Effect of Designed Educational Guidelines on Nurses` Performance regarding Management of Children undergoing Bone Marrow Transplantation

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Abstract

Background: Bone marrow transplantation is a medical procedure that is performed to replace bone marrow or stem cells that has been destroyed by disease especially certain types of malignant (cancerous) and nonmalignant (noncancerous) diseases. **Aim of study:** Was to evaluate the effect of designed educational guidelines on nurses' performance regarding management of children undergoing bone marrow transplantation. **Design:** A quasi-experimental research design was utilized to conduct this study. **Settings:** This study was carried out in Bone Marrow Transplantation Unit of Mansoura university children hospital affiliated to Mansoura University Hospital, Tanta University Educational Hospital affiliated to Tanta University Hospital and Nasser Institute affiliated to Specialized Medical Centers. **Subject:** A convenient sample included (57) nurses who are providing direct care for children undergoing bone marrow transplantation at previously mentioned settings. **Tools of data collection:** Data were collected by using tools which are: **Tool (I):** A structured interviewing questionnaire sheet. **Tool (II):** Observation checklist for nurses' practice to evaluate nursing practice before and after implementation of designed educational guidelines regarding bone marrow transplantation**. Results:** The majority of the studied nurses had satisfactory level of total knowledge regarding bone marrow transplantation post-designed educational guidelines compared to pre-designed educational guidelines implementation. Also, the majority of the studied nurses had competent level of total practice in post designed educational guidelines compared to predesigned educational guidelines implementation**. Conclusion:** The designed educational guidelines were effective in improving nurses` performance regarding management of children undergoing bone marrow transplantation. Also, there was a positive correlation between nurses' total level of knowledge and total practice at pre and post designed educational guidelines implementation. **Recommendations:** Conducting continuous training programs about bone marrow transplantation for nurses to enhance their knowledge and practice.

Keywords: Bone marrow transplantation, Designed educational guidelines, Management of children, Nurses' performance.

Introduction:

Bone Marrow Transplantation (BMT) or Hematopoietic Stem Cell Transplantation (HSCT) involves the intravenous infusion of hematopoietic stem cells of any donor type and any source in order to re-establish blood cell production in children whose bone marrow is damaged or defective. Stem cells for BMT can derive from bone marrow, peripheral blood or cord blood (CB) **(Moore & Besa, 2023).**

Bone marrow is the spongy tissue found inside the bones. Bone marrow makes stem cells, which grow and divide and become red blood cells (which carry oxygen to body

tissues), white blood cells (which help fight off infection), and platelets (which aid in blood clotting) **(National Cancer Institute, 2022).**

The types of bone marrow transplantations: there are four types; Autologous bone marrow transplant in which stem cells are removed from the child and are stored in a freezer. After high-dose chemotherapy or radiation treatments, the child's stems cells are put back in his body to make normal blood cells. This is called a rescue transplant. Allogeneic bone marrow transplant in which stem cells are removed from another person, called a donor. Most times, the donor's genes must at least partly match the child's genes. Umbilical cord blood transplant is a type of allogeneic transplant. Stem cells are removed from a newborn baby's umbilical cord immediately after birth. The stem cells are frozen and stored until they are needed for a transplant. Umbilical cord blood cells are very immature so there is less of a need for perfect matching. Due to the smaller number of stem cells, blood counts take much longer to recover **(American Society of Clinical Oncology, 2020).**

The indications for hematopoietic stem cell transplantation for hematological diseases, solid tumors and immune disorders include; Hematological malignancies such as, acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), chronic myelogenous leukemia (CML), juvenile myelomonocytic leukemia (JMML), myelodysplastic syndromes (MDS), Hodgkin lymphoma (HL) and Non Hodgkin lymphoma (NHL). Non-malignant disorders and solid tumors as mucopolysaccharidosis (MPS), Thalassemia, sickle cell disease (SCD), Osteopetrosis, severe aplastic anemia (SAA), inborn marrow failure syndromes (IBMFS) (Fanconi anemia, dyskeratosis congenita, Blackfan–Diamond anemia. Germ cell tumors as: Soft tissue sarcoma, Ewing's sarcoma, Osteogenic sarcoma, Neuroblastoma, Wilms' tumor and autoimmune disorders **(Duarte et al., 2019).** Preparation therapy called conditioning therapy is most crucial in preparing the child for transplantation which administered various days prior the infusion of stem cell. It comprises utilizing different protocol regimens of chemotherapy, radiation, and/or immunotherapy. Alternatively, the pre hematopoietic stem cell transplantation conditioning can be chemotherapy only without radiation. It used for eradication of disease, generate a space in child's bone marrow for engraftment of new stem cells and act as immunosuppressant to decrease the risk of rejection of stem cells by the host cells **(Saraceni et al., 2021).** Possible complications of a bone marrow transplant depend on the child's age, the child's overall health, how good of matching with the donor, pre-transplant chemotherapy or radiation therapy and the type of bone marrow transplant the child received **(Im & Pavletic, 2020).**

