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Effect of Applying Structured Teaching Programme on Knowledge and Attitude Regarding Umbilical Cord Blood Collection and Its Barriers among Maternity Nurses

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**ARTICLE INFO**

ABSTRACT

Umbilical cord blood collection increases the life expectancy of end-stage or chronically ill patients. The knowledge and attitude of health professionals are essential to the success of this attempt. This inquiry aimed to evaluate the effect of applying a structured teaching program on knowledge and attitude concerning umbilical cord blood collection and its barriers among maternity nurses. A quasi-experimental research design was used. It was carried out in Obstetrics and Gynaecological departments (antenatal, postnatal, and operating room) at Banha University Hospital. Based on a convenient sampling method, 89 maternity nurses at Banha University Hospital were chosen. To gather the data, two instruments were utilized: a) An organized interview questionnaire sheet, including two sections of socio-demographic features of maternity nurses and knowledge of maternity nurses concerning umbilical cord blood collection and its barriers; b) a modified Likert scale to assess the nurses' attitudes regarding umbilical cord blood collection and its barriers. The results showed that a minority of the nurses (11.2%) had good knowledge about umbilical cord blood collection and its barriers pre-intervention, which increased to (86.5%) post-intervention; however, only one-fifth of nurses (20.0 %) had a positive attitude of umbilical cord blood collection and its barriers pre-intervention which increased to (89.9%) post-intervention. Additionally, a highly direct correlation between total knowledge and total attitude score pre-and post-intervention was noticed. Structured teaching program regarding umbilical cord blood collection significantly improved nurses' knowledge and attitude regarding umbilical cord blood collection and its barriers. As a recommendation, appropriately designed in-service training programs concerning umbilical cord blood banking and its barriers must be founded to improve nurses' knowledge and attitude to suit newly developed concepts in care.

GRAPHICAL ABSTRACT
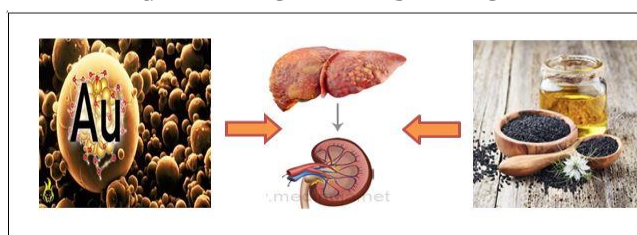
Introduction

The umbilical cord is the main link and vital attachment between mother and baby, always represented as a blood and emotional parenthood relationship [1]. The placenta with umbilical cord blood was discarded as medical waste. The cord blood was revealed to include stem cells and initial precursor cells that would be lifesaving and applied in stem cell transplantation for both adults and children [2].

Umbilical cord blood stem cells are similar to cells from bone marrow. Furthermore, the stem cells from umbilical cord blood (UCB) are not expected to be rejected in transplantation than bone marrow cells. Many advantages include the easily gathering of cells, availability of UCB, and reduced diseases transmission. As a result, UCB can be utilized instead of bone marrow for transplantation ٣]]. Due to their ability to self-replicate and differentiate into other body cells, stem cells are considered unique cells. This enables the body to replace tissue and heal itself, assisting in the restoration of tissues, organs, and blood vessels and providing clinicians with a means of treating various diseases that require stem cell transplantation [2].

Umbilical cord blood collection (UCBC), also called umbilical cord blood banking, gathers and stores umbilical cord blood immediately after the baby's birth [4]. Umbilical cord blood can be gathered without any harm to the mother or infant donor. These, in contrast to embryonic stem cells, are not ethically questionable. Blood can be taken from the portion of the umbilical cord still linked to the placenta after the new-born baby is delivered and the umbilical cord is separated. The remaining section of the umbilical cord and placenta collects stem cells from the blood [1]. The sampling of UCB from the placenta is implemented immediately 10-15 minutes following the placental delivery by puncturing the umbilical veins using a needle. It is carried out aseptically, and the UCB is gathered into a sterile bag, including an anticoagulant, to avoid clotting [5]. Cord blood can be collected following both a vaginal or caesarean section birth. The in-utero collection is the preferred collection method, occurring after the baby's birth but before the placenta is delivered. The in-utero collection takes advantage of the rhythmic contractions of the uterus to facilitate blood collection from the placenta and the umbilical vein [6] while ex-utero collection occurs after placental expulsion [7].

Cord blood must be processed within 48 to 72 hours of collection to avoid losing viability before freezing. Once the necessary processing steps have occurred, cord blood units are cryopreserved in liquid or vapour nitrogen. Stem cells can remain cryopreserved for more than 20 years; they do not lose their biological activity when stored undisturbed at minus 196 degrees Celsius [6].

