	4.902*	<0.001*
Benefits of Covid19 vaccination	1.20 \pm 0.90	2.49 \pm 0.50	9.047*	<0.001*
Most common Covid 19 vaccines	1.64 \pm 1.25	4.02 \pm 0.95	10.051*	<0.001*
Routes of administration	0.75 \pm 0.44	0.90 \pm 0.10	5.488*	<0.001*
Pfizer vaccine	0.96 \pm 1.06	3.40 \pm 1.21	9.295*	<0.001*
Moderna vaccine	0.85 \pm 1.01	2.68 \pm 1.24	9.495*	<0.001*
Sinopharm vaccine	1.18 \pm 1.07	3.54 \pm 1.25	9.632*	<0.001*
Astrazenica/ Oxford vaccine	1.05 \pm 1.02	3.11 \pm 1.17	9.769*	<0.001*
Gamalaya vaccine	1.01 \pm 1.09	2.29 \pm 1.05	8.118*	<0.001*
Side effects that might occur after vaccination	2.75 \pm 1.83	5.23 \pm 0.34	9.985*	<0.001*
Time of monitoring the patient after vaccination	0.21 \pm 0.41	0.51 \pm 0.50	5.267*	<0.001*
Achieving immunity against covid19 vaccine	0.49 \pm 0.50	0.65 \pm 0.48	4.796*	<0.001*
Steps for receiving vaccine	1.54 \pm 1.15	2.69 \pm 0.55	8.202*	<0.001*
Eligible Population	1.86 \pm 1.03	2.81 \pm 0.39	7.987*	<0.001*
Non-Eligible population	3.95 \pm 2.56	9.09 \pm 1.57	10.455*	<0.001*
Protective measures after vaccination	3.36 \pm 1.55	5.42 \pm 0.15	9.662*	<0.001*
Total Mean knowledge	24.58 \pm 9.15	52.55 \pm 5.49	10.515*	<0.001*

Z: Wilcoxon signed ranks test

p: p-value for comparing the pre and post

*: Statistically significant at $p \leq 0.05$

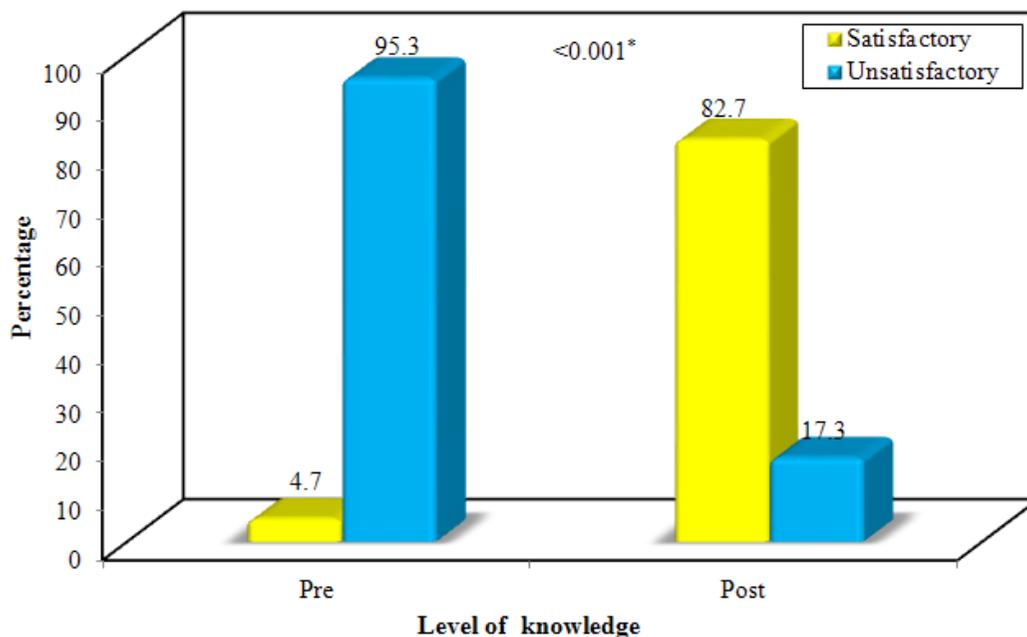
Figure (1): Distribution of the Studied Nurses according to their Total Knowledge Score Levels regarding the COVID-19 Vaccine Pre- and Post-intervention (n = 150).

