The Effect of Empowerment Scheme Based on Health Behavior Theories Regarding COVID-19 Vaccine on Mothers' Knowledge and Attitude

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Abstract

Background: Mothers' knowledge and attitude have been proven to be a significant determinant of childcare and impact their decision about child vaccination. Habitually, mothers make the main decisions regarding their children's health, including vaccination. Ergo, this research **aimed to** evaluate the effect of empowerment scheme based on health behavior theories regarding COVID-19 vaccine on mothers' knowledge and attitude. **Method:** A pre-and post-test evaluation was conducted using a quasi-experimental design. The research was implemented at the Pediatric Medical and Surgical departments at Tanta University Pediatric Hospital. A purposive sample of 368 mothers was involved. Two questionnaires were utilized as data collection tools: one focused on assessing COVID-19 vaccine knowledge and the other on evaluating health behavior theories constructs of the Health Belief Model and Theory of Planned Behavior. These instruments were adapted and employed to examine mothers' attitudes regarding the COVID-19 vaccine. **Results:** Mothers have good knowledge and positive attitudes 81% and 78.3% respectively with highly significant differences p =≤0.001 post the empowerment scheme application. **Conclusion:** The application of the empowerment scheme significantly improved mothers' knowledge and attitude regarding the COVID-19 vaccine for their children. **Recommendation:** Ongoing implementation of the empowerment scheme should be conducted for mothers to enhance their knowledge and attitude.

Keywords: Children, COVID-19 vaccine, Empowerment scheme, Health Behavior Theories, Mothers.

Introduction

One of the most significant achievements in pediatrics is descent of mortality and morbidity of communicable diseases due to the diffuse use of vaccines for diseases that can be prevented and the creation of newer vaccines. The vaccines help the immune system to identify and combat the COVID-19 virus, which helps to prevent disease if you come into contact with the virus **(Abdalla et al., 2022 & Mohmmed & Ismail, 2022).**

Our dreams are incarnate in children; they require special attention in order to stay healthy because the children are the most susceptible segment in the community. For a variety of reasons, children are especially prone to illness. Particularly vaccines have helped save thousands of children's lives **(Chen et al., 2022).**

The key to achieving the aim of good health for all children depends on primary prevention level. The vaccine for any communicable disease is one of the essential health interventions with the highest economic returns. Children's health experts place a high importance on immunization because it has eradicated several communicable diseases that once wiped out significant portions of a nation's population **(Graupensperger et al., 2021& Yoon et al., 2022)**

In general, vaccines are used to prevent infectious diseases around the world as well as mortality and morbidity. The aim of immunization is to protect children by using immunizing agent to stimulate antibody formation **(Al-Qerem et al., 2022& Ma et al., 2022).**

The COVID-19 is not a benign illness in children, it leads a tremendous effect on children's health, it's a contagious respiratory disease caused by the SARSCoV2 virus, and it led to a global pandemic for a long time .During the first wave of the pandemic, all countries of the world tried to control the virus by following preventive measures as hand washing and wearing mask. But now all countries of the world are seeking to limit the spread of the disease through vaccinations. **(Al-**

Khlaiwi et al., 2022 & European Centre for Disease Prevention and Control, 2021)

Vaccination is a process of conserve child from the infectious disease through administration of live, killed or fractional ingredient of the invasive microorganism into the child body.

Antibodies produced by a child's body give them immunity and prevent communicable disease. Indeed, the vaccines offer perfect protection without risk **(Asmare et al., 2022& İkışık et al., 2021 & Rahman et al., 2022).**

The Centers for Disease Control and Prevention and the Advisory Committee on Immunization Practices currently accepted three vaccines for children. The Pfizer vaccine was approved for youngsters between the ages of twelve and fifteen years old in December 2020. In addition, on July, 2022, Moderna vaccine was authorized for use in children aged six months to five years **(Office of the Chief Medical Officer, Alberta Health, 2021 & U.S. Food & Drug Administration, 2022).**

The American Academy of Pediatrics and the European Pediatric Association both highly advise children aged 5 to 16 to get the COVID-19 vaccine in order to lower the COVID-19 epidemic, avoid complications of virus, and prevent the psychological effects of isolation and quarantine on the children **(Korioth & Writer, 2021; Ngai et al., 2022).**

The reactions after getting the COVID-19 vaccine are mild and for a short period for instance, discomfort, fatigue, muscle or joint pain, headache, and low fever may appear. These side effects are typical indicators that the body is fortifying its defenses. Serious adverse reactions following vaccination are incredibly rare **(Kaplan & Milstein, 2021& Musa & Mansoori, 2022).**

One of the most powerful weapons against the dissemination of COVID-19 virus remains immunization and COVID-19 boosters. Therefore, it is essential to increase mothers trust in vaccines. Studies show a major relation between attitudes and knowledge of mothers about vaccine and their agreement to vaccinate their children **(Taylor et al., 2020 &Yoon et al., 2022).**

Increasing COVID-19 vaccine coverage for children is deemed one of the greatest effective areas of the healthy people objectives. The definitive challenge is verifying that children receive vaccine, it's necessary to motive mothers to attain COVID-19 vaccine for their children and emphasis on this issue at every chance **(Alfieri et al., 2021 & ElSayed et al., 2022).**

Immunization endeavor in the eastern Mediterranean area are incessant in spite of COVID-19 vaccine coverage remains far below of the WHO worldwide immunization goals of 70% of total nations and100 % of high risk groups should be vaccinated. On July 2022, only 45% of the eastern Mediterranean area populations are completely immunized, 8% partially immunized, and 47% have not received any doses of the COVID-19 vaccine even now **(WHO Regional Office for the Eastern Mediterranean, 2022).**