Cord blood could be sampled and stored either in private or public blood banks. The latter is employed in all developed countries and within most developing countries. It gathers, translocates, handles analyses, and stores cord blood units (CBU), selflessly donated for allogeneic use, with no financial cost. This CBU unit is not kept for the use of the donating family [4]. The private cord blood banks charge parents a fee for collecting, handling, and storing their infant's cord blood for exclusive autologous or family use [1]. Researchers have found that participants identify many barriers to decide not to have UCBC gathered that included care about the safety of the mother and neonate, beliefs about the placenta, threats versus privacy, refusal of UCBC, and the impact of fathers, such as the cost of cord blood banks, policies, and procedures of their hospitals, the time needed to educate the mothers, lack of nurses' knowledge about UCBB, cultural believes of the placenta, pregnancy as a difficult time to make decisions, lack of mothers' knowledge about UCBC and religious barriers [8]. Maternity nurses are an integral part of health care providers in all phases of life. Nurse's knowledge and attitude regarding umbilical cord blood collection will help to achieve this process successfully. Nurses have a specified role in teaching patients. They have a reliable source of health information, so they must be aware of the latest medical diagnosis and treatment [9].

The aim of this study was to assess the effect of applying structured teaching programme on

knowledge and attitude regarding umbilical cord blood collection and its barriers among maternity nurse.

Justification of the study

Umbilical cord blood collection is a new approach in medical science. It is the most innovative technology available internationally to repair the body's failing system; most clients are unaware of this clinical entity. Hence, the UCBC is mainly performed by obstetricians, midwives, and nurses trained in that field [5].

By 2014, the international cord blood banking network has grown to include over 160 public cord blood banks in 36 countries, storing over 731,000 UCBU [1]. UCBC is a significant source of stem cells. It treats many diseases in Egypt by transplanting stem cells such as Mediterranean anaemia, leukaemia, diabetes, and liver cirrhosis due to viral hepatitis. The healthcare team, especially the nurse, is supposed to educate the pregnant women regarding this issue to make an informed decision [10].

Nurses, especially in the maternity field, must be informed about the most modern advances and receive the required training. So that, increasing the knowledge level and improving attitude to UCB banking and its barriers among the maternity nurses will help develop UCB banking as an essential aspect of the Egyptian healthcare team [9].

Research hypothesis
This study tested the following hypothesis:
Application of structured teaching program regarding umbilical cord blood collection and its barriers will positively affect maternity nurses' knowledge and attitude more than before application.

Material and Methods

Research design
A quasi-experimental one-group pre-test post-test research design was employed in this study.

The setting of the study
The study was performed in Obstetrics and Gynaecological departments (antenatal, postnatal, and operating room) at Banha University Hospital.

Sampling
Convenient sampling was used. All maternity nurses working in the Obstetrics and Gynaecological departments at the data collection were included in the study. The total numbers were (89) maternity nurses.

Instruments

An organized interview questionnaire
It was developed by the researcher based on reviewing related literature, and it was written in simple, clear Arabic language which covers two parts. Part one concerned with socio-demographic data and contains (5 questions) related age, educational level, occupation, years of experience, attended training courses on umbilical cord blood collection and its barriers. And part two concerned with nurses' knowledge concerning UCB banking and its barriers. It consisted of 27 questions, divided into three sections: a) Section 1 pertains to knowledge of nurses regarding umbilical cord blood to assess the understanding of maternity nurses about umbilical cord blood (UCB), including 8 questions for the definition of UCB, blood vessels in the umbilical cord, the best time for UCB collection, responsible persons for collecting UCB, advantages, and disadvantages of UCB, contraindication of UCB collection and diseases that can be treated with umbilical cord blood); b) section 2 focuses on knowledge of nurses regarding umbilical cord blood collection, containing (10-questions) regarding UCB banking (Definition of UCB-banking, definition of stem cells, policies of storing, length of time for UCB storage, types of UCB-banking, advantages of public banks, reasons for using private banks, disadvantages of private banks, advantages of hybrid banks and recommended procedures when storing umbilical cord blood banking; and c) section 3 delves into knowledge of nurses regarding umbilical cord blood collection barriers, containing 9 questions about barriers of umbilical cord blood banking; labour is improper time to make cord blood banking decision because of the barriers like cultural beliefs about the placenta, the cost of preserving the umbilical cord blood, hospital policies and procedures, the

lack of knowledge of the medical team, the mother's fear for the child's life, and religious issues.

Scoring system

Each item of the knowledge questionnaire was assigned a score of (2) for the complete, right answer, (1) for the incomplete correct answer, and (0) for the incorrect answer. These scores were transformed to a percent score. Knowledge score was classified into three categories as follows: a) A score of < 50% of the total score indicating poor knowledge; b) a score of 50< 75% of the total score indicating fair knowledge; and c) a scoring of ≥ 75% of the total score showing good knowledge.

