

Quality of Life among Adolescents with Leukemia

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Abstract

Background: Leukemia disease is a common cancer and remains a life-threatening malignancy in adolescents, that affects on adolescents over the world physical health, psychological health and social wellbeing. **This study aimed** to assess quality of life among adolescents with leukemia. **Research design:** Descriptive research design was used for this study. **Setting:** This study was conducted at Mansoura Oncology Out-patient Clinics. **Sampling:** Convenient sample were used in this study, the total sample included 90 adolescent patients. **Tools:** two tools used in this study. The first tool: A structured interviewing questionnaire which covers the following parts: **Part I:** A socio demographic characteristics of adolescent patients. **B-** medical history of the adolescents' suffering from leukemia. **Part II:** knowledge of the adolescents' regarding leukemia disease. **Part III:** Concerned with practices of adolescents' regarding leukemia disease. **Second tool:** Concerned with adolescent patients Quality of Life Scale regarding leukemia. **Results:** 56.7% of adolescent patients were males, 47.8 % of adolescent patients had basic education and 54.4% of the studied adolescent patients were from rural area. 64.4 % of the studied adolescent patients with leukemia hadn't teenagers or relatives with leukemia or cancer disease. 54.5% of the studied adolescent patients with leukemia had average total knowledge regarding leukemia. 84.4 % of the studied adolescent patients with leukemia had satisfactory with total reported practices regarding leukemia. 45.6% of the studied adolescent patients with leukemia had moderate total quality of life level. There were a highly statistically significant relations between total knowledge level of adolescent patients with leukemia and their socio demographic characteristics regarding age and level of education. **Conclusion:** There were statistically positive correlation between total adolescent patients knowledge, their total practices and total quality of life scores related to leukemia disease. **Recommendation:** Booklets and posters should be available at outpatient clinics to guidance all adolescent patients about leukemia disease and the treatment.

Key words: Adolescents, Leukemia, Quality of Life.

Introduction:

Adolescence Is the transitional phase between childhood and adulthood, characterized by critical period in brain development. The world Health Organization (WHO) defines an adolescent as any person between ages 10 and 21 years. Adolescence is narrowly equated with puberty and the cycle of physical changes in reproductive maturity, change typically occurs

in every aspect of individual development with biological changes usually preceding other changes include physical, sexual, cognitive, social, and emotional changes that happen during this time can bring anticipation and anxiety for both adolescent and families (Salmanzadeh et al., 2021).

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Leukemia is a group of malignant cells of the blood and bone marrow, characterized by excessive proliferation, uncontrolled and immature growth of blood cells, which can damage red blood cells, bone marrow, and the defense system. Leukemia is a cancer of White Blood Cells (WBCs) in which the bone marrow produces irregular white blood cells. leukemia is subdivided into several types which are classified based mainly on whether the leukemia is acute (fast growing) or chronic (slower growing), and whether it starts in myeloid cells or lymphoid cells. Acute Lymphocytic or Lymphoblastic Leukemia (ALL). It starts in the bone marrow where blood cells are made. It is more common in children than in adults (**Lu et al., 2020**).

Most leukemia cases occur in children and adolescents, with an incidence of 3 to 4/100,000 in patients from 0 to 14 years of age and ~1/100,000 in patients older than 15 years, in the United States and represent 75% of all acute leukemia (which in turn represent 34% of all cancers in this age group), with a peak incidence at 2 to 5 years of age. This percentage is much lower in adults, in whom Acute Myeloid Leukemia (AML) and Chronic Lymphocytic Leukemia (CLL) are more common (**American Cancer Society (ACS), 2019**). The estimated numbers of new cases with leukemia 33% (61,090) cases of adolescent under age 20 years old in the United States (U.S) and expected to cause death estimated 57,750 in 2021 (**Leukemia & Lymphoma Society 2021**).

The incidence rate of adolescent under age 20 years in the United States is 1.8 per 100,000 individuals per year, with approximately 5,690 new cases and 1,580 deaths estimated in 2021. The median age at diagnosis for ALL is 17 years with 53.5% of patients diagnosed at younger than 20 years of age. In contrast, 29.6% (**Brown et al., 2021**).

