

## **Designed Nursing Guidelines regarding Care of Children Undergoing Bone Marrow Aspiration**

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### **Abstract**

**Background:** Bone Marrow Aspiration (BMA) is an essential invasive technique for diagnosis, examinations or transplantation. BMA should be carried out by trained individuals who are aware of the indications, contraindications and complications of the procedure. **Aim of the study:** This study aimed to evaluate the effect of the designed nursing guidelines on nurses' performance regarding care of children undergoing bone marrow aspiration. **Research design:** Quasi experimental design was utilized. **Sample:** A convenient sample of all available nurses (30) working in Hemato-oncology department at Benha Specialized Pediatric Hospital and purposive sample of 60 child undergoing bone marrow aspiration. **Tools:** Two tools were used. **Tool I:** A structured interviewing questionnaire to assess personal characteristics of the studied nurses, characteristics of children, and nurses' knowledge regarding cancer and bone marrow aspiration. **Tool II:** Observational checklist to assess nurses' practice regarding care of children with cancer undergoing bone marrow aspiration. **Results:** There was a highly positive statistical correlation between total knowledge and total practices scores of the studied nurses at pre and post-implementation of designed nursing guidelines. **Conclusion:** The designed nursing guidelines were effective in improving nurses' knowledge and enhancing their practices regarding care of children undergoing bone marrow aspiration. **Recommendations:** Sustainable update of nurses' knowledge and practices regarding care of children undergoing bone marrow aspiration and continuing in- service educational programs should be designed and implemented to motivate nurses in achieving high competent care.

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**Keywords:** Bone Marrow Aspiration, Children, Designed Guidelines.

### **Introduction**

Cancer remains the leading cause of death from disease among children. About 10,470 children in the United States under the age of 15 are diagnosed with cancer in 2022. Childhood cancer rates have been rising slightly for the past few decades. Cancer starts when cells grow out of control and crowd out normal cells. This makes it hard for the body to work normally. Cancer can start any site in the body. Then, it can spread from where it started to other parts of the body which called

metastasis. A cancer diagnosis is upsetting at any age but especially so when the patient is a child (**American Cancer Society, 2022**).

Bone marrow aspiration (BMA) is the direct removal of a small amount (about 1–5 milliliters) of bone marrow by suction through a hollow needle. The posterior iliac crest of the hip bone is the most common site for aspiration. The sternum (breastbone) may be used for aspiration, but is less desirable because it carries the risk of injury to the heart, lungs and great vessels in the chest. Other sites that

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used are the upper part of the tibia, the anterior superior iliac crest and a spinal column bone (Tikkanen, 2022). Nurses having vital role through their active participation in the BMA procedure at multiple time points; the nurse provides pre-procedural education to investigate and address the child and parents' information needs, assesses the child's medical history and laboratory data, and assists in the child preparation regarding the aspiration site. Also, the nurse assists during the procedure by preparing equipment, preparing the aspiration site and cleaning the site with the antiseptic solution, immobilizing the child and providing reassurance (Chaves et al., 2018).

### **Significance of the study:**

Cancer is the leading cause of death by disease among children in the United States. Approximately one in 285 children is diagnosed with cancer each year. In Egypt, age-standardized incidence rates of cancer are 166.6 per 100 000 children, and 5-years survival of childhood cancer was estimated to be 40% based on baseline assessment of pediatric oncology care in Egypt (Soliman et al., 2020). Each year, approximately 400 000 children and adolescents are diagnosed with cancer (WHO, 2021). According to Benha Specialized Pediatric Hospital, there were 164 cases undergone bone marrow aspiration in 2020, meanwhile, there were 167 cases undergone bone marrow aspiration in 2021 (Benha Specialized Pediatric Hospital Statistical Office, 2020-2021).

Oncology nurses are at the heart of tackling the increasing global burden of cancer. Their contribution is unique because of the scale and the diversity of care roles and responsibilities in cancer care. Supportive care enables and empowers children to self-manage

where possible. Globally, oncology nurses make a great positive difference to cancer care worldwide. So, the nurses should have sufficient knowledge and skills about cancer in children and especially about bone marrow aspiration because of its importance in diagnosis and treatment of cancer (Young et al., 2020).