The mothers play an imperative role in maintaining the health and prevent illness of children. Many mothers have misinformation and myth of knowledge related to Corona vaccine for children, it's necessary to increase knowledge about vaccine stressing that the vaccines are safe and protect against infection and in case of infection, it protect child from complications **(Nandwani, 2022& Zhang et al., 2020).** In addition to giving mothers the information and abilities needed to handle with curative and preventative aspects of COVID-19, Prevention of Corona virus has successfully improved many different health outcomes especially in developing countries and lead to less illiterate mothers **(Humble et al., 2022& Sinuraya et al., 2022).**

Numerous mothers around the world are worried about their children receiving vaccines against the Corona virus. Even some mothers who have received the vaccines and not yet decided if their children will receive the vaccine **(Al-Qerem et al., 2022& Kitro et al., 2022 & Lau et al., 2022).** Empowerment is a personal process that enables mothers to promote and utilize the skills, competence, trust, and knowledge required to create their voices heard. Depending on the level of empowerment of each mother, nurses can offer information and help to mothers of sick children **(Hockenberry, M. & Wilson, 2023).**

In order to promote the adoption of the vaccine and ensure the attainment of herd immunity, as well as to curtail the prevalence of severe cases, public health departments must engage in efforts to elevate maternal health beliefs and cultivate a sense of social responsibility through the dissemination of information that accentuates the vaccine

booster's effectiveness and its inherent social value. Health behavior theories provide frameworks for understanding the factors influencing individuals' health-related decisions and actions. Theoretical models of health beliefs and risk perception are essential tools for understanding the factors that motivate and inhibit health behavior **(Rosental & Shmueli, 2021).**

The Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) are widely recognized as two of the most impactful theories employed to anticipate health behaviors. The TPB is regarded as one of the most prominent socio-cognitive paradigms utilized within the psychosocial literature to forecast health intentions and behaviors. Socio-cognitive models of health behavior not only facilitate the identification of the pivotal determinants of behavior, but also encompass the consideration of how external factors may influence the process of behavior modification. A significant advantage of these models is their capacity to serve as a foundational framework for the development of interventions **(Sumerlin et al., 2022).**

Health belief model is a social theory that highlights an individual's attitudes and beliefs about a particular problem, as well as the benefits and barriers to take preventive actions that may lead to certain behaviors. It includes perceived susceptibility, severity, benefits, barriers, and behavioral cues. Perceived susceptibility represents mothers' belief that they know the risk of negative health outcomes. A perceived benefit refers to mothers' prediction of the benefits of engaging in healthy behaviors. The more mothers perceive the benefits of engaging in healthy behaviors, the more likely they are to do so. This relates to mothers' perceptions of the health benefits of vaccinating their children. Perceived barrier refers to the subjective prediction of barriers that individuals may face in engaging in healthy behaviors. The more barriers people perceive in adopting healthy behaviors, the more difficult it is to get them to adopt healthy behaviors **(Dayton et al., 2022& Caso et al., 2021).**

The health belief model postulates that an person's chance of adopting a particular health behavior is influenced by his or her belief in the personal threat of disease or in the efficacy of the recommended health behavior. Its constructs include perceived severity and susceptibility to the virus, perceived benefits and barriers to receiving a vaccine, self-efficacy to overcome barriers, and cues to action **(Yang et al., 2021).**

Three core components of the theory of planned behavior including attitude, subjective norm, and perceived behavioral control, affect an individual's vaccination intentions. An individual's attitude toward a behavior refers to the degree to which an individual has a favorable or unfavorable evaluation of a particular behavior. Perceived subjective norms for a behavior refer to an individual's perception of the judgment of significant others (e.g., friends, family, and members of society in general) in engaging in a particular behavior. Perceived behavioral control indicates trust in the likelihood of successfully engaging in a specific behavior **(Fan et al., 2021).**

Significance of the study:

The coronavirus is not finished yet and is still in the public health emergency stage. All countries have noticed a large number of cases and deaths until now. The WHO motivates all governments to immunize all citizens, especially children because they are the most likely to transmit the coronavirus **(World Health Organization, 2023).**

COVID-19 cases among children represent a notable proportion of global infections because it is a grave disorder in pediatrics that leads to fetal squeal during childhood and teenage. Since the beginning of the pandemic, COVID-19 has infected about 105 million children. Hospitalization rates for children reach more than 92,000 children As a result of COVID-19; more than 80,000 children have a multisystem inflammatory syndrome **(American Academy of Pediatrics, 2023)**.

In the United States, over 21 million cases occurred among children, with an estimated 10–20% potentially experiencing long COVID-19 symptoms **(European Centre for Disease Prevention and Control, 2023).** The incidence of COVID-19 infections among children in Egypt has been documented to account for approximately 7.5% of confirmed COVID-19 cases. Data indicates that approximately 0.4% of all reported

COVID-19 deaths occurred in children and adolescents under 20 years old, amounting to over 17,400 deaths as of December 2023. Within this group, 53% of the deaths were among adolescents aged 10–19, while 47% were children aged 0–9 **(World Health Organization, 2023).**

In Egypt, the Pfizer vaccine is recommended for all children from 12 to 18 years, the total number of children scheduled to be vaccinated with the COVID-19 vaccine is 7 million and 932,000 children. In addition, the number of children who already received the first dose is 732,000 child while, the number of those who received the second dose reached 267,000 child **(Ministry of Health and Population Egypt, 2023).** The total number of cases of COVID-19 in Egypt is 515,335 while the total number of deaths reached 24,796. Regarding COVID-19 vaccine coverage in Egypt, only 38% of the total population has been fully vaccinated with COVID-19 **(WHO Regional Office for the Eastern Mediterranean, 2023).**

This is the first research in Egypt utilized health behavioral theories to investigate the mothers' attitude about COVID-19 vaccine for their children. As yet, few studies have been performed scheme to empower mothers and increase their knowledge and attitude about COVID-19 vaccine for children in Egypt. This research was done to fill in the gap of knowledge and prevent rumors depending on erroneous information.

