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Effect of Nursing Instructions on Knowledge and Therapeutic Adherence among Leukemic Patients Undergoing Bone Marrow Transplantation

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Abstract: Leukemia arise from the dysfunctional of developing leukocytes. Bone marrow transplantation used to replace bone marrow cells which damaged by disease or chemotherapy with healthy cells. Therapeutic adherence is the extent to which patients take medication as prescribed by their doctors, failure of therapeutic adherence lead to poor health outcomes**.** Nursing instructions help leukemic patients to take a proactive role in their own care, they need to comprehend their condition, therapeutic and healthy life style adherence. **Aim**: to evaluate the effect of nursing instructions on knowledge and therapeutic adherence among leukemic patients undergoing bone marrow transplantation. **Methods:** Quasi-experimental design was utilized included pre, immediately post, and follow up after six months **Subjects:** A purposive sample of 70 patients with leukemia undergoing BMT and excluded the patients with other associated disorders**, Setting** bone marrow transplantation units at Nasser Institute for Research and Treatment. **Tools:** Three tools were used. Tool (I): Patient`s structured Interview Questionnaire included, patients` personal data, patients` medical history assessment, patients` current complaint and physical symptoms assessment, patients` knowledge about leukemia and BMT and patients knowledge about healthy life style, Tool (II): Patient`s therapeutic adherence include Morisky adherence medication scale and therapeutic adherence barriers questionnaire. Tool (III): patients' adherence to healthy life style. **Results:** the current study indicated that less than one tenth of studied patients had good level of total knowledge about leukemia, bone marrow transplantation and healthy life style at pre implementation nursing of instructions, while the level improved to most of them immediately post implementation, but at follow up period there was slightly decreased in total knowledge score to more than three quarters of them.in addition, the present study portrayed that less than one fifth of studied patients had high level of medication adherence pre-implementation of nursing instruction, while immediately post-implementation the level of medication adherence was high among most of them, but this percentage slightly decreased at follow up period**. Conclusion:** Implementation of nursing instructions have appositive effect in improving studied patient 'knowledge and therapeutic adherence among leukemic patients undergoing BMT. **Recommendation**: The nursing instruction on knowledge and therapeutic adherence among leukemic patients undergoing bone marrow transplantation should be revised periodically and be available in all hospitals in both Arabic and English language. In addition, the educational intervention and patient's psychosocial support should be included in routine nursing care as a protocol before, after bone marrow and stem cell transplantation surgery, and at the time of follow up phase.

Key Words: Bone Marrow Transplantation, Leukemia, Nursing Instructions, Therapeutic Adherence

Introduction*:*

Leukemia is a heterogeneous group of hematologic malignancies that arise from the dysfunctional proliferation of developing leukocytes. It is a production of abnormal leukocytes either as a primary or secondary process. Based on the rapidity of proliferation, they can be classified as acute or chronic, and myeloid or lymphoid based on the originator cell. **[1]**

Bone marrow transplantation; it defined as medical procedure used to replace bone marrow cells which damaged by disease or chemotherapy with healthy cells. This procedure involves transplanting blood stem cells, which travel to the bone marrow where they produce new blood cells and promote growth of new marrow. **[2]**

Therapeutic adherence is the extent to which patients take medication as prescribed by their doctors. The American Medical Association says, "A patient is considered adherent if they take 80% of their prescribed medicine(s). If patients take less than 80% of their prescribed medication(s), they are considered non adherent." non-adherence leads to poorer health outcomes, such as increased incidence of transplant-related morbidity and mortality, higher cancer recurrence rates and shorter survival**.[3]** Nutritional

recommendations after BMT process include ongoing nutrition assessment throughout the BMT process including nutritional and medical histories, anthropometry, chemistry review, and assessment of additional factors that may interfere with the patient taking adequate nutrition (pain control, activity level, etc.). **[4]**

Nursing instructions help leukemic patients to take a proactive role in their own care, they need to comprehend their condition, therapeutic and healthy life style adherence. As well as, work to prevent or minimize complications after BMT process**.[5]**

Significance of the study:

There are fifteen transplant centers, and the transplant rate/million is 8.4, which is considerably higher than the number we reported previously in 2008, where the transplant rate/million was 2.8. **[6]**

Leukemia comprises 10% of all malignancies in Egypt, According to the latest WHO data published in 2022 leukemia deaths in Egypt reached 3,763 or 0.70% of total deaths. The age-adjusted death rate is 4.53 per 100,000 of population ranks Egypt42 in the world. **[7]**

The biggest BMT center in Egypt is at the Nasser Institute, which contains 20 cabins equipped with high efficiency particulate air (HEPA) filters, positive pressure and vertical laminar airflow. According to the Nasser Institute Hospital Statistical record, the center performs about 360 case of stem cell transplantation during the period January 2021 to December 2020, about 80% of the transplants are allogeneic and 20% autologous**. [6]**

Hypotheses:

H1. Studied leukemic patients' knowledge score regarding bone marrow transplantation process could be improved post the nursing instructions implementation than before.

H 2. The therapeutic adherence score among the studied leukemic patients could be improved post-nursing instructions implementation than before.

Subjects and Method

Research design:

A quasi-experimental research design including pre, post, and follow-up.

Study setting:

This study conducted in bone marrow transplantation units at Nasser Institute for Research and Treatment in Qalyubia Governorate. BMT unit consist of 20 isolated rooms with 24 beds, all rooms provided with negative pressure to protect patients from any infection.

