

Effect of Educational program for nurses on their knowledge and Practiceregarding obligatory vaccination for children

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Abstract: Background: Immunization is one of the most cost-effective intervention for the child health promotion. It is a safe and effective method of preventing many series of major illnesses. Nurses need to be confident, knowledgeable and up to date. A high level of knowledge and practice of immunization in healthcare workers is an important element in achieving and maintaining high vaccine uptake. Aim: Assessing the effect of educational program for nurses on their knowledge and practices regarding obligatory vaccination for children. Research design: This study used pre/post Quasi- experimental research design. Sample: All nurses who are working in the (7) health office and centers at Minia city and responsible for vaccination of children the total were 39 nurses. Setting: The selected vaccination office and centers represented all geographic areas of Minia City as this study was conducted in 7 places (all vaccination centers in Minia City). Tools for Data Collection: Two tools were used in this study. Tool I: structured interview questionnaire sheet in Arabic language. It was composed of two parts (demographic data and knowledge assessment questionnaires). Tool II: Observation competent checklist sheet which included three parts (universal precaution checklist, oral administration vaccine checklist and safe injection checklists). Results: The finding of the current study revealed that there were statistically significant differences between nurses' knowledge and practices at pre and post-program. Conclusion: The study concluded that the health education program was effective in improving nurses' knowledge and practice in post program than before. Recommendation: The study recommended that the provision of continuing education programs is suggested in order to refresh and update nurses' knowledge, as well as reinforce proper practice related to infection control.

Key Words: Educational program, immunization guideline, infection control, pediatric immunization, nurse's knowledge & practices.

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I. Introduction

Immunization is one of the most cost-effective intervention for the child health promotion. It is a safe and effective method of preventing many series of major illnesses. Immunization arouses the body's own immune system to defend the individual against different communicable disease such as polio, tuberculosis, diphtheria, pertussis, tetanus, hepatitis B, Hemophilus influenza type B and measles (Swarnkaret al., 2016). Ensuring public and professional confidence is critical to the success of these programs. So, it becomes important to understand the knowledge level and practice of health workers responsible for immunization (Asim et al., 2012).

Nurses need to be confident, knowledgeable and up to date. A high level of knowledge and practice of immunization in healthcare workers is an important element in achieving and maintaining high vaccine uptake. Nurses have a major role in advising and promoting immunization, as well as administering vaccinations within the childhood immunization program. All vaccine providers should receive education and competency-based training on vaccine administration before providing vaccines to the public (Guide, Canadian Immunization, 2013).

Nurses responsible for handling vaccines should be familiar with the manufacturer's packaging insert for each vaccine including recommendations for handling, storage, administration site, dosage and route to minimize the risk of vaccine failures (Centers for Disease Control and Prevention (CDC), 2011). Nurses should follow the professional standards and guidelines. Good knowledge and practice regarding immunization is required. Therefore, it is reasonable for nurses and other health care provider to provide parents with comprehensive information about immunization, which in turn help to shape positive attitude toward vaccinations and improve their practices (Omotara et al., 2012).

Significance of the study

The World Health Organization (WHO) acknowledges that immunization is one of the most effective health investments, estimated at preventing between two and three million deaths each year (The Australian Immunization Handbook, 2018). Egypt vaccinates over 35 million children every year. Estimated national coverage rates of children that are fully immunized 2014 is (91.0 %) (UNICEF, 2015) & (WHO, 2019). Every year in the United States between 3,000 and 4,500 severe vaccine reactions are reported to the centers for disease control. These severe reactions can land somebody in the hospital, the intensive care unit, cause a permanent disability or death. From 1,244 cases of people reported hospitalized 416 cases of people reported a disability, 122 reported deaths, and 388 reported life-threatening cases (Bob Sears, 2015).

Aim of the Study

The aim of this study is to assess the effect of educational program for nurses on their knowledge and practices regarding obligatory vaccination for children

Research Hypothesis

Nurses who will be involved in the educational program will have a higher score of knowledge and practices than before the program.