Operational definitions

Empowerment Scheme: This refers to a structured educational program formed to enhance mothers' capacity to make autonomous decisions. It focuses on building knowledge and attitudes and improving health outcomes regarding the COVID-19 vaccine for their children .

Health behavior theories: Denote a structured set of concepts and propositions utilized to describe and predict health-related behaviors by investigating the associations among individual beliefs, social and environmental influences, and behavioral outcomes.

Aim of the study

This research aimed to evaluate the effect of empowerment scheme based on health behavior theories regarding COVID-19 vaccine on mothers' knowledge and attitude.

Research hypotheses

Mothers who received an empowerment scheme based on health behavior theories will have better knowledge, and attitude regarding COVID-19 vaccine for the children.

Subjects and Method

Study Design: This study employed a quasi-experimental design featuring a pre- and post-test evaluation.

Settings: The current research was performed at Pediatric Medical and Surgical Departments of Tanta Main University Hospital, Egypt which is allied to the Ministry of Higher Education and Scientific Research. It serves as referral hospital for many regions at this city. The Pediatric Department consists of three floors, with each floor containing four rooms. Each floor is divided into two wards, with each ward accommodating six beds, making a total of 12 beds for the two wards. Meanwhile, the Surgery Department comprises two large wards, each containing more than ten beds.

Subjects and Sample:

This study involved a purposive sample of 368 mothers chosen according to defined eligibility and exclusion criteria. The eligibility criteria included mothers with children between 7 and 15 years who were not taking the COVID-19 vaccine, a willingness to participate in the research, and the ability to read and write. On the other hand, mothers were excluded if they were illiterate or suffered from any mental or psychiatric disorders. A formula was applied to decide the sample size, considering the total population of mothers (N = 8670) in the study setting. The formula used was:

Sample equation

$$\frac{N\times p(1-p)}{[N-1\times(d2\div Z2)]+P(1-P)}$$

Where P=0.5P = 0.5P=0.5 (probability of success), 1−P=0.51-P = 0.51−P=0.5, d=0.05d = 0.05d=0.05 (margin of error), and Z=1.96Z = 1.96Z=1.96 (Z-score for a 95% confidence level). We determined the sample size to be 368 mothers using these values.

Data Gathering Tools:

Tool (I): Structured interviewing questionnaire it was adapted from **(Mohamed et al., 2021 & Chris et al 2015**) after reviewing the related articles. Four sections were included in it:

A: The socio-demographic data sheet for the participating mothers includes details such as their age, gender, educational background, marital status, place of residence, monthly income, and the

sources from which they acquired information about the COVID-19 vaccine.

B: The demographic data sheet for the children includes information on their age, gender, and educational level.

C: COVID-19 vaccine history comprises suffering from any chronic diseases, family history for COVID-19, other siblings take COVID-19 vaccine and willingness to give the children COVID-19 vaccine.

D: Mothers knowledge questionnaire was used twice before and after empowerment scheme implementation and drafted in the style of multiple-choice questions that involves nine questions covering knowledge about COVID-19 disease such as definition, mode of transmission, clinical manifestations, investigations, incubation period, high risk group for COVID-19, wrong behaviors that must be avoided, complications and precautions needed for COVID-19 disease. Also, four questions covering knowledge about prevention of COVID-19 disease as hand washing, wearing mask questions and home ventilation. Twelve questions covering knowledge about COVID-19 vaccine as definition of vaccine, types, route, age needed for taking vaccine, side effect of vaccine, contraindications, and care for the child after vaccination. For each item of the questions, the following calculation was made to determine the mothers' level of knowledge: The “right answer was recorded 2” point and “incomplete answer was scored1”, while the" wrong answer was scored 0” point. The overall scores which ranging from 0 to 50, were calculated and divided by the number of items to obtain a mean score. It is categorized as follows: a good level of knowledge (75% or higher), an average level of knowledge (60% to less than 75%), and a poor level of knowledge (less than 60%).

Tool (II): We utilized the health behavior theory, which encompasses the health belief model (HBM) and theory of planned behavior (TPB) constructs, to apply the attitude questionnaire and assess mothers' attitudes about the COVID-19 vaccine, it was employed twice before and after the empowerment scheme implementation. These theories are instrumental in designing effective interventions and encourage individuals to take steps that will help them prevent, maintain, and improve their health. It examines how human capabilities, social norms, personal beliefs, and environmental circumstances influence health-related decisions.