### **Aim of the study:**

The aim of this study was to evaluate the effect of designed guidelines on nurses' performance regarding care of children undergoing bone marrow aspiration.

### **Research hypothesis:**

The designed nursing guidelines improved nurses' knowledge and enhanced their practices regarding care of children undergoing bone marrow aspiration.

### **Research design:**

Quasi-experimental design (pre & post-test) was utilized to conduct this study.

### **Research setting:**

This study was conducted at Hemato-oncology department that located in the 4<sup>th</sup> floor at Benha Specialized Pediatric Hospital affiliated to Egyptian Ministry of Health and Population and Secretary of Specialized Medical Centers at Benha city.

### **Research subjects:**

- A. A convenience sample of all available nurses (n=30) working in the previously mentioned setting, regardless of their characteristics.
- B. A purposive sample of all children (n=60) undergoing the following inclusion criteria:
  1. Male and female children.
  2. Undergoing bone marrow aspiration.
  3. Free from auto immune diseases.

### **Tools of data collection:**

Data of the current study was conducted through using the following tools:

**Tool (I): A Structured Interviewing Questionnaire:**

It was developed by the researcher under supervision of the supervisors in a simple Arabic language after reviewing the related and recent literatures **Ramsethu &Suna, (2019)** and **Rindy & Chambers, (2021)**. It included the following parts:

**Part (1):** Personal characteristics of the studied nurses such as; age, gender, educational level, years of experience and attendance of training courses related to care of children undergoing bone marrow aspiration.

**Part (2):** Characteristics of children such as; age, gender, residence, educational level, diagnosis and medical data (previous hospitalization, previous bone marrow aspiration and previous post BMA complications).

**Part (3):** Nurses' knowledge assessment sheet (pre / post designed guidelines): It included:

• **Nurses' knowledge regarding cancer:**

It consisted of closed and open-ended questions about definition, causes, types, risk factors, diagnosis, prevention, treatment and nursing role toward care of children with cancer (8 questions).

• **Nurses' knowledge regarding bone marrow aspiration:**

It consisted of closed and open ended questions about definition, indications, contraindications, sites of bone marrow aspiration, nursing role before BMA, complications, medications used during BMA, positions for the child during BMA, prevention of bleeding, infection and feeling of pain and discomfort and nursing role after bone marrow aspiration (14 questions).

**Scoring system for nurses' knowledge:**

Scoring system for nurses' knowledge designed as following; each complete correct answer scored (2), incomplete correct answer scored (1) and incorrect or unknown answer scored (0). The total level of nurses' knowledge was categorized as the following:

- Good knowledge ( $\geq 85\%$ )
- Average knowledge (60% to  $< 85\%$ )
- Poor knowledge ( $< 60\%$ )

**Tool (II): Observational Checklists (pre/post designed guidelines):**

It was developed by the researcher after reviewing the related literatures **Wiegand, (2017)**, **Lister et al., (2018)** and **Ramsethu & Suna, (2019)** to assess nurses' practice regarding care of children with cancer undergoing bone marrow aspiration. It included the following:

- Care before bone marrow aspiration (preparatory stage), including child assessment and child preparation.
- Care during bone marrow aspiration (technique).
- Care post bone marrow aspiration (post procedure).
- Discharge care.

**Scoring system for nurses' practice:**

- Each step done correctly scored (1) and each step done incorrectly or not done scored (0). The total level of nurses' practice was categorized as the following:

- Competent ( $\geq 85\%$ )
- Incompetent ( $< 85\%$ )

**Content validity:**

Tools of data collection were designed in Arabic language and submitted to a jury of three experts in Paediatric Nursing from the Faculty of Nursing/Benha University to test the content validity of tools and judge its clarity,

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comprehensiveness, relevance, simplicity and accuracy.

### **Reliability:**

The reliability of the developed tools was estimated using the Chronbach's Alpha coefficient which revealed that, each of the two tools consisted of relatively homogenous items as indicated by high reliability for each tool. The internal consistency of the structured interviewing questionnaire was 0.89 and for the observational checklist was 0.85.