Subjects*:*

A purposive sample of 70 patients with leukemia undergoing BMT and with age ranged from 20 to 60 years from both sexes will be involved in the study, from the above mentioned setting, and excluded the patients with other associated disorders. The sample size was calculated by adjusting the power of the test using the following equation based on the number of patients (360) patient during the period January 2021 to December 2022, and performed BMT at Nasser Institute hospital. the following equation will be adapted from **[8].**

$$n = \frac{N \times p\,(1-p)}{N-1 \times (d^2 \div z^2) + p\,(1-p)}$$

N = Community size

z = Class standard corresponding to the level of significance equal to 0.95 and 1.96

d = the error rate is equal to 0.05

p = Ratio provides a neutral property = 0.125

Aim of the study:

The present study aimed to evaluate the effect of nursing instructions on knowledge and therapeutic adherence among leukemic patients undergoing bone marrow transplantation

Data collection:

Tool (I): Patient Structured Interview Questionnaire: included the following parts: The scientific references used were: [9],[10],[11],[12][4]. This tool consisted of five parts: **Part 1**: Patients` personal data: it included age, sex, marital status, work, educational level, and residence. **Part 2:** Patients` medical history assessment: it included; family history, past medical history, onset of disease, previous and current medication, route and frequency of medication. **Part 3:** Patients` present complaints and physical symptoms assessment: it included assessment of patients` present complaints and assessment of respiratory system, digestive system, cardiovascular system, bowel system and urinary system. **Part 4:** Patients` knowledge about leukemia and BMT: it consisted of four sessions: A- Patients' knowledge about leukemia: which consist of six questions, B- Patients' knowledge related to bone marrow transplantation: which included three questions C-The preparation stage (before the transplantation process): which included four questions, D- post-transplantation stage: which included of five questions

Scoring system of parts:

Good ≥ 75%of the total score (answer from18 to 13 questions)

Average 60%- < 75% of total score (answer from 10 to 13 questions)

Poor <60% of total score (answer less than 10 questions)

Part 5: Patients knowledge about healthy life style: it consisted of 7 questions included questions to assess patients about healthy diet, recommended physical exercise and prescribed medications.

Scoring system of part 5:

Good ≥ 75%of the total score (answer from 5 to 7 questions)

Average 60%- < 75% of total score (answer from 3 to 5questions)

Poor <60% of total score (answer less than 3 questions)

Tool (II): Patients therapeutic adherence: the purpose of this tool was to investigate the factors associated with therapeutic adherence in patients with leukemia, it include two parts.

Part 1: Morisky adherence medication scale (MMAS-8): It was adopted from **[13]** The scale was applied to measure patients` therapeutic adherence.

The Morisky Medication Adherence Scale, otherwise known as the Morisky Scale (MMAS-8), has proved to be a valuable resource to address adherence concerns, such as forgetting to take medications or discontinuing medications without guidance It consisted of eight questions about: the forget to take medications, reduced or stopped taking medications without telling the doctor, forget to bring medications during travel, felt bad about adhering to treatment plan, and find it difficult to remember to take all medications..

Scoring system of part 1:

The overall score is each response (yes) is rated as (1score) and each (no) was rated as (0 score). -The scores of the MMAS-8 range from (0 to 8):

A score below (<6) indicated low adherence

A score between (6<8) indicated medium adherence

A score of (8) indicated high adherence

Part 2: Therapeutic adherence barriers questionnaire: adapted from [14].It included different items about intentional adherence barriers, unintentional adherence barriers, medication-related barriers, and health care system-related barriers.

Scoring system of part 2:

The overall score is each response (yes) is rated as (1score) and each (no) was rated as (0 score).

A score below (<7) indicated low barriers

A score between (7 <11) indicated moderate barriers

A score of (11-14) indicated high barriers

Tool (III): Patients' adherence to healthy life style: it was be adapted from **[15]:** Lifestyle behaviors were determined by diet index, physical activity, weight, smoking, and alcohol consumption. It improve quality of life and longevity of BMT patient's survivors.

Scoring system:

All lifestyle behaviors questions were weighted according to the items included three scoring levels for questions were used. Each answer, which the patient performed it usually, was scored (2), each answer which patient performed it sometime was scored (1). Each answer, which the patient not performed it, was scored (0). Theses scores were summed-up, converted into a percent, and categorized as follows:

- Good & ≥75% of the total score (answer from 39 to 52 questions)
- Average 60% - <75% of total score (answer from 31 to 39 questions)
- Poor <60% of total score (answer less than31 questions)

Nursing Instructions Booklet: designed by the researcher through a reviewing of recent related literatures, these instructions planned to cover knowledge and therapeutic adherence for leukemic patients undergoing bone marrow transplantation

Content validity: Validity of tools was done by a group of experts to check the relevancy, clarity, comprehensiveness, and applicability of the questions. According to their opinion, minor modifications were done and the final forms were developed. Face and content validation of the studied tools were done according to opinions of the five experts in related fields. Jury experts involved two professors and three assistant professor of medical surgical nursing department in the faculty of nursing, Benha University.

Reliability: Reliability of the developed tools was done statistically through Chronbach`s Alpha test to measure the internal consistency of the tool. There was Tool (I): patients` knowledge0.926, Tool (II): Patients therapeutic adherence: part (1) morisky adherence medication scale 0.899, part(2)therapeutic adherence barriers questionnaire0.877 and Tool (III): patients' adherence to healthy life style0.985.

Ethical considerations: Written approval was obtained from the research ethical committee of faculty of nursing; also, an official permission was obtained from hospital administrators to conduct the study. Additional written and oral consent was taken from the patients who participated in the study after explanation of the nature, aims and expected outcomes of the study. The participants were informed that they allowed to choose to participate or not in the study and they have

the right to withdrawal from the study at any time. The research assured ethical cods of research as honesty and integrity in research design, data collection, and reporting, respect for human subjects and responsible data sharing and confidentiality protocols.

Pilot study: was carried out on 10% of the studied subject (7 patients) that was excluded from the total subjects. The pilot study was done in order to test the clarity and applicability of the study tools and the guidelines, to estimate the time required for each tool to be filled in as well as to identify any possible obstacles that may hinder data collection. Based on the results of the pilot study few modifications were done to have more applicable tools for data collection. The pilot study was done at February 2024 two weeks before starting the study.