Subjects and Methods

Research design: This study used pre/post Quasi- experimental research design. A Quasi- experimental research design is one type of experimental design that is very similar to the true experimental design except that it loses one criterion which is control or randomization (Burns & Grove, 2012)

Setting: The selected vaccination office and centers represented all geographic areas of Minia City as this study was conducted in 7 places (all the vaccination centers in Minia City). four health offices (first health office, second health office, third health office and fourth health office) in addition to three health centers (Shabab Elmostakbal MCH center {Minia El-Gedida}, first health care center and second health care center).

Sample: The sample involving all nurses who are working in the (7) health office and centers at Minia city and responsible about vaccination of children the total numbers of nurses were 39 nurses. Numbers of nurses in each health office and centers as the following:

Four health offices:

- 8 nurses from the first health office
- 9 nurses from the second health office
- 4 nurses from the third health office
- 5 nurses from the fourth health office

Three health centers:

- 8 nurses from the Shabab Elmostakbal MCH center (Minia El-Gedida)
- 3 nurses from the first health care center
- 2 nurses from the second health care center

Inclusion criteria: All nurses who are responsible for giving vaccination for children and working in the previously mentioned health offices and health centers.

Exclusion criteria: Nurses who attended training courses about infection control or vaccination less than one year ago weren't included in the sample.

Tool for Data Collection: Two tools were used in this study:

Tool I: Structured Interview Questionnaire Sheet in Arabic language and was developed by the researcher after reviewing related literature. It was comprised from two parts:

Part 1: Demographic data about nurses including nurses' age, qualifications, years of experience and previous training courses about vaccination.

Part 2: knowledge assessment questionnaires: To assess the nurses' knowledge about vaccination. Which involves 66 multiple choice questions and divided to 7 sections: section 1 contains 11 questions regarding general information about vaccination. Section 2 contains 5 questions about infection control measures. Section 3 contains 11 questions about oral polio vaccine. Section 4 contains 12 questions about BCG vaccine. Section 5 contains 12 questions about Pentavalent {DPT, hepatitis B, Haemophilus influenza type B (Hib)} vaccine. Section 6 contains 12 questions about MMR vaccine. Finally, section 7 which contains 3 questions about vitamin A capsule.

Scoring system: The nurses' knowledge was compared with model key answer and accordingly scored as correct or incorrect answers. A score of one for correct answers and a zero for incorrect answers. The total score of knowledge was 66 degrees and the scores were converted into a percent score. The nurses' knowledge was considered satisfactory if the percent score is 60% or more and unsatisfactory if less than 60%.

Tool II: Observation competent checklist sheet was developed by the researcher after reviewing related literature. The tool was containing three parts:

Part 1: Universal precaution checklist: To assess nurses' practice regarding infection universal precaution: It contains 4 checklists {hand washing (15 steps), hand rub (9 steps), wearing gloves (7 steps), and safe disposable for needles and syringes (10 steps)}.

Part 2: Oral administration vaccine checklist: To assess the nurses' practice regarding administration of oral vaccine: It contains oral administration vaccine (15 steps).

Part 3: Safe injection checklists: To assess the nurses' practice regarding administration of intramuscular (IM), subcutaneous (SC), and intradermal (ID) injection: it contains 3 checklists {administration of vaccine via IM injection (30 steps), administration of vaccine via SC injection (30 steps), and administration of vaccine via ID injection (36 steps)}. The total steps of the three parts were 152 steps.

Scoring system: A score of two was given for correctly practice, score of one was given for incomplete and score of zero for incorrect or not done. The Total score of practice was 304 degrees and the scores were converted into a percent score. Nurses' practices were considered satisfactory if the percent score is 60% or more and unsatisfactory if less than 60%.

Validity and Reliability: The two tools were tested for content validity by a jury of three experts in the pediatric nursing field and necessary modifications were done. Reliability of the tools that to be tested by using Cronbach's Alpha to insure the internal consistency of the tools. Test-retest reliability of a structured interview questionnaire sheet was (0.75) and the observation competent checklist sheet was (0.88).

Pilot study: A pilot study was conducted on 10% (4) nurses from the selected centers using the previously mentioned tools, to evaluate their applicability and clarity as well as to determine the time required for filling the data for each tool. Nurses involved in the pilot study were excluded from the main study subjects.