### **Ethical considerations:**

The study was approved by the Ethics Committee at the Faculty of Nursing, Benha University. All ethical issues were taken into consideration during all phases. The researcher clarified the aim of the study and the expected outcomes to all studied nurses during the initial interview. Oral consent was taken to participate in the study. The studied nurses were assured that all information would be confidential and their participation in the study was voluntary. Additionally, nurses were allowed to withdraw from the study at any time without giving any rational. Nurses' practice not taken into consideration of job evaluation for studied nurses. Confidentiality of the gathered data and results were secured.

### **Pilot study:**

A pilot study was conducted on 10% (3 nurses and 6 children) of the study subjects to evaluate the clarity, feasibility, applicability of the study tools and time needed for each data collection tool to be filled in. It was done during march2022.

### **Field work:**

The process of data collection was carried out from the beginning of April 2022 to the end of September 2022, covering six months. The following phases were carried out to achieve

the aim of the study; assessment, planning, implementation and evaluation.

### **Assessment phase:**

The assessment phase involved interviewing the studied nurses individually to collect their personal data. The researcher was available in study setting during morning and afternoon shifts, two days weekly. The researcher introduced herself to the nurses and explained the purpose of study and took their oral approval to participate in the study prior to data collection. This period took about two months from the beginning of April 2022 to the end of May 2022.

### **Planning phase:**

After assessing the nurses' performance, the researcher designed guidelines guided by an educational booklet regarding care of children undergoing bone marrow aspiration. The guidelines designed by using simple Arabic language and different illustrated colored pictures in order to facilitate understanding care of children undergoing bone marrow aspiration.

### **Implementation phase:**

The total numbers of sessions were 7 and they were divided into 4 sessions for theory and 3 sessions for practice. The study sample was 30 nurses divided into 6 equal groups and each group was consisted of 5 nurses. The time of theoretical sessions ranged from 30-45 minutes. The duration of practical session was about 45-60 minutes according to the nurses' understanding and span of attention in form of demonstration and re-demonstration for each group. The researcher used different teaching methods such as; group discussion, role playing, brain storming and lecture as teaching methods for theoretical sessions. Media utilized were educational program guided by an educational booklet, visual materials, colored

pictures, videos and PowerPoint presentation that was constructed by the researcher after reviewing the related literature.

**Evaluation phase:**

After the implementation of the designed guidelines, the post tests were administered to assess nurses' knowledge and practice using the same format pretest. This helped to evaluate the effect of designed guidelines on nurses' performance regarding care of children undergoing bone marrow aspiration. This is done immediately after the intervention and took about 2 months (from the beginning of August to the end of September 2022).

**Statistical analysis:**

Statistical analysis was done by using Statistical Package for Social Sciences (SPSS) version 20. Data were collected, revised, organized, coded, tabulated, and analyzed using frequencies, number, percentage, mean scores, standard deviation and correlation coefficient. Data were presented in the form of tables and figures. Quantitative data was presented by mean ( $\bar{x}$ ) and standard deviation (SD). Qualitative data was presented in the form of frequency distribution tables, numbers and percentages. Qualitative variables were analyzed by Chi-Square test ( $\chi^2$ ) & correlation coefficient ( $r$ ) to detect the relation between the variables of the study (P-value). A highly statistical significant level value was considered when ( $p < 0.001$ ). A statistical significant level value was considered when ( $p < 0.05$ ) and no statistical significance difference was considered when ( $p > 0.05$ ).

**Results:**

**Table (1):** Displays personal characteristics of the studied nurses. It is clear from this table that, half (50.0%) of the studied nurses were in the age group  $\geq 40$  years, with mean age of

38.33 $\pm$ 8.142 years. As regards the gender, this table reveals that, all (100.0%) of them were females. Regarding the educational level, this table shows that, two-fifths (40.0%) of them were graduated from secondary school of nursing. Also, the table represents that, two-thirds (66.7%) of them had  $\geq 10$  years of experience and less than three-quarters (73.3%) of them didn't attend any training courses related to care of children undergoing bone marrow aspiration.