Filed work; (data collection): was carried out through nine months from the beginning of March 2024 to the end of November 2024. The researcher visited the BMT units at Nasser Institute for Research and Treatment three days weekly to collect the data by using previous tools. The study was conducted through the following three phases:

Phase I: assessment phase: The researcher interviewed with patients in BMT unit, explained the aim of the study, and take their approval to participate in the study prior to data collection, and then the researcher assessed the patient's knowledge regarding the disease of leukemia and the process of BMT by using questionnaire sheet as following:

First, the researcher used patient structured interview questionnaire, it was designed and written in simple clear Arabic language, which include personal data, medical history, Patients` present complaints and physical symptoms assessment, and knowledge about leukemia and BMT. (Tool I).

Second, Assessment of patients` therapeutic adherence by using medication adherence scale among patients with leukemia. Tool (II).

Third, Assessment of patients` adherence to healthy life will be using tool (III). The time required to fill each chick list was between 20 – 30 minutes.

Phase II: Planning Phase: Based on data collection by the study tools and determination of patient medical history and general knowledge.

Nursing Instructions Booklet: designed by the researcher through a reviewing of recent related literatures, these instructions planned to cover knowledge and therapeutic adherence for leukemic patients undergoing bone marrow transplantation, the instructions content divided into two parts:

theoretical part: included the following items: definition of leukemia, introduction of bone marrow, types of bone marrow and their importance, chemotherapy and radiation therapy and their side effects, bone marrow transplantation phases, types of bone marrow transplantation, methods for donating bone marrow cells, expected complications after BMT, patient health education about the therapeutic adherence, therapeutic adherence barriers and how to beat on it

Practical part: included methods of preventing complication after discharge as: therapeutic adherence, life style and nutrition therapy after BMT process, personal hygiene, caring for wounds, caring for intravenous catheter, and commitment to periodic follow up.

Phase III: Implementation phase: included the following steps:

The researcher visited the study setting during the morning & afternoon shifts three days weekly (Saturday, Monday, Thursday) during the time of the study, and then the researcher-divided patients into 10 small groups included 7 patients in each session. The appointment for starting educational sessions was be scheduled with the patients and the head nurse of the unite according to patient's circumstances as (load of work and short of staff) or their scheduled medical services. The nursing instructions consisted of (12) sessions for theoretical and practical parts. It divided as follows: (8) sessions for theoretical part, and (4) sessions for the practical part. The time of theoretical sessions ranged between 45 minutes to 6o minutes. The patients divided into 10 small groups included 7 patients in each session to acquire the related information. Each patient was supplemented with the booklet. The researcher continued to reinforce the gained information, answered any raised questions and gave feedback. The duration of skills sessions ranged between 45 minutes to 60 minutes, and numbers of sessions were 3 sessions for each group in the form of demonstration and re-demonstration for each group. Implementation of nursing instructions for leukemic patients during phases of BMT conducted by the researcher and nursing instructions booklet distributed by using available media for better understanding. The researcher allowed patients to ask questions, explanation, or elaboration in case of misunderstanding

Phase IV. Evaluation Phase: The effect of implementation of nursing instructions on patients' level of knowledge, healthy life style

and therapeutic adherence was evaluated by comparing the results pre, immediately post, and follow up implementation after six months by using the same data collection tools.

Results:

Table (1): revealed that 40% of studied patients aged between 40 to less than 50 years old with mean age of 43.77± 4.14 years; males were 52.9 % of the patients. 48.6% of patients were married. Regarding their educational level, 54.3% had secondary education; also, there were 70% of patients do not work and 54.3% from urban area.

Table (2): there was highly significant at p ‹ 0.01 of total patients' knowledge about leukemia, bone marrow transplantation and healthy life style during the study period. There was 7.1% of studied patients had good level of total knowledge about leukemia, bone marrow transplantation and healthy life style at pre implementation nursing of instructions, while the level improved to 82.9% immediately post implementation. In addition, at six months post intervention there was slightly decreased in total knowledge score to 78.6%.

Figure (1): reveals that 7.1% of the studied patients had good knowledge about leukemia, bone marrow transplantation and healthy life style at pre implementation of nursing, while immediately post implementation 82.9% had good knowledge and slightly decline to 78.6% at six months post intervention.

Table (3): show that there was statistical significant during the study period. This table illustrate that 17.2% of studied patients had high level of medication adherence pre implementation of nursing instruction to the studied patients, while immediately post implementation the level of medication adherence was 88.6%, but slightly decreased to 82.9% was noticed at six months post intervention.

Figure (2): reveals that 17.2% of the total studied patients had high medication adherence pre implementation of nursing instructions, while immediately post there was 88.6% had high level of adherence, but slightly decline to 82.9% at six months post intervention

Table (4): illustrate that there was statistical significant of total therapeutic adherence barriers during the study period. There was 44.3% and 50% of studied patients had high level of total adherence barriers pre implementation of nursing instructions, while immediately post implementation the total adherence barriers were 4.3% and 10%, but there was slightly increase in total adherence barriers at six months post intervention to 8.6% and 12.9%.

Figure (3): show that 57.1% of studied patients had high level of total therapeutic adherence barriers pre implementation of nursing instructions, while immediately post implementation 7.2% had high level of adherence barriers, but at six months post intervention the total therapeutic adherence barriers level slightly increased to 11.4%

Table (5): there was statistical significant of total patients' adherence to healthy life style during the study period. There was10% of studied patients had good level of the total patients' adherence to healthy life style at pre implementation of nursing instructions, while immediately post implementation the level was increased to 85.7%, but after six months at six months post intervention the level of total patients' adherence to healthy life style slightly declined to 80%.