The program: The educational program was designed by the researcher after reviewing the related literature, the program about vaccination and infection control information (vaccine and immunity definitions, types of immunity and vaccines, storage and cold chain system regrading general and specific guidelines for each vaccine, vaccine schedule information about types, child age, sites, route, and dosage for each vaccine. Health teaching related to each vaccine and parent education, vaccines waste management and health hazards, Precautions and side effects for each type of vaccines, Methods of transmission of infection, infection universal precaution {hand washing, hand rubbing, wearing gloves and safe disposal}. Finally different route of vaccine administration procedures {oral administration, IM, SC, and ID injection }.

1- Preparatory phase Included:

- An official permission was obtained from the concerned immunization centers authorities to conduct the study. The aim and nature of the study was explained to the administrators and nurses.
- The researcher prepared the following:
 - The objective, content of the program, strategies (timetable of sessions, teaching methods, media used, learner's activities and evaluation methods), selected the teaching sitting inside each health office and centers and learning content of the program.
 - The program finances (supplied by the researcher) and providing the program resources and facilities such as printed materials, doll, gloves, hand gel, soap, tissue papers, cotton, adhesive tab, syringes.
 - The teaching methods and media such as (lectures, group discussions, pictures, data show on the researcher's personal laptop, demonstrations and hand out Arabic booklet developed by researcher).
 - The data collection tool was constructed (structured interview questionnaire sheet in Arabic language and observation competent checklist sheet)

2- Assessment phase included:

- Through pre-test which was conducted before the program implementation by using the tools:
- Before vaccination of each child, the research investigator met the parents to explain the aim and nature of the study to gain their oral approval. after that during actual vaccination for the child, the observation competent checklist sheet was filled as pretest to assess the nursing actual practices. the duration to fill the sheet was 30-45 mints by the researcher, who attend from 8Am-12pm during vaccination session (the researcher attended two vaccination days in each office and centers for two days only).
- The research investigator attended two days during the rest days (non-vaccination days) according to the availability of nurses' time and according the numbers of nurses inside each center. Through an individual interview with each nurse, the research investigator introduced himself and explained the aim and nature of the study and gave them tool 1 (structured interview questioner sheet) to answer it, in the present of the research investigator for more clarification whenever needed. the duration was 30-45 mints to fill the tool.

3- Intervention phase included:

- Regarding the program sessions conducted during the rest days (non-vaccination days),the research investigator attended two days according to the availability of nurses' time and according the numbers of nurses inside each center. Each group of nurses was given the freedom to choose their optimal time for receiving the program whenever they have minimal workload. The centers or the office which contain large numbers of nurses were divided into two smalls groups, the total nurse's groups were 10 groups (each group ranged between 2 to 5 nurses). 2 hours was assigned for each group at the same day.Each session usually started by a summary of what has been taught during the preceding session.
- The program was conducted over 8 session four session for theory and four sessions for practice as the researcher conducted two sessions per week, the duration for every session are 2 hours to cover all information and practices skills regarding the vaccination program. Theoretical part included definitions of vaccination and immunity, types of vaccines and immunity, site and dose, precaution, side effects for each vaccine, storage and cold chain system, vaccine waste management, benefits and risks associated with each vaccine and health teaching related to each vaccine which must be given for parent. The practical part contains Infection control and universal precaution procedure which used during vaccination for example (hand washing, hand rub, wearing gloves, and safe disposable for needles and syringes), in addition to the different routes of vaccine administration and safe injection (IM, SC and ID injection).
- Method of teaching involved modified lectures, group discussions, pictures, videos show by using the personal computer, demonstration and re-demonstration. Suitable teaching aids were used especially for the program such as real equipment and facilities for example using the baby doll, syringes, alcohol swap, alcohol gel, gloves and cotton to ensure easily understand and demonstration of the program content. Different methods used to motivate nurses and reinforce correct techniques such as recognition during the program sessions.
- The researcher developed an Arabic booklet for nurses about immunization. It contained general updated knowledge. Copy of the program booklet was given to each participant nurse before starting the program implementation.

4- Evaluation phase:

- All nurses and children were reassessed by using the same tools, immediately after the end of the program and after three months as a follow up phase. The study work was conducted through 4 months starting from July to October 2017.

Ethical consideration: Administrative approval was obtained from ethics committee; Faculty of Nursing, Minia University. The purpose and nature of the study was explained to the nurses and oral consent was obtained from each of them to participate in this study. They were informed that they can withdraw from the study without giving a reason and they were assured that anonymity and confidentiality of information was protected. Ethics, values, culture, and beliefs were respected.