The complications of bone marrow transplantation may include: anemia, bleeding in the lungs, intestines, brain, and other areas of the body, cataracts, clotting in the small veins of the liver, damage to the kidneys, liver, lungs, and heart, delayed growth, graft failure, which means that the new cells do not settle into the body and start producing stem cells, Graft-versus-host disease (GVHD), a condition in which the donor cells attack the own body, infections, which can be very serious, inflammation and soreness in the mouth, throat, esophagus, and stomach, mucositis, pain and stomach

problems which including diarrhea, nausea, and vomiting **(Uzumcu & Erbas, 2021).**

The critical role of BMT nurse is to guide the child and family through all the information that is needed to understand care options. The emotional context of coping with illness, of grieving the many losses, and of anticipating death can make education and learning a challenge. So this is important for the hospital to ensure that nursing staff have knowledge, experience, and training to perform the required tasks. There should be training plan for all staff to maintain a suitable level of competence and ensure that they are perform the tasks that full within their job description **(Khalil et al., 2022).**

Nurses should be oriented with the potential complications of bone marrow transplantation in order to prevent or discovering the warning signs as sepsis, fluid overload, organ malfunction and take the necessary actions to reduce negative consequences and restore the child's clinical status. Prior to discharge, nurses also give the children and their families' intensive instruction on after bone marrow transplantation restrictions, food, medications, fluid balance, test results, and the importance of follow-up **(Elsantawy et al., 2023).**

Significance of the study:

Cancer and blood disorders are becoming the most common problems in Egypt and all over the world. The majority of bone marrow disorders may develop many problems and there are several complications of bone marrow transplantation such as nausea and vomiting, infection, bleeding, cataracts, interstitial pneumonitis, graft-versus-host-disease, graft failure, new cancers, abnormal growth of lymph tissues and hormonal changes, such as changes in the thyroid or pituitary gland. These complications may be arise due to inadequate nursing management. Knowledge and practice for health care team are very important especially for nurses who are providing direct contact care for children undergoing bone marrow transplantation. It is necessary to conduct the designed educational guidelines of this study to improve nurses' knowledge and practice regarding bone marrow transplantation and update their knowledge and skills in the light of recent guidelines to decrease post transplantation complications.

Aim of the study:

The aim of the study was to evaluate the effect of designed educational guidelines on nurses` performance regarding management of children undergoing bone marrow transplantation

Research hypothesis:

The designed educational guidelines will improve the nurses' knowledge and practice regarding management of children undergoing bone marrow transplantation.

Subjects and Method:

Research design:

A quasi-experimental design was utilized for conducting this study.

Settings:

The current study was carried out in Bone Marrow Transplantation Unit of Mansoura University Children Hospital affiliated to Mansoura University, Tanta University Educational Hospital affiliated to Tanta University and Nasser Institute affiliated to Specialized Medical Centers.

Subject:

A convenient sample included 57 nurses who are providing direct care for children undergoing bone marrow transplantation working at the previously mentioned settings.

Tools of data collection:

Data of the current study were collected through using the following two tools:

Tool (1): A structured interview questionnaire sheet: This tool was developed by the researchers and after reviewing the relevant literatures (national and international). It was designed in a simple Arabic language and was composed of two parts as following:

Part (1): Personal characteristics of the studied nurses which was included; age, gender, level of education, nurses' position, years of experience in bone marrow transplantation units and number of previous courses attainment related to bone marrow transplantation.

Part (2): Nurses' knowledge Assessment regarding bone marrow transplantation: It was developed by the researchers after reviewing of the related literatures **Morrison & Morris (2017) & Ali et al., (2019).** It contained of (31) questions.

Scoring system for nurses' knowledge:

Nurses' knowledge was evaluated upon completion of the interview questionnaire where the studied nurses' knowledge was checked with a model key answer and accordingly, then (1) score was given for correct answers, and (0) score was given for incorrect and didn't know answers. A high score was indicated a better level of knowledge. The maximum score was (31).

The nurses' total knowledge score was categorized as the following:

- Satisfactory level of knowledge: (≥80%)

of total knowledge score (25-31).

- Unsatisfactory level of knowledge: (< 80%) of total knowledge score (less than 25).

Tool (II): Observation checklist for nurses' practice: This tool was adapted from **Goodwin (2015) & Abed El-Hay et al., (2018)** and used to evaluate nursing practice before and after implementation of designed educational guidelines regarding bone marrow transplantation procedure. It was consisted of the following;

- Caring of children pre bone marrow transplantation.
- Caring of children during bone marrow transplantation.
- Caring of children after bone marrow transplantation.

Scoring system for nurses' practice:

Each item was calculated as the following; done practices was scored (1) and not done practices was scored (0). Total score of nurses' practice was categorized into two levels as:

-Competent → ≥ 85% of the total score.

-Incompetent → < 85% of the total score.