A modified Likert scale

It was adopted according to past research [11,12] to ascertain nurses' attitudes toward UCB-banking and its barriers. It includes 19 statements divided into two parts: a) It has 11 statements about umbilical cord blood collection and its barriers as follows: Cord blood must be provided for life; I think it is necessary to store the umbilical cord blood of a child; it is essential to collect cord blood immediately after birth; the UCB should not be used only for the baby and his family; obtaining UCB does not waste time during childbirth; umbilical cord blood collection does not affect the mother's health or that of the new-born baby; the child is not harmed at all when taking UCB; pregnant mothers should be advised to store cord blood; everyone can benefit from the saving UCB; the use of umbilical cord blood is safer than the bone marrow of others and family history should be taken and adequate information disclosed before the cord blood is collected; b) it consists of 9 statements pertaining to considerations and recommendations about umbilical cord blood collection and its barriers as follows: Informed consent must be obtained to collect, store and use the cord blood; donor records must be kept private; umbilical cord blood collection centers must have clear policies; collection, storage and use of umbilical cord blood consistent with religion, experiences and competencies are required to collect and keep cord blood; collection of UCBs should be a normal

procedure in delivery rooms; the nursing curriculum should consist of a lecture on umbilical cord blood; it is necessary to conduct workshops and training courses for nursing on umbilical cord blood banks.

Scoring system

A score of (2) was given for agreement, a score of (1) grade was given for neutral, and a score of (0) grade was given for disagreement. Each item score was summated and then expressed as a percentage score. The total score was classified into: Positive behaviour: ≥ 75% and negative behaviour: < 75%.

Validity and reliability

Content validity of the instruments was evaluated after a jury of 5 experts revised them, three specialised in the related nursing field, and two experts specialised in blood banking. Pre-testing of the instruments revealed that they were clear, feasible and there was no ambiguity in the language. Simple modifications were done accordingly based on their comments and remarks. Internal consistency and a reliability coefficient Cronbach's alpha were the components of the questionnaire tested by SPSS software version 20. And it was 0.832 for the knowledge assessment part, 0.796 for the attitude scale.

Pilot study

It was performed on 10% of the total sample (8 nurses) to check the clarity and application of study instruments. It was done to estimate the period required to fill the questionnaire, evaluate relevance and clarity of the instruments and assess the feasibility of fieldwork. Nurses included in the pilot survey participated in the study as no significant variations were needed.

Ethical considerations

The research approval was achieved from the Scientific Research Ethical Committee, Faculty of Nursing at Banha University. Before starting the study, each nurse was informed about the research aim. Before data collection began, informed consent was obtained, confidentiality was maintained throughout the study, and maternity nurses were assured that all data would be used solely for research purposes. Each

maternity nurse was informed that participation was voluntary and that she was free to withdraw from the study at any time or to refuse to answer the specific question without providing an explanation.

Procedure

The aim of the current study was fulfilled through the following phases: Preparatory, assessment, implementation, and evaluation phases.

The first phase of the research included reviewing current and related literature. Also, theoretical knowledge of various aspects of the survey relied on books, articles, periodicals and magazines, and the Internet to develop data collection instruments. The study was performed from the 1st of August 2020 until the end of January 2021, covering six months.

In the second phase, i.e. assessment phase, the researchers alternately visited the obstetrics and gynaecological department during the (morning and afternoon shifts) three days each week to conduct the program. The researchers introduced themselves, greeted each nurse, and explained the research's aim for obtaining formal consent. Then the researcher interviewed the nurses for 30 minutes and collected the baseline data. Pre-test was carried out to evaluate nurses' knowledge and attitude regarding the umbilical cord blood collection and its barriers for further comparison after conducting the structured teaching program. Based on the data collected from the pre-test assessment, the structured teaching program sessions were conducted.

In the third phase, i.e. implementation phase, six sessions were provided in the Arabic language to suit to different educational levels of maternity nurses. The teaching methods included brainstorming, lectures, and group discussion with the application of infection control measures due to Covid 19. In addition, the researchers were able to direct the group by asking stimulating questions, listening to all comments and opinions, and from time-to-time summarising important points. The teaching media included visual aids as posters, PowerPoint presentation, and video. The program encompassed six planned sessions and was implemented according to job load, nurses' shifts, and

intellectual and physical willingness. The sessions were repeated to each subgroup included (4-5nurses). Each session continued for 30-45 minutes, including time for discussion and differs according to the nurses' recognition, comments, and feedback.

The first session began with an orientation to the programme and its purpose. It covered information about the umbilical cord, such as definition and anatomy, and giving a simple introduction about umbilical cord blood collection. The second session included knowledge about umbilical cord blood, such as the definition of stem cells, diseases treated by UCB cells, the advantages, and disadvantages of umbilical cord blood cells. The third session aimed to increase knowledge about the Contraindication of UCB collection and the nursing role in umbilical cord blood collection. The fourth session aimed to increase knowledge about umbilical cord blood banking, such as the definition of UCB banking and types of umbilical cord blood banking. The fifth session was meant to increase knowledge about recommended procedures during umbilical cord blood banking and improve attitude about umbilical cord blood collection. The sixth session aimed to increase knowledge about barriers to umbilical cord blood collection. This session was applied for revising all data provided at the previous sessions and discussing all questions' answers. Instructional booklets were distributed at the end of the sessions. At the beginning of each session, feedback was given about the previous one.

