

## 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** was to evaluate the effect of the designed nursing guidelines on nurses' performance regarding care of children undergoing bone marrow aspiration. **Research design:** Quasi-experimental research design was used. **Sample:** A convenience sample of all available nurses (30) working in Hemato-oncology department at Benha Specialized Pediatric Hospital and purposive sample of 60 children undergoing bone marrow aspiration. **Tools:** Two tools were utilized. **Tool (I):** A structured interviewing questionnaire to assess personal characteristics of the studied nurses, characteristics of children and nurses' knowledge about cancer and bone marrow aspiration. **Tool (II):** Observational checklist to assess nurses' practice concerning caring of children with cancer undergoing bone marrow aspiration. **Results:** There was a highly statistical positive 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 concerning care of children undergoing bone marrow aspiration. **Recommendations:** Continuing in-service training programs should be carried out to encourage nurses providing 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 continue to increase without control and crowd out normal cells, making 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 a procedure to remove 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 used are the upper part of the tibia, the

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anterior superior iliac crest and a spinal column bone (Tikkanen, 2022). Nurses have 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 prime cause of disease-related death among children in the United States. Approximately one in 285 children has cancer each year. In Egypt, the 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 assessment of pediatric oncology care in Egypt (Soliman et al., 2020). Yearly, about 400 000 children and adolescents are diagnosed with cancer (WHO, 2021). According to Benha Specialized Pediatric Hospital, there were 164 children undergone bone marrow aspiration in 2020, meanwhile, there were 167 children undergone bone marrow aspiration in 2021 (Benha Specialized Pediatric Hospital Statistical Office, 2020-2021).

Oncology nurses have a crucial part in tackling the growing universal burden of cancer. Nurses' function is unparalleled due to the standard and the variety of care roles and responsibilities in cancer management. Supportive care assists and motivates children to self-manage as possible. The oncology nurses achieve a considerable positive difference in cancer management. Therefore,

the nurses should have sufficient knowledge and skills about cancer and especially about bone marrow aspiration because of its importance in diagnosing and treating 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.

### **Study design:**

Quasi-experimental design (pre & post-test) was utilized to carry out the study.

### **Study setting:**

This study was done 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. Both genders.
  2. Undergoing bone marrow aspiration.
  3. Free from auto immune diseases.

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

Two tools were utilized to gather data:

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

It was designed by the researcher under supervision of the supervisors in a simple Arabic language after reviewing the related and

recent literatures **Ramasethu & Suna, (2019)** and **Rindy & Chambers, (2021)**. It included the following:

**Part (1):** Personal characteristics of the studied nurses as; age, gender, educational level, years of experience and attendance of training courses concerning caring 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:**

Each complete correct answer scored (2), incomplete correct answer scored (1) and incorrect or unknown answer scored (0). Total level of nurses' knowledge was classified as follows:

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

- Poor knowledge ( $< 60\%$ )

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

It was constructed by the researcher based on relevant literatures **Wiegand, (2017)**, **Lister et al., (2018)** and **Ramasethu & Suna, (2019)** to assess nurses' practice concerning caring of children with cancer undergoing bone marrow aspiration. It comprised 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 follows:

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

**Content validity:**

Data collection tools were developed 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, comprehensiveness, relevance, simplicity and accuracy.

**Reliability:**

The reliability of the developed tools was estimated using the Chronbach's Alpha coefficient which reflected that, used tools had relatively homogenous items. The internal consistency of the structured interviewing questionnaire was 0.89 and for the observational checklist was 0.85.

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### **Ethical considerations:**

An approval letter was taken from the Ethics Committee at the Faculty of Nursing, Benha University. All ethical issues were considered through all phases. The researcher illustrated the aim and the expected outcomes to all participants during the initial interview. Written consent was taken to take part in the study. The nurses were informed that all data would be confidential and participation in the study was voluntary. Also, nurses had the right to withdraw from the study at any time without affording any rational.

### **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 required for each tool to be completed. It was done during March 2022.

### **Field work:**

The data related to this study were collected from the beginning of April 2022 to the end of September 2022, covering six months. The next phases were fulfilled to accomplish the purpose of the study.

### **Assessment phase:**

The assessment phase concerned with interviewing the studied nurses individually in order to gather 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 illustrated the aim of study and took their written consent to take part in the study before collecting data. This period took about two months from the beginning of April 2022 to the end of May 2022.