Table (4): Distribution of Studied Nurses according to their Attitude towards COVID-19 Vaccination at Pre and Post intervention

Attitude items	Pre intervention										Post intervention										MH	P value
	Strongly Disagree		Disagree		Not Sure		agree		Strongly Agree		Strongly Disagree		Agree		Not Sure		Agree		Strongly Agree			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		
There is no harm in taking COVID-19 vaccine.	30	20.0	65	43.3	16	10.7	24	16.0	15	10.0	11	7.3	23	15.3	25	16.7	51	34.0	40	26.7	305.5	<0.001 ^a
There is benefits from the COVID-19 vaccine in preventing Covid-19 infection.	28	18.7	86	57.3	23	15.3	7	4.7	6	4.0	10	6.7	8	5.3	28	18.7	50	33.3	54	36.0	371.5	<0.001 ^a
The COVID-19 vaccination is free to obtain.	35	23.3	51	34.0	44	29.3	17	11.3	3	2.0	15	10.0	19	12.7	31	20.7	45	30.0	40	26.7	316.0	<0.001 ^a
Healthcare professional doctors recommend taking vaccine.	43	28.7	36	24.0	40	26.7	20	13.3	11	7.3	15	10.0	24	16.0	24	16.0	45	30.0	42	28.0	315.5	<0.001 ^a
The advantages of receiving the COVID-19 vaccine outweigh the hazards.	51	34.0	50	33.3	33	22.0	12	8.0	4	2.7	20	13.3	12	8.0	27	18.0	36	24.0	55	36.7	333.0	<0.001 ^a
Taking COVID-19 vaccine is societal responsibility.	43	28.7	61	40.7	19	12.7	20	13.3	7	4.7	10	6.7	20	13.3	39	26.0	39	26.0	42	28.0	309.0	<0.001 ^a
The government has disclosed enough information about the vaccine's efficacy and safety.	53	35.3	36	24.0	19	12.7	23	15.3	19	12.7	14	9.3	21	14.0	33	22.0	42	28.0	40	26.7	268.0	<0.001 ^a
Many people are taking COVID-19 vaccine.	53	35.3	38	25.3	25	16.7	30	20.0	4	2.7	13	8.7	24	16.0	37	24.7	40	26.7	36	24.0	270.0	<0.001 ^a
Covid-19 vaccine will help in eradicating COVID-19 infection.	59	39.3	34	22.7	22	14.7	25	16.7	10	6.7	23	15.3	18	12.0	32	21.3	40	26.7	37	24.7	261.5	<0.001 ^a
My role model/ senior doctor /scientists have taken COVID-19 vaccine.	69	46.0	41	27.3	20	13.3	13	8.7	7	4.7	19	12.7	29	19.3	26	17.3	46	30.7	30	20.0	266.5	<0.001 ^a
There's a probability I won't get easy access to COVID-19 vaccination.	12	8.0	9	6.0	23	15.3	49	32.7	57	38.0	34	22.7	28	18.7	40	26.7	27	18.0	21	14.0	237.5	<0.001 ^a
I could get quick, severe side effects with the COVID-19 vaccination.	8	5.3	14	9.3	21	14.0	63	42.0	44	29.3	40	26.7	30	20.0	33	22.0	28	18.7	19	12.7	243.5	<0.001 ^a
The COVID-19 vaccine can be fake or malfunctioning.	0	0.0	7	4.7	32	21.3	68	45.3	43	28.7	74	49.3	50	33.3	15	10.0	8	5.3	3	2.0	435.5	<0.001 ^a
The COVID-19 vaccine was quickly created and authorised.	0	0.0	7	4.7	33	22.0	69	46.0	41	27.3	78	52.0	50	33.3	15	10.0	4	2.7	3	2.0	446.0	<0.001 ^a
The covid19 vaccine might have some unanticipated long-term impacts on me.	7	4.7	16	10.7	23	15.3	41	27.3	63	42.0	36	24.0	26	17.3	39	26.0	28	18.7	21	14.0	326.5	<0.001 ^a
The COVID-19 vaccination is being marketed by pharmaceutical companies for financial gain.	10	6.7	27	18.0	21	14.0	33	22.0	59	39.3	40	26.7	37	24.7	32	21.3	18	12.0	23	15.3	268.5	<0.001 ^a
Total mean score	35.69 ±5.42										56.65 ±5.90										10.628	<0.001