At this phase, i.e. evaluation phase, the researcher distributed the post-test to evaluate the knowledge and attitude of the maternity nurses by using the same predesigned instruments to compare the difference between pre and post-test results and assess the effect of the implemented educational program and compare.

Limitation of the study

Sometimes, the sessions were extended because of the workload and interference that required extra time devoted and effort.

Administrative design

Official approval documents to perform the study was attained from Dean of Faculty of Nursing to the Director of Banha University Hospital before starting the data collection. The researcher interviewed each participant and obtained informed oral consent before starting the data collection.

Data analysis

The data were coded and computed using version 20 SPSS program. Data were expressed as frequency and percentages (qualitative variables) and mean ± SD (continuous quantitative variables). Further, the study hypothesis was tested. The correlation coefficient was estimated between knowledge and attitude scores. The difference at $p \leq 0.05$ was considered statistically significant, and a highly significant at $p \leq 0.001$.

Result and Disscution

Table 1 shows that 57.3% of studied nurses aged 25 to 30 years with a mean ± SD 31.42±5.45. Regarding the educational qualification, 49. 4% of studied nurses held diploma. Most of the surveyed nurses (84.3%) were working under other nurses. Also, 55% of them had experienced more than ten years with a mean ± SD of 11.47±5.46. Most of them (83.1%) had no training about cord blood collection and its barriers, only 16.9% of them had training courses, and 60.0% of them were trained in hospitals.

Table 1: Sociodemographic characteristics of the 89 nurses surveyed (n=89)

Characteristics	No	%
Age (years)		
<25	8	9.0
25-30	51	57.3
> 30	30	33.7
Mean ±SD	31.42±5.45	
Educational qualification		
Diploma nurse.	44	49.4
Technical nurse.	31	34.8
Bachelor nurse.	11	12.4
Postgraduate studies	3	3.4
Occupation		
Bedside nurse	75	84.3
Staff nurse	10	11.2
Nurse supervisor	4	4.5
Experience (years)		
< 5	15	16.9
5-10	25	28.1
>10	49	55.0
Mean ±SD	11.47±5.46	
Attending training courses		
Yes	15	16.9
No	74	83.1
Site of training (n=15)		
Outside the hospital	6	40.0
At hospital	9	60.0

Figure 1 represents the nurses who took special scientific sessions regarding types of training courses, infection control, family planning, and CRP, respectively, by 46.7%, -33.3%, -20.0%.
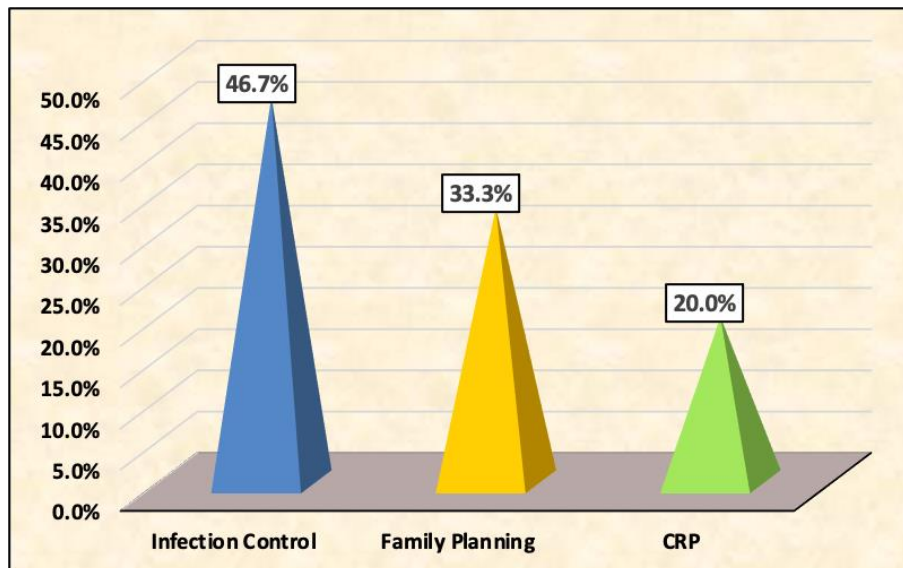
Figure 1: Distribution of nurses who took special scientific sessions regarding types of training courses (n=15)

Table 2 revealed a highly statistically significant improvement of total knowledge items means scores in post-intervention compared with pre-intervention (P ≤ 0.001).