**Table (2):** Reveals characteristics of the studied children. It is clear that, more than one third (38.3%) of the studied children were in age group 1 - < 6 years and (36.7%) are in age group 6 < 12 years respectively, with a mean age of 8.216 $\pm$ 3.80 years. Concerning the educational level, this table demonstrates that, two-fifths (40.0%) of them were in nursery school. Regarding the medical diagnosis, this table reflects that, less than half (45.0%) of them were medically diagnosed with leukemia. Increasingly, less than two-thirds (61.7%) of them had been admitted to the hospital before to receive care. Furthermore, (26.7%) of them had previous bone marrow aspiration and (37.5%) of them experienced complications after bone marrow aspiration.

**Figure (1):** Shows that, less than three-quarters (71.7%) of the studied children were males.

**Figure (2):** Represents that, 60.0% of the studied children were from urban areas.

**Figure (3):** Reveals that, half (50.0%) and (13.3%) of the studied nurses had average and poor total percentage score of knowledge pre-designed guidelines respectively. While 76.7% of them had good total percentage score of knowledge post-designed guidelines.

**Figure (4):** Reveals that, more than one third (36.7%) of the studied nurses had incompetent

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total practices score pre-designed guidelines. While (93.3%) of them had competent total practices score post-designed guidelines.

**Table (3):** Clarifies that, there was a positive correlation between total knowledge and total

practices scores of the studied nurses pre-and post-implementation of designed guidelines ( $p \leq 0.001$ ).

**Table (1): Distribution of the studied nurses according to their personal characteristics (n=30).**

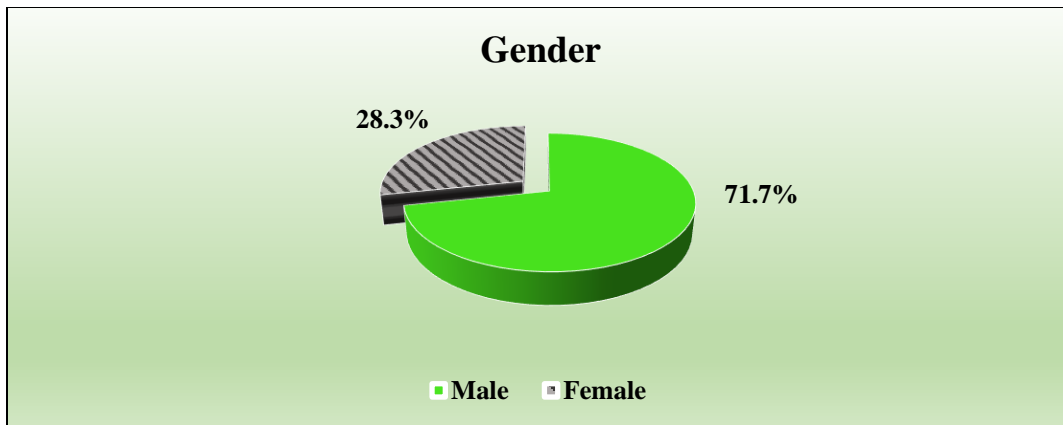
Personal characteristics of the studied nurses	No.	%
<b>Age (years)</b>		
20- <30	3	10.0
30-<40	12	40.0
≥ 40	15	<b>50.0</b>
<b>Mean ±SD=38.33±8.142 year</b>		
<b>Gender</b>		
Male	0	0.0
Female	30	<b>100.0</b>
<b>Educational level</b>		
Secondary school of nursing	12	<b>40.0</b>
Nursing technical institute	8	26.7
Bachelor of nursing	7	23.3
Postgraduate studies	3	10.0
<b>Years of experience</b>		
< 5 years	4	13.3
5 - <10 years	6	20.0
≥ 10 years	20	<b>66.7</b>
<b>Attendance of training courses related to care of children undergoing bone marrow aspiration</b>		
Yes	8	26.7
No	22	<b>73.3</b>
<b>If yes (n=8)</b>		
<b>Name of the course:</b> Safety standard regarding bone marrow aspiration	8	<b>100</b>