Table (5): Distribution of Studied Nurses according to their Acceptance of COVID-19 Vaccine Pre and Post intervention

Nurses' Acceptance	Pre						Post						MH	P value
	No		Not sure		Yes		No		Not sure		Yes			
	n	%	n	%	n	%	n	%	n	%	n	%		
Willing to take the COVID-19 vaccine.	43	28.7	25	16.7	82	54.7	7	4.7	10	6.7	133	88.7	95.50 [†]	<0.001 [*]
Willing to get the COVID-19 vaccine even its protection last for short time.	25	16.7	63	42.0	62	41.3	93	62.0	29	19.3	28	18.7	101.0 [*]	<0.001 [*]
I'm ready to pay for the COVID-19 vaccine in order to get it.	81	54.0	57	38.0	12	8.0	62	41.3	37	24.7	51	34.0	70.0 [*]	<0.001 [*]
I'll advise my family and friends to receive the COVID-19 vaccine.	69	46.0	42	28.0	39	26.0	5	3.3	6	4.0	139	92.7	131.0 [*]	<0.001 [*]
Total mean score	3.35 ± 1.73						6.09 ± 1.36						Z test 9.941 [*]	<0.001 [*]

MH: Marginal Homogeneity test, p value for comparing **pre** and **post***: Statistically significant at $p \leq 0.05$

Table (6): Relationship between the studied nurses' total knowledge score level and their demographic and occupational characteristics Pre and Post-intervention.

Demographic characteristics	Total nurses' knowledge (pre-test)				χ^2	p	Total nurses' knowledge (post-test)				χ^2	p
	Un satisfactory (n = 143)		Satisfactory (n = 7)				Un satisfactory (n =26)		Satisfactory (n =124)			
	n	%	n	%			n	%	n	%		
Age (years)												
<25	38	25.4	2	1.3	0.702	MC p= 0.912	5	3.3	35	23.3	2.101	MC p= 0.544
25-<35	69	46	3	2			13	8.7	59	39.3		
35-<45	30	20	2	1.3			6	4	26	17.4		
≥45	6	4	0	0.0			2	1.3	4	2.7		
Qualifications												
Diploma	57	38	1	0.7	2.733	MC p= 0.255	11	7.3	47	31.3	0.671	0.715
Technical nurse	29	19.3	3	2			4	2.7	28	18.7		
Bachelor's	57	38	3	2			11	7.3	49	32.7		
Years of experience												
<10	53	35.3	3	2	0.678	MC p= 0.756	11	7.3	45	30	0.622	0.733
10<15	70	46.7	4	2.7			11	7.3	63	42		
≥15	20	13.3	0	0.0			4	2.7	16	10.7		
Residence												
Urban	94	62.6	4	2.7	6.707	MC p= 0.136	7	4.6	91	60.7	12.324	0.023*
Rural	49	32.7	3	2			19	12.7	33	22		
Attending training courses about Covid-19 Vaccines												
Yes	5	3.3	0	0.0	0.653	FE p= 1.000	0	0.0	5	3.3	1.085	FEp= 0.788
No	138	92	7	4.7			26	17.3	119	79.4		

 χ^2 : Chi square test

MC: Monte Carlo

FE: Fisher Exact

*: significant at p < 0.05

Discussion

The effectiveness of immunization programs is primarily dependent on widespread public acceptance, it is vital to design educational initiatives that can have a positive impact on vaccine uptake, ensuring the vaccines' efficacy and limit disease pandemics (**Chen, 2020**).

As a result, the goal of this study was to see how effective an educational intervention about COVID-19 vaccine was in terms of nurses' knowledge, attitude, and acceptance. Regarding the demographic characteristics of the studied sample, the mean age was 29.97 ± 7.13 and all of them were females. This could be due to the increasing number of females who choose nursing as a career nowadays in Egypt. This finding is consistent with **Fakonti et al. (2021)** who revealed that most of the study participants were women. Two-fifths of the studied nurses in this study have a bachelor's degree in nursing. In accordance with this finding, a study carried out by **Fakonti et al. (2021)** concluded that nearly one-half of their studied sample had a bachelor's degree in nursing.