The HBM scale was adapted from (Wong et al. 2021) and amended by the researchers after focusing on the literature review. It entailed lists of 39 items and was divided into the following five subscales: "Perceived Susceptibility (6 Items) measures beliefs about the likelihood of contracting COVID-19 without vaccination. Perceived Severity (8 Items) measures beliefs about the seriousness of COVID-19 and its potential consequences. Perceived Benefits (8 Items) assess beliefs about the advantages of getting the COVID-19 vaccine. Perceived Barriers (10 Items) explore obstacles or concerns about receiving the vaccine. Cues to Action (7 Items) assess factors or triggers that encourage vaccination ". The second section was the TPB construct adapted from (**Zhou et al. 2022)**, which included four dimensions: "Attitudes toward the Behavior (3 items) assess the mother's evaluation of the health behavior (vaccination), Subjective Norms (3 items) measure perceived social pressure to perform or avoid the behavior, Perceived Behavioral Control (3 items) assess the mother's confidence in her ability to perform the behavior, and Behavioral Intention (3 items) evaluate the likelihood of performing the behavior". Mothers' responses to the items of the HBM and TPB models were scored based on five points of the Likert scale as follows: "strongly disagree (1), disagree (2), neutral (3), agree (4), strongly agree (5) ". The total score (207) was summed up and graded based on the following ratings: negative attitude (0-50%) and positive attitude (51-100%).

Ethics issue: This research was accepted through the Faculty of Nursing's institutional review committee at Tanta University with the code number **89-9-2022-** After describing the study's purpose to the mothers, participation in the study was confirmed through the completion of the questionnaire.

Validity: To achieve the study's objective, the research tool was reviewed by a panel of five pediatric nursing specialists who evaluated its content validity, clarity, relevance, and adequacy. Feedback from the specialists was considered, adjustments were implemented, and the last version of the instrument was completed to ensure its suitability for the study.

Reliability was performed using the Cronbach's Alpha test, which showed that each component of

the tools used was composed of largely homogeneous items. The knowledge questionnaire demonstrated an internal consistency of 0.81, while the mothers' attitude questionnaire regarding the COVID-19 vaccine had an internal consistency of 0.89.

A pilot test was conducted to evaluate the study tool's readability and comprehension, to determine the estimated time needed for participant interviews, to identify any issues or potential roadblocks to data collection, and 37 mothers (10%) participated in the pilot test, and as no changes were made as a result of its findings, they were added to the study's main sample.

Procedure

The fieldwork was conducted in three stages: assessment, implementation, and evaluation. These stages were conveyed from the earliest starting point of January till the end of June 2023 covering 6 months. The authors were accessible three days a week at the study areas from 9.00 am to 2.00 pm.

Assessment stage (Pre empowerment scheme)

This stage included conducting interviews with mothers to gather initial data. The author greeted mothers and their children at the beginning of the interview and described the goal, timeline, and activities of the study. Each mother was individually assessed for their knowledge and attitude using the study tools; it took nearly 30- 45 minutes. This stage lasted for one month.

Implementation stage (Empowerment scheme application)

Based on the needs identified during the pretest period, the researchers designed empowerment scheme sessions using the constructs of the Health Behavior theories. The sessions were conducted in simple Arabic to match the mothers' level of comprehension, aiming to enhance their knowledge, attitude and reshape their health beliefs regarding vaccine, and empower them to adopt preventive behaviors to reduce COVID-19 risks.

The implementation stage was accomplished over six sessions a period of three days per week from Tuesday to Thursday two sessions per day. The interval of each session lasted between 30-60 minutes and mothers were distributed into small groups getting between 9-10 mothers of each group, the authors interviewed two or three groups per day according to readiness of the mother at pediatric medical and surgical departments at Tanta University Hospital. Each session begins with the conclusion of the preceding session and explains the objectives of the new one. Diverse interactive and resourceful teaching strategies were employed as lectures, and group discussions, and appropriate instructional resources were utilized as posters, handouts, and colored pictures and given to mothers at the end of the session. The scheme lasted for four months.

Evaluation stage (Post empowerment scheme)

The evaluation was done immediately after empowerment scheme application through using the similar pretest tools to evaluate mothers' knowledge and attitude. This stage lasted for one month.

Data Analysis: The acquired data were tabulated and statistically analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive measurements (Numbers, percentages, mean, and standard deviation) were used. Additionally, tests of significance, paired t-tests that compare variables and correlation coefficient tests (r) that evaluate the associations between quantitative variables with normally distributed distributions. Using Cronbach's Alpha, the study tools' reliability was calculated. When the p-value was below 0.001, it was regarded to be extremely significant, when it was below 0.05, it was considered to be significant, and when it was over 0.5, it was not statistically significant.

Results

Table (1): The distribution of the mothers under the study based on their socio-demographic data (n=368)

Items	No.	%
Age /years		
- 20-30	143	38.9
- 31-40	184	**50.0**
- >41	41	11.1
Mean ±SD	**31.22±5.861**	
Marital status		
- Married	321	**87.2**
- Widow	11	3.0
- Divorced	36	9.8
- **Educational level**		
- Basic education	101	27.4
- Secondary education	205	**55.7**
- University education	62	16.8
Monthly income		
- Enough and saves	21	5.7
- Enough	225	**61.1**
- Not enough	122	33.2
Residence		
- Rural	272	**73.9**
- Urban	96	26.1
Source of knowledge		
- Health team	79	21.5
- Media	191	**51.9**
- Relatives and friends	98	26.6