Statistical analysis: Data entry was done using compatible personal computer. The statistical analysis was done using SPSS-20 Statistical Software Package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables. Qualitative studied variables were compared using chi-square test. Person correlation analysis was used for assessment of the inter-relationships between the nurses' knowledge and practices about infection control of procedure, statistical significance difference at p value <0.05.

II. Results

Table (1): Demographic Characteristics of Studied Nurses (N=39)

Demographic Data		Total N =39	
		No	%
Age/year	20: <30	1	2.6
	30: < 40	13	33.3
	40: <50	15	38.5
	>50	10	25.6
Mean and SD	41.5±9.1		
Years of Experiences	5: <10	1	2.6
	10: < 15	4	10.3
	15: <20	11	28.2
	>20	23	59.0
Mean and SD	20.02±4.9		
Qualification:	Diploma Nurse	38	97.4
	Technical Nurse	1	2.6
Training Courses:	No	32	82.1
	Yes	7	17.9

Type of Training Courses (N=7)	Infection control	5	71.4
	Vaccine administration	2	28.6
Date of Training Courses (N=7)	Less than one year	0	0
	More than one year	7	100

Table (1) illustrated that more than one third of the studied nurses (38.5%) their age was ranged between 40: <50 years old with a mean and SD of age 41.5±9.1. More than one quadrant of them (28.2%) had years of experience ranged from 15 to<20years with a mean and SD of years of experience 20.02±4.9. Majority of the nurses (97.4%) had diploma degree in nursing. More than four fifth (82.1%) of the studied nurses didn't attend any training courses. On the other hand, less than three fourth of nurses (71.4%) who exposed to training courses, attended training courses related to infection control. All nurses (100%) attended the training courses for during a period of one and more than one year before this study.

Table (2): Nurses Total Score of Knowledge about General Information and all Types of Vaccines Pre, Immediate, and Follow up of Educational Program N= 39

Items	Pre		Immediate		Follow up		χ^2	P
	N	%	N	%	N	%		
General Information								
Satisfactory	33	84.6	37	94.9	22	56.4	18.4	0.001***
Un satisfactory	6	15.4	2	5.1	17	43.6		
Infection Control Information								
Satisfactory	28	71.8	39	100	36	92.3	15.7	0.003***
Un satisfactory	11	28.2	0	0	3	7.7		
Oral Polio Vaccine								
Satisfactory	33	84.6	36	92.3	34	87.2	1.1	0.5
Un satisfactory	6	15.4	3	7.7	5	12.8		
BCG Vaccine								
Satisfactory	35	89.7	39	100	28	71.8	14.2	0.001***
Un satisfactory	4	10.3	0	0.0	11	28.2		
Pentavalent/DPT Vaccine								
Satisfactory	35	89.7	39	100	23	59	25.1	0.001***
Un satisfactory	4	10.3	0	0.0	16	41		
MMR Vaccine								
Satisfactory	34	87.2	37	94.9	38	97.4	3.4	0.1
Un satisfactory	5	12.8	2	5.1	1	2.6		
Vitamin A capsule								
Satisfactory	38	97.4	37	94.9	39	100	2.05	0.3
Un satisfactory	1	2.6	2	5.1	0	0		
Total Score								
Satisfactory	31	79.5	37	94.9	33	84.6	4.1	0.1
Un satisfactory	8	20.5	2	5.1	6	15.4		

χ^2 : chi-square test * P≤0.05 ** P≤0.01 *** p≤0.001

Table (2) show that nurses' knowledge improved significantly immediately and during the follow up posttest after educational program than preprogram pretest regarding their general information ($\chi^2=18.4$, P=0.001), infection control ($\chi^2=15.7$, P=0.003), BCG vaccine ($\chi^2=14.2$, P= 0.001) and pentavalent vaccine ($\chi^2=25.1$, P=0.001). While no statistical significance differences were detected about nurses' knowledge concerning oral polio, MMR vaccine and vitamin A capsule.