Acute Myeloid Leukemia (AML) is also called acute myelocytic leukemia, acute myelogenous leukemia, acute granulocytic leukemia, or acute non-lymphocytic leukemia. It is most common in older people. Chronic Lymphocytic Leukemia (CLL) is a type of cancer that starts in white blood cells (called lymphocytes) in the bone marrow. CLL mainly affects older adults and accounts for about one-third of all leukemia. Chronic Myeloid Leukemia (CML) is also known as chronic myelogenous leukemia. It's a type of cancer that starts in the blood-forming cells of the bone marrow and invades the blood. About 15% of leukemia in adults are CML. Chronic Myeloid Monocyte Leukemia (CMML) is a type of cancer that starts in blood-forming cells of the bone marrow and invades the blood. It affects mainly older adults (**Abdulkareem et al., 2020**).

The cause of leukemia is unknown but there are risk factors which include a combination of genetic and environmental non-inherited factors are believed to play a role. Risk factors include people with a family history of leukemia, smoking, ionizing radiation, some chemicals such as benzene, prior chemotherapy and down syndrome, lifestyle as decrease sleep and rest, not practice exercise and eat fast food these predisposing factors. Exposure to ionizing radiation and electromagnetic fields. Previous treatment for cancer with chemotherapy or radiation. Exposure to pesticides and to infections benzene is used in the making of plastics, rubbers, dyes, pesticides, drugs and detergents, many household products such as soaps, shampoos and cleaning products. Risk factors are a major contributors of adolescents leukemia burden worldwide but leukemia can occurred to anyone. Patient may get leukemia and have none of these risk factors. Other people have

one or more of these risk factors and never get leukemia (Alburaiki et al., 2021).

Health Related Quality of Life (HRQoL) is a multi-dimensional term including physical, mental, emotional and social functioning domains. HRQoL is a measurable health outcome that incorporates patients' functional capacity and wellbeing. HRQoL of leukemia adolescent patients generally would be understandably lower than the general population. Leukemic adolescent patients not only have to deal with the clinical progress of the disease and worsening of symptoms, but also the funding issues to deal with when spending for medication, treatment and long-term follow-up. Psychological states may be affected as well, as may have to deal with the expectation of themselves, family and the society. Moreover, personal beliefs, social relationship and relationship to the surroundings may also be of concern (Wan et al., 2021).

Community Health Nurse (CHN) plays an important role regarding adolescent patients with leukemia. CHN has basic roles as three level of prevention, including primary prevention as providing health education to adolescent patients, focused on reducing exposure to environmental risk factors for the disease and give chemoprophylaxis in adolescent at high risk for leukemia disease. Community Health Nurse in secondary prevention provides screening, early detection of new cases and effective treatment. Community Health Nurse provides in tertiary prevention care and meets immediate needs of adolescent patients and families which includes strategies to prevent or manage complications and sequelae of the disease, occupational therapy is a form of rehabilitation directed at preventing disability after the disease and encourage adolescent patients to make follow up periodically (Hauer et al., 2021; Balliot et al., 2019).

Significance of the study:

Egypt is a middle income country where 40% of the population are adolescent under 18 years old (38.9 million in 2018). Leukemia is the most common childhood and adolescent from (0 to 18 years) malignancies constitutes 33.2% of all childhood and adolescent malignancies (Soheir et al., (2019). The total new cases of leukemia in Egypt were 4.314 (3.74 %) and the total mortality rate was 3.752 (4.84 %) (World Health Organization (WHO), 2020).

Aim of the study

The study aimed to assess Quality of life among adolescents with leukemia.

Research questions:

- 1-What is adolescents knowledge regarding leukemia ?
- 2-What is practices of adolescents regarding leukemia?
- 3- Is there a relationship between socio-demographic characteristics of the studied adolescents and their knowledge regarding leukemia ?
- 4- Is there relationship between duration of illness and QOL for adolescents with leukemia?

Subject and Methods

Research design:

A descriptive research design was used to conduct this study.

Setting:

This study was conducted at Mansoura Oncology Out-patient Clinics. Which characterized by high flow rate of adolescents with leukemia and there weren't found sample for Oncology Out-patient Clinics at Benha. So, the researchers chose this setting.

Sampling: -

Convenient sample was used in this study which included 90 Adolescent patients were chosen randomly according to the following Criteria: Age between 10-21 years, and free from any other chronic disease.

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Tools of data collection:

Two tools were used in this study to collect the data.