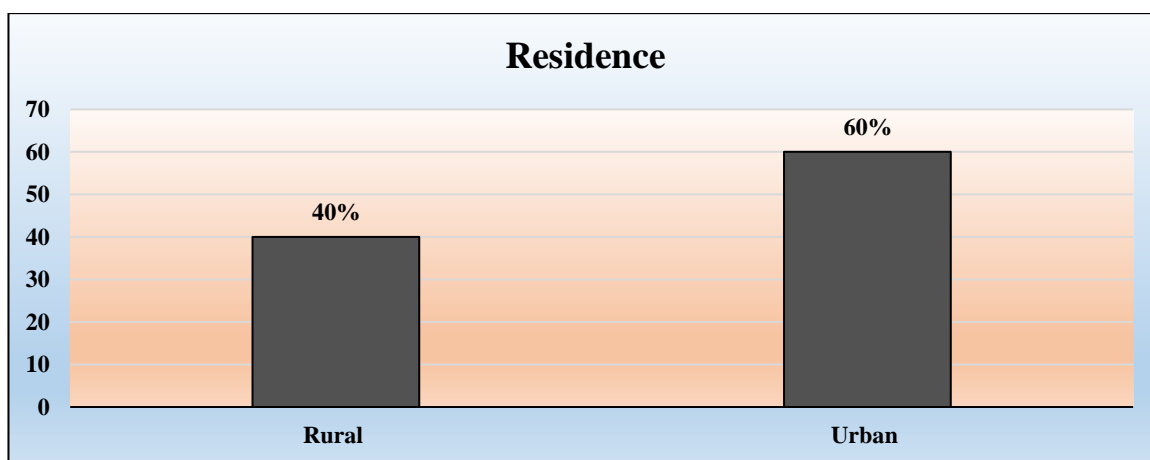
**Table (2): Distribution of the studied children according to their characteristics (n=60).**

<b>Personal characteristics of the studied children</b>	<b>No</b>	<b>%</b>
<b>Age (years)</b>		
<1 year	1	1.7
1 - < 6 years	23	<b>38.3</b>
6 - < 12 years	22	<b>36.7</b>
12 - ≤ 18 years	14	23.3
<b>Mean ±SD=8.216±3.80 year</b>		
<b>Educational level</b>		
Nursery	24	<b>40.0</b>
Primary	22	36.7
Preparatory	8	13.3
Secondary	6	10.0
<b>Medical diagnosis</b>		
Leukemia	27	<b>45.0</b>
Lymphoma	10	16.7
Wilms tumor	7	11.7
Neuroplastoma	4	6.7
Bone tumor	2	3.3
Retinoblastoma	2	3.3
Gusher syndrome	1	1.7
Idiopathic thrombocytopenic purpura	4	6.7
Aplastic anemia	2	3.3
Hepatosplenomegaly	1	1.7
<b>Previous hospital admission for receiving care</b>		
Yes	37	<b>61.7</b>
No	23	38.3
<b>previous bone marrow aspiration</b>		
Yes	16	26.7
No	44	<b>73.3</b>
<b>If yes, experiencing any complications after bone marrow aspiration (n=16)*</b>		
Yes	6	37.5
No	10	<b>62.5</b>

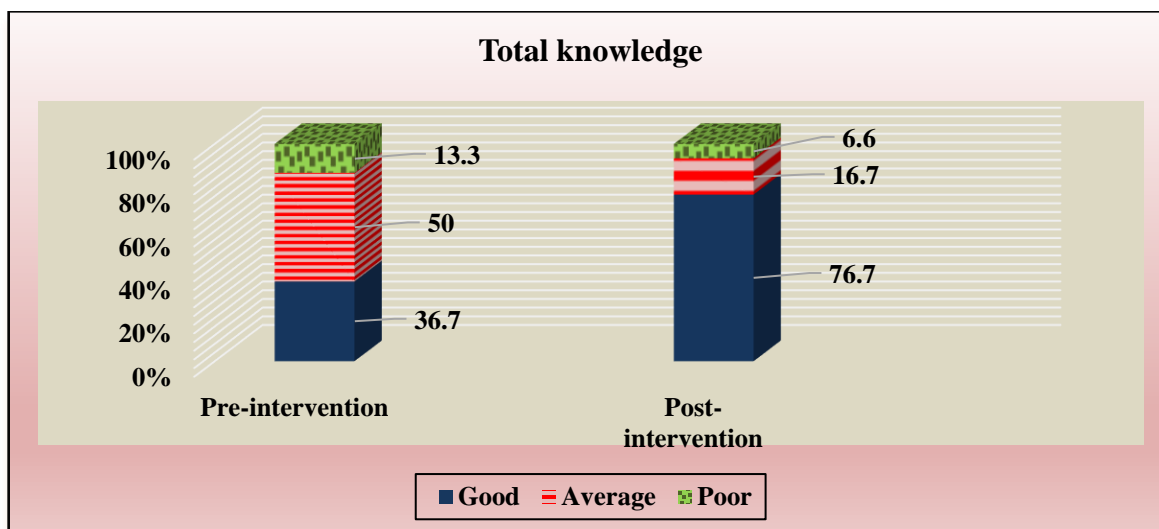
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**Figure (1): Distribution of the studied children according to their gender (n=60)**