### **Planning phase:**

After the nurses' performance had been assessed, the researcher developed guidelines

guided by an educational booklet about care of children undergoing bone marrow aspiration. The guidelines were prepared in simple Arabic language and numerous colored pictures were used to ease 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 theoretical parts and 3 sessions for practical parts. The study sample was 30 nurses divided into 6 equal groups and each group was composed of 5 nurses. The theoretical sessions lasted for 30-45 minutes. The practical session took about 45-60 minutes according to the nurses' understanding and span of attention in form of demonstration and re-demonstration. The researcher utilized different teaching methods such as; group discussion, role playing, brain storming and lecture for theoretical parts. Media utilized were educational program guided by an educational booklet, visual materials, colored pictures, videos and PowerPoint presentation.

### **Evaluation phase:**

After the designed guidelines were implemented, the researcher administered post tests for evaluating nurses' knowledge and practice using the same pretest form. This assisted to evaluate the effect of designed guidelines on nurses' performance regarding care of children undergoing bone marrow aspiration. It was performed 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 performed 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 displayed in the form of tables and figures. Quantitative data was presented by mean ( $\bar{x}$ ) and standard deviation (SD). Qualitative data were showed in the form of frequency distribution tables, numbers and percentages. Qualitative variables were analyzed by Chi- Square test ( $\chi^2$ ) & correlation coefficient ( $r$ ) to determine the relation between the variables (P- value). A highly statistical significant level was considered when ( $p < 0.001$ ). A statistical significant level was considered when ( $p < 0.05$ ) and no statistical significance difference was considered when ( $p > 0.05$ ).

#### **Results:**

**Table (1):** It is clear from this table that, half (50.0%) of the studied nurses aged  $\geq 40$  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. As regards the educational level, 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%) didn't attend any training courses concerned with care of children undergoing bone marrow aspiration.

**Table (2):** Reveals 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 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 nurses had average and poor total knowledge score pre-designed guidelines respectively. While 76.7% of them had good total knowledge score post-designed guidelines.

**Figure (4):** Reveals that, more than one third (36.7%) of the studied nurses had incompetent 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 ( $p \leq 0.001$ ).

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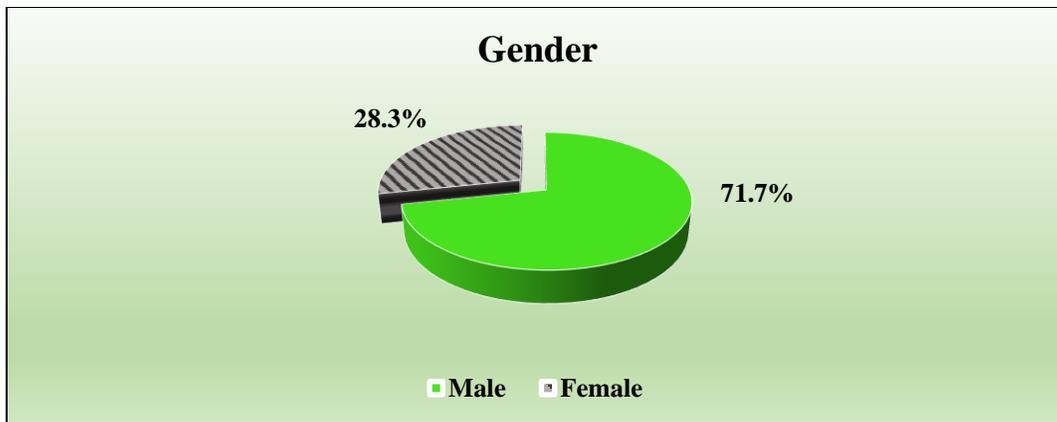
**Table (1): Distribution of the studied nurses according to their personal characteristics (n=30).**

<b>Personal characteristics of the studied nurses</b>	<b>No.</b>	<b>%</b>
<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>