Table 2: Mean score of total knowledge of studied maternity nurses regarding umbilical cord blood collection and its barriers pre- and post-intervention (n=89)

Total knowledge	Maximum score	Intervention		T-test	
		Pre-	Post-	T	*p*-value
		Mean ± SD	Mean ± SD		
Umbilical cord blood	16	8.93±3.64	14.39±1.67	17.4	0.000**
Umbilical cord blood banking	20	11.95±4.55	17.97±1.23	13.6	0.000**
Barriers of umbilical cord blood banking	18	11.10±3.50	16.83±1.43	15.1	0.000**
Total	54	31.98±10.54	49.20±3.34	18.0	0.000**

** highly significant at p< 0.001

Figure (2) reveals that most of the studied nurses had a good level of knowledge post-intervention (86.5%) compared with pre-intervention (11.2%).
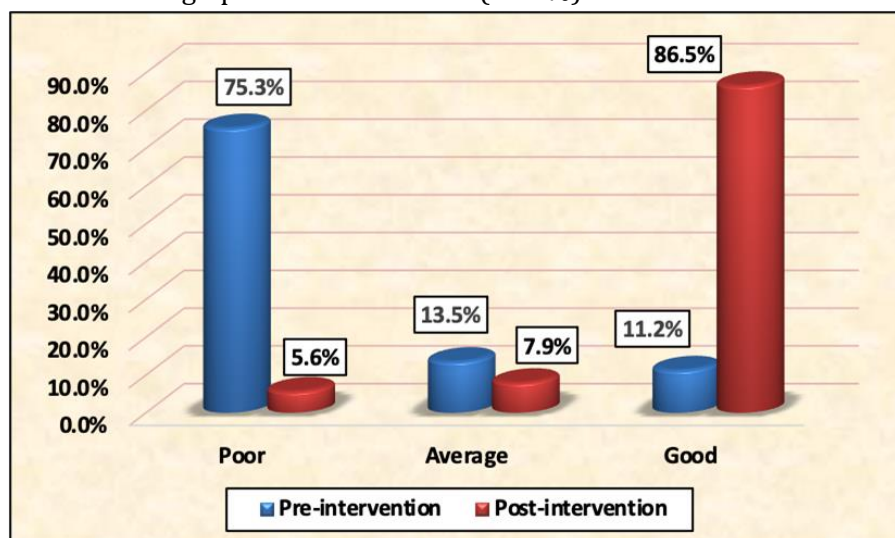

Figure 2: Total knowledge level of the surveyed nurses regarding umbilical cord blood collection and its barriers at pre- and post-intervention (n=89)

Table 3 illustrates a highly statistically significant improvement of total attitude items means scores post-intervention than pre-intervention (P ≤ 0.001).

Table 3: Total attitude at Pre- and Post-intervention phases of surveyed samples (n= 89)

Total Attitude	Intervention				Chi-square test	
	Pre-		Post-		χ2	*p*-value
	No	%	No	%		
umbilical cord blood banking and its barriers						
Positive attitude	85	95.5	89	100.0	162.6	<0.001 ***
Negative attitude	4	4.5	0	0.0		
considerations and recommendations about umbilical cord blood banking and its barriers						
Positive attitude	82	92.1	89	100.0	152.0	<0.001 ***
Negative attitude	7	7.9	0	0.0		

*, **, ***, significant at p< 0.05, 0.01, 0.001; NS, non-significant at p>0.05

Figure 3 represented that most studied nurses had a positive level of attitude (89.9%) post-intervention compared to (20.0%) pre-intervention.
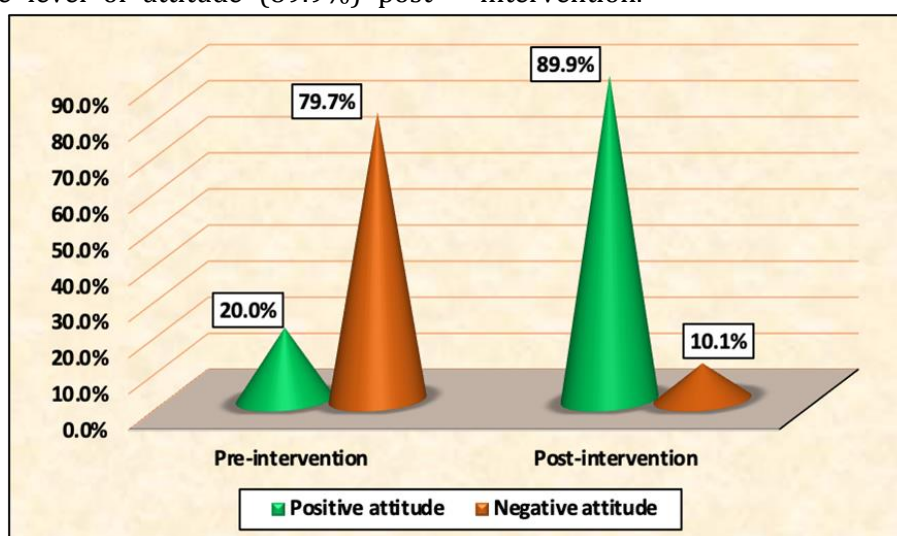

Figure 3: Total attitude level of surveyed nurses regarding UCB banking and its barriers pre- and immediate post-intervention (n=89)

Table 4 demonstrates a highly significant relationship between the total knowledge score of the studied nurses and their socio-demographic characteristics (age, educational qualification, occupation, and years of experience) at the pre-intervention phase (P≤ 0.001) compared with no statistically significant relation at post-intervention stage (P>0.05). Meanwhile, there was no statistically significant relationship between the total knowledge score of the studied nurses and training courses at pre-post-intervention (p> 0.05).