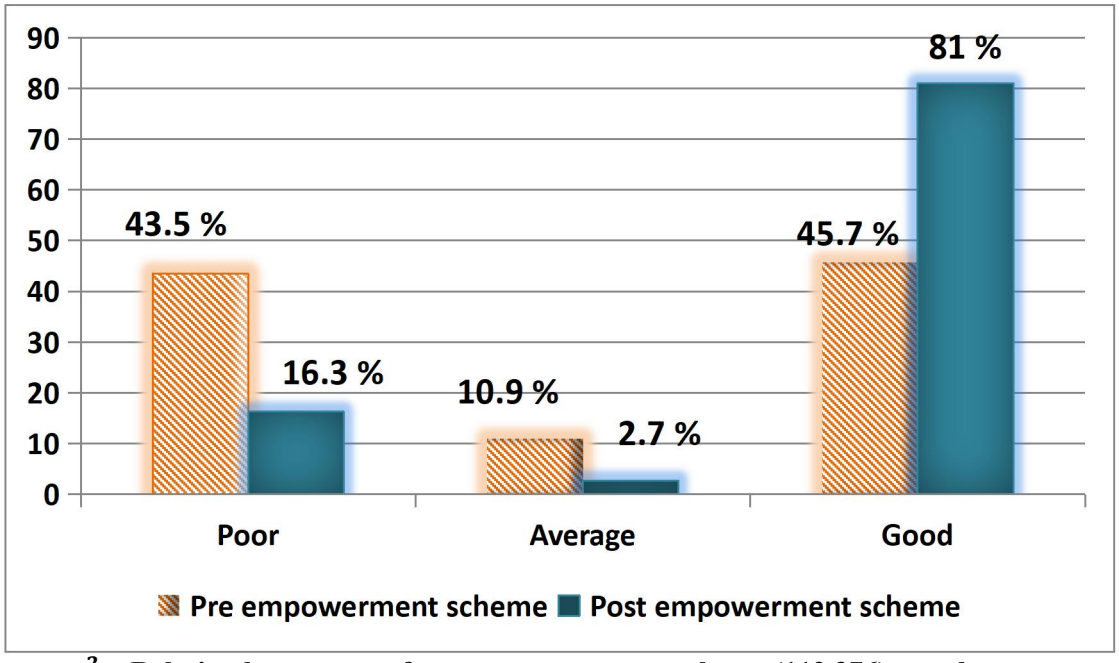
Table (2): The distribution of the children under the study depending on demographic data and COVID-19 vaccination history (n=368).

Items	No.	%
Age /years		
- 7< 9	184	**50.0**
- 9 <11	140	38.1
- 11<13	31	8.4
- 13<15	13	3.5
Mean ±SD	**8.83±1.696**	
Sex		
- Male	284	**77.2**
- Female	84	22.8
Educational stage		
- Primary stage	329	**89.4**
- Preparatory stage	35	9.5
- Secondary stage	4	1.1
Suffering from chronic diseases		
- Yes	21	5.7
- No	347	**94.3**
Family history for COVID -19		
- Yes	306	**88.2**
- No	62	16.8
The other siblings take COVID -19 vaccine		
- Yes	19	37.8
- No	229	**62.2**
Willing to give the children COVID -19 vaccine		
- Yes	104	28.3
- No	264	**71.7**

Table (3): Level of knowledge and attitudes pre and post empowerment Scheme implementation (n=368).

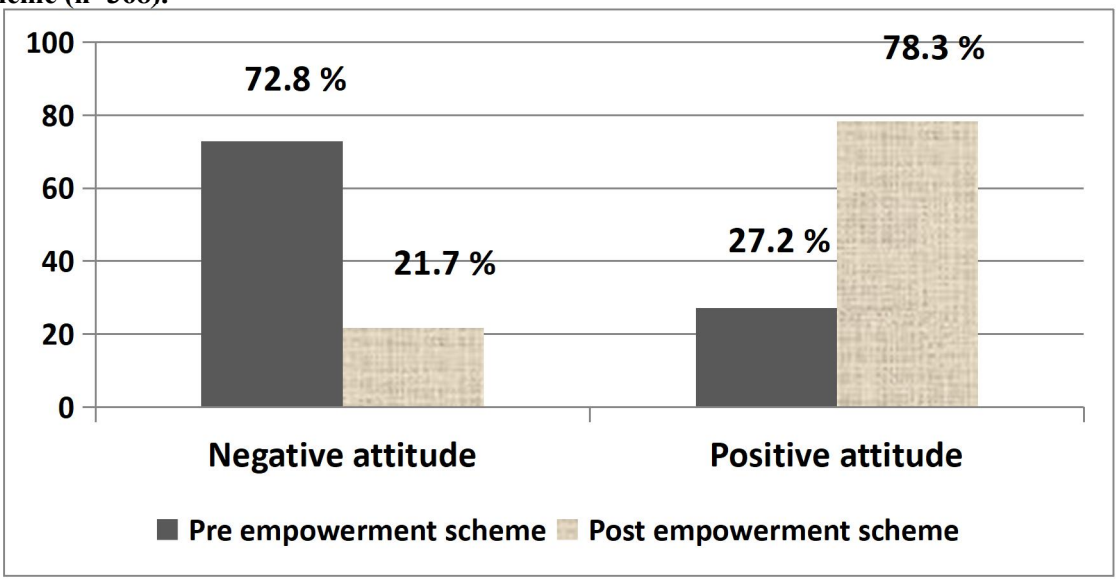
Variables	Pre	Post	Paired t test	p-value	Effect size	
	Mean ± SD	Mean ± SD			Cohen's d	Level
Total knowledge score (possible score: 0–50)	25.12±18.649	39.64±15.474	23.716	0.000**	1.236	Large
Knowledge toward COVID- 19(possible score: 0–18)	9.09±6.728	14.36±5.538	23.334	0.000**	1.21	Large
Knowledge toward preventive methods for COVID- 19 (possible score: 0–8)	4.34±3.020	6.48±2.528	21.301	0.000**	1.11	Large
Knowledge toward COVID- 19 vaccines (possible score: 0–24)	11.69±8.937	18.81±7.475	24.383	0.000**	1.27	Large
Total attitude (possible score: 51–255)	124.03±70.152	198.36±61.447	26.343	0.000**	1.37	Large
Health Belief Model scale (possible score: 39–195)	93.27±54.745	151.34±49.350	23.525	0.000**	1.23	Large
Perceived Susceptibility(possible score: 6–30)	14.02±8.558	22.96±7.306	21.358	0.000**	1.11	Large
Perceived Severity(possible score: 8-40)	19.63±11.450	29.90±10.109	20.714	0.000**	1.07	Large
Perceived Benefits(possible score: 8–40)	18.79±11.300	30.48±10.272	20.716	0.000**	1.08	Large
Perceived Barriers(possible score: 10–50)	23.84±13.856	40.23±14.317	23.141	0.000**	1.2	Large
Cues to Action(possible score: 7–35)	16.59±10.002	27.76±10.663	21.485	0.000**	1.12	Large
Theory of planned behavior score (possible score: 12-60)	30.73±17.466	47.02±14.311	28.350	0.000**	1.47	Large
Attitudes Toward the Behavior (possible score: 3–15)	7.07±4.269	11.63±5.583	32.519	0.000**	1.69	Large
Subjective Norms (possible score: 3–15)	7.55±4.311	12.02±3.608	29.171	0.000**	1.52	Large
Perceived Behavioral Control (possible score: 3–15)	7.32±4.223	11.77±3.849	28.994	0.000**	1.51	Large
Behavioral Intention (possible score: 3–15)	7.51±4.428	11.60±3.755	29.064	0.000**	1.51	Large

