Effectiveness of Using Mobile Health Supportive Care Intervention on Mother's Awareness of their Children with Leukemia

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Abstract

Background: Leukemia is a significant public health and life threating problem for pediatric cancer patients, caring for children with leukemia is challenging for parents (mothers). A mobile health supportive care intervention was developed to improve mothers' awareness about leukemia. **Hence, the study aimed to** evaluate the effectiveness of using mobile health supportive care intervention on mother's awareness of their children with leukemia. **Design:** Quasi-experimental research design was utilized to achieve the aim of the study. **Subjects:** A purposive sample of 60 educated mothers of their children diagnosed with leukemia. **Setting:** The study was conducted at Oncology Institute in Sohag City and Pediatric Oncology Unit in Sohag University Hospital. **Tool:** An interview structured questionnaire was utilized for collecting the data. It included three parts; **Part (1):** Socio-demographic date of mothers of children with leukemia; **Part (2):** Demographic and clinical data of children; **and Part (3):** Mothers awareness about leukemia. **Results:** There was a highly statistically significant improvement in mothers' awareness regarding leukemia after using mobile health supportive care intervention compared to pre-intervention (P<0.000). **Conclusion:** Mobile supportive care intervention had a positive effect on improving awareness among mothers of children with leukemia. **Recommendations:** The study emphasized that hospitals should apply mobile health care programs for mothers to improve their awareness about leukemia.

Keywords: Awareness, Children with leukemia, Mobile Health, Mothers, Supportive Care.

Introduction

Leukemia is a group of blood cancers that usually begin in the bone marrow and result in high numbers of abnormal blood cells. These blood cells are not fully developed and are called blasts or leukemia cells. Symptoms may include bleeding and bruising, bone pain, fatigue, fever, and an increased risk of infections. These symptoms occur due to ~~a~~ lack of normal blood cells. Diagnosis is typically made by blood tests or bone marrow biopsy **(Wang, et al., 2018).**

The exact cause of leukemia is unknown. A combination of genetic factors and environmental (non-inherited) factors is believed to play a role. Risk factors include smoking, ionizing radiation, some chemicals (such as benzene), prior chemotherapy, and Down syndrome. People with a family history of leukemia are also at higher risk **(Belsky, et al., 2021).**

Treatment may involve some combination of chemotherapy, radiation therapy, targeted therapy, and bone marrow transplant, in addition to supportive care and palliative care as needed. Certain types of leukemia may be managed with watchful waiting. The success of treatment depends on the type of leukemia and the age of the person **(Ranney, et al., 2020).**

Childhood chronic illness often results in worry, stress, disruptions in routine, change, financial constraints, and more; these types of effects notably manifest themselves in the physical, social, financial, emotional spheres. A childhood illness in the family can cause tremendous amounts of stress for all members **(DeGroote, et al., 2021).**

The child with a cancer diagnosis may produce a jumble of reactions for the parents including shock, denial, fear, anxiety, anger, grief, and sadness. The parent's sense of security and their religious or spiritual beliefs may be shaken. Many parents experience this mix of feelings throughout their child's illness. It is common for family members including parents to react differently from one another to the initial diagnosis. Each person is an individual with her way of expressing emotion and there is no right way to feel or react. Parents often balance each other, with one being worried and the other one remaining calm. Given the intensity of the experience, the emotion it evokes and the number of important decisions to be made **(Alseraty, and Amin, 2019).**

A childhood illness in the family can cause tremendous amounts of stress for all members. It often results in changes in family roles, relationships, and disrupts family normalcy. These changes are especially difficult because the structure is so important in early childhood development. Routine and structure give children a sense of security, help them develop self-discipline and boundaries, lead to clear and foreseeable expectations, create a sense of mastery over their own lives, and ultimately allow them to handle change **(Ranney, et al., 2020).**

Mobile health (mHealth) is defined by the Global Observatory for eHealth as a subcomponent of electronic health (eHealth) for medical and public health practice supported by mobile communication devices such as mobile phones, personal digital assistants (PDAs), and other wireless devices. In some literature the term 'mHealth' has been used interchangeably with 'telemedicine' and 'telehealth' (which are also part of eHealth for providing clinical health care at a distance), refers to mobile and wireless technologies **(Jong, et al., 2020).**

The usage of consumer electronics and Web-enabled mobile devices is steadily increasing in the medical sector. Mobile health care apps are summarized by the World Health Organization under the term "mHealth" (mobile health) and have recently shown a significant rise in availability and market share. Far from being but a response to the increased availability of smartphones and similar devices, the increased role of mHealth can be interpreted as a reaction to structural and demographic challenges faced by health care providers in today's society **(Ross, et al., 2018).**