Tool I: A structured interviewing questionnaire sheet: It was developed by the investigator and supervisor staff, based on reviewing related literatures and written in a simple clear Arabic language. It consisted of three parts:

Part I: Concerned with socio demographic characteristics of the studied adolescent patients with leukemia which consisted of 8 closed ended questions as (age, gender, ranking in the family, brother number, educational level, occupation, residence and income).

Part II: It was concerned with adolescent patients' knowledge about leukemia which included 7 closed ended questions about leukemia disease, 2 closed ended questions about leukemia investigations and 13 closed ended questions about treatment of leukemia disease. Knowledge scoring system: It was calculated as follows (2) score for correct and complete answer, while (1) score for correct and in complete answer and (0) score for in correct and in complete answer. Total knowledge score = 48 points. Good if the total score was 75% to 100% (>36 points). Average if the total score was 50 to less than 75% (24-36 points). Poor if the total score was less than 50% (<24 points).

Part III: It was design to assess adolescent patients' reported practices regarding leukemia. It was consisted of 13 question divided in to 85 items where about hygienic lifestyle, infection control, temperature measurement, pain management, appetite, control of bleeding, control of red spots, control oral ulcer, exercise, alopecia, practices before chemotherapy session, practices during chemotherapy session and practices post chemotherapy session. Practices scoring system: It was calculated as follows 1 score for

done and zero score for not done. Total scores of practices for adolescent patients with leukemia = 85 points Satisfactory when the total score was $\geq 80\%$ (≥ 68 points). Unsatisfactory when the total score was $<80\%$ (< 68 points).

Second tool: concerned with quality of life scale for adolescent patients with leukemia. It was translated into Arabic by the investigator and divided into; physical, psychological, social and school achievements. Scoring system: each response had three levels of answers: always, sometimes and never. These were respectively scored 2, 1 and 0. The scores of the items were summed-up and the total divided by the number of the items, giving a mean score. These scores were converted into a percent score and means and standard deviations.

Total scores of quality of life = 76 points. Good if the $> 80\%$ (> 61 points). Moderate satisfied if it equals 60 - 80% (30 - 61 points). Poor if it equals $< 60\%$ (< 30 points).

Content validity and reliability:

The tools of the study were given to a group of 5 members of Faculties Staff Nursing experts from the Community Health Nursing Specialists who reviewed the tools for clarity, relevance, comprehensiveness, applicability and easiness for implementation. The reliability of the developed tools was estimated using Chronbach's α test to measure the internal consistency of the tools. It was found that the reliability of knowledge was 0.712, reliability of practices was 0.741 and the reliability of quality of life was 0.743.

Pilot study:

The pilot study was conducted on 10% of the total sample (90) adolescents to test the tools clarity, simplicity and applicability and time needed to fill tools as well as to identify any possible obstacles that may hinder the data collection. The pilot study wasn't excluded as no modifications were done.

Ethical considerations:

All ethical issues were assured; an oral consent was obtained from each adolescent to participate in the study and withdraw at any time when needed during the study. The aim of the study was explained to studied adolescent applying the tools to gain their confidence and trust. The study hadn't any physical, social or psychological risks. Privacy and confidentiality were assured. Ethics, values and cultures were respected

Field work:

The data was collected from adolescents patients with leukemia in Mansoura oncology outpatient clinics. Data was collected over a period of four months from the beginning of April 2021 to the end of July 2021. Approvals were obtained orally after the investigator introduced herself to each adolescent patients with leukemia and after explaining the purpose of the study. The investigator visited Mansoura Oncology Out-patient Clinics 3 days/week (Saturdays, Mondays and Wednesdays) from 10.00 a.m. to 1.00 p.m. to collect the data, taking into consideration the use of simple language to suit the understanding level of studied adolescent. The average time needed for the sheet was around 30 minutes; the average number of interviewed adolescent was 2-3 persons each time depending on the understanding and response of interviewers, the respondents filled the questionnaire in the presence of the investigator all the time to clarify any ambiguities and answer any queries and collect the questionnaire from patients at out patients clinic at Mansoura university.