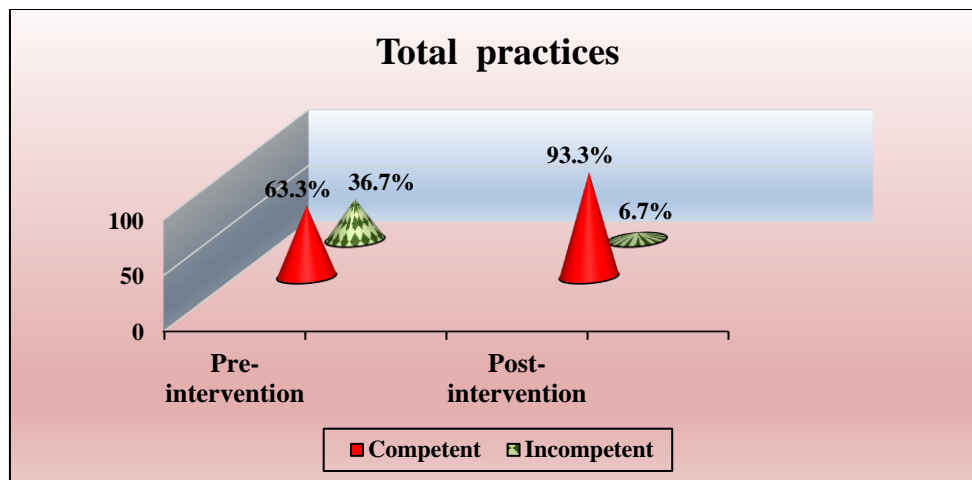


**Figure (2): Distribution of the studied children according to their residence (n=60)**



**Figure (3): Percentage distribution of the studied nurses regarding their total knowledge score pre and post designed guidelines (n=30)**





**Figure (4): Percentage distribution of studied nurses' total practices score regarding care of children undergoing bone marrow aspiration (Pre& post-designed guidelines) (n=30).**

**Table (3): Correlation coefficient between total knowledge and total practices scores of studied nurses (Pre& post-designed guidelines) (n=30).**

Variables	Total knowledge			
	Pre- designed guidelines		Post- designed guidelines	
	r	P-value	r	P-value
<b>Total practices</b>	0.577	0.001**	0.775	0.000**

### Discussion

Regarding personal characteristics of the studied nurses, the results of the present study revealed that, half of the studied nurses were in age group  $\geq 40$  years, with a mean age of  $38.33 \pm 8.142$  years. These findings disagree with **Khalil et al., (2022)**, in study entitled "Effect of evidence based guidelines on nurses' performance to reduce complications for patients after bone marrow transplantation", who found that, 38.3% of the studied nurses aged between 25 to less than 30 years old with mean age of  $29.3 \pm 7.4$  years.

The present study showed that, all of the studied nurses were females. According to the researcher interpretation, this may be due to decreased numbers of male students who admitted to the field of nursing. These findings of the present study were supported by the findings of **Beykmirza et al., (2019)**, in a study entitled "Nursing adherence to ethical codes in pediatric oncology wards", who found that, all nurses were females.