Paired t test, * * highly statistically significance p≤ 0.001 ,* statistically significance p≤ 0.05, Cohen's d, 0.2 small effect, 0.5 medium effect, 0.8 large effect



x^2 = Relation between pre& post empowerment scheme (112.376), p-value (0.000)**

Figure (1): Distribution of the mothers based on their total knowledge level regarding COVID- 19, method of prevention and its vaccine pre and post empowerment scheme (n=368).



X2=38.143, P-value=0.000**

Figure (2): Distribution of the mothers based on their total attitudes regarding COVID-19 vaccine pre and post empowerment scheme (n=368).

Table (4): Mean of total knowledge and attitude to socio- demographic data of the studied mothers regarding COVID -19 vaccine pre and post empowerment Scheme implementation(n=368).

Variable	Knowledge				Attitudes			
	Pre empowerment Scheme		Post empowerment Scheme		Pre empowerment Scheme		Post empowerment Scheme	
	Mean ±SD	t-test/ANOVA (p-value)	Mean ±SD	t-test/ANOVA (p-value)	Mean ±SD	t-test/ANOVA (p-value)	Mean ±SD	t-test/ANOVA (p-value)
Age /years								
20-30	20.49±20.49	10.206 (0.000**)	32.46±19.021	29.351 (0.000**)	112.76±72.564	7.926 (0.000**)	172.12±76.287	24.103 (0.000**)
31-40	29.38±16.905		44.55±10.856		137.90±69.763		214.25±46376	
>41	22.15±13.099		42.61±8.30		101.07±47.915		218.56±10.067	
Marital status								
Married	25.70±19.33	1.449 (0.236)	39.23±16.231	0.920 (0.399)	127.68±72.442	3.978 (0.020*)	195.39±65.174	2.997 (0.051*)
Widow	24.45±14.86		43.82±7.332		118.0±62.749		223.0±14.206	
Divorced	20.14±11.64		41.97±8.607		93.36±37.373		217.28±7.622	
Educational level								
Basic education	18.49±17.776	9.925 (0.000**)	33.96±18.503	11.221 (0.000**)	100.19±59.263	8.551 (0.000**)	167.74±70.10	23.953 (0.000**)
Secondary education	26.90±18.703		40.96±14.791		131.66±71.719		204.08±59.059	
University education	30.02±17.226		44.52±8.012		137.65±72.965		229.31±18.985	
Monthly income								
Enough and saves	44.0±0.0	12.149 (0.000**)	47.00±0.0	8.476 (0.000**)	181.48±20.304	8.267 (0.000**)	234.38±2.837	7.839 (0.000**)
Enough	24.17±17.197		41.24±13.823		117.82±61.659		202.81±52.616	
Not enough	23.61±21.014		35.41±18.446		125.59±84.696		183.94±76.511	
Residence								
Rural	24.25±17.80	2.280 (0.132)	39.64±15.307	0.022 (0.882)	118.91±64.199	5.628 (0.018*)	197.90±60.040	0.057 (0.812)
Urban	27.58±20.772		39.44±16.015		138.54±83.465		199.65±65.581	

t- test/ ANOVA* statistically significance p≤ 0.05. * * Highly statistically significance p≤ 0.001 * statistically significance p≤ 0.05 No statistically significance p> 0.05

Table (5): Correlation between the total knowledge level and total attitudes of the studied mothers regarding COVID -19 vaccine pre and post empowerment Scheme implementation (n=368).

Scale	Total attitudes			
	Pre-program		Post –program	
	r	p- value	r	p- value
Total knowledge	0.633	0.000**	0.900	0.000**

A highly statistical significance differences (p=≤0.001** r- Pearson Correlation Coefficient

Table (1): Shows that half (50.0%) of the mothers in the study were aged between 31 and 40 years, with a mean age of 31.22 ± 5.861. The majority (87.2%) were married, more than half (55.7%) had secondary education, and less than two-thirds (61.1%) had sufficient monthly income. Additionally, nearly three-quarters (73.9%) of them lived in rural areas, and more than half (51.9%) obtained their knowledge from the media.