Statistical design:

All data collected were organized, tabulated and analyzed using appropriate statistical test. The data were analyzed by using the Statistical Package for Social Science (SPSS) version 25, which was applied to calculate frequencies and

percentages as well as test statistical significance and associations by using chi-square test and person correlation test to detect the relation between the variables for (p value). The observation differences and associations were considered as the following: Highly statistically significant (HS) $p < 0.001$. Statistically significant (S) $p \leq 0.05$. Not statistically significant (NS) $p > 0.05$

Results:

Table (1): Reveals that; 43.3% of the studied adolescent patients with leukemia their age were from 14 to 16 years old with mean and standard deviation 15.98 ± 2.58 years old and 56.7 % of adolescent patients were males and 36.7% of them 1st rank in the family. But also 40% of them their brother number more than three and 47.8 % of adolescent patients had basic education. While 74.4% of them were not employed . Regarding residence 54.4% of the studied adolescent patients were from in rural areas with enough monthly income.

Figure (1): Illustrates that; 54.5% of the studied adolescent patients with leukemia had average total knowledge level regarding leukemia disease, and 32.2% of them had good total knowledge level. While only 13.3% of them had poor total knowledge level regarding leukemia disease.

Figure (5): Illustrates that 84.4 % of the studied adolescent patients with leukemia had satisfactory with total reported practices regarding leukemia disease. While only 15.6% of them had unsatisfactory with total reported practices regarding leukemia disease.

Figure (2): Reveals that; 45.6% of the studied adolescent patients with leukemia had moderate total quality of life level. And 43.3% of them had poor total quality of life level. While only 11.1% of them had good quality of life level.

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Table (3): Indicates that; there were a highly statistically significant relations between total knowledge level of adolescent patients with leukemia and their socio demographic characteristics regarding age and level of education (p-value <0.01). While there were no statistically significant relation between total knowledge level of adolescent patients with leukemia and their socio demographic characteristics regarding gender, ranking in the family, occupation, residence and income (p-value > 0.05).

Table (5): Present that; there was statistically significant relationship between total quality of life level of studied adolescent patients with leukemia and their duration of illness (p-value<0.05) that means that when duration of illness increase the quality of life decreased.

Table (6): Describes that; there were statistically positive correlation between total knowledge, total practices and total quality of life scores of the studied adolescent patients with leukemia (p< 0. 05).

Table (1): Frequency distribution of the studied adolescent patients with leukemia regarding their socio demographic characteristics (n=90).

Socio demographic characteristics	No.	%
Age/years		
10-13	14	15.6
14-16	39	43.3
17-19	24	26.7
20-21	13	14.4
Mean \pmSD 15.98\pm2.58		
Gender		
Male	51	56.7
Female	39	43.3
Rank in the family		
First	33	36.7
Second	31	34.4
Third or more	26	28.9
Siblings		
One	4	4.4
Two	25	27.8
Three and more	36	40.0
None	25	27.8
Level of education		
Can't read and write	6	6.7
Basic education	43	47.8
Intermediate education	26	28.9
University education	15	16.7
Occupation		
Employed	23	25.6
Not employed	67	74.4
Residence		
Rural	49	54.4
Urban	41	45.6
Income		
Enough and save	26	28.9
Enough	49	54.4
Not enough	15	16.7

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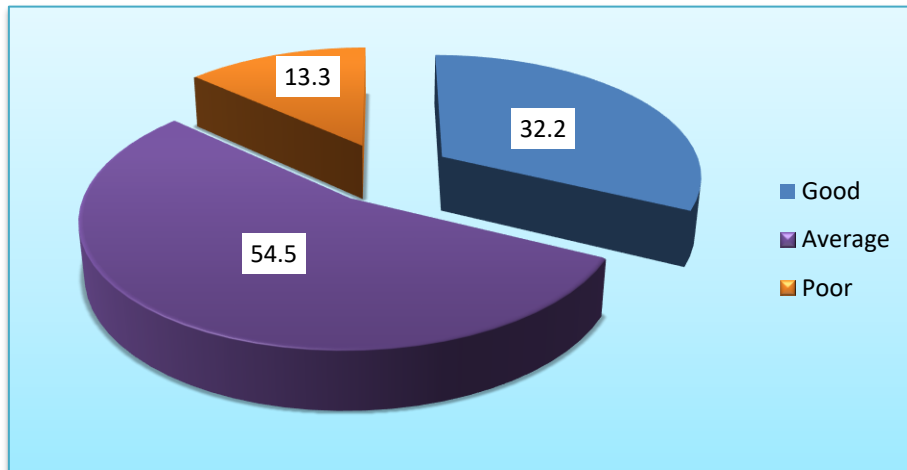