Table (3): Nurses Total Score of Practice Related to Universal Precaution Procedure About Infection Control Pre, Immediate and Follow up of Educational Program (N= 39)

Universal precaution		Pre		Immediate		Follow up		χ^2	p
		No	%	No	%	No	%		
Hand washing	Satisfactory	0	0.0	39	100	31	79.5	90.5	0.003***
	Un satisfactory	39	100	0	0.0	8	20.5		
Hand rubbing	Satisfactory	0	0.0	39	100	37	94.9	108.6	0.001***
	Un satisfactory	39	100	0	0.0	2	5.1		
Wearing gloves	Satisfactory	0	0.0	39	100	33	84.6	95.5	0.001***
	Un satisfactory	39	100	0	0.0	6	15.4		
Safe disposal	Satisfactory	31	79.5	39	100	39	100	17.1	0.001***
	Un satisfactory	8	20.5	0	0.0	0	0.0		
Total scoring	Satisfactory	0	0.0	39	100	32	82.1	92.9	0.001***
	Un satisfactory	39	100	0	0.0	7	17.9		

χ^2 : chi-square test * P≤0.05 ** P≤0.01 *** p≤0.001

Table (3) illustrated that all nurses had unsatisfactory practice in pre educational program about all the universal precaution procedures about infection control concerning hand washing, hand rubbing, wearing gloves and safe disposal, while all of them had satisfactory practice immediately post program, with statistically significant differences between pre, immediate and follow up (P- value = 0.003, 0.001, 0.001, 0.001 & 0.001 respectively). For that the total score related to universal precautions practice of nurses improved significantly immediately and follow up than pre educational program ($\chi^2=92.9$, P=0.001).

Table (4): Nurses Total Score of Practice Related Vaccine Administration Procedure Pre, Immediate and Follow up of Educational Program (N= 39)

Items	Pre		Immediate		Follow up		χ^2	P
	No	%	No	%	No	%		
Oral Vaccine Administration								
Satisfactory	0	0.0	39	100	39	100	117	0.002***
Un satisfactory	39	100	0	0.0	0	0.0		
IM Injection Administration								
Satisfactory	1	2.6	39	100	39	100	112.5	0.001***
Un satisfactory	38	97.4	0	0.0	0	0.0		
SC Injection Administration								
Satisfactory	1	2.6	39	100	39	100	112.5	0.001***
Un satisfactory	38	97.4	0	0.0	0	0.0		
ID Injection Administration								
Satisfactory	21	52.8	39	100	39	100	42.5	0.005***
Un satisfactory	18	46.2	0	0.0	0	0.0		
Total Score								
Satisfactory	1	2.6	39	100	39	100	102	0.001***
Un satisfactory	38	97.4	0	0.0	0	0.0		

χ^2 : chi-square test * P≤0.05 ** P≤0.01 *** p≤0.001

Table (4) showed that all nurses and most of them gained unsatisfactory scores (100% & 97.4% respectively) in pre educational program about administration of oral polio, IM, SC injection. While all of them had satisfactory score in immediate and after three months of educational program about all types of vaccine administration. There were highly statistical significance differences between pretest, immediate and follow up posttest for nurses' practice related to all different vaccine administration procedures (oral, IM, SC, ID) (P-value = 0.002, 0.001, 0.001, 0.005 respectively). In addition, most of nurses (97.4%) had unsatisfactory total score in pre intervention comparing to all of them had satisfactory performance score about all types of vaccination in immediate and follow up with highly statistical significance differences ($\chi^2=102$, P= 0.001)

Table (5): Relation between Nurses' Demographic Data and Their Total Score of Knowledge and Practice (N= 39)

Items	Knowledge			Practice		
	Pre	Immediate	Follow up	Pre	Immediate	Follow up
Age						
R	-0.49	-0.23	-0.45	-0.32	-0.41	-0.51
P	0.001***	0.08	0.001***	0.04*	0.001***	0.001***
Qualification						
R	0.27	0.12	0.22	-0.29	0.17	0.21
P	0.09	0.3	0.1	0.07	0.2	0.1
Years of experience						
R	-0.51	-0.19	-0.37	-0.42	-0.44	-0.40
P	0.001***	0.2	0.01**	0.001***	0.005***	0.01**
Trainingcourses						
R	-0.10	0.33	0.07	-0.04	0.04	-0.003
P	0.4	0.01**	0.6	0.7	0.7	0.9