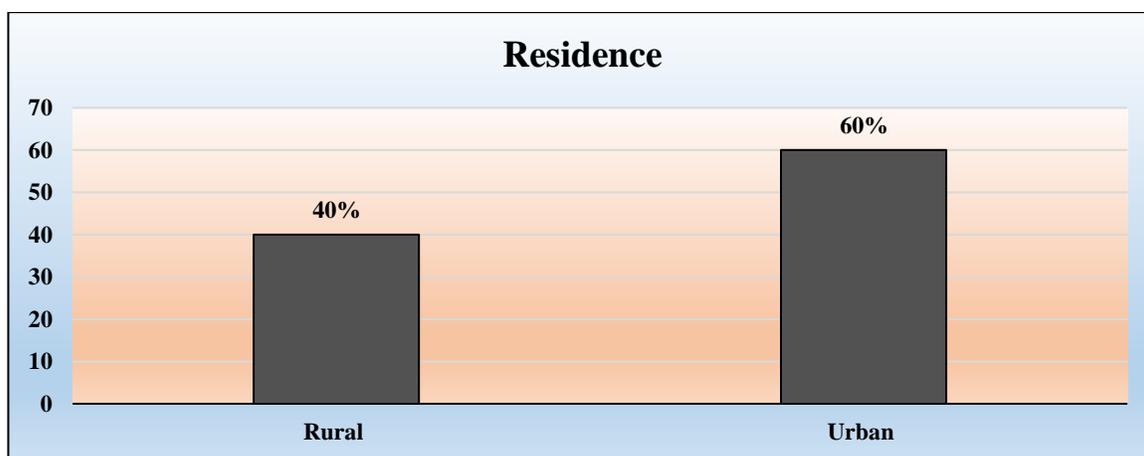
**Table (2): Distribution of the studied children according to their characteristics (n=60).**

<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>

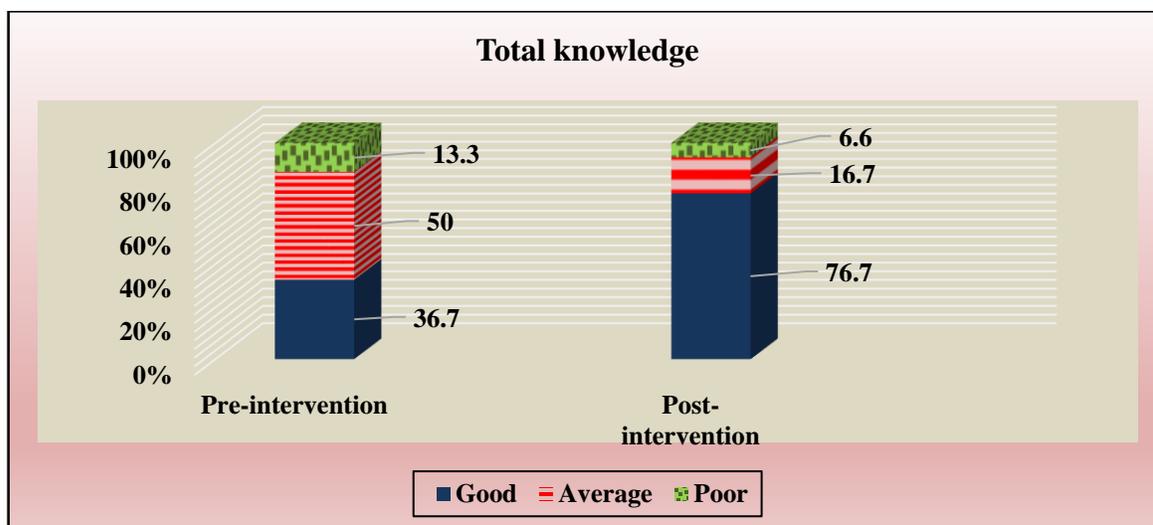
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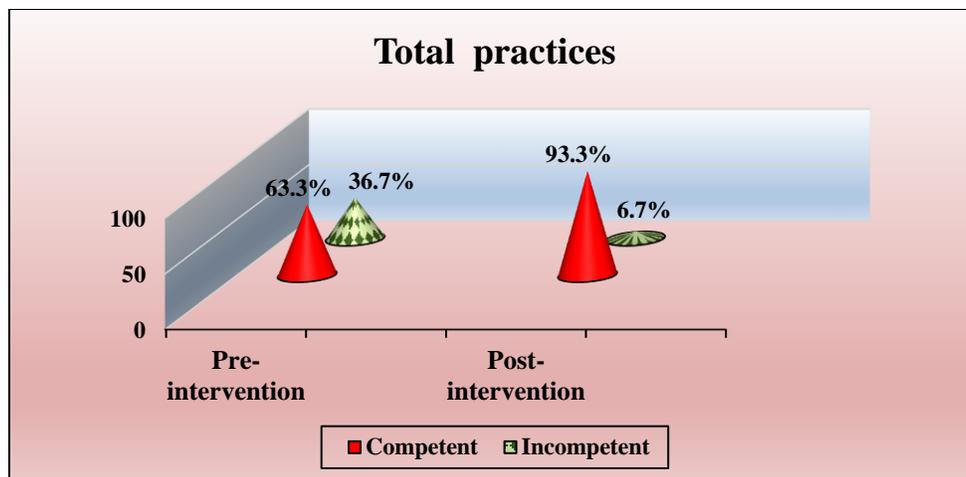
**Figure (1): Distribution of the studied children according to their gender (n=60)**