Mobile apps have been well implemented for the management of highly prevalent conditions such as diabetes, obesity, or cardiovascular diseases. Cancer, with generally improved long-term survival rates, is developing into a chronic illness with similar requirements such as close patient monitoring and extensive and long-term supportive care. Few mobile apps have been established for supportive cancer care, and the areas of use are still limited **(Robertson, et al., 2019).**

Significance of the Study:

A previous study found that parents of leukemic children need these aspects of supportive care as communication with physicians, timely provision of information, suitable and accessible psychosocial care **(Support Care Cancer, 2017).** Smartphone applications (apps) are important mHealth tools and tend to be easy to be acquired. Smartphone apps allow mothers to access health information and healthcare services anytime and anywhere. Studies have documented the feasibility and effectiveness of mobile apps in supporting cancer patients and survivors in healthcare and clinical practice however, to our knowledge; there has not been much use of apps in supporting parents of leukemic children **(Wang et al., 2018).** Through this study, the researcher can determine the awareness of mothers on a leukemic child who is undergoing treatment. By assessing the awareness of leukemia in different aspects; the areas of lack of awareness can be identified. The perception of parents regarding the leukemic child helps to give effective care to the leukemic child and also improves the awareness and information of mothers about the disease and how to deal with her child **(Dixon, 2017).**

Aim of the Study:

The study aimed to evaluate the effectiveness of Using Mobile Health Supportive Care Intervention on Mother's Awareness of their Children with Leukemia through:

1. Assessing mothers' awareness about leukemia.
2. Design and implement mobile-based intervention in the light of the actual need assessment of the study sample.
3. Evaluated the effectiveness of using mobile health supportive care intervention on Mother's Awareness of their Children with Leukemia.

Research hypothesis:

Mothers' awareness about leukemia is expected to be improved after using mobile health supportive care intervention.

Subjects and Method:

Research Design:

A pre/post-quasi-experimental research design was utilized to achieve the aim of the study. The design is the mean that the researcher still tries to find a relationship between the variables even though there is little control over all factors that might affect the outcome.

The setting of the study:

The study was conducted in Sohag University Hospital which is located in the oncology building; on the second floor. Also, the study was conducted at Oncology Institution in Sohag City, it consists of two buildings, adult and pediatric building, for pediatric building, unit of receiving chemotherapy on the second floor. The leukemic child ward on the third floor of the pediatric building is divided into two parts. Part one consists of five rooms, each room containing two beds, two commodes, and a bathroom. Part two consists of six rooms each room contains two beds, two commodes, and a bathroom. This setting was selected because of the high prevalence of children suffering from leukemia in the selected settings and also, it serves the biggest region of the population from both rural and urban areas.

Subjects:

A purposive sample of 60 educated mothers of children diagnosed with leukemia within six months.

Sample size calculation:

The sample size was calculated based on considering the level of significance of power analysis of 0.95(β=1-0.95=0.5) at alpha .05 (one-sided) with a large effect size (0.5) was used as the significance, 0.001 was used as the high significance.

Inclusion criteria for mothers:

Mothers of children diagnosed with leukemia.
Educated mothers who had network and Whats App
Mothers who are willing to participate in the study.
Mothers can use mobile.

Inclusion criteria for children:

Children from both sexes.
The age of children is less than 15years old.

The child is conscious.

The exclusion criteria included:

The child with severe illness or chronic diseases.

The child with a critical condition.

Tool for data collection:

One tool was used to collect the required data for this study.

Tool: An interview structured questionnaire was utilized for collecting the data. A structured interviewing questionnaire was designed by the researchers in simple Arabic language after reviewing related literature; it consisted of three parts:

Part (1): It included information related to the demographic date of mothers of children with leukemia (5 items) such as age, residence, marital status, occupation, and education.

Part (2): It included information related to the demographic and clinical data of children it ~~was~~ contained 5 items regarding age, gender, and residence, onset of disease and family history.

Part (3): Mother's knowledge about leukemia, included 10 items related to meaning, incidence, causes, signs and symptoms, risk factors, complications, side effects of chemotherapy, diagnostic tests, treatment and nursing care, the importance of using mobile in improving children health care, the time mothers spend on mobile searching for information about leukemia, and sources of awareness about leukemia.

Scoring system of mothers' awareness:

The scoring system for mothers' awareness was evaluated upon fulfillment of the interviewing questionnaire as the mothers' awareness was checked with a model key answer. Therefore, correct answers scored 1degree, and incorrect or do not know answers scored 0. The total score ranged from 0-10. Mothers' total awareness was assigned into ≥60% was considered a satisfactory level of awareness, a score ~~which~~ less than 60% was considered an unsatisfactory level of awareness.