R: correlation * P≤0.05 ** P≤0.01 *** p≤0.001

Regarding correlation between nurses' demographic data and their knowledge and practice table (5) clarified that, nurses age had negative correlation with their knowledge in pre-program (R= -0.49, P=0.001), and follow up (R= - 0.45, P=0.001). Another negative correlation was found between years of experiences and their knowledge in pretest (R= -0.51, P=0.001) and follow up (R= -0.37 P=0.01). While a positive correlation was detected between nurses' knowledge and their training courses in immediate educational program (R= 0.33, P=

0.01). Regrading nurses' practice, it correlated negatively with their age in preprogram (R= -0.32, P=0.04), immediately after the program (R=-0.41, P=0.001) and follow up posttest (R= -0.51, P=0.001). Also, there were negative correlation between nurse's years of experiences and their practice in pretest (R= -0.42, P=0.001), immediately after completion of the program (R= -0.44, P=0.005) and after three months of training program (R= -0.40, P=0.01).

Table (6): Relationbetween Nurses Total Score of Knowledge and Practice about Vaccination Pre, Immediate and Follow up of Educational Program (N= 39)

Vaccination knowledge	Vaccination practice		
	Pre	Immediate post	Follow up
Pre			
R	0.33		
P	0.04*		
Immediate post			
R		0.34	
P		0.03*	
Follow up			
R			0.43
P			0.007**

R: correlation * P≤0.05 ** P≤0.01 *** p≤0.001

Table (6) proved that, there were positive correlation between pre-knowledge and pre-practice of nurses (R=0.33, P=0.04), immediate knowledge and immediate practice (R=0.34, P=0.03) and between knowledge and practice of follow up (R=0.43, P=0.007).

III. Discussion

Life of many children can be saved by successful immunization, but its success depend on knowledge and practice of health workers how are vaccinating. Healthcare providers need to display confidence and establish an environment that promotes a sense of security and trust for the patient and family, utilizing a variety of techniques to minimize the stress and discomfort associated with receiving injections. This is particularly important when administering vaccines to children (The California Department of Health Services, 2016).

Regarding nursing qualification, the present study results showed that most of nurses had diploma degree in nursing. This result matches with Fahim et al., (2011) who assessed nurses' practice regarding to infection control during vaccination in children at El-Minia and reported that all nurses' qualification was diploma nurse. This might be in Egypt the majority of nurse's was diploma nurse especially in immunization centers because the work is easy and have one shift only so, it is matching with the diploma nurse capabilities.

Regarding training courses about infection control and vaccination, it was noticed that 82.1% of the studied nurses did not attend any training courses. These may be attributed to the shorting in nursing staff, so the health centers can't let them attend any training courses to prevent interruption of work due to their attendance. Our results agreed with Eskander, Morsy andElfaky, (2013) who studied the intensive care nurses' knowledge & practices regarding infection control standard precautions at a selected Egyptian cancer hospital, and reported that 63.6% of nurses had not attend any training courses related to universal precautions, and Standard precautions (such as hand washing, wearing gloves, correct sharps handling and aseptic technique) to be followed at all times by nurses.

There were a highly statistically significant differences between pretest, immediate and follow-up posttest in most of questions regarding general information about vaccination as the results showed that the highest percentage of nurses answered the permanent contraindication of vaccination incorrectly. This result matching with Al-Ayed& Sheik, (2006), who mentioned it is necessary to educate and provide the vaccine providers with updates and reviews of true and false contraindication for immunization, and the development of clinic guidelines on appropriate reasons to withhold immunization, to avoid missed opportunities that may be attributable to deficiencies in the provider's knowledge of the immunization schedule and true vaccine contraindications as the study surveyed 313 health professional, about 69.5 % from the nurse's sample didn't answer the questions regarding possible precautions or contraindications of vaccination correctly. Might be the cause of that due to lack of nurses' knowledge regarding different precautions and contraindication for each vaccine related to lack of training program about vaccination.

The current study shows that, the nurses' knowledge regarding infection control information considered satisfactory as the majority of nurses had correct information about the most of infection control questions during the pretest and this result disagree with Eskander, Morsy &Elfaky, (2013) who reported that 63.6% of the studied sample has unsatisfactory knowledge level regarding infection control measures.