Figure (4): show that 68.6% of studied patients had poor level of total patients' adherence to healthy life style pre implementation of nursing instructions, while immediately post implementation 5.7% had poor level of total patients' adherence to healthy life style, but at six months post intervention the total adherence level slightly increased to 8.6%

Table (6): show that there was negative correlation between total patients' knowledge score and total therapeutic adherence barriers score at pre , immediately post and six months after implementation of nursing instructions, also there was negative correlation between total medication adherence score and total therapeutic adherence barriers score at pre , immediately post and six months after implementation of nursing instructions.

Table (1): Number and percentage distribution of the studied patients according to their personal data (n=70).

Personal data		No.	%
Age (Years)			
20 -< 30		9	12.9
30 -< 40		26	37.1
40 -<50		28	**40.0**
50 – 60		7	10.0
Mean ± SD	**43.77±4.14 SD**		
Gender			
Male		37	**52.9**
Female		33	47.1
Marital status			
Married		34	**48.6**
Divorced		11	15.7
Widower		7	10.0
Single		18	25.7
Education level			
Illiterate		6	8.6
Read and write		8	11.4
Secondary education		38	**54.3**
High education		18	25.7
Occupation			
Working		49	**70.0**
Don't work		21	30.0
Nature of work (n=21)			
Office work		13	**61.9**
Manual work		8	38.1
Residence			
Urban		38	**54.3**
Rural		32	45.7

Table (2): Comparison between total patients' knowledge about leukemia, bone marrow transplantation and healthy life style at pre, immediately post and six months after implementation of nursing instructions (n=70).

Knowledge subscales	Pre- instructions						Immediately post- instructions						After six months						Chi-square test		
	Good		Average		Poor		Good		Average		Poor		Good		Average		Poor		(p_1)	(p_2)	(p_3)
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
Leukemia	6	8.6	16	22.9	48	68.6	53	75.7	11	15.7	6	8.6	52	74.3	10	14.3	8	11.4	**X^2=71.03 P=0.000****	**X^2=0.343 P=٠.842**	**X^2=94.97 P=0.000****
Bone marrow transplantation	8	11.4	19	27.1	43	61.4	58	82.9	9	12.9	3	4.3	55	78.6	10	14.3	5	7.1	**X^2=76.23 P=0.000****	**X^2=0.632 P=٠.729**	**X^2=103.54 P=0.000****
Healthy life style	5	7.1	16	22.9	49	70.0	54	77.1	10	14.3	6	8.6	52	74.3	10	14.3	8	11.4	**X^2=75.69 P=0.000****	**X^2=0.323 P=٠.851**	**X^2=99.66 P=0.000****
Total knowledge score	5	**7.1**	17	24.3	48	68.6	58	**82.9**	9	12.8	3	4.3	55	**78.6**	9	12.8	6	8.6	**X^2=86.75 P=0.000****	**X^2=1.080 P=٠.583**	**X^2=115.35 P=0.000****

X2: Chi-square test. **P=** p-value. **No significant** at p >0.05. *** Significant at** p ‹ 0.05. ****Highly significant** at p ‹ 0.01.
P1: p value for comparing pre and post intervention. **P2:** p value for comparing post and after six months. **P3:** p value for comparing between three phases.

Figure (1): Percentage distribution of total patients' knowledge about leukemia, bone marrow transplantation and healthy life style at pre, immediately post and six months after implementation of nursing instructions (n=70).

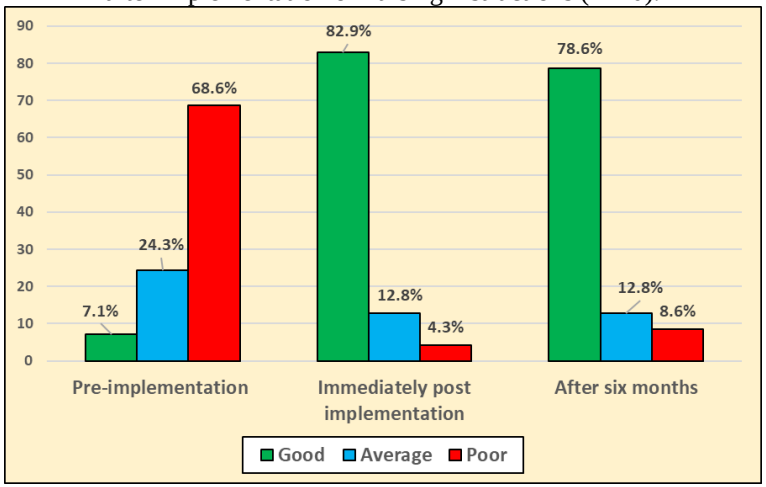

Table (3): Comparison between total patients' medication adherence at pre, immediately post and six months after implementation of nursing instructions (n=70).

Levels of total medication adherence	Pre- instructions		Immediately post-instructions		After six months		Chi-square test		
	No.	%	No.	%	No.	%	(p_1)	(p_2)	(p_3)
High adherence	12	**17.2**	62	**88.6**	58	**82.9**	**X^2=77.63**	**X^2=3.192**	**X^2=109.54**
Medium adherence	18	25.7	8	11.4	9	12.8	**P=0.000****	**P=٠.203**	**P=0.000****
Low adherence	40	57.1	0	0.0	3	4.3			

X^2: Chi-square test**.** **P=** p-value. No significant at p >0.05. **Highly significant at p ‹ 0.01.
P_1: p value for comparing **pre and post** intervention. **P_2:** p value for comparing **post and after six months**.
P_3: p value for comparing between **three phases**.

Figure (2): Percentage distribution of total patients' medication adherence at pre, immediately post and six months after implementation of nursing instructions (n=70).