Procedures

Preparatory phase:

The researcher used books, evidence-based articles, periodicals, and magazines to review local and international related literature related to leukemia and develop these study tools by using books, evidence-based articles, periodicals, magazines and designing mobile health supportive care intervention that was used for mothers' education. From the beginning of March 2021 to the end of April 2021.

Pilot study:

The pilot study was conducted on 10% of mothers (6 mothers who had children diagnosed with leukemia) of the total sample to ensure the clarity, applicability of the measures, and the time needed to be completed. According to the results obtained from the pilot study, the required modifications were performed as paraphrasing sentences and correct grammar. Studied mothers who were in the pilot study subjects were excluded from the study sample.

Validity of the tool

The content validity of the tool, its clarity, comprehensiveness, appropriateness, and relevance were reviewed by five experts professors in pediatric nursing. Modifications were made according to the panel judgment to ensure sentence clarity and content appropriateness.

Reliability of the tool

The internal consistency of the tools was calculated using Cronbach's alpha coefficients. The study tool revealed reliability at Cronbach's alpha 0.807.

Administrative and ethical considerations:

An official letter requesting permission to conduct the study was obtained before embarking on the study from the Dean of the Faculty of Nursing, to the directors of each study setting. This letter explained the purpose and importance of the study. Then, approval from the manager of the Pediatric Oncology Institute and Sohag University Hospital was obtained. Approval of the Ethical Research Committee of the Faculty of Nursing was obtained before conducting the study. The researcher met both medical and nursing directors of the selected settings to clarify the purpose of the study and take their approval. Written consent was obtained from mothers to gain their cooperation. The aim of the study was explained and the expected outcomes from the implementation of the study were included in this letter to obtain permission for data collection. The researcher informed them that, the study was voluntary; they were allowed to refuse to participate in the study. Mothers had the right to withdraw from the study at any time, without giving any reason. Mothers were assured that their information would be confidential and used for research purposes only.

Fieldwork:

The data collection period was carried out for 6 months, from the beginning of March 2021 to the end of August 2021. The researcher was available two days per week (from Sunday to Tuesday) during the morning shift. The mobile health supportive care intervention was implemented through the following phases:

1-Assessment Phase:

The researcher ~~was~~ met each mother individually, introduced herself to the mother, and obtained written consent from the recruited mothers in the study after explaining the purpose of the study and collecting their demographic data, children' demographic data, mothers' awareness about leukemia before using mobile health supportive care intervention.

2-Planning phase:

The researcher prepared educational material about voluntary participation and confidentiality was assured by the researcher for each mother by

clarifying that all information will be used for scientific research only. All the study mothers were subjected to routine care of children and then the content of nursing intervention through the mobile phone was prepared in the light of the actual needs assessment of the mothers. Mothers involved in the study were interviewed and assessed to apply the mobile supportive care intervention two times per week from 10:00 am to 12:00 pm.

3-Implementation phase:

The researcher provided 6 educational sessions lasting for three months, including video, photo, and audio sessions placed on mobile. Each session is lasting from 45 minutes to 1 hour. These sessions were illustrated by using a PowerPoint, photos, and educational videos. Mothers were informed that their privacy was assured especially during the online meeting. Mobile supportive care intervention to all mothers who had children diagnosed with leukemia included six sessions.

The first session (30 minutes) focused on knowledge about mobile health education (meaning, types, methods, uses, and importance of it). The second session (45 minutes) focused on awareness about leukemia (meaning, incidence, causes, signs and symptoms). The third session (50 minutes) focused on complications, side effects of chemotherapy, diagnostic tests, treatment, and nursing care. The fourth session (60 minutes) focused on awareness about diet management for children diagnosed with leukemia (recommended and not recommended) diet and the relationship between diet and control of leukemia. The fifth session (40 minutes) focused on awareness related to therapy (types, importance, preparation, and complications of each type). The sixth session (60 minutes) focused on problems that face mothers and how to treat them. Videos and mobile were used to demonstrate the management and health education for mothers who had children diagnosed with leukemia. SMS were sent weekly through (Whats App) application to the mothers to refresh their knowledge about leukemia by mobile phone. Chatting with the mothers was every two days to follow up ~~on~~ their children's health condition. Also, using mobile and telephone calls sometimes were needed to discuss any issue about leukemia control.

Evaluation phase:

After three months, the mothers' awareness was evaluated after implementing the Mobile health supportive care intervention by using the same tool before and after intervention.