Table 5 shows that there was a statistically highly significant relationship between total attitude score of the studied nurses and their socio-demographic characteristics (age, educational qualification, and occupation) at the pre-intervention phase (p≤ 0.001) compared with no statistically significant relation at post-intervention stage (p> 0.05). There was a significant relationship between the total attitude score of the studied nurses and years of experience at the pre-intervention phase (p<0.05) compared with no statistically significant relation at the post-intervention stage (p> 0.05). Meanwhile, no statistically significant relationship was found between total attitude score of the studied nurses and training courses at pre-and post-intervention phases (p> 0.05).

Table 4: Relation between the total knowledge score of studied nurses and their socio-demographic characteristics at pre- intervention and post-intervention phases (n=89)

Socio-demographic characteristics	Total Knowledge																	
	Pre-intervention								Post-intervention									
	Poor (n=67)		Average (n=12)		Good (n=10)		Chi-square test	p-value	Poor (n=5)		Average (n=7)		Good (n=77)		Chi-square test	p-value
	No	%	No	%	No	%			No	%	No	%	No	%		
Age:																	
< 25	8	11.9	0	0.0	0	0.0	43.87	0.000	1	20.0	1	14.3	6	7.8	1.74	0.78
25-30	49	73.1	0	0.0	2	20.0			3	60.0	3	42.9	45	85.4		
> 30	10	14.9	12	100.0	8	80.0			1	20.0	3	42.9	26	33.8		
Educational qualification :																	
Diploma nurse.	41	61.2	3	25.0	0	0.0	69.03	0.000	1	20.0	2	28.6	41	53.2	7.64	0.26
Technical nurse.	26	38.8	4	33.3	1	10.0			2	40.0	4	57.1	25	32.5		
Bachelor nurse.	0	0.0	5	41.7	6	60.0			1	20.0	1	14.3	9	11.7		
Postgraduate studies	0	0.0	0	0.0	3	30.0			1	20.0	0	0.0	2	2.6		
Occupation :																	
Bedside nurse	65	97.0	7	58.3	3	30.0	37.08	0.000	4	80.0	5	71.4	66	85.7	2.39	0.66
Staff nurse	1	1.5	4	33.3	5	50.0			1	20.0	1	14.3	8	10.4		
Nurse supervisor	1	1.5	1	8.3	2	20.0			0	0.0	1	14.3	3	3.9		
Years of experience:																	
<5 years	15	22.4	0	0.0	0	0.0	19.55	0.001	3	60.0	1	14.3	11	14.3	7.99	0.09
5-10 years	24	35.8	1	8.3	0	0.0			1	20.0	3	42.9	21	27.3		
>10 years	28	41.8	11	91.7	10	100.0			1	20.0	3	42.9	45	58.4		
Training courses:																	
Yes	59	88.1	8	66.7	7	70.0	4.71	0.09	5	100.0	6	85.7	63	81.8	1.14	0.56
No	8	11.9	4	33.3	3	30.0			0	0.0	1	14.3	14	18.2		

Table 5: Relation between the total attitude score of studied nurses and their socio-demographic characteristics at pre-intervention and post-intervention phases (n=89)

Socio-demographic characteristics	Total Attitude											
	pre-intervention						post-intervention					
	Positive (n=18)		Negative (n= 71)		Chi - square test	P-value	Positive (n=79)		Negative (n= 10)		Chi - square test	p-value
	No	%	No	%			No	%	No	%		
Age:												
< 25	0	0.0	8	11.3	30.81	0.000	8	10.1	0	0.0	1.37	0.50
25-30	2	11.1	49	69.0			44	55.7	7	70.0		
> 30	16	88.9	14	19.7			27	34.2	3	30.0		
Educational qualification :												
Diploma nurse.	0	0.0	44	62.0	49.24	0.000	43	54.4	1	10.0	7.59	0.05
Technical nurse.	6	33.3	25	35.2			25	31.6	6	60.0		
Bachelor nurse.	10	55.6	1	1.4			9	11.4	2	20.0		
Postgraduate studies	2	11.1	1	1.4			2	2.5	1	10.0		
Occupation :												
Bedside nurse	6	33.3	69	97.2	44.56	0.000	69	87.3	6	60.0	5.07	0.07
Staff nurse	9	50.0	1	1.4			7	8.9	3	30.0		
Nurse supervisor	3	16.7	1	1.4			3	3.8	1	10.0		
Experience (years)												
<5	1	5.6	14	19.7	7.30	0.02	11	13.9	4	40.0	4.88	0.08
5-10	2	11.1	23	32.4			22	27.8	3	30.0		
>10	15	83.3	34	47.9			46	58.2	3	30.0		
Training courses:												
Yes	13	72.2	61	85.9	1.92	0.15	67	84.8	7	70.0	1.38	0.22
No	5	27.8	10	14.1			12	15.2	3	30.0		

**highly statistically significant p< 0.001

Table 6 shows that there was a highly direct correlation between total knowledge and total attitude (p≤ 0.000**).