Tools validity and reliability:

The study tools were revised by a panel of three experts in the field of pediatric nursing from faculty of nursing, Benha University to assess the content validity of the study tools. The experts reviewed the tools for clarity, relevance, comprehensives, simplicity, applicability and sequence of items. All their remarks were taken into consideration regarding the format, layout, rephrasing, consistency, accuracy and relevance of the study tools. Then the final form was used in data collection. Reliability for tools was applied by researchers for testing the internal consistency of the tools by administrating the tool to the same subject under similar condition using cronbach's alpha coefficient test. Answer from repeated testing was compared (test-retest reliability), this turned to be (r=0.934) for nurses' knowledge and (r= 0.979) for nurses' practice.

Ethical considerations:

The Benha University Faculty of Nursing Scientific Research Ethical Committee accepted this study. All ethical issues were taken into consideration during all phases of

the study; the researchers explained the aim, nature and expected outcomes of the study to the studied nurses before their participation in order to obtain their acceptance and cooperation. The studied nurses were informed that the study is harmless, and all gathered data are confidential and are used for the study purpose only. Moreover, participation in the study was voluntary and nurses were informed that they have the right to withdraw from the study at any time without any obligations. An oral consent was taken from nurses.

Filed Work:

The actual field work started from the beginning of July 2022 to the end of December 2022, six months for data collection. The data was collected from the previously mentioned settings until reaching the size of sample. The researchers was available in each study setting by rotation three days weekly (Saturday, Monday and Wednesday) at morning and afternoon shifts from 9 A.M until to 5 P.M to collect the data using the previous data collection tools.

Assessment Phase

A pre test carried out by using the study tools to assess nurses' knowledge and practice regarding management of children undergoing bone marrow transplantation. The average time needed for the complition of each tool was ranged between 20-30 minutes. The period of assessment phase (pre-test) took one month (July 2022).

Planning phase

Based on baseline data obtained from pre-test assessment and relevant of review of literature, the designed educational guidelines were developed by the researchers according to the actual needs assessment of the studied nurses. Accordingly, the designed educational guidelines were designed by researchers using simple Arabic language and coloured pictures in order to facilitate nurses' understanding.

Statement of objectives:

General objective: The aim of implementation of the designed educational guidelines was to improve the nurses' knowledge and practice regarding management of children undergoing bone marrow transplantation based on fulfilling their needs of knowledge and practice.

Implementation phase:

The designed educational guidelines were implemented at period of (4) months from the beginning of August 2022 till the end of November 2022. General and specific objectives of designed educational guidelines were stated and implemented to satisfy the actual needs of the studied nurses. The studied nurses were (57) nurses and divided into (10) groups each group ranged between (5-7) nurses taking into consideration precautionary measures. The designed educational guidelines were implemented 3 days per week. The implementation phase was achieved through (6) sessions, (2) sessions for the theoretical part and (4) sessions for the practical part, the time of each theoretical session lasted for 60 minutes, and the time of each practical session ranged from (45-60) minutes.

A schedule suitable for nurses developed including date, time, place, topics and duration of each session. Each session started by summary of the previous session and objectives the new one, take into considerations, and the use of Arabic language that suits the nurses' education level. During session, each nurse has an opportunity to ask questions and share information with each other. Otherwise, the researchers answered any questions about the designed educational guidelines as needed.

Measures of precautions are taken into consideration during data

- Personal protective materials such as facemask, gloves, antiseptic solution for hand hygiene.
- Personal distancing to maintain a minimum 1.5m distance.
- Avoiding shaking hands or hugging.
- Avoid touching one's mouth, nose or eyes to prevent spread of infection.

Motivation and enhancement during sessions were used to enhance sharing in this study. Different teaching methods were used as lecture, group discussion, brain storming and role- play. The media used were booklet, colored poster, white board, videos and power point. Evaluation methods as feedback through oral questions were used in sessions of designed educational guidelines. Researchers motivated the studied nurses by encouraged them with words and gave pens and notebooks as rewards to gain their participation. The designed educational guidelines were implemented in (6) sessions for all nurses as the following:

A-Theoretical session as the following,

first session: it was focused on Identification of the objectives of the study and its expected outcomes, definition of the bone marrow and its locations in the body, formation and development of bone marrow, types of bone marrow, functions of bone marrow, elements that make up the blood, diseases that affecting the bone marrow of children, definition of bone marrow transplantation and types of bone marrow transplantation to children.

Second session: it was focused on, contraindications of bone marrow transplantation for children, the way of separating bone marrow cells from a donor for transplantation into children, and characteristics that should be present in the bone marrow donor, stages of bone marrow transplantation and complications of bone marrow transplantation and treatment of them for children.

B-Practical sessions: Third session it was focused on the steps of routine and surgical hand washing. **Fourth session** it was focused on caring and removal of central venous catheter. **Fifth session** it was focused on the steps of oral and skin care and the steps of kidney and liver function follow up. **Sixth session:** it was focused on discharge plan containing health education for the children and his family and reducing possible complications after discharge from the hospital..