Statistical analysis:

Data were analyzed using Statistical Program for Social Science (SPSS) version 24.0. Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage. The following tests were done: paired-samples(McNemar test), paired-samples (t-test), independent (t-test), ANOVA One Way test. Significance was used to compare proportions between more than two qualitative parameters. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following.

Results:

Table 1. Shows that the mean age of the studied mothers was 32.875 ± 9.518 years, 65.0% of studied mothers were from urban areas. Concerning marital status, more than 78.3% of mothers were married. About two-thirds of them 60.0% were housewives and 51.7% had secondary education.

Figure 1: Illustrates that less than half 45.0% of children diagnosed with leukemia were 3<4 years old, 33.3% were 4<5 years old, 21.7% were 5<6 years old. Regarding gender 66.7% were boys.

Figure 2. Portrays that 35.0% of the children were suffering from illness were the age was less than 1 year, while 40% of them were from 1 to 2 years. Regards family history, 41.7% of children had a positive family history of leukemia.

Table 2. Illustrates that the time the studied mothers were spent on social media was increased 60.0% after intervention compared to before intervention 16.7%. There was a highly statistically significant difference detected between the time that mothers spent on social media pre-and post-mobile supportive care intervention. (P=0.000).

Figure 3. Reveals that most of the mother's sources of knowledge were physicians 70% followed by nurses 65% and 34% from social media

Table 3. Illustrates the positive effect of mobile supportive care intervention on mothers' awareness about leukemia. It was obvious that the majority of them have more awareness about leukemia in all items post- mobile supportive care intervention than pre-intervention and there was a highly statistically significant difference between mothers' awareness regarding leukemia pre and post mobile supportive care intervention (P<0.000).

Table 4. Regarding participants' awareness about leukemia, the table shows that 23.3% of participants had satisfactory knowledge on pre-intervention compared to 100% at post-intervention meanwhile 76.7% of participants had unsatisfactory knowledge in pre-intervention compared to 0.0% on post-intervention. It shows a highly statistically significant difference between pre- and post-intervention (McNemar test=61.02, P=0.000).

Table 5. Illustrates that there was a highly significant statistical relationship between the total awareness of the studied mothers and their demographic data pre and post using mobile supportive care intervention (P < 0.05).

Table 6. Illustrates that there was a highly significant statistical relationship between the total awareness of the studied mothers and children's demographic data pre and post using mobile supportive care intervention (P < 0.05).

Table 7. Shows that most of the studied mothers

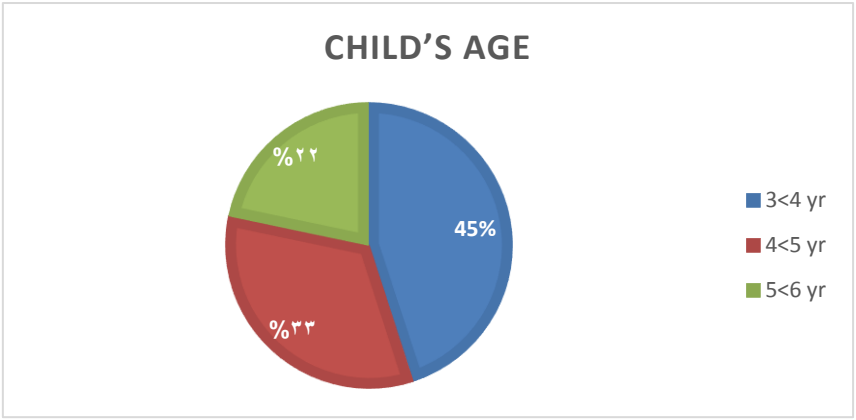
98% reported that the contents were enough and 97% of them were satisfied from mobile supportive care intervention. Regarding its effect on knowledge, nearly all of them 98% reported that it improved their knowledge. Regarding the disadvantage of mobile supportive care intervention; nearly all of them 97% reported that it was internet interruption.

Results

Table (1): Frequency and percentage distribution of the studied mothers regarding their demographi (n=60).

Mothers ' demographic data		No.	%
Age	<20 years old	3	5.0
	20: <35 years old	32	53.3
	35: <5years old	20	33.3
	45:60 years old	5	8.3
Mean± SD	32.875 ± 9.518years		
Residence	Rural	21	35.0
	Urban	39	**65.0**
Marital status	Married	47	**78.3**
	Divorced	8	13.3
	Widowed	5	8.3
Occupation	Housewife	36	**60.0**
	Working mother	24	40.0
Education	Primary education	3	5.0
	Secondary education	31	**51.7**
	High education	26	43.3

Figure (1): Frequency and percentage distribution of the leukemic children regarding their demographic data (n=60).