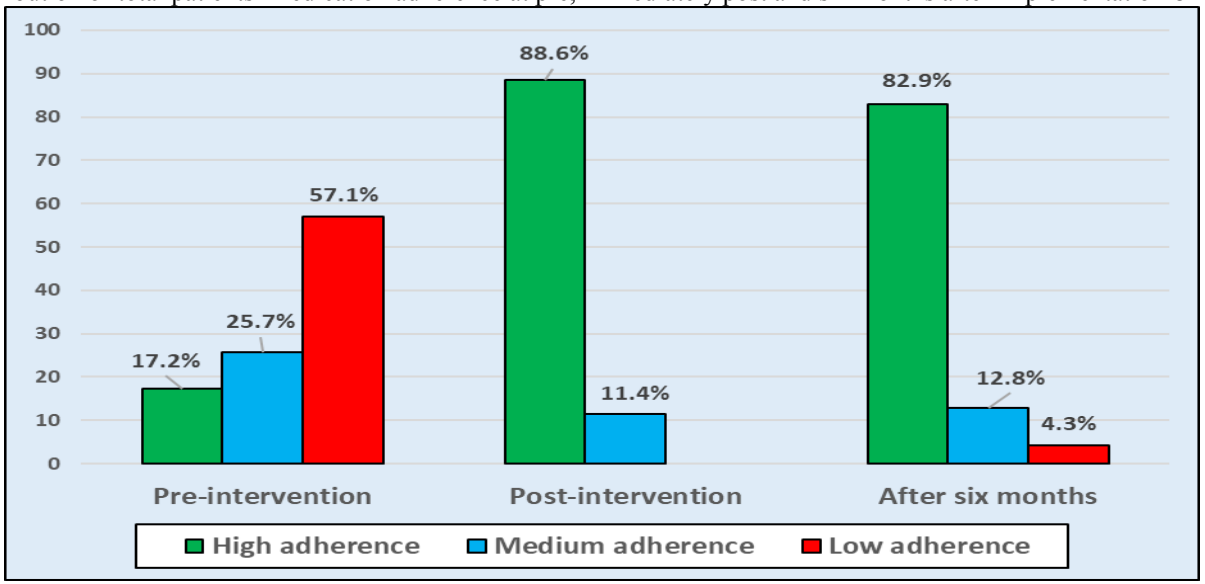

Table (4): Comparison between total therapeutic adherence barriers as perceived by patients at pre, immediately post and six months after implementation of nursing instructions (n=70).

Therapeutic adherence barriers	Pre-instructions						Immediately post- instructions						After six months						Chi-square test		
	High		Moderate		Low		High		Moderate		Low		High		Moderate		Low		(p_1)	(p_2)	(p_3)
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
Intentional obstructions	43	61.4	18	25.7	9	12.9	6	8.6	13	18.6	51	72.8	8	11.4	11	15.7	51	72.9	**X^2=58.14 P=0.000 ****	**X^2=0.452 P=٠.798**	**X^2=79.22 P=0.000 ****
Unintentional obstacles	40	57.1	20	28.6	10	14.3	10	14.3	16	22.8	44	62.9	15	21.4	14	20.0	41	58.6	**X^2=39.58 P=0.000 ****	**X^2=1.239 P=٠.538**	**X^2=47.34 P=0.000 ****
Treatment obstacles	31	**44.3**	29	41.4	10	14.3	3	**4.3**	10	14.3	57	81.4	6	**8.6**	10	14.3	54	77.1	**X^2=65.28 P=0.000 ****	**X^2=1.081 P=٠.582**	**X^2=84.51 P=0.000 ****
Health system obstacles	35	**50.0**	18	25.7	17	24.3	7	**10.0**	10	14.3	53	75.7	9	**12.9**	9	12.9	52	74.2	**X^2=39.46 P=0.000 ****	**X^2=0.312 P=٠.855**	**X^2=53.32 P=0.000 ****
Total therapeutic adherence barriers score	40	57.1	20	28.6	10	14.3	5	7.2	11	15.7	54	77.1	8	11.4	11	15.7	51	72.9	**X^2=60.08 P=0.000 ****	**X^2=0.778 P=٠.678**	**X^2=77.99 P=0.000 ****

X^2: Chi-square test**.** **P=** p-value. No significant at p >0.05. **Highly significant at p ‹ 0.01.
P_1: p value for comparing **pre and post** intervention. **P_2:** p value for comparing **post and after six months**. **P_3**: p value for comparing between **three phases**.

Figure (3): Percentage distribution of total therapeutic adherence barriers as perceived by patients at pre, immediately post and six months after implementation of nursing instructions (n=70).

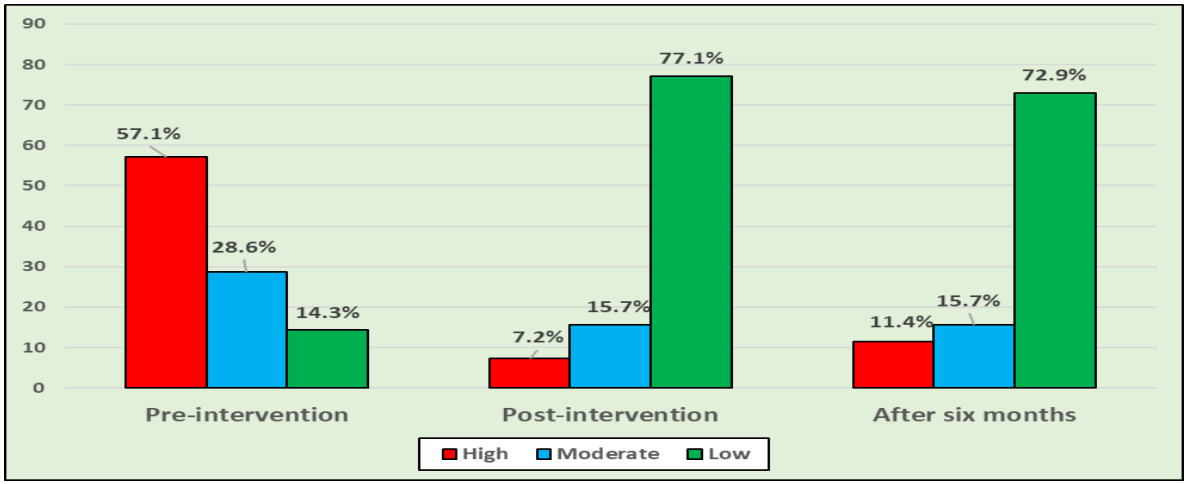

Table (5): Comparison between total patients' adherence to healthy life style at pre, immediately post and six months after implementation of nursing instructions (n=70).