Evaluation phase:

During this phase, the effect of designed educational guidelines on nurses' knowledge and practice regarding management of children undergoing bone marrow transplantation was evaluated by using the same forms of tools which used before the guidelines implementation for all nurses. Reassessment was done immediately after implementing the designed educational guidelines and took about one month.

Statistical Analysis:

The collected data was organized, analyzed and tabulated using appropriate statistical methods. Data were extracted from the interview questionnaire and computerized in Microsoft Excel 2019. Statistical analysis was done by IBM SPSS (Statistical Package for Social Science) version 22.0. Qualitative data were represented using numbers and percentages. Quantitative data were described as mean and standard deviation. Chi-Square Test was used to examine the relationship between two qualitative variables. Spearman Correlation Analysis was used to assess the strength of association between two quantitative variables. A significant level values was considered when the p-value ≤ 0.05, while a highly significant

level value was considered when the p-value ≤ 0.001, and p-value > 0.05 indicates non-significant results.

Results:

Table (1): Showed that, more than two fifth (43.9%) of nurses were in the age group 20>25 years. Regarding to educational level, less than two thirds (56.2%) of them had Technical institutes of nursing. As regards to position, the majority (89.4%) of them were staff nurse. As regards to years of experience, more than two fifth (43.9%) of the studied nurses had experience from 2 to less than 5 years. Regarding previous training courses, more than three quarters (78.9%) of them didn't attend training courses about care of children undergoing bone marrow transplantation.

Figure (1): Showed that, the majority (91.2%) of the studied nurses had satisfactory level of knowledge regarding bone marrow transplantation post designed educational guidelines implementation, compared to one third (33.3%) pre designed educational guidelines implementation.

Figure(2): Showed that ,the majority of the studied nurses (93.0%) had competent level of total practice in post designed educational guidelines implementation compared to slightly less than one quarter (22.8%) pre designed educational guidelines implementation.

Table (2): Cleared that, there were statistically significant relations between nurses' age, educational level, years of experience, and previous training courses with their total level of knowledge at pre and post designed educational guidelines implementation (P≤0.05). On the other hand, there were no statistically significant relation between nurses' gender with their total level of knowledge at pre and post designed educational guidelines implementation (P>0.05).

Table (3): Illustrated that, there were statistically significant relations between nurses' years of experience, and previous training courses with their total level of practice at pre and post educational guidelines implementation (P≤0.05). On the other hand, there were no statistically significant relation between nurses' gender with their total level of practice at pre and post designed educational guidelines implementation (P>0.05).

Table (4): Represented that, there was a positive correlation between nurses' total knowledge and total practice at pre and post designed educational guidelines implementation.

Table (1): Percentage distribution of the studied nurses according to their characteristics (n= 57)

Nurses' characteristics	No.	%
Age (years)		
20-<25	25	**43.9**
25 - <30	22	38.6
30-<35	8	14.0
≥ 35	2	3.5
Educational level		
Diploma of secondary nursing school	6	10.5
Technical institute of nursing	32	**56.2**
Bachelor in nursing science	19	33.3
Position		
Staff nurse	51	**89.4**
Head nurse	3	5.3
Unit supervisor	3	5.3
Years of experience at BMT unit		
>2 years	17	29.8
2-<5	25	**43.9**
5-<8	12	21
≥8	3	5.3
Previous training courses regarding care of children undergoing BMT		
Yes	12	21.1
No	45	**78.9**