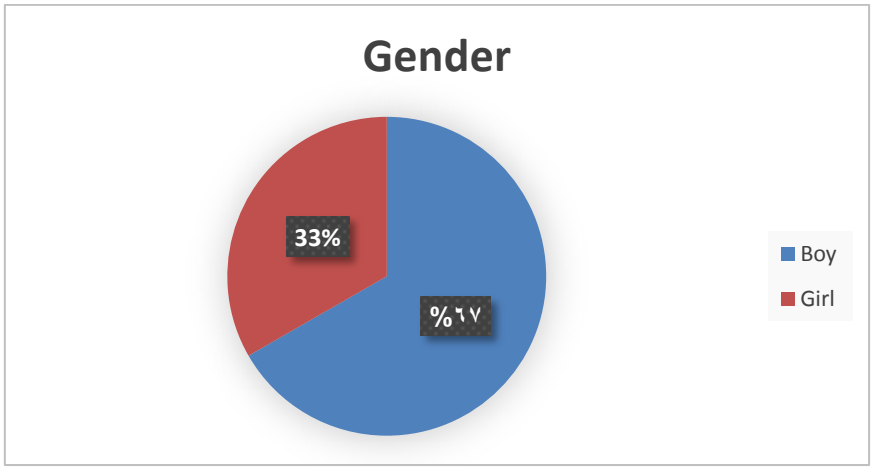
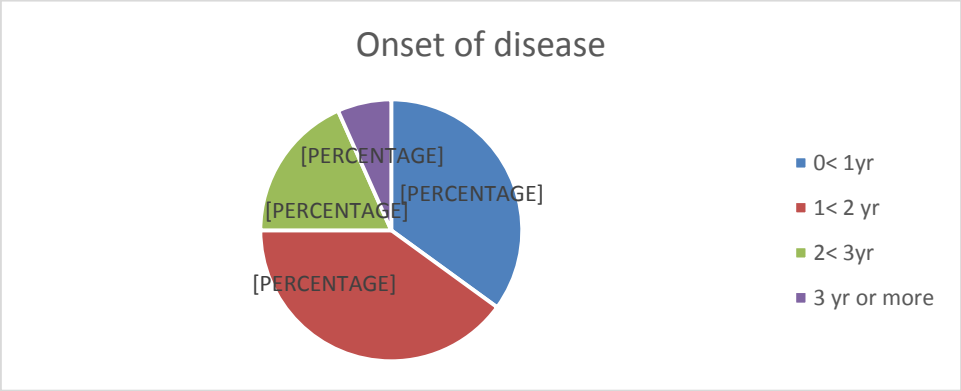


Figure (2): Percentage distribution of the leukemic children according to their medical history (N=60).



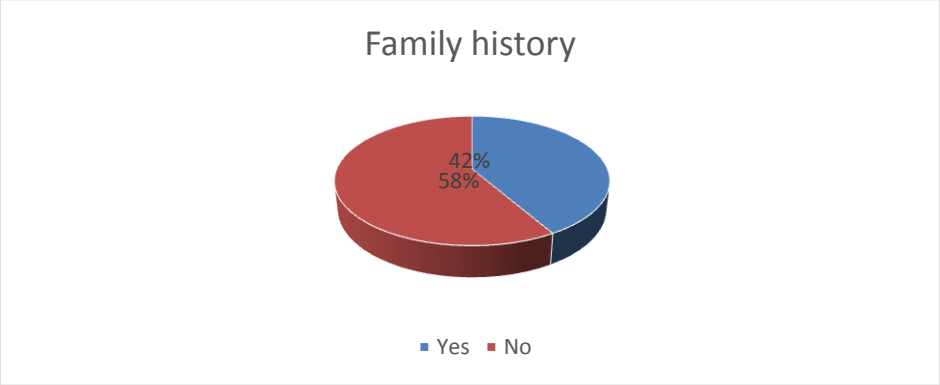


Table (2): Distribution of the studied mothers regarding the time they spent on social media (Whats app) (n=60) pre/post using mobile supportive care intervention

The time they spent on social media		Pre using mobile supportive care intervention		Post using mobile supportive care intervention		T	P-value
		No.	%	No.	%		
How many times	1 hour	48	80.0	16	26.7	-8.44	0.000
	2 hours	10	16.7	36	60.0		
	≥ 2 hours	2	3.3	8	13.3		

Paired Sample t-Test

Figure (3): Percentage distribution of the studied mothers regarding their source of knowledge about leukemia.