Figure (1): Percentage distribution of the studied adolescent patients with leukemia regarding their total knowledge level (n= 90)

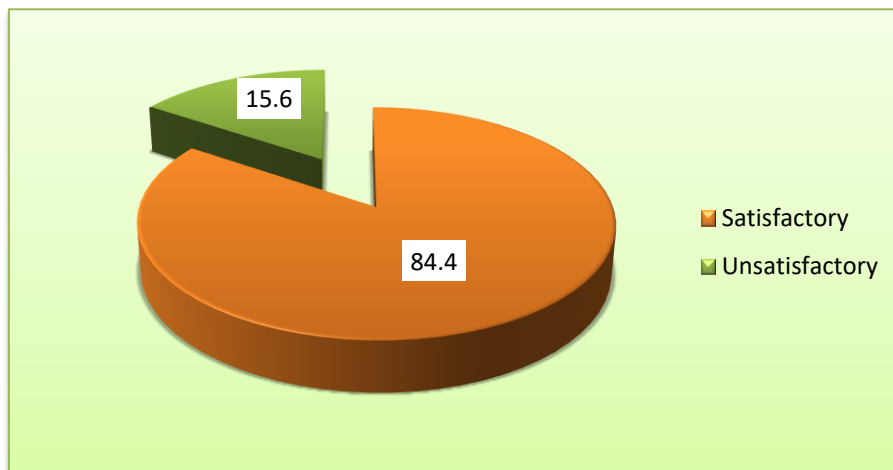


Figure (2): Percentage distribution of the studied adolescent patients' with leukemia regarding their total practices (n=90).

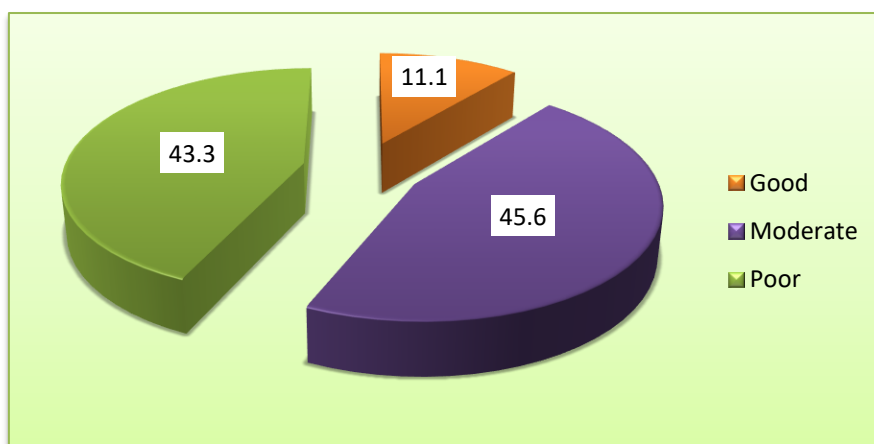


Figure (3): Percentage distribution of the studied adolescent patients' with leukemia regarding their total quality of life (n=90).

Table (2): Relationship between total adolescent patients with leukemia knowledge level and their socio demographic characteristics (n=90)

Socio demographic characteristics	Total knowledge level						X ²	p-value
	Good (n=29)		Average (n=49)		Poor (n=12)			
	No.	%	No.	%	No.	%		
Age / Years								
10-13	4	13.8	7	14.3	3	25.0	34.22	.000**
14-16	2	6.9	31	63.3	6	50.0		
17-19	17	58.6	4	8.2	3	25.0		
20-21	6	20.7	7	14.3	0	0.0		
Gender								
Male	16	55.2	28	57.1	7	58.3	0.044	0.978
Female	13	44.8	21	42.9	5	41.7		
Rank in the family								
First	10	34.5	18	36.7	5	41.7	0.728	0.948
Second	10	34.5	18	36.7	3	25.0		
Third and more	9	31.0	13	26.5	4	33.3		
Level of education								
Can't read and write	1	3.4	4	8.2	1	3.4	27.59	.000**
Basic education	5	17.2	33	67.3	5	17.2		
Moderate education	15	51.7	5	10.2	15	51.7		
University education	8	27.6	7	14.3	8	27.6		
Occupation								
Employ	7	24.1	11	22.4	5	41.7	1.916	0.384
Not Employ	22	75.9	38	77.6	7	58.3		
Residence								
Rural	14	48.3	26	53.1	9	75.0	2.527	0.283
Urban	15	51.7	23	46.9	3	25.0		
Income								
Enough and save	10	34.5	13	26.5	3	25.0	3.197	0.525
Enough	17	58.6	26	53.1	6	50.0		
Not enough	2	6.9	10	20.4	3	25.0		