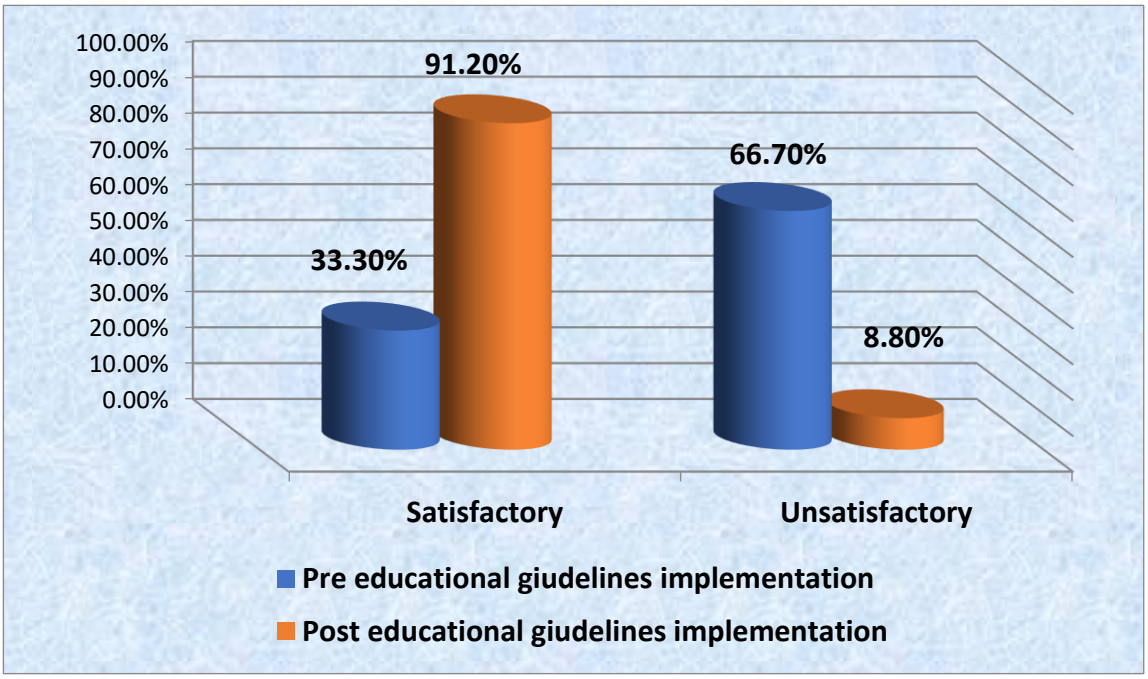

Figure (1): Nurses' total knowledge regarding bone marrow transplantation pre and post designed educational guidelines implementation. (n= 57)

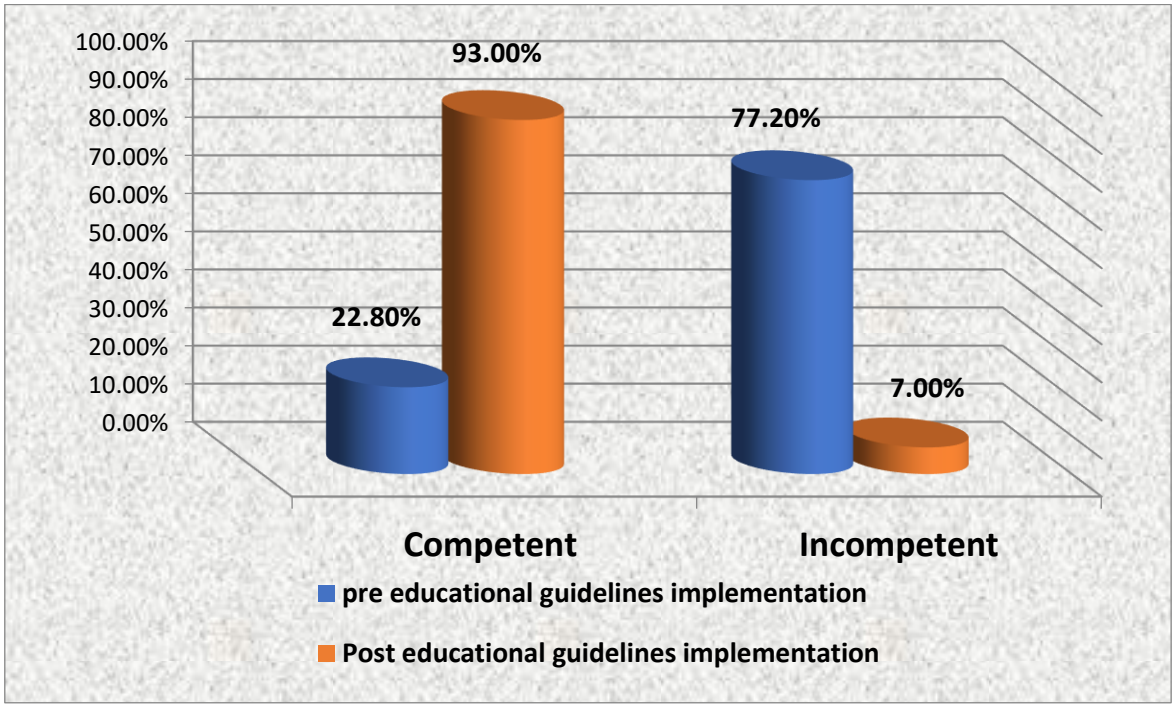

Figure (2): Total score of nurses' practice regarding care for children undergoing bone marrow transplantation pre and post designed educational guidelines implementation. (n=57)

Table (2): Relation between nurses' characteristics and their total knowledge pre and post designed educational guidelines implementation. (n= 57)