Patient`s adherence to healthy life style	Pre- instructions						Immediately post- instructions						After six months						Chi-square test		
	Good		Average		Poor		Good		Average		Poor		Good		Average		Poor		(p_1)	(p_2)	(p_3)
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
Weight	11	15.7	21	30.0	38	54.3	58	82.9	10	14.3	2	2.8	56	80.0	9	12.9	5	7.1	**X^2=68.31 P=0.000****	**X^2=1.373 P=٠.503**	**X^2=93.75 P=0.000****
Healthy nutrition	14	20.0	21	30.0	35	50.0	62	88.6	8	11.4	0	0.0	58	82.9	9	12.8	3	4.3	**X^2=71.14 P=0.000****	**X^2=3.192 P=٠.203**	**X^2=99.44 P=0.000****
Physical exercises	4	5.7	13	18.6	53	75.7	50	71.4	12	17.2	8	11.4	48	68.6	14	20.0	8	11.4	**X^2=72.42 P=0.000****	**X^2=0.195 P=٠.907**	**X^2=98.61 P=0.000****
Personal hygiene	16	22.8	20	28.6	34	48.6	64	91.4	6	8.6	0	0.0	59	84.3	8	11.4	3	4.3	**X^2=70.33 P=0.000****	**X^2=3.489 P=٠.175**	**X^2=97.63 P=0.000****
Sleep	6	8.6	16	22.8	48	68.6	58	82.9	8	11.4	4	5.7	54	77.1	10	14.3	6	8.6	**X^2=82.14 P=0.000****	**X^2=0.765 P=٠.682**	**X^2=109.49 P=0.000****
Participation in social life	9	12.9	21	30.0	40	57.1	54	77.1	10	14.3	6	8.6	51	72.9	10	14.3	9	12.8	**X^2=61.17 P=0.000****	**X^2=0.686 P=٠.710**	**X^2=77.87 P=0.000****
Prevention of unhealthy habits	7	10.0	16	22.9	47	67.1	56	80.0	9	12.9	5	7.1	54	77.1	9	12.9	7	10.0	**X^2=73.99 P=0.000****	**X^2=0.370 P=٠.831**	**X^2=99.40 P=0.000****

Periodic follow-up	18	25.7	16	22.9	36	51.4	65	92.9	5	7.1	0	0.0	60	85.7	7	10.0	3	4.3	**X^2=68.37 P=0.000****	**X^2=3.533 P=٠.171**	**X^2=96.70 P=0.000****
Total adherence to healthy life style score	7	**10.0**	15	21.4	48	68.6	60	**85.7**	6	8.6	4	5.7	56	**80.0**	8	11.4	6	8.6	**X^2=83.01 P=0.000****	**X^2=0.824 P=٠.662**	**X^2=110.97 P=0.000****

X^2: Chi-square test. **P=** p-value. No significant at p >0.05. **Highly significant at p ‹ 0.01.
P_1: p value for comparing **pre and post** intervention. **P_2:** p value for comparing **post and after six months**. **P_3**: p value for comparing between **three phases**.

Figure (4): Percentage distribution of total patients' adherence to healthy life style at pre, immediately post and six months after implementation of nursing instructions (n=70).

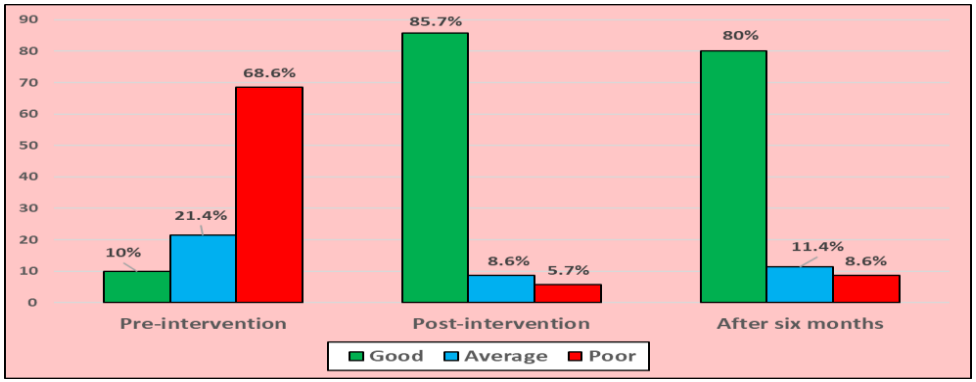

Table (6): Correlation between total patients' knowledge, medication adherence, therapeutic adherence barriers and adherence to healthy life style at pre, immediately post and six months after implementation of nursing instructions (n=70).

Variables		Total knowledge score			Total medication adherence score			Total therapeutic adherence barriers score		
		Pre	Immediately post	After six months	Pre	Immediately post	After six months	Pre	Immediately post	After six months
Total medication adherence score	**r**	0.864	0.811	0.821						
	p	0.000**	0.000**	0.000**						
Total therapeutic adherence barriers score	**r**	-0.854-	-0.850-	-0.878-	-0.850-	-0.755-	-0.674-			
	p	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**			
Total adherence to healthy life style score	**r**	0.906	0.904	0.941	0.946	0.858	0.903	-0.838-	-0.883-	-0.866-
	p	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**

r= coefficient correlation test**.** **(-)=** Negative correlation**.** **p=** p-value. ******highly significant at p ‹ 0.01**.**

Discussion:

This study aimed to evaluate the effect of nursing instructions on knowledge and therapeutic adherence among leukemic patients undergoing bone marrow transplantation.