According to the educational level of the studied nurses, the results of the present study showed that, two-fifths of them had secondary school of nursing. From the researcher point of

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view, this could be linked to the fact that, nursing diploma provided the hospitals with large number of graduated diploma nurses than other agencies such as faculties of nursing and technical nursing institute. These results disagree with **Abdullah & Khudhur, (2020)**, who studied "Effectiveness of an educational program on nurses knowledge toward leukemic patients at Kirkuk oncology center in Kirkuk city", and found that, half of the studied nurses were females and half of them were graduated from nursing institute.

According to the years of experiences of the studied nurses, the results of the present study found that, , two-thirds of them had  $\geq 10$  years of experience in this field. These results disagree with **Nukpezah et al., (2021)**, in study entitled "A qualitative study of Ghanaian pediatric oncology nurses' care practice challenges", who found that, only one third of the participants had more than ten years work experience.

According to attendance of training courses regarding care of children undergoing bone marrow aspiration, the results of the present study revealed that, less than three-quarters of them didn't attend any training course related to the care of children undergoing bone marrow aspiration. These findings disagree with **Al-gbury & Khudur, (2021)**, in a study entitled "Evaluation of nurses knowledge about diagnostic bone marrow aspiration and biopsy at blood diseases center in medical city directorate", who showed that, less than two- third of the nurses attended to previous training courses about bone marrow aspiration.

Regarding personal characteristics of the studied children, the results of the present study revealed that, more than one third of the studied

children were in age group 1 - < 6 years and 36.7% were in age group 6 < 12 years respectively, with a mean age of  $8.216 \pm 3.80$  years. These findings agree with **Triarico et al., (2019)**, in a study entitled "Impact of malnutrition on survival and infections among pediatric patients with cancer: a retrospective study", who pointed that, children aged between 5 and 15 years was the largest group, followed by adolescents older than 15 years and by children younger than 5 years. The median age at diagnosis was 10 years.

Concerning gender, the present study showed that less than three-quarters of the children were males. This result agrees with **Rudresha et al., (2021)**, in study entitled "A Pilot study on the addition of tramadol or eutectic mixture of local anesthetics (prilocaine plus lignocaine) to local lignocaine infiltration for prevention of bone marrow aspiration/biopsy associated pain", and mentioned that, more than half of the studied sample was males. Also, the study is supported by **Goel et al., (2020)**, in study entitled "Analysis of bone marrow and peripheral blood film findings in sixty diagnosed cases of lymphoma", who showed that, 71.4% of cases were males and 28.6% were females.

The present study showed that, less than two-thirds of the children lived in urban area and two-fifths of the studied children were still educating in nurseries. This result agrees with **Hassan & Ibrahim, (2018)**, in study entitled "The effect of supportive nursing intervention on burden and coping strategies of caregivers of children with cancer", who revealed that, more than half of the studied cancer children were from urban areas and less than three quarters (73.3%) of them were in nursery.

Concerning the medical diagnosis, the present study showed that, less than half of the studied children were medically diagnosed with leukemia. This result agrees with **Al Qahtani & Naz Syed, (2018)**, in a study entitled “An audit- indications and diagnosis of bone marrow biopsies at a tertiary care hospital in Saudi Arabia”, who found that, the most common bone marrow examination finding was leukemia followed by cases of lymphoma.

The present study revealed that, less than three-quarters of the studied children had bone marrow aspiration before. This result disagrees with **Onec et al., (2021)**, who studied “Type and level of anxiety affects the perception of pain during bone marrow biopsy”, and found that, 13.6% of children had bone marrow aspiration before. While, this result agrees with **Yuvalı Karacan, (2017)**, in study entitled “Pain, anxiety and depression during bone marrow aspiration and biopsy” and found that, more than half of the children had not been applied BMA before.

Concerning experiencing complications after bone marrow aspiration, the present study revealed that, more than half didn't experience any complications after bone marrow aspiration. These findings agree with **Obasi & Umpierrez De Reguer, (2019)** in study entitled “Safety profile of bone marrow aspiration and biopsies performed by the hospitalist procedure service at an academic center: an observational study”, who pointed that, only 0.4% of the children experienced a procedural complication secondary to a hematoma.