The current study's findings revealed that about half of the sample had ten to less than fifteen years of experience. This finding is consistent with a study done by **Nzaji et al (2020)**, who found that most of their studied subjects had more than 10 years of experience. Regarding attending COVID-19 vaccine training courses, most of the studied nurses did not attend any. This finding could be attributed to a lack of in-service education and training for nurses, which could be related to organizational factors such as insufficient training funds and a nursing staff shortage, which prevents them from attending training programs outside of the hospital. This is contradicted by **Cordina et al. (2021)**, who found that nearly one-third of respondents had received COVID-19 vaccination training or orientation.

As regard to place of residence, it was noticed that more than three-fifths of this study's participants were from urban areas. This is in agreement with **Mesesle, (2021)** who clarified that about four-fifths of respondents were from urban areas.

According to recent evidence, educational interventions, and the introduction of information about COVID-19 vaccines will increase health care workers' knowledge, acceptance, and attitude toward COVID-19 vaccines. The current study's findings revealed that a majority of the studied sample had unsatisfactory total knowledge level at the pre-test, this could be due to nurses having limited access to information about COVID-19 vaccines, especially since it is a new pandemic disease that is spreading rapidly around the world, as well as misinformation and unsubstantiated rumors about the new vaccines. In this regard, **Abedin et al. (2021)** stated that more than half of the studied sample lacked knowledge about COVID-19 vaccinations.

While the current study revealed that (82.7%) had a satisfactory total knowledge level at the post-test. The significant improvement in nurses' knowledge score levels could be attributed to the educational intervention's positive impact. The success can be attributed to the process of education and interaction that followed during its implementation, as well as the fact that it was custom-tailored to the needs of nurses. There were also highly statistically significant differences in total and subtotal mean scores of nurses' knowledge of the COVID-19 vaccine between the pretest and post-intervention implementation. **Mohamed et al. (2021)** confirmed this finding, reporting significant improvements in the total level of COVID-19 knowledge after implementing an educational program.

According to the current study, the most common negative attitude toward COVID-19 vaccines was concern about the vaccine's side effects; more than half of the nurses disagreed that the Covid-19 vaccine would be useful in protecting against Covid-19 infection. Furthermore, more than one-third of them strongly agreed that the covid-19 vaccine could have unanticipated side effects in the future. These findings are consistent with those of **Wang et al. (2020)**, who discovered that almost half of respondents postponed immunization until the safety of the shot was established, reflecting vaccine safety concerns. Furthermore, **El-Elimat et al., (2021)** revealed that slightly less than one half of the

participants were concerned about the vaccine's safety once it became available, as evidenced by their concerns about related side effects. This is also consistent with **Pogue et al. (2020)**, who found that the majority of participants in the United States were concerned about the COVID-19 vaccines' side effects.

The current study found that several individual differences could cause participants to be hesitant about vaccines, with slightly less than half of the studied sample agreeing that the Covid 19 vaccine was rapidly developed and approved. The current study's findings were consistent with those of **Issanov et al. (2021)**. They concluded that participants were least likely to receive the COVID-19 vaccine due to a number of criteria, including vaccine safety, efficacy, and place of origin. In the same line, **Pogue et al., (2020)** reported that approximately one-third of the participants were opposed to being vaccinated due to concerns about side effects, efficacy, and testing duration.

Following the implementation of the educational intervention, there were statistically significant improvements in total and subtotal nurses' attitudes toward COVID-19 vaccination, with statistically significant improvements pretest and post-test. The results showed that after the educational intervention, the total attitude score toward the COVID-19 vaccination improved significantly on a scale of 16–80. **Elashri et al. (2021)** confirmed these findings, reporting that the COVID-19 vaccination attitude of the studied sample improved significantly after the implementation of the COVID-19 educational bag compared to before it. Furthermore, **Abebe et al. (2021)** found that after the intervention, the average attitude toward the COVID-19 vaccination increased, indicating generally positive attitudes.