According to American Academy of Pediatrics Committee on Infectious Diseases, (2007) the new guidelines modify standard precautions by indicating gloves are not required when administering vaccines, unless contact precautions are required. In the same respect the result of this study found that all nurses had unsatisfactory performance regarding universal precautions procedures (hand washing, hand rubbing and wearing gloves) during the pretest as no one of the total nurse's sample perform handwashing, hand rubbing or wear gloves while administering vaccination. This is in accordance with Gragnani et al., (2019) who clarified that administering vaccinations not require gloves to be worn, unless persons administering vaccinations are likely to contact with potentially infectious body fluids or have open lesions on their hands. From the researcher' point of view this may be due to different causes lack of adequate hand washing facilities & supplement for example (source of water, soap, tissue paper & gloves), second, nursing staff shortage and nursing work overload as the nurse contact many children within a limited time, finally lack of training programs regarding infection control measures and it's important.

It was found that the highest percent of nurses had satisfactory knowledge about general information and infection control (84.6, 71.8% respectively) preprogram. Their knowledge improved significantly immediately and during the follow up after the educational program than preprogram. Our results supported by Al-Ayed, (2005) who studied 479 respondents, (39.4%) were physicians and (60.5%) were nurses included to assess knowledge and practices of childhood immunization among primary health care providers in Riyadh City, and he documented that (66 & 86.1 %) have satisfactory knowledge regarding general information and infection control information respectively.

The current study detected that the majority of nurses had satisfactory knowledge preprogram about oral polio, BCG, Pentavalent and MMR vaccine. This finding matching with El Shazly et al., (2016) who assessed the level of knowledge of healthcare providers regarding each vaccine and found that the majority of nurses have a satisfactory level of knowledge for all typed of vaccines except for Hib vaccine.

In comparison of scores of the studied nurses related to universal precaution procedures, it illustrated that there were highly statistically significant differences between nurses' practice pre, immediate and after three months of program. as all nurses didn't perform hand washing, hand rubbing or wearing gloves during pre-program phase. This finding is in accordance with many studies: Brown, Oluwatosin & Ogundeji, (2017) who assessed the impact of training intervention on immunization providers' knowledge and practice of routine immunization in Ibadan and reported that poor practices regarding infection control precautions such as hand washing. Esa, (2007) who found poor compliance to hand hygiene as none of studied nurses wash their hands before vaccination session. This finding contradicted with El Shazly et al., (2016) who recorded that 100% of the studied participants reported washing their hands. The basic handwashing and clean hygiene, essentially. So, The Persons administering vaccinations should follow appropriate precautions to minimize risk for disease exposure and spread. Hands should be cleaned with an alcohol-based waterless antiseptic hand rub or washed with soap and water before preparing vaccines for administration and between each patient contact (Hockenberry & Wilson, 2018).

Nurses had deficiency in their information about how to use alcohol or let it to dry before give the vaccine in the same line with Hutin et al., (2003) who mentioned that not recommended to use of alcohol swabs before vaccine injection. However, Taddio, (2017) mentioned that no clinical impact of using or not using alcohol swabs on infections and infection symptoms. While Saiman et al., (2017) stated that use of 70% isopropyl alcohol is recommended for skin cleaning before immunizations injection and blood draws. If Alcohol is used for cleaning, it should be allowed to dry before injection is given as this could inactivate live vaccine. This opinion contradicted with the result of current study as the highest percentage of the nurses answered the question related to clean the injection site incorrectly and they mentioned that the alcohol has effect on the vaccine potency. From the researcher opinion, it is better if nurses disinfect the injection site with alcohol because the site of injection is near to the diaper area, also poor hygiene can provide good media for growth microorganism, so it's necessary to disinfect the injection site with alcohol swap and allowed it to dry to avoid alcohol effect on vaccine potency.

In this study, correct practices of the nurses regarding the universal precaution aspects (hand washing, hand rubbing, wearing gloves, & sharp handling) had a highly statistical significantly improvement in immediate and follow-up than pre-program. This finding is similar to previous studies showed that nurses had statistically significant higher total knowledge and practice scores were revealed in the postintervention phase as compared with the preintervention one as reported by Galal, Labib & Abouelhamd, (2014). May be this improvement because the essential equipment for universal percussion steps were provided by researcher for example soap, tissue papers, alcohol Swap, also the update information about infection control which provided through our program.