Nurses' characteristics	Pre educational guidelines implementation						Post educational guidelines implementation					
	Satisfactory (n=19)		Unsatisfactory (n=38)		Significance		Satisfactory (n=52)		Unsatisfactory (n=5)		Significance	
	No.	%	No.	%	X2	p	No.	%	No.	%	X2	P
Age												
20-<25	4	21.0	21	55.3	8.94	0.030*	20	38.5	5	100.0	7.015	0.051*
25-<30	9	47.4	13	34.2			22	42.3	0	0.0		
30-<35	4	21.0	4	10.5			8	15.4	0	0.0		
≥ 35	2	10.6	0	0.0			2	3.8	0	0.0		
Gender												
Male	4	21.0	11	28.9	0.40	0.523	15	28.8	0	0.0	1.957	0.162
Female	15	79.0	27	71.1			37	71.2	5	100.0		
Educational level												
Diploma of secondary nursing school	2	10.6	4	10.5	5.07	0.051*	4	7.7	2	40.0	6.365	0.041*
Technical institutes of nursing	7	36.8	25	65.8			29	55.8	3	60.0		
Bachelor in nursing science	10	52.6	9	23.7			19	36.5	0	0.0		
Years of experience												
Less than 2 years	3	15.8	14	36.8	9.70	0.021*	13	25.0	4	80.0	6.780	0.059*
2-<5	7	36.8	18	47.4			24	46.2	1	20.0		
5-<8	6	31.6	6	15.8			12	23.1	0	0.0		
>8	3	15.8	0	0.0			3	5.7	0	0.0		
Previous training courses regarding care of children undergoing BMT												
Yes	10	52.6	2	5.3	6.04	0.006*	12	23.1	0	0.0	9.119	0.001**
No	9	47.4	36	94.7			40	76.9	5	100.0		

Table (3): Relation between nurses' characteristics and their total practice pre and post designed educational guidelines implementation. (n= 57)

Nurses' characteristics	Pre educational guidelines implementation						Post educational guidelines implementation					
	Competent (n=13)		Incompetent (n=44)		Significance		Competent (n=53)		Incompetent (n=4)		Significance	
	No.	%	No.	%	X2	p	No.	%	No.	%	X2	P
Age in years												
20-<25	1	7.7	24	54.6	31.861	0.000**	22	41.5	3	75.0	1.912	0.591
25-<30	3	23.1	19	43.1			21	39.6	1	25.0		
30-<35	7	53.8	1	2.3			8	15.1	0	0.0		
≥ 35	2	15.4	0	0.0			2	3.8	0	0.0		
Gender												
Male	2	15.4	13	29.5	1.038	0.308	14	26.4	1	25.0	0.004	0.951
Female	11	84.6	31	70.5			39	73.6	3	75.0		
Educational level												
Diploma of secondary nursing school	2	15.4	4	9.1	2.146	0.342	6	11.3	0	0.0	0.815	0.665
Technical institutes of nursing	5	38.4	27	61.4			29	54.7	3	75.0		
Bachelor in nursing science	6	46.2	13	29.5			18	34.0	1	25.0		
Years of experience												
Less than 2 years	1	7.7	16	36.4	16.305	0.001**	14	26.4	3	75.0	6.425	0.029*
2-<5	3	23.1	22	50.0			24	45.3	1	25.0		
5-<8	7	53.8	5	11.3			12	22.6	0	0.0		
>8	2	15.4	1	2.3			3	5.7	0	0.0		
Previous training courses regarding care of children undergoing BMT												
Yes	11	84.6	1	2.3	5.914	0.019*	12	22.6	0	0.0	3.118	0.064*
No	2	15.4	43	97.7			41	77.4	4	100.0		

Table (4): Correlation between the nurses' total knowledge and total practice pre and post designed educational guidelines implementation. (n= 57)

Variables	Total practice			
	Pre educational guidelines implementation		Post educational guidelines implementation	
	r	P-value	r	P-value
Total knowledge	0.021	0.878	.049	0.720

Discussion:

The use of bone marrow for healing purposes dates back long in history, and BM from hunted animals might have contributed as rich nourishment to the evolution of Homo sapiens. In the medical operation known as a bone marrow transplantation, healthy stem cells are used to repair the deficient bone marrow of children with both malignant and non-malignant disorders **(Niess, 2019).** The nurses are committed to improving quality of life for children and their families and giving them the best possible physical and mental comfort **(Colella et al., 2023).**

Regarding studied nurses characteristics, the current study showed that more than two fifth of nurses were in the age group 20<25 years; It may be due to the unit was recently established and the administrators selected young age nurses to be able to perform mainly tasks in the unit effectively. This result was in the same line with **Mohamed & Sayed, (2015)** who reported in their study about nurses' knowledge regarding stem cells therapy that less than half of nurses were aged from 20-25 years. This result was in contrary with **Ali et al., (2019),** who conducted their study entitled "Effect of Teaching Program on Nurse's Performance Regarding Bone Marrow Transplantation" and demonstrated that more than half of the studied nurses were in the age group 25<35 years.

Regarding the educational level, less than two thirds of them had Technical institutes of nursing. This finding may be due to the fact that, the number of health technical institute of nursing graduates is more than the number graduated from other agencies as faculty of nursing. This result is not congruent with **Mohamed & Sayed, (2015),** who reported the majority of nurses who are working in the BMT unit had a diploma degree in nursing.

Also, the current study stated that the majority of the studied nurses were staff nurse and more than two fifth of them had experience from 2 to less than 5 years. In relation to previous training courses, less than two thirds of them attended training courses about care of children undergoing bone marrow transplantation and less than half of them attended training courses one time.