Personal data of the studied patients:

Regarding to age: The current study revealed that two fifth of the studied patients aged between 40 to less than 50 years old with mean age of 43.77± 4.14 years. This might be due to that most of the patients with bone marrow transplantation had the acute form of leukemia, which could appear in the middle age of those patients. This result was in accordance with a study carried out by**.[16]** who reported in their study about "Impact of age, functional status, and comorbidities on quality of life and outcomes in elderly patients with AML" in France, that the incidence of acute myeloid leukemia increases with age. On the other hand, also this result was in the same line with **[11],** entitled "Effect of Evidence Based Guidelines on Nurses' Performance to Reduce Complications for Patients after Bone Marrow Transplantation" in Egypt and reported that the more than half of the studied patients aged between 40 to less than 50 years old with mean 40.2 ±6.83 years.

Regarding to gender: the current study demonstrated that males were more than half of the studied patients. It may be due to the greater prevalence of risk factors such as smoking and occupational carcinogens among male gender. This result was compatible with **[17],** who applied a study about "Symptom burden and recovery in the first year after allogeneic hematopoietic stem cell transplantation" in Sweden, and found that more than half of the studied patients were males. Also, the results is in the same line with[**18**] who documented in his study about "Role of Age and Sex on the Incidence of Leukemia in a Sample of Iraqi Patients" that the higher burden among males of a few leukemia types might be attributed to the greater prevalence of risk factors such as smoking and occupational carcinogens. In the opposite line [**19**] conducted study entitled "Investigation of healthy lifestyle behaviors and quality of life in individuals undergoing hematopoietic stem cell transplantation", in Turkey and showed that about two thirds of patients were female.

Regarding to marital status: the present study showed that nearly half of the studied patients were married. This result is congruent with a study carried out by **[20]** whose study entitled "Assessment of knowledge, attitudes, and practices of chronic myeloid leukemia (CML) patients and their families toward tyrosine kinase inhibitors (TKIs) therapy in China" and reported that most of the studied patients were married. In addition, this result was congruent with a study carried out by [**21**] entitled "Knowledge, attitude, and practice

toward leukemia in the general population and among family members of patients with leukemia", in China and found that the highest percentage of the studied patients were married.

Regarding educational level: the current study indicated that more than half of the studied patients had secondary education. According the researcher opinion the high level of education help in increasing rate of success the treatment process. This result was in harmony with study carried out by[**22**] who carried out study about "Effect of Educational Guidelines on Patients' Knowledge and Practices regarding Complications Post Bone Marrow Transplantation" in Egypt and reported that most of the studied patients had secondary education.

Regarding occupational status: the present study displayed that more than two thirds of the studied patients were working. According to the researcher opinion, worker patients are exposed to many risk factors as rays and chemicals. This result is consistent with a study carried out by **[23]** whose study found that the more than half of the studied patients were working. Also**,** This result was consistent with a study carried out by [**24**]**,** about "Medication Adherence in Patients with Hematologic Malignancies Who Are Hematopoietic Stem Cell Transplantation Survivors" in USA, and found that the highest percentage of the studied patients were employed.

Regarding of the residence: the current study revealed that more than half of the studied patients were from urban area. According to the researcher opinion the nature of environment in urban has more risk factors for leukemia occurrence such as exposure to car exhausts, the crowd, and the nearest of many factors. This result was compatible with a study carried out by [**25**] who carried out the study about "Effects of lifestyle and environmental factors on the risk of acute myeloid leukemia: result of a hospital-based case-control study" that most of the studied patients were urban residents.

Concerning the studied patients' knowledge about leukemia, bone marrow transplantation and healthy life style : the current study indicated that less than one tenth of studied patients had good level of total knowledge about leukemia, bone marrow transplantation and healthy life style at pre implementation nursing of instructions, while the level improved to most of them immediately post implementation, but at follow up period there was slightly decreased in total knowledge score to more than three quarters of them.as researcher opinion this could be due to their educational level and lack of guidance from health care members at pre-implementation phase. Improvement of knowledge post-implementation may be attributed to influence of nursing of instructions using attractive methods with a simple language. This result was supported by **[26]** about "Impact of educational interventions on psychological distress during allogeneic hematopoietic stem cell transplantation" in Italy, and demonstrated that there was statistically significant increase in total knowledge about allogeneic hematopoietic stem cell transplantation among patients post –transplant compared to pre transplant. Correspondingly, this result was in accordance with a study by **[27]** stated that there was a statistically significant improvement in patients' total knowledge level regarding stem cell transplantation post- and follow up compared to before implementation of transplant preparation.

Considering the studied patients' total medication adherence: the present study portrayed that less than one fifth of studied patients had high level of medication adherence pre-implementation of nursing instruction, while immediately post-implementation the level of medication adherence was high among most of them, but this percentage slightly decreased at follow up period. This may be due to the positive impact of the nursing instruction on patients' understanding of their medication regimen, fostering better adherence immediately after its implementation.

This result was congruent with **[28]Schaefer, (2021)** who carried out a study entitled "Improving medication adherence and symptom management in patients with cancer" in USA and affirmed that there were significant improvements in patients' medication adherence after educational intervention, indicating that, 100% medication adherence was achieved.

Aligned with this finding a study by **[29]** who conducted a study about "Pro-adherence complementary audiovisual educational intervention model for chronic myeloid leukemia patients treated with imatinib mesylate" in Brazil and reported that there was a substantial increase of patient adherence from less than one quarter (pre-education) to less than two third (post-education). They concluded that the educational intervention was an effective complementary pro-adherence model, activating patient memory and improving treatment adherence.