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Table (3): Statistically relation between total adolescent patients quality of life level and their duration of illness (n = 90).

Duration of illness	Total quality of life						X ²	p-value
	Good (n=10)		Moderate (n=41)		Poor (n=39)			
	No.	%	No.	%	No.	%		
-Less than 6 months	1	10.0	19	46.3	14	35.9	17.29	.002*
-6-12 months	2	20.0	16	39.0	19	48.7		
-12 months and older	7	70.0	6	14.6	6	15.4		

Table (4): Correlation matrix between total adolescent patients with leukemia knowledge, and both total practices and total quality of life related to leukemia disease (n=90)

Items		Total Knowledge	Total Practices	Total QoL
Total knowledge	R	1	.582	.267-
	p-value		.007*	.011*
	N	90	90	90
Total practices	R	.582	1	.718
	p-value	.007*		.039*
	N	90	90	90
Total QoL	R	.267-	.718	1
	p-value	.011*	.039*	
	N	90	90	90

Discussion:

According to socio demographic characteristic of the studied adolescent patients with leukemia, the finding of the present study showed that; approximately two fifth of the studied adolescent patients with leukemia their age were from 14 to 16 years old with mean stander deviation 15.98+2.58. This finding disagreed with **Derwich et al., (2021)**, who studied on “Acute lymphoblastic leukemia in adolescents and young adults in European Countries” reported that 85.8% for patients 0 to 14 years of age and a decreased 62.2% and 52.8% for patients 15–19 and 20–39 years,

respectively. This might be due to adolescent are more vulnerable stage and exposure to many risks as changes in lifestyle as eat fast foods and smoking.

The present study revealed more than half of the studied adolescent patients with leukemia were male. This finding agreed with **Ribera et al., (2020)**, who studied on “A pediatric regimen for adolescents and young adults with Philadelphia chromosome-negative acute lymphoblastic leukemia in Spanich”, (N=487), reported that over 55, 4% of adolescent patients with leukemia were

male and 44,6% were female. This might be due to adolescent were male more exposure to predisposing risk factor as chemicals substance, smoking and fast foods.

The present study showed that less than third of the studied adolescent patients with leukemia had good total knowledge regarding leukemia disease . This finding is in the same line with **Zhang et al., (2021)**, who studied on “ The application effect analysis of personalized health education in acute leukemia nursing in US”, (N=108), and reported that adolescent patients with leukemia had better total knowledge regarding leukemia disease. This might be due to when educational level increase the awareness of adolescent about disease increase.

The present study showed that majority of adolescent patients with leukemia were satisfactory total reported practice regarding leukemia disease. This finding is disagreed with **Anil et al., (2018)**, they reported that adolescent patients with leukemia had unsatisfactory practice to care regarding leukemia disease. This might be due to adolescent patients use technology for research about leukemia disease, self care and how help self to recover and decrease feeling of side effects of medication

Regarding to the studied adolescent patients with leukemia to total score about quality of life level. The present study showed that, approximately two fifth of the studied adolescent patients with leukemia had moderate total score to quality of life level . This finding agreed with **Vlachioti et al., (2016)**, who conducted a study on “Assessment of quality of life of children and adolescents with cancer during their treatment in Athens”, (N= 56) reported that, 53,6 % of adolescent patients with leukemia had poor total score quality of life level. This might due to effect of the disease and side effect of

treatment that cause more complications that prevent adolescent patients from practice daily life activities.

The present study showed that, there were a highly statistically significant relations between total knowledge level of adolescent patients with leukemia and their demographic characteristics regarding age and educational level. This finding agreed with **Abd el Aziz et al., (2018)**, who studied on the “ Promoting healthy lifestyle for survivor adolescents with leukemia and their caregivers in Benha City”, reported that there were a statistically significant relations between total knowledge level of adolescent patients with leukemia and their demographic characteristics age and educational level. This might be due to when level of education and age increase the knowledge and awareness of adolescent patients about leukemia disease increase.