This finding was in agreement with **Ahmed et al., (2023),** who conducted a study entitled" Social Media- Assisted In-Services Training Instructional Guidelines on Nurse's Performance regarding Bone Marrow Transplant " and found that more than two fifth of the studied nurses had experience from 2 to less than 5 years. On the other hand, this result was in disagreement with **Tork et al., (2018**) mentioned that in their study entitled " Stem Cells: Knowledge and Attitude among Health Care Providers in Qassim region " participants, nurses had never attended training courses on BMT.

The current study showed that less than three quarters of the studied nurses were females, while more than one quarter of them were males. This result might be due to larger percentage of nursing students are females due to government regulations. This result was

congruent with **Wheatley, (2019)** who conducted a study entitled "Implementing & Evaluating a Nurse-Led Educational Intervention for Bone Marrow Transplant Patients in the Acute Care Setting" and stated that less than three quarters of the studied nurses were females.

Regarding Nurses' total knowledge regarding bone marrow transplantation pre and post designed educational guidelines implementation, the current study showed that, the majority of the studied nurses had satisfactory knowledge regarding bone marrow transplantation post designed educational guidelines implementation, compared to one third pre designed educational guidelines implementation.

From researchers point of view, this result might be due to nursing curricula remained deficient in this issue which affects the level of nurses' knowledge, while there was an improvement of nurse's knowledge post implementation of which indicated the effectiveness of program implementation and the quick responses of nurses. This finding was matched with **Khalil et al., (2022),** who conducted a study entitled "Effect of Evidence Based Guidelines on Nurses' Performance to Reduce Complications for Patients after Bone Marrow Transplantation" and found that Nurse's knowledge score regarding bone marrow transplantation was be significantly improved after implementing Evidence- based guidelines than their score before. On the other hand, **Khalil & Sharshor (2016),** not supported this finding, which assessed the nurses' knowledge about stem cells in Tanta, Egypt, they reported that nurses' knowledge about bone marrow and stem cells was adequate in only the minority of participants, so they need an educational program to improve it.

Moreover, the total score of nurses' practice regarding care for children undergoing bone marrow transplantation pre and post designed educational guidelines implementation, the current study showed that the majority of the studied nurses had competent level of total practice in post designed educational guidelines implementation compared to slightly less than one quarter pre designed educational guidelines implementation.

This result may be due to increasing the nurses' knowledge post designed educational guidelines implementation that leads to improvement in nurses' practice. This result supported with **Mohamed et al., (2021),** who conducted a study entitled "Nursing Intervention for Caregivers of Post Autologous Bone Marrow Transplantation Patients at Home" and reported that the majority of the studied nurses had competent level of total practice in post designed educational guidelines implementation. Conversely, this result was disagreeing with **Khalil et al., (2022),** who states that more than one half of the studied nurses had competent level of total practice at pre designed educational guidelines implementation.

According to the relation between nurses' characteristics and their total knowledge pre and post designed educational guidelines implementation, the current study represented that there were statistically significant relations between nurses' age, educational level, years of experience, and previous training courses with their total level of knowledge at pre and post designed educational guidelines implementation. This result may be due to the increasing age, high qualification and many years of experiences build more knowledgeable staff nurses.

This result is in agreement with **Abo-Baker & Elsaid, (2021),** who conducted their study

about " Stem Cell Therapy: Health Care Providers' Knowledge and Attitude;" and found that there were a highly statistically significant relation between nurses total knowledge and educational level, years of experience, and previous training courses. On the other hand, this result was disagreement with **Amin et al., (2018),** who conducted their study entitled " Knowledge Regarding Umbilical Cord Stem Cell Therapy among Staff Nurses with the View to Develop Self-Instructional Module" and stated that there were no statistically significant relation between nurses total knowledge regarding stem cell therapy and their educational level.

While, there were no statistically significant relation between nurses' gender with their total level of knowledge at pre and post designed educational guidelines implementation. This result indicates that gender type had no influences in gain knowledge. This result matched with **Abed El-Hay et al., (2018),** who conducted a study entitled "Effect of Educational Guidelines on Nurses` Performance Regarding management of Patients undergoing Bone marrow Transplantation" and found no statistically significant relation between nurses' gender with their total level of knowledge at pre and post designed educational guidelines implementation.

As regards to the relation between nurses' characteristics and their total practice pre and post designed educational guidelines implementation, the current study illustrated that there were statistically significant relations between nurses' years of experience, and previous training courses with their total level of practice at pre and post educational guidelines implementation. This finding may be attributed to years of experience, and previous training courses add more knowledge and experience in nursing staff careers. This result is accordance with **Abed El-Hay, (2018)** who reported that there was statistically significant relation between the studied nurses' total practice and their years of experience, and previous training courses pre and post educational program implementation. Also, this result was supported with **Abo-Baker et al., (2021),** who stated that there were statistically significant relations between nurses' years of experience, and previous training courses with their total level of practice during assessment.

On the other hand, there were no statistically significant relation between nurses' gender with their total level of practice at pre and post designed educational guidelines implementation. This finding was congruent with **Keng, (2019),** who revealed that there was no statistically significant relation between nurses' gender with their total level of practice.