Regarding therapeutic adherence barriers: the present study portrayed that less than half of the studied patients and half of them had high level of medication adherence barriers related to treatment obstacles and health system obstacles pre implementation of nursing instructions, while immediately post implementation the total adherence barriers reported by minority of them, but there was slightly increase in adherence barriers at follow up period. This may be due to the initial effectiveness of nursing instructions in enhancing patients' understanding and management of treatment-related challenges, leading to a significant reduction in perceived adherence barriers immediately post-implementation.

In the same scene, [**30**] who reported that non-adherence was associated with treatment obstacles and health system obstacles before pharmaco-therapeutic follow-up and improved significantly after follow-up to less than one quarter of them. Likewise, a study by [**31**] about "Barriers and facilitators associated with implementing interventions to support oral anticancer agent adherence in academic and community cancer center settings" in USA who stated that, individual and system level factors were identified as determinants of implementation effectiveness of medication adherence interventions.

Concerning total therapeutic adherence barriers: the current study clarified that more than half of the studied patients had high level of total therapeutic adherence barriers pre implementation of nursing instructions, while immediately post implementation minority of them had high level of adherence barriers, but at follow up period the total therapeutic adherence barriers level slightly increased. This result was consistent with[**32**] who studied "Adherence to oral anticancer medications after implementation of an ambulatory adherence program at a large urban academic hospital" in Atlanta, and affirmed that the studied patients' perceived barriers of adherence decreased after implementation of the program. In the same line, [**33**] who carried out a study entitled "Strategies for Implementing an Oral Medication Adherence Intervention in Academic and Community Cancer Settings" in USA and reported that the implementation of structured adherence interventions significantly improved perceived barriers of medication adherence among cancer patients.

Considering total patients' adherence to healthy life style: the current study highlighted that one tenth of the studied patients had good level of the total adherence to healthy life style at pre implementation of nursing instructions, while immediately post implementation the level increased to be most of them, but after six months at follow up period the level of adherence to healthy life style slightly declined. According to the researcher opinion it may be due to the positive impact of nursing instructions in enhancing patients' awareness, motivation, and ability to adopt a healthier lifestyle immediately post-implementation.

Similar to the results of the current study, a study by Similar to the results of the current study, a study done by**[34]** About "Adherence to healthy lifestyle recommendations in Brazilian cancer survivors" in Brazil, and found that there was moderate to large improvement in adherence to lifestyle modifications among the studied patients after implementation of the educational intervention Healthy lifestyle may reduce mortality and cancer recurrence, and improve quality of life in cancer survivors. Identifying factors associated with the adherence to healthy lifestyle in cancer survivors may be useful to support actions and interventions.

Correspondingly, a study done by **[35]** entitled "Effects of a we-chat-based multimodal psycho-educational intervention on psychological well-being and quality of life in acute leukemia patients in China" and reported that there were statistically significant improvements in physical well-being, social/family well-being, functional well-being. They affirmed that educational intervention demonstrated a significant effect in improving quality of life among the studied patients.

In this concern,[**36**] who conducted a study entitled "A novel digital educational strategy improves treatment adherence and quality of life in patients with multiple myeloma" in Colombia, stated that the educational intervention empowered patients to understand the disease and therapeutic options and helped patients recall treatment information and implement healthy lifestyle habits, this results support that patient-targeted educational strategies can positively influence treatment adherence and thus improve their quality of life.

Concerning the correlation between total knowledge, medication adherence, therapeutic adherence barriers and adherence to healthy life style: The present study showed that there was negative correlation between total patients' knowledge score and total therapeutic adherence barriers score at pre-, immediately post- and six months after implementation of

nursing instructions, also there was negative correlation between total medication adherence score and total therapeutic adherence barriers score at pre-, immediately post- and six months after implementation of nursing instructions, and there was positive correlation between total patients' knowledge, total medication adherence, and adherence to healthy life style at pre-, immediately post- and six months after implementation of nursing instructions. This may be due to the fact that as patients' knowledge increases, their perceived therapeutic adherence barriers decreased. Similarly, patients with higher medication adherence may encounter fewer obstacles in following their treatment regimen. Additionally, well-informed patients are more likely to adhere to their medications and adopt healthier lifestyle behaviors. This highlights the crucial role of nursing instructions in enhancing patients' understanding, promoting medication adherence, and fostering long-term commitment to a healthy lifestyle. This result aligned with study carried out by[**37**] Entitled" The relationship between medication adherence and illness perception in breast cancer patients with adjuvant endocrine therapy" in china and noticed that medication adherence was negatively correlated with identity, environmental or immune factors. This result was in agreement with a study carried out by**[38]** about "Patient Knowledge, Medication Adherence, and Influencing Factors" in Greece, noticed that patients with higher knowledge levels were more adherent to medications. The study emphasized the importance of knowledge in improving adherence. In the same line, a study carried out by [**39**] whose study reported that found there was a positive correlation between patients' knowledge, medication adherence, and quality of life, further supporting the positive correlation observed in your study.

Conclusion:

The current study concluded that:

Implementation of nursing instructions have appositive effect in improving studied patient's knowledge and therapeutic adherence among leukemic patients undergoing BMT.

Recommendation:

The nursing instruction on knowledge and therapeutic adherence among leukemic patients undergoing bone marrow transplantation should be revised periodically and be available in all hospitals in both Arabic and English language. In addition, the educational intervention and patient's psychosocial support should be included in routine nursing care as a protocol before, after bone marrow and stem cell transplantation surgery, and at the time of follow up phase.

Discharge nursing health education:

Before patient discharge from hospital, the nurse must give patient and his family some of nursing instruction that help him after discharge as:

Avoid crowded places, eat clean and fresh vegetables, avoid semi-cocked food or spicy foods, take your medication at the prescribed time, obligate to regular follow up, and if you have any signs of complications as respiratory distress, fever or chest pain go to the hospital quickly.

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