The present study showed that, there was a statistically significant relation between total quality of life level of the studied adolescent patients with leukemia and duration of illness this means that when duration of illness increase the quality of life decreased. This finding agreed with **Calaminus et al., (2020)**, who conducted a study on “Quality of life in children and adolescents with cancer in Germany”, (N= 72), reported that there was statistically significant relation between total quality of life level of studied adolescent patients with leukemia and duration of illness, the effect of disease cause poor quality of life. Regarding to correlation between total adolescent patients with leukemia knowledge, and both total practices and total quality of life related to leukemia disease.

The present study showed that, there were statistically positive correlation between total knowledge, total practices and

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total quality of life scores of the studied adolescent patients with leukemia. This finding agreed with **Johnson et al., (2018)**, who conducted a study on “Knowledge and beliefs about oncofertility and associations with quality of life among adolescent and young adult survivors of pediatric cancer. in Columbia ”, reported that there were statistically positive correlation between total knowledge and total quality of life scores of the studied adolescent patients with leukemia. These findings might be due to knowledge play important role for a change of behavior leading to change of practices and affect on the quality of life. As when the patients have good and enough knowledge the adolescent patients will know everything about leukemia and perform good practice regarding their disease.

Conclusion

The study shows that approximately two fifth of the studied adolescent patients with leukemia their age were from 14 to16 years old with mean \pm SD 15.98+2.58 and more than three fifth of them were male. Slightly less than three fifth of the studied adolescent patients with leukemia had good total knowledge score regarding leukemia disease. Majority of adolescent patients with leukemia had satisfactory to total reported practice regarding leukemia disease. There were a highly statistically significant relations between total knowledge level of adolescent patients with leukemia and their socio demographic characteristics regarding age and level of education. There were no statistically significant relation between total knowledge level of adolescent patients with leukemia and their socio demographic characteristics regarding gender, ranking in the family, occupation, residence and income. There was a statistically significant relation between total quality of life level of the studied

adolescent patients with leukemia and duration of illness this means that when duration of illness increase the quality of life decreased.

Recommendations:

1. Health education program for adolescent patients
2. Booklets and posters should be available at outpatient clinics to guidance all adolescent patients about leukemia disease and the treatment.
3. Encourage participate social activities to improve psychological and school achievements for quality of life.

Further studies:

- 1- develop and implement continuous health education program for adolescent patients with leukemia to increase their knowledge about leukemia disease and their practice to manage leukemia disease and side effect of treatment.

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جوده حياه المراهقين المصابين بسرطان الدم

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يعد مرض سرطان الدم من امراض السرطان الخبيثة التي تهدد حياة المراهقين في جميع أنحاء العالم ويمثل ما يقرب من 33 ٪ من الانواع الأخرى من مرض السرطان لدى الأطفال والمراهقين الذين تقل أعمارهم عن 20 عامًا. ويعتبر السيطرة على مرض سرطان الدم هو الهدف الرئيسي من العلاج. ويعمل العلاج علي تحسين جوده الحياه المتعلقة بصحة المراهقين من خلال تقديم الرعاية التمريضية لهم، وتقليل الآثار الجانبية للعلاج الكيميائي . لذلك هدفت الدراسة الي تقييم جوده حياة المراهقين المصابين بسرطان الدم وقد تم اجراء هذه الدراسة في العيادات الخارجية بمركز الأورام بالمنصورة. وقد اخذت العينة المتاحة في هذه الدراسة من المجموع الكلي للعينه 90 من المرضي المراهقين المصابين بسرطان الدم. حيث اسفرت نتائج هذه الدراسة ان حوالي خمسين من المرضي المراهقين المصابين بسرطان الدم لديهم معلومات جيدة عن مرض سرطان الدم. ومعظم المرضي المراهقين الدم. بينما اكثر من نصف المرضي المراهقين كان لديهم جوده حياه سيئة. كما اوصت الدراسة انه يجب تقديم التثقيف الصحي للمرضي المراهقين المصابين بسرطان الدم لزياده الوعي الصحي لديهم.