As regard to the correlation between the nurses' total knowledge and total practice pre and post designed educational guidelines implementation, the current study represented that, there was a positive correlation between nurses' total knowledge and total practice at pre and post designed educational guidelines implementation. From the researchers point of view, satisfactory level of knowledge is associated with competent level of nurses' practice. This result may be confirmed when knowledge is increased post-instructional guidelines which led to a raise in nurses' practices as a result of sufficient knowledge.

This finding is in a concordance with **Azzazy & Mohamed, (2019),** who conducted a study entitled "Effect of Educational Intervention on Knowledge and Attitude of Nursing Students Regarding Stem Cells Therapy and indicated there was statistically significant positive correlation was found between knowledge and practice among the studied nurses. In the same line **Abed El-**

Hay, (2018), who reported there was a highly statistical significant differences regarding management of patients undergoing bone marrow transplantation pre and post program. Also, **Eskander et al., (2019),** supported this finding on their study entitled "Intensive Care Nurses' Knowledge & Practices Regarding Infection Control Standard Precautions at a Selected Egyptian Cancer Hospital " when revealed a statistically significant positive correlation between knowledge and practice of universal precautions and showed that with improving knowledge the nurses' practice improves. On the other hand, **Najeeb & Taneepanichsakul, (2018)** reported a weak, negative relationship between knowledge and practice regarding infection control among doctors and nurses.

Conclusion:

The designed educational guidelines were effective in improving nurses` performance regarding management of children undergoing bone marrow transplantation. Also, there was a statistical significant positive correlation between nurses' total level of knowledge and total practice at pre and post designed educational guidelines implementation.

Recommendations:

-Conducting a continuous training programs about bone marrow transplantation for nurses to enhance their knowledge and practice.

-Providing the nurses in bone marrow transplantation units with designed guidelines to ensure continuous revision.

-Integrating bone marrow transplantation care in pediatric nursing care courses to enhance nursing students acquisition for knowledge and practice.

-Further researches, repeating the study on large sample to enable the generalization of the results.

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تأثير الإرشادات التعليمية المصممة على أداء الممرضين تجاه العناية بالأطفال الذين يخضعون لعملية زرع نخاع العظام

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إن زرع نخاع العظام أو (زرع الخلايا الجذعية المكونة للدم) هو إجراء يتم فيه حقن خلايا جذعية سليمة إما من الطفل نفسه (زراعة ذاتية) أو من متبرع آخر لتحل محل نخاع العظام التالف جزئيا أو كليا. للممرضين دورًا هاما فى الحفاظ على الحالة الصحية لهؤلاء الاطفال الذين يخضعون لعمليات زرع نخاع العظام ومنع حدوث المضاعفات التى من الممكن ان تهدد حياتهم. لذلك هدفت هذه الدراسة إلى تقييم تأثير الإرشادات التعليمية المصممة على أداء الممرضين تجاه العناية بالأطفال الذين يخضعون لعملية زرع نخاع العظام. تم تطبيق هذه الدراسة علي جميع الممرضين (57) الذين يعملون بوحدات زرع نخاع العظام بمستشفى الأطفال الجامعي التابعة لجامعة المنصورة والمستشفى التعليمي العالمي التابعة لجامعة طنطا بالإضافة إلي معهد ناصر التابع للمراكز الطبية المتخصصة. و أظهرت نتائج هذه الدراسة أن غالبية (91.2٪) الممرضين الخاضعين للدراسة يتمتعن بمستوى مرضٍ من المعلومات الكلية فيما يتعلق بزرع نخاع العظام بعد تنفيذ الإرشادات التعليمية المصممة مقارنة ب 33.3٪ قبل تنفيذ الإرشادات التعليمية المصممة، وأن غالبية الممرضين الخاضعين للدراسة (93٪) لديهم مستوى كفء للممارسة الكلية بعد تطبيق الإرشادات التعليمية المصممة مقارنة ب 22.8٪ منهم قبل تنفيذ الإرشادات التعليمية المصممة. كما أظهرت الدراسة أيضا وجود ارتباط إيجابي بين معلومات الممرضين وممارساتهم قبل وبعد تنفيذ الارشادات التعليمية المصممة. واستنتجت الدراسة أنه كان للإرشادات التعلمية المصممة أثر إيجابي في تحسين معلومات وممارسات الممرضين تجاه العناية بالأطفال الذين يخضعون لعملية زرع نخاع العظام، أيضا كان هناك ارتباط إيجابي بين معلومات الممرضين وممارستهم قبل وبعد تنفيذ الإرشادات التعليمية المصممة. وقد أوصت الدراسة بإجراء برامج تدريبية مستمرة تتعلق بزرع نخاع العظام للممرضين بهدف تعزيز معلوماتهم وممارستهم وإجراء المزيد من الأبحاث وتكرار الدراسة على عينة كبيرة من الممرضين للتمكن من تعميم النتائج.