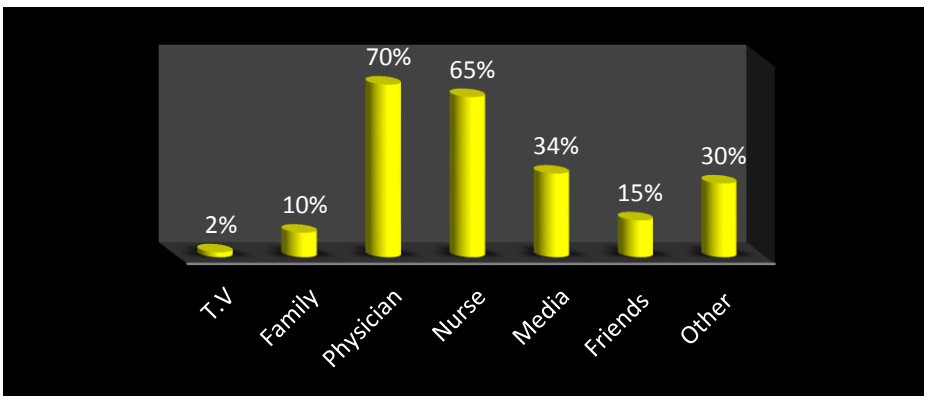


Table (3): Percentage distribution of the studied mothers' awareness about leukemia before and after using mobile supportive care intervention

Mothers' awareness		Before using mobile supportive care intervention		After using mobile supportive care intervention		McNemar test	P-value
		No.	%	No.	%		
Definition	Satisfactory	40	66.7	58	96.7	19.20	0.000
	Unsatisfactory	20	33.3	2	3.3		
Incidence	Satisfactory	4	6.7	46	76.7	40.02	0.000
	Unsatisfactory	56	93.3	14	23.3		
Causes	Satisfactory	23	38.3	55	91.7	28.27	0.000
	Unsatisfactory	37	61.7	5	8.3		
Signs and Symptoms	Satisfactory	13	21.7	56	93.3	41.02	0.000
	Unsatisfactory	47	78.3	4	6.7		
Risk factors	Satisfactory	5	8.3	51	85.0	44.02	0.000
	Unsatisfactory	55	91.7	9	15.0		
Complications	Satisfactory	3	5.0	51	85.0	46.02	0.000
	Unsatisfactory	57	95.0	9	15.0		
A side effects of chemotherapy	Satisfactory	45	75.0	60	100	20.12	0.000
	Unsatisfactory	15	25.0	0	0.0		
Diagnostic tests	Satisfactory	24	40.0	54	90.0	24.74	0.000
	Unsatisfactory	36	60.0	6	10.0		
Treatment	Satisfactory	43	71.7	59	98.3	19.87	0.000
	Unsatisfactory	17	28.3	1	1.7		
Nursing care	Satisfactory	3	5.0	48	80.0	43.02	0.000
	Unsatisfactory	57	95.0	12	20.0		

Paired Samples (McNemar test)

Table (4): Percentage distribution of the total mothers' awareness level regarding leukemia pre-and pre-using mobile supportive care intervention (n=60).

Awareness level	Mother's demographic data		Mother's demographic data		McNemar test	P-value
	No.	%	No.	%		
Satisfactory	14	23.3	60	100	61.02	0.000
Unsatisfactory	46	76.7	0	0.0		

Paired Samples (McNemar test)

Table (5): Relation between mother's demographic data and their total awareness about leukemia pre and post using mobile supportive care intervention

Mother's demographic data		No (60)		T*	P-value
		Pre using mobile supportive care intervention	Post using mobile supportive care intervention		
		Mean ± Std	Mean ± Std		
Age	<20	1.80±0.10	1.10±0.09	22.0	0.000
	20:>35	1.67±0.16	1.09±0.10	18.8	0.000
	35:>45	1.61±0.18	1.13±0.09	9.34	0.000
	45:>60	1.74±0.21	1.10±0.07	5.49	0.005
	F**	1.630	0.502		
	P-value	0.193	0.682		
Residence	Rural	1.66±0.19	1.12±0.10	14.36	0.000
	Urban	1.66±0.17	1.09±0.09	16.14	0.000
	T***	0.008	1.20		
	P-value	0.994	0.235		
Marital status	Married	1.67±0.18	1.11±0.09	18.54	0.000
	Divorce	1.59±0.06	1.09±0.11	8.819	0.000
	Widow	1.74±0.17	1.08±0.11	6.128	0.004
	F**	1.262	0.308		
	P-value	0.291	0.736		
Occupation	Housewife	1.65±0.20	1.11±0.10	15.00	0.000
	Work	1.68±0.13	1.09±0.09	15.57	0.000
	T***	-0.634	0.755		
	P-value	0.529	0.453		
Education	Primary	1.6±0.10	1.07±0.11	16.00	0.004
	Secondary	1.67±0.21	1.11±0.10	13.39	0.000
	High	1.67±0.14	1.10±0.09	15.80	0.000
	F**	0.194	0.223		
	P-value	0.825	0.801		