Regarding to the total knowledge score pre and post designed guidelines; the present study showed that, there was with a statistical significant improvement in nurses' total

percentage score of knowledge post-designed guidelines as compared with pre-designed guidelines ( $p \leq 0.05$ ). According to the researcher interpretation, it could be due to the impact of the designed guidelines on developing the knowledge of the studied nurses and their adherence to research guidelines booklet as well as, different teaching methods and illustrative media used to deal with nurses during giving instructions.

These findings were similar with **Aljobury et al., (2021)**, who studied “Effectiveness of educational program on nurses' knowledge toward malignant solid tumors of children at the oncology center”, who found that, the level of nurses' knowledge is increased after the educational program during post-test.

Concerning nurses' total practices score regarding care of children undergoing bone marrow aspiration, the study reveals that, more than one third of the studied nurses had incompetent total percentage score of practice pre-designed guidelines respectively. While 93.3% of the studied nurses had competent total percentage score of practice post-designed guidelines, with a statistical significant improvement in nurses total percentage score of practice post-designed guidelines as compared with pre-designed guidelines with ( $p \leq 0.05$ ). From the researcher point of view, the designed guidelines were a successful method to improve their practice regarding care of children undergoing bone marrow aspiration. This finding was in line with **Al-gburi & Khudur, (2022)** who studied " Effectiveness of an interventional program on nurse's knowledge & practices concerning nursing management for leukemic patients after bone marrow aspiration and biopsy at blood diseases

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center in medical city directorate”, and showed that, there was a high significant difference between the level of nurse's practice pre-interventional program and post-interventional program at ( $P \leq 0.05$ ).

Moreover, the results were in the same line with **Abd Elbaky et al., (2018)**, who found that, knowledge levels and skills regarding invasive procedures had improved after educational program and had become satisfactory and in turn resulted in higher performance of staff nurses.

Concerning the correlation coefficient between total knowledge and total practices scores of the studied nurses, the results of the current study clarifies that, there was a highly positive statistical correlation between total knowledge and total practices scores of studied nurses at pre-and post-implementation of designed guidelines ( $p \leq 0.001$ ). The researcher believes that, good knowledge level can lead to competent level for practices because nurses can give care with trust. This result is in the line with **The American Association of Colleges of Nursing, (2019)**, which recommended that, improving nurses' practice mainly depends upon improving knowledge regarding patient's safety principles.

### **Conclusion**

The designed nursing guidelines were effective in improving nurses' knowledge and enhancing their practices regarding care of children undergoing bone marrow aspiration.

### **Recommendations**

- Sustainable update for nurses' knowledge and practices regarding care of children undergoing bone marrow aspiration is mandatory for nursing quality improvement.
- Continuing in-service training programs should be designed and implemented to

motivate nurses in achieving high competent care.

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## الإرشادات التمريضية المصممة تجاه رعاية الأطفال الذين يخضعون لسحب النخاع العظمي

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يعد سحب عينة من النخاع العظمي من الاختبارات الهامة لتشخيص ومتابعة سرطان الأطفال, ويعتبر سحب نخاع العظم إختبار ضروري تؤخذ خلاله عينات من أنسجة نخاع العظم الموجود داخل عظام الجسم من أجل فحصها بدقة تحت المجهر. لذا هدفت هذه الدراسة إلي تقييم تأثير الإرشادات التمريضية المصممة على أداء الممرضات تجاه رعاية الأطفال الذين يخضعون لسحب النخاع العظمي. وقد أجريت هذه الدراسة علي الممرضين المتاحين بقسم الأورام وأمراض الدم بمستشفى الأطفال التخصصي بينها التابعة لوزارة الصحة والسكان المصرية بمدينة بنها وعددهم ٣٠ ممرضة . وقد أوضحت النتائج أنه توجد علاقة إيجابية ذات دلالة إحصائية بين مستوي معلومات وممارسات الممرضين تجاه رعاية الأطفال الذين يخضعون لسحب عينة من النخاع العظمي قبل وبعد تنفيذ الإرشادات التمريضية المصممة. كما أوصت الدراسة بالتحديث المستمر لمعلومات و ممارسات الممرضين تجاه رعاية الأطفال الذين يخضعون لسحب عينة من النخاع العظمي وتصميم وتنفيذ البرامج التعليمية المستمرة لتحفيز الممرضات على تحقيق رعاية عالية الكفاءة.