Table 6: Correlation coefficient between total knowledge and total attitude scores of studied nurses at pre-post intervention phases (n=89)

Total practices	Total knowledge			
	Pre-intervention		Post-intervention	
	r	P-value	r	P-value
	0.89	<0.001**	0.90	<0.001**

** highly statistical significant p< 0.001

Umbilical cord blood (UCB) is the remaining blood in placenta and umbilical cord at birth. The UCB has several benefits as it consists of several great hematopoietic stem cells. Current statistics have proved that umbilical cord blood cells can treat nearly eighty diseases, and more than fifty

thousand transplants have been successfully implemented worldwide. UCB is considered as a source of stem cells that are being progressively used for treating many diseases, including immune system disease, blood cell, and genetic disorders, leukaemia, myelomas, lymphomas [4]. Regarding their disparate levels of knowledge and attitudes toward cord blood collection, maternity nurses and midwives wanted additional information about UCB. Many had not received recent formal education on umbilical cord blood banking [13]. The present study aimed to evaluate applying a structured teaching program on knowledge and attitude toward umbilical cord blood collection and its barriers between maternity nurses. The results of the current study indicated that using a structured teaching program about umbilical cord blood collection and its barriers will positively affect maternity nurses' knowledge and attitudes more than before.

Regarding socio-demographic features of the surveyed nurses, the present study showed that more than half of the surveyed participants were in the age group 25 to 30 years old with an average age of 31.42±5.45 years. These findings were matched with a past study [13], indicating that about three-quarters of the surveyed sample (n=78) were in the age group 25 to 30 years. This is in the same line with past research [14], reporting that most of the participants (n=50) fell between the ages of 21-30 years.

Regarding educational qualification, the present study found that nearly half of the studied sample had a nursing diploma, being congruent with past research [9, 13].

Like a past study [8], regarding the occupation, the present study's finding clarified that most of the maternity nurses were bedside nurses. However, this result was dissimilar to that of a previously conducted study [9], which indicated that practice nurses were 37.5%, 38.8% were head nurses and 24.2% were staff nurses. The result of the present study may have been due to hospital requirements.

In line with past research [8], regarding years of experience, the current study reported that more than 50% of the surveyed sample had experienced more than ten years with a mean of 11.47±5.46years. While on the contrary, a past study [12] showed that 1% of the studied sample (n=170) had 10:15 years of experience.

In congruence with past research [15, 16, 17], the results of the current study revealed that most of the surveyed sample had not attended any special scientific training course on umbilical cord blood collection and its barriers. therapy. In line with previous studies [12, 18], regarding nurses' knowledge about umbilical cord blood and cord blood collection, the current study showed that studied nurses had a poor level in all items of pre-intervention. At the same time, there was a highly significant development in all items of post-intervention (p<0.001). This result agreed with a past study [9], revealing that the level of knowledge of the sample was very poor in pre-intervention and improved after the implementation of educational intervention. Also, the results of the current study were congruent with a past investigation [17], reporting that the studied nurses had a lack and inadequate knowledge regarding UCB-banking. However, this study disagreed with past research [12], revealing that most of the studied sample (n=170) had average knowledge regarding UCB collection and stem cells preservation.

Like past research [13], regarding maternity nurses' knowledge about barriers to umbilical cord blood collection, the present study revealed a highly statistically significant improvement in all items about knowledge regarding barriers to UCB banking post-intervention (p<0.001).

In congruence with past inquiries [5,15], regarding maternity nurses' total knowledge about UCB banking and its barriers, the present study exhibited a highly statistically significant difference between the results of immediate post-test compared which pre-test in favour of immediate post-test, which improved from Mean±SD 31.98±10.54 pre-intervention to 49.20±3.34 immediate post-intervention. The total knowledge level was improved from poor level pre-intervention to a good level post-intervention. The above results were contrary to a study done previously [19], reporting that (42.86%) of the studied sample (56) had

moderate knowledge regarding stem cells and UCB banking.

This improvement might have been due to structured teaching program sessions and the instructional booklet distributed to nurses used as an ongoing reference, and nurses' interest to learn and acquire knowledge about UCB banking and its barriers.

In line with previous research [5,20], concerning maternity nurses' attitude about UCB banking and its barriers, the results of the current study displayed that about few nurses had positive attitudes pre-intervention and the majority improved immediate post-intervention. However, unlike the present study, it has been reported that no statistical significance difference between attitude in pre and post-test assessment. Additionally, [21] revealed that 86.6% of their nursing students (n=97) showed good attitudes toward stem cells therapy [13].