*Paired Samples t-Test **ANOVA One Way ***independent Samples t-Test

Table (6): Relation between children's demographic data and mother's total awareness about leukemia pre and post using mobile supportive care intervention

Mother's demographic data		What mother knows about leukemia?		T*	P-value
		Pre using mobile supportive care intervention	Post using mobile supportive care intervention		
		Mean±std	Mean±std		
Child's age	3<4 yr	1.73±0.16	1.10±0.11	18.03	0.000
	4<5 yr	1.64±0.19	1.11±0.09	10.35	0.000
	5<6 yr	1.57±0.13	1.11±0.08	10.02	0.000
	F**	4.368	0.127		
	P-value	0.017	0.881		
Gender	Male	1.67±0.19	1.09±0.09	15.78	0.000
	Female	1.66±0.13	1.11±0.11	18.148	0.000
	T***	0.208	-1.816		
	P-value	0.836	0.075		
Residence	Rural	1.66±0.19	1.12±0.10	14.36	0.000
	Urban	1.66±0.17	1.09±0.09	16.14	0.000
	T***	0.008	1.20		
	P-value	0.994	0.235		

*Paired Samples t-Test **ANOVA One Way ***independent Samples t-Test

Table (7): Percentage distribution of the studied mothers regarding their feedback regarding mobile supportive care intervention (N=60).

Mobile supportive care intervention	N0	%
Is the content enough?		
-Yes	98	98.0
-No	2	2.0
Satisfaction with the mobile supportive care intervention		
-Yes	97	97.0
-No	3	3.0
Did mobile supportive care intervention improves knowledge		
-Yes	98	98.0
-No	2	2.0
Advantages of mobile supportive care intervention:		
#Active participation	95	95.0
#Participants can get a chance for live chat.	92	92.0
#Participants can reach it at any place.	94	94.0
#They offer calendar scheduling and invites	97	97.0
#Ease of users to stay in touch with teaching program providers	100	100.0
Disadvantages of mobile supportive care intervention:		
#Internet interruption	97	97.0
#Inability of participants to join a mobile supportive care intervention with a large sample	3	3.0

Note: # that more than one answer is chosen.

Discussion:

This study indicated the potential effectiveness of the mHealth intervention in supporting mothers of children with leukemia. Results found that the intervention improved mothers' awareness of leukemia and care. Parents were satisfied with the intervention and their role in the caregiving process.

The results of the current study revealed that the majority of mothers their age ranged from 20 to 35 years and had secondary school education. The vast majority of mothers were married and housewives. Similarly, in a recent study conducted **by Sutanr., et al (2017)** to assess the correlation between coping strategies and the health-related quality of life of 299 mothers whose children are suffering from ALL. The study summarized that the mothers' age ranged from 23 to 54 years old and the mean age was 37.7 years. The majority was married and with the highest education achieved was minimum of secondary education level, and about half of the respondents were employed.

As shown in the current study about two-thirds of mothers came from urban areas and near one-third of them were from rural areas. In the same context **Institute of Statistics (2017)** documented that the rural population was more than half of the total population all over the world. In the same line, **Egypt Demographic Profile (2015)** portrayed that in Egypt, the urban population was more than two-fifths of the total population and the rate of urbanization was 1.68% annual rate of change. Besides, **the International Journal of Recent Scientific Research (2015)** reported that more than two-thirds of the urban places had more incidence of childhood leukemia in India.

Concerning the characteristics of children with leukemia, the results of the current study revealed that more than two-thirds of children were boys and their ages ranged from 3 to 4 years. These results are in accordance with the results conducted by the **Worldwide organization (2016)** which reported that the incidence of cancer in boys was higher than in girls. Also, these results are contradicted with **Sutan, et al (2017)** who conducted a study about "Coping strategies among parents of children with acute lymphoblastic leukemia" and found that more than three-fifths of the children who participated in the study were boys and their age ranged from 5 months to 18 years. Furthermore, **Forsythe, et al (2010)** studied the gender differences in incidence rates of childhood B-precursor acute lymphocytic leukemia in Mississippi in the United States, the study concluded that childhood leukemia is significantly more prevalent in boys. An Egyptian study held by **Fawzy, et al (2013)** to identify the health-related quality of life profile among 67 Egyptian pediatric cancer patients aged 8-12 years summarized that about two-thirds of children were boys. On the same perspective **Tantawy, et al (2013)** evaluated the outcome of childhood acute lymphoblastic leukemia in 52 Egyptian children aged 1-17 years. And find that the mean age at diagnosis was 5.9 + 3.3 years, boy/girl ratio of 1.6:1.