**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**

The present study displayed 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 current study showed that, all of the studied nurses were females. According to the researcher interpretation, this could be due to

decreased numbers of male students who admitted to the field of nursing. This finding is supported by **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, the results of the current study showed that, two-fifths of them had secondary school of nursing. From the researcher point of 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

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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, the result of the present study found that, two-thirds of them had  $\geq 10$  years of experience. This result disagrees 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 nurses had more than ten years work experience.

According to attendance of training courses, the findings of the current study illustrated that, less than three-quarters of them didn't attend any training courses regarding the care of children undergoing bone marrow aspiration. These findings disagree with **Algbury & 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 had previous training courses about bone marrow aspiration.

Regarding characteristics of the studied children, the current study revealed that, more than one third of the studied children were in age group 1 - < 6 years and 36.7% aged 6 < 12 years respectively, with a mean age of  $8.216 \pm 3.80$  years. This result is consistent with **Triarico et al., (2019)**, who evaluated "Impact of malnutrition on survival and infections among pediatric patients with cancer: a retrospective study", and 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.

Concerning gender, the current study showed that less than three-quarters of the children were males. This finding agrees with **Rudresha et al., (2021)** who pointed that, more than half of the studied sample was males. Also, **Goel et al., (2020)**, in study entitled "Analysis of bone marrow and peripheral blood film findings in sixty diagnosed cases of lymphoma", showed that, 71.4% of cases were males and 28.6% were females.

The current study displayed that, less than two-thirds of the children were from 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 children were from urban areas and less than three quarters (73.3%) of them were in nursery.

Concerning the medical diagnosis, the current study presented that, less than half of 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, leukemia followed by cases of lymphoma was the widespread bone marrow examination finding.

The present study clarified that, less than three-quarters of the studied children had bone marrow aspiration before. This finding 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 **Yuvali 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 determined 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”, who pointed that, only 0.4% of the children had a procedural complication secondary to a hematoma.

Regarding total knowledge score, the current study illustrated that, there was a statistical significant improvement in nurses' total knowledge score post-designed guidelines compared with pre-designed guidelines ( $p \leq 0.05$ ). This may be contributed to the impact of the designed guidelines on improving the nurses' knowledge and nurses' adherence to guidelines booklet besides, using various teaching methods and illustrative media to give instructions to nurses.

This finding is in the same line with **Aljobury et al., (2021)**, who evaluated “Effectiveness of educational program on nurses' knowledge toward malignant solid tumors of children at the oncology center”, who revealed that, nurses' knowledge were improved after implementing the educational program during post-test.

Concerning nurses' total practices score concerning care of children undergoing bone

marrow aspiration, the study reveals that, more than one third of the studied nurses had incompetent total practice score before implementing of designed guidelines. While 93.3% of them had competent total practice score post-implementation of designed guidelines, with a statistical significant improvement in nurses total practice score compared with pre-implementation of designed guidelines ( $p \leq 0.05$ ). From the researcher's perspective, the designed guidelines were an effective mean in developing nurses' practice about care of children undergoing bone marrow aspiration.

This result is consistent 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”, and illustrated that, there was a high significant difference between level of nurses' practice before and after implementation of the program ( $P \leq 0.05$ ).

Moreover, the finding is in harmony with **Abd Elbaky et al., (2018)**, who reflected that, levels of knowledge and skills regarding invasive procedures had developed after educational program and became satisfactory, resulting in higher performance level.

As regards correlation coefficient between total knowledge and total practices scores, the findings of the current study clarifies that, there was a highly positive statistical correlation between total knowledge and total practices scores of studied nurses 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**

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**American Association of Colleges of Nursing, (2019)**, which recommended that, enhancing nurses' practice mainly relies on developing knowledge concerning principles of patient's safety.

### **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 caring of children undergoing bone marrow aspiration is mandatory for nursing quality improvement.
- Continuing in-service training programs should be carried out to encourage nurses providing 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.