Additionally, the present study demonstrated a highly statistically significant variation between the immediate post-test and pre-test scores in favour of the immediate post-test for all UCB banking items (p<0.001). This could be because interventional sessions provided participants with valuable knowledge influencing their beliefs, which in turn influenced their attitude.

Regarding the relation between the studied nurse's socio-demographic characteristics and knowledge level about UCB collection pre and post-intervention, the present study revealed that there was a highly statistically significant relationship between the total knowledge score of the surveyed nurses and their socio-demographic characteristics (age, educational qualification, occupation, and years of experience) at pre-intervention phase (p≤ 0.001) compared with no statistically significant relation at post-intervention phase (p>0.05). Meanwhile, there was no statistically significant relationship between the total knowledge score of the studied nurses and training courses at pre-intervention & post-intervention phases (p> 0.05).

These findings of the study were partially in agreement with a previous study [18], stating a direct significant correlation between total knowledge scores and education level. However,

there was a negative significant relationship between total knowledge scores and age, as well as between the total knowledge scores and experience (in years) at various evaluation times. These results disagreed with past research [15], revealing no association between knowledge score and the selected demographic variables like age, year of experience, and educational status.

Concerning the relation between the studied nurse's demographic characteristics and level of attitude, the present survey illustrated that there was a highly statistically significant relationship between total attitude score of the surveyed nurses and their socio-demographic characteristics (age, educational qualification, and occupation) at pre-intervention phase (p≤ 0.001) compared with no statistically significant relation at post-intervention phase (p> 0.05). There was a significant relationship between the total attitude score of the studied nurses and years of experience at the pre-intervention phase (p<0.05) compared with no statistically significant relation at the post-intervention phase (p> 0.05). Meanwhile, there was no statistically significant relationship between the total attitude score of the studied nurses and training courses at pre- & post-intervention phases (p> 0.05). The present study findings are partially supported by a past inquiry [13], reporting significant differences between attitude and years of experience but no significant differences between attitude and level of education. Also, partially in agreement with this study, it has been reported [18] that there was a positive statistically significant correlation between total attitude scores and educational level. However, a negative significant correlation was noticed between total attitude scores and age and between total attitude scores and experience (years) at various evaluation times. The current results indicated that gaining information and accepting a positive attitude improved with age and more years of experience. Regarding correlation between studied nurses' complete knowledge and attitude scores about umbilical cord blood banking pre- and post-intervention, the present study demonstrated a positive, highly significant relationship between total knowledge and total

attitude scores at pre- and immediate post-intervention (p≤ 0.001).

The present study findings are supported by past research [12], showing the correlation between knowledge and attitude with similar consequences, as well as a survey by a past study [19], demonstrating that a positive correlation exist between knowledge and attitude scores of surveyed nurses (p<0.01). Additionally, the present study findings are supported by another inquiry [22], which demonstrated a significant relationship between the knowledge level and attitude level regarding stem cells. In contrast to the present study results, it has been reported that there were no significant differences with a positive correlation between the total knowledge score and total attitude score throughout the periods of the study [5]. Additionally, a poor association between the undergraduate nursing students' knowledge and attitude score has been evidenced [21].

The present finding may be because of level of knowledge on their attitude; lack of knowledge causes negative attitude while the increased level of knowledge helps improve attitude.

In sum, there was a statistically high significant difference between results of immediate post-test compared with pre-test in favour of immediate post-test concerning maternity nurses' knowledge and attitude with (p≤ 0.001). Thus, increased awareness of UCB banking should be enhanced by mass media, additional educational initiatives, and university and pre-university curricula. Also, it is necessary to update the nurse's knowledge on the trends and new technology so that they can give correct information to the parents.

Dissection and Conclusion

Based on results of present study, the application of structured teaching programs on UCB collection and its barriers had a positive effect on maternity nurses' knowledge and attitude concerning the umbilical cord blood banking and its barriers. There was a highly significant improvement of total knowledge between pre and immediate post-intervention (p≤ 0.001). A highly significant difference among the results of immediate post-intervention was observed compared with pre-intervention in favour of immediate post-intervention in all items of attitude regarding umbilical cord blood banking and its barriers (p<0.001). There was a significantly positive relationship between total knowledge and attitude scores at pre- and immediately post-intervention (p≤0.001). Therefore, the study hypothesis was supported, and the aim was achieved. Future studies are needed to recognize and explore maternity nurses' concerns regarding their practice of UCB collection techniques. Also, replication of the study on a large sample size in a different setting for generalizing the findings can be addressed by future research. The following recommendations are made in light of the findings of this study:

a) Appropriately designed in-service training programs regarding UCB collection must be established to improve nurses' knowledge and attitude to suit newly developed concepts in care;

b) booklet regarding cord blood banking should be available in Obstetrics and Gynaecological departments to be accessible to all nursing staff; and

c) The umbilical cord blood banking and cord tissue should be integrated as a new technological advancement in the nursing curriculums.

Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Conflict of Interest

The authors declare no conflicts of interest.

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