The current study's results illustrated that there were a highly statistical significance differences between pre, immediate and follow up posttest for nurse's practice related to all different routes of vaccine administration procedure (oral, IM, SC, ID). This result contradicted with El Shazly et al., (2016) who studied

the practice of the studied healthcare participants for each vaccine, found that the majority of participants has good performance. This finding supported by Brown, Oluwatosin &Ogundeji, (2017) who studied the Impact of training intervention on immunization providers' knowledge and practice of routine immunization in Ibadan, south-western Nigeria, and illustrated that there was a sharp increase in the mean scores of the participants' knowledge and practice immediately after the training in the two groups. Thereafter, there was a drop in the mean scores of the same groups at the three months and six months post-intervention assessment. In our study the improvement in the nurse's performance in the immediate post assessment can be attributed to the effectiveness of the training program.

Regarding correlation between nurse's demographic data and their knowledge and practice, the present study clarified that, nurses age had negative correlation with their knowledge in pre-program and post program follow up phase. Also, nurses practice correlated negatively with their age in preprogram, immediately and post program. This finding is in the same line with the results of a study conducted by Tomboloni et al., (2019)whoassessed the knowledge, attitude and disinformation regarding vaccination and immunization practices among healthcare workers of a third-level paediatric hospital and found that the younger nurses had higher statistically significant of adequate practice, compared to the older one.

A negative correlation was found between years of experiences and their knowledge in preprogram and follow up. Also, there were negative correlation between nurse's years of experiences and their practice in pre, immediate and during the follow up after the program. This result matching with Swarnkar et al., (2016) who assessed knowledge and practice about immunization among health care providers and mentioned that, there was negative correlation between knowledge and practice of Health workers with increase in duration of years of experience. also, these findings were congruent with Metwally, Donia& Abdel Aziz, (2016) who indicated that nurses with 5 to less than 10 years of experience had higher mean percent practice score than those with more than 10 years of experience. It is from the researcher point of view, general concept that with increase in years of working, knowledge and practices improves but it was not found true in our study as the finding of the present study illustrated that younger nurses with few years of experiences have better knowledge and practice.

The result of the present study against the finding of study which conducted in Thailand by Widsanugorn, (2011)who assessed the health care worker's knowledge and practice regarding expanded program about immunization and found that significant improvement occurs in knowledge and practice with increase in duration of occupation. From the researcher point of view the causes of this issue may be because the younger nurses have updating knowledge and good practice because they were newly graduated and have updating knowledge and have desire to learn rather than the older nurses.

A positive correlation was detected in the present study between nurse's knowledge and their training courses during immediate educational program, this finding supported by El Shazly et al., (2016) who revealed that receiving training courses has a significance effect on total knowledge of health care providers about vaccination. On the other hand, the result of Brown, Oluwatosin &Ogundeji, (2017) contradicted with the current study as mentioned "immunization providers' age, years of experience of immunization practice and previous attendance of immunization training did not have any significant association with their performance in all the assessments conducted". From the researcher point of view this finding reflecting the direct effect of attending training courses on nurse's knowledge.

There was positive correlation between pre-knowledge and pre-practice of nurses, immediate knowledge and practice and between knowledge and practice of follow up phase and observed that nurse's knowledge and practice improved immediately after educational program and during the follow up phase. The above findings were consistent with Brown, Oluwatosin &Ogundeji, (2017) who revealed that a statistically significant improvement in the participant knowledge and practice in all three parameters of the study evaluation (immediate, after 3 months & after 6 months) from the training program than the pre intervention phase assessment.

IV. Conclusion

The study concluded that the health education program was effective in improving nurses' knowledge and practice in post program than before about general information, infection control, BCG, DPT vaccine, component of health education giving for parents. In addition, nurses' practice improved in post program than before about the universal precaution and vaccine administration.

V. Recommendations

- Provision of continuing education programs on regular basis is suggested in order to refresh and update nurses' knowledge, as well as reinforce proper practice related to infection control.
- There should be a continuous supervision and periodic evaluation of nurses that is needed to determine any defects related to knowledge or performance. Provision of adequate resources and facilities, (such as protective barriers, sinks, soap, towels, etc.) and equipment related to procedures in health care settings.

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