Nurses are at high risk of contracting COVID-19. Their immunization is regarded as a critical preventive measure. Until now, there have been some issues with nurses' acceptance of COVID-19 vaccines (**Li et al., 2021**). The current study found that more than half of nurses were willing to be vaccinated pre application of the educational intervention. This is considered low in comparison to other

studies that reported vaccine acceptance among French healthcare workers to increase during the first pandemic wave (**Gagneux-Brunon et al., 2021**). This could be due to several factors, including inadequate COVID-19 knowledge among HCWs, a negative attitude, and fear toward vaccine long-term side effects. Furthermore, global acceptance of COVID-19 vaccines was more than four-fifths in China and most Western countries report relatively higher levels of public acceptance (**Lazarus et al., 2020**). Similarly, Saudi Arabia reported a nearly two-thirds acceptance rate (**Al-Mohaithef & Padhi, 2020**). Furthermore, **Gadoth et al. (2020)** found that more than half of HCWs intend to accept COVID-19 vaccination.

While acceptance level of COVID-19 vaccines in this study is considered high when compared to a national Egyptian survey on COVID-19 vaccine acceptability among health care workers, which reported that 13.5 percent accepted the vaccine (**Hussein et al., 2021**). Vaccination campaigns disseminate vaccine information through educational initiatives, combat misinformation and "fake news," and raise awareness about the critical importance of widespread.

Following the implementation of the educational intervention, the mean acceptance level among the studied sample increased significantly, rising from 3.35 ± 1.73 to 6.09 ± 1.36 . In the same line, **Rutten et al. (2021)** reported that using educational interventions within clinical organizations was beneficial in bridging this critical gap and increasing population trust in COVID-19 vaccination. This improvement is directly related to their increased knowledge and attitude toward vaccines. Furthermore, after implementing the educational intervention, the majority of the studied nurses stated that they will advise their families and friends to get vaccinated against COVID-19. The findings were supported by **Abebe et al. (2021)**, They stated that health education campaigns were crucial tools for reducing rejection of the COVID-19 vaccination. They also stated that acceptance of the COVID-19 vaccine and higher readiness to receive the vaccine were both substantially correlated with good information and attitude about the COVID-19 vaccination. Accordingly,

Mesele (2021) reported that the prevalence of COVID-19 vaccination acceptance was low, and that public education is an effective strategy for increasing COVID-19 vaccine acceptance.

In terms of the relationship between nurses' demographic data and total knowledge score levels, the current study found a statistically significant relationship between nurses' residence and their knowledge level after applying the educational intervention. This is congruent with **Ajanaku, & Mutula, (2018)** who concluded that nurses' place of residence positively influences nurses' knowledge level. While there were no statistically significant differences between gender, age, qualifications, and attendance at training courses and nurses' total knowledge level at pre- and post-intervention.

This is consistent with the findings of **Elpasiony et al, (2021)**, who found no statistically significant difference between nurses' knowledge and age, and education during the pre-test and post-program. The **Pan American Health Organization (2021)** agreed with this finding and concluded there was no difference in nurses' knowledge based on gender. This contradicted with **Mesele (2021)**, who stated that gender, grade, and educational level were the most influential factors influencing nurses' knowledge of the coronavirus vaccine.

Conclusion:

The current study results concluded that the mean willingness of the studied nurses to take the COVID-19 vaccine increased significantly after the educational intervention and this improvement was significantly associated with the significant improvement in their knowledge and attitude toward vaccines. These findings support the research hypothesis that the educational intervention was effective in improving nurses' knowledge, attitude, and acceptance of the COVID-19 vaccination.

Recommendations:

In light of the current study results, the following recommendations are proposed:

- Well-structured training programs targeting all nurses in Egypt must be

launched to improve their knowledge and attitude toward COVID-19 Vaccination.

- Comprehensive approaches that incorporate teaching and recommendation are required to raise vaccine confidence and vaccination rates among nurses.
- Nurses should receive ongoing education to improve comprehension and eliminate any ambiguities or incorrect information regarding vaccination.
- Further studies are needed to increase people's awareness regarding COVID-19 vaccination to build and maintain trust in COVID-19 vaccines in Egypt.
- Develop other effective instructional methods and address additional challenges among other health settings with regards to vaccine acceptance.

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