Table (2): Reveals that, half (50.0 %) of the children under the study aged between 7 <9 years with Mean ±SD= (8.83±1.696), more than three quarters (77.2 %) of them were male, the majority (89.4%) of them at primary stage and most (97.3 %) of them didn't suffer from chronic diseases and (83.2) having family history of COVID-19. Vaccination rates are relatively low, with only (37.8%) of other siblings having received the COVID-19 vaccine. Furthermore, a notable proportion of mothers (71.7%) expressed unwillingness to vaccinate their children.

Table (3): Proves a statistically significant improvement across all measured variables, as indicated by the paired t-test and p-values (<0.000) with large effect sizes (Cohen's d > 1.0). Notably, there were significant gains in overall knowledge about COVID-19, preventive methods, and vaccines post empowerment scheme application Mean ± SD = (14.36±5.538, 6.48±2.528, 18.81±7.475) respectively. Additionally, positive changes were observed in attitudes post- empowerment scheme application, as measured by the health belief model Mean ± SD = (151.34±49.350) and the theory of planned behavior Mean ± SD = (47.02±14.311).

Figure (1): Illustrates that, less than half of the studied mothers (43.5 %) had poor level of total knowledge at pre empowerment scheme application, which improved significantly to the majority (81.0 %) of them had good level of knowledge regarding COVID - 19, method of prevention and its vaccine at post empowerment scheme application. There was a statistical significant difference regarding total knowledge level of the studied mothers about COVID -19 vaccine at pre and post empowerment scheme application with X2= (112.376), p-value (0.000).

Figure (2): Displays that, more than two thirds of the studied mothers 72.8 % had negative attitude at pre empowerment scheme application, while more than three quarters 78.3 % of them had positive attitude regarding COVID-19 vaccines at post empowerment scheme application. A significant difference was observed in the overall attitude levels of the mothers concerning the COVID-19 vaccine pre and post implementing the empowerment scheme, with X^2 = (38.143) and p-value = (0.000).

Table (4): Demonstrates a significant relation was detected in the overall knowledge levels of the mothers under the study and their age, educational level, and monthly income in the pre and post-empowerment scheme application (p=≤0.001). Also, a significant relation was shown between mothers' overall attitude and their age, educational level and monthly income in the pre and post-empowerment scheme application (p=≤0.001).

Table (5): Illuminates a highly statistically significant correlation between the total knowledge level of the studied mothers and their overall attitudes regarding the COVID-19 vaccine after the implementation of the empowerment scheme ($p \leq 0.001$).

Discussion

Mothers' beliefs and decisions regarding vaccination will continue to be influenced by their questions about the COVID-19 vaccine's effectiveness; as a result, open communication between healthcare professionals and mothers will aid in raising their awareness of vaccine safety and the significance of immunization. Healthcare professionals must explain and persuade mothers about the advantages of vaccinations, particularly those who have high health literacy levels **(Kyprianidou et al., 2021).**

According to the present study, a significant percent of mothers are unwilling to immunize their children. This may be attributed to mothers' shortage of knowledge about vaccine safety issues, their perception of their efficacy, their mistrust of the competence of public health specialists to assure vaccination safety, the lack of communication from providers and the community, and the characteristics of the vaccines may all be contributing factors to this. These findings contradicted the results of **(Humble et al., 2022 & Taylor et al., 2020)** who indicated that more than half of the mothers

in the research group planned to give vaccines to their children when the vaccine was strongly suggested for them.

These findings are in line with those reported by **(Bianco et al., 2022& Kitro et al., 2022)** who showed that most of mothers were unwilling to immunize their children and that guardians' top three fears were vaccination negative impacts , safety , and vaccine effectiveness. So they recommended that the government and healthcare practitioners should educate this people on the importance and advantages of COVID-19 vaccinations, create positive attitudes regarding prophylactic immunization and encourage mothers to vaccinate their children.

The present study demonstrates that less than half of the surveyed mothers exhibited inadequate total knowledge before application of empowerment scheme. However, this figure underwent a substantial improvement, with the majority of them demonstrating sufficient knowledge regarding the etiology of the novel strain of coronaviruses, its modes of prevention, and the available vaccine at the time of application for the post-empowerment scheme. This may be due to that more than half of them had secondary education and this might be as a result of their poor level of education and the fact that the most of them come from rural areas with minimal healthcare facilities and a reduction in mother health programs. This result was consistent with **(Awijen, et al 2022)** reported that overall, more than half of participants demonstrated poor perception about the vaccine and recommended that there is a large gap in people's perceptions of the vaccine. As a consequence of this, there is a strong need for public awareness programs to eliminate the community misconceptions of the vaccine.

The current research determined that there were significant improvement in total knowledge, preventive methods, and vaccines about COVID-19 post empowerment scheme application and there were a statistically significant improvement across all measured variables, as indicated large effect sizes. This finding was consistent with **(Khumayanti et al., 2022)** who discovered that the majority of respondents demonstrated familiarity with preventative measures against the novel strain of the SARS-CoV-2 virus. **(Ma et al., 2022)** also were consistent with the current result who found that most of mothers got the right answer on the question items and had good knowledge about the vaccine

This finding was consistent with **(Choi et al., 2022)** who suggested that mothers should proceed with caution when choosing to immunize their children against this virus. An efficient COVID-19 immunization program demands effective communication in consideration of the safety and utilization profiles, which requires the inclusion of verified sources of information about the multidisciplinary team of health care.