Regarding the medical history of cancer among children, the present study indicated that more than half of the children had no family history of cancer. **From the researcher point of view** this is explained by the early life exposure to infectious agents, fetal or childhood exposure to an environmental toxin such as pesticides, solvents, or other household chemicals, or

radiation. Concerning the duration of the disease, the current study revealed that more than one-third of the children had cancer for one to two years. This finding is in congruence with the study carried out by **Hassan, (2015)** who studied "Effect of Guided Imagery Relaxation Session and Story-Telling on the Intensity of Nausea and Vomiting Among Children Undergoing Chemotherapy" and found that approximately one-half of children had cancer for less than 6 months. These results were consistent also, with **Abd El Razik (2010)** who studied "Effect of Educational Program on Quality of life for patients with cancer undergoing chemotherapy "and found that more than two-thirds of children developed cancer for less than one year. This could be due to delayed discovery of cancer in the young age of children as a result of mothers' knowledge deficit regarding leukemia.

Concerning the time, the studied mothers were spent on social media, results of the current study revealed that there was a highly statistically significant difference and an increase was detected between the time that mothers spent on social media pre-and post-mobile supportive care intervention. **From the researchers' point of view,** it may be related to mobile supportive care is an easy method to be used at any time and easy access of information to remember any information they need.

The finding of the present study revealed that after using mobile supportive care intervention, highly statistically significant improvements were noticed in mothers' knowledge regarding leukemia in all tested areas. The effectiveness is in accordance with traditional interventions' results **Wu et al (2014)** investigated the effect evaluation on the establishment of the support system of parents of children with leukemia and reported the same results. In this study, parents accepted and were willing to go on using this app and the WeChat Official Account. In the interviews, parents mentioned several times the ease of access to scientific knowledge about the disease and care for their children, which improved their care confidence and communication efficiency with physicians and nurses. The easy access of information increased parents' existing knowledge and decreased their knowledge needs, which matched with the quantitative data **(Applebaum and Breitbart, 2013).**

The finding of the present study indicated that the use of social media and mHealth apps has been increasing to improve mothers' awareness regarding leukemia, almost all of them used mobile health for only one-hour pre-test compared with two-thirds used mHealth for two hours post-test. These results agree with **Wang et al., (2016)** a qualitative study with parents of children with ALL was initially conducted to gain an in-depth understanding of the characteristics and supportive care needs of parents. The chat applications were then developed according to a user-centered development process with a multidisciplinary group including software engineers and researchers. A scoping review of the usability evaluation of mobile apps for cancer was conducted, which guided the app's usability evaluation. Parents, physicians, and nurses participated in the usability evaluation. Their use experience data were collected and analyzed.

Results of the current study revealed that there was a highly statistically significant difference between mothers' awareness regarding leukemia pre- and post-mobile supportive care intervention (P<0.000). **From the researcher point of view,** it may be explained by the achievement of the main goals of care by using mobile supportive care intervention to improve the total mothers' knowledge, improving the health education.

Regarding participants' awareness about leukemia, the results of the current study revealed that the majority of participants had unsatisfactory awareness in pre-intervention

compared to none of them on post-intervention. **From the researcher point of view,** it showed a highly statistically significant difference between pre- and post-intervention. This reflected the positive effect of using mobile-supportive care intervention in improving mothers' awareness.

Findings of the current study revealed that approximately all of the studied mothers reported that the contents were enough and were satisfied from mobile supportive care intervention which indicated the positive effects of nursing intervention by using mobile and supported the aim and the hypothesis of the study.

Conclusions:

Based on the results and hypothesis of the present study, the study findings concluded that the results support the research hypothesis. Whats application has increased mothers' awareness about leukemia. They were satisfied with this intervention and willing to continue receiving the intervention.

Recommendations:

Based on the results of the current study, the following recommendations are suggested:

-The study emphasized that hospitals should apply mobile health care programs for mothers to modify their awareness about leukemia.

-Integration of the designed MHealth care for mothers of children with leukemia undergoing chemotherapy in Pediatric Oncology Units; would provide a framework for mothers' role for their children with leukemia.

-Replication of the current study with a larger sample of mothers with leukemia in different settings is required for generalizing the results.

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