The present study's findings depicted that, following the application of the empowerment program; there was statistically significant association among the investigated mothers' total knowledge level, and their attitudes towards the covid19 vaccine. This may be due to that during the COVID-19 pandemic, participants' broad understanding of COVID-19 contributed to good and safe behavior which suggests improved practice after empowerment scheme implementation. The application of theoretical frameworks to real-life practical scenarios is advantageous because theories offer a comprehensive examination of behavioral changes concerning critical factors. A notable illustration of this practical application is the Theory of Planned Behavior (TPB), which serves as a pragmatic framework for comprehending crucial factors influencing individuals' intentions to receive the vaccination for the novel coronavirus, officially designated as SARS-CoV-2, and the subsequent development of antibodies in response to the virus. **(Fan et al 2021**).

This result was matched with the recommendation of **(Lau et al., 2022)** to conduct an effective vaccine campaign that considers the qualities and choices of mothers who are hesitant to immunize their children and boosts their knowledge of the vaccine. These

outcomes were not evidenced by **(Al-Hanawi et al., 2020)** who noticed that there was no statistically significant association among knowledge scores did not differ statistically and attitudes.

This study showed that post introduction of the empowerment scheme implementation, but before the program, mothers have negative attitudes about COVID-19 vaccine, worry about adverse effect of the vaccine, safety production of it and the effective protection of their children from infection. This may be explained on the basis of access the program improves their awareness, empower them and improved illness and vaccination knowledge is made available so that people can decide more effectively and embrace new perspectives.

The current study demonstrated that positive changes and significant improvement were observed in in total mothers' attitudes and beliefs post- empowerment scheme application, as measured by the both behavioral theory with large effect size. **(Caso et al 2021)** supported this result and stated that their study examined the relationship between attitudes regarding non-vaccination and intentions to vaccinate children. Moreover, this attitude was found to be associated with a negative perception of vaccines. This, in turn, was influenced by a variety of distal factors, including risk perception, trust in healthcare institutions, and trust in scientific knowledge. (**Anagaw et al 2023)** who demonstrated that potential for behavioral change models, such as the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB), to be utilized in the determination of influential factors in regard to vaccine uptake.

A significant positive correlation was observed between the knowledge score and total attitude scores of the mothers. This finding suggests that increased knowledge levels have a significant impact on vaccine attitudes, which in turn affects vaccine acceptance. This finding aligns with the observations reported by (**Kyprianidou et al. 2021),** who also noted a comparable association between knowledge and attitude scores. Efforts to keep up and boost vaccination rates should be focused on mothers who display attitudes and actions that are suggestive of vaccine safety issues in addition to those who have socioeconomic risk factors.

The current study demonstrated that positive changes and significant improvement were observed in mothers' attitudes post-empowerment scheme application, as measured by the health belief model and the theoretical framework of the theory of planned behavior, exhibited a substantial effect size. **(Guidry et al. 2020)** found that individuals with a more positive attitude toward vaccination, who scored higher on subjective norms, and who had higher intentions to vaccinate against the virus had higher rates of uptake. Additionally, a study by (**Lin et al. 2022 & Dayton et al. 2022)** found that awareness of the vaccine's widespread use among the general public may positively influence the uptake of the COVD-19 vaccination.

This finding aligns with the conclusions of (**Fan et al. 2021),** who argued that the study incorporated the fundamental components of the TPB (i.e., attitude, subjective norms, and perceived behavioral control). The results indicated an enhancement in knowledge concerning the COVD-19 vaccine and risk perception of COVD-19, which had a positive influence on attitude toward COVD-19 vaccination uptake. This conclusion is further corroborated by the findings of (**Wollast et al. 2021** & **Beca et al. 2021),** who concurred with the prevailing perspective that a more positive attitude, heightened social norms, augmented perceived control, and elevated intentions are associated with greater adherence to hand hygiene practices. The analysis revealed that subjective norms and perceived behavioral control of the participants were associated with their intention to adhere to the recommended practices. Furthermore, the study found that good knowledge and a positive attitude were significant factors associated with the participants' preventive practice.

A highly statistically significant correlation was identified among the studied mothers' total knowledge level and their total attitudes regarding the COVID-19 vaccine post-empowerment scheme implementation.

According to the investigator, a high level of education translated into a high knowledge and attitude. Undoubtedly, mothers who have more education are better able to comprehend the instructional contents. Also, these mothers have more opportunity to acquire extensive knowledge about new vaccines and health issues through the platforms, social networking sites, and online research.

Juin et al (2022) were in accordance with the findings who revealed statistically significant differences between the attitudes, education, and knowledge levels of the examined mothers. The current study proved that there was a statistically significant difference between studied mothers' total attitudes and beliefs and their age and educational level. **(Li et al 2023** & **Merkelbach et al 2023)** were in agreement with this result and demonstrated that socio-demographic factors, including age and education level, exert an influence on vaccination intention. Specifically, the findings indicate that females, older age groups, and less educated individuals exhibit a diminished inclination to vaccinate against the novel strain of influenza, designated as SARS-CoV-2, which is responsible for the ongoing global pandemic.

Conclusion

Applying empowerment scheme significantly improved mothers' knowledge, and attitude regarding COVID-19 vaccine for the children. These results support the study hypothesis throughout the implementation of it; there was a significant correlation between mothers' knowledge and attitude.

Recommendation

1-Ongoing implementation of the empowerment scheme should be conducted for mothers to enhance their knowledge and attitude.

2-It is imperative to enhance communication and public health initiatives to facilitate informed decision-making among mothers regarding the immunization of their children against the novel strain of the virus.

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