

The Impact of Education via Short Message Service (SMS) versus that of by e-mail: A Quasi-Experimental Study Among Parents of Children with Leukemia in Shiraz, Iran

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Abstract: Educating parents of children with leukemia increases the quality of provided care to pediatric patients. This study has been designed to determine the impact of education via email and Short Message Service (SMS) on caring knowledge of chemotherapy complications in parents of children with acute lymphoblastic leukemia (ALL). The valid and reliable questionnaire consisted of personal information and knowledge of the effects of chemotherapy in children with leukemia. Seventy four SMS were sent to the parents in form of 5 categories of education about how to care complications of chemotherapy during 10 weeks of the study. The findings of this study indicated that, the awareness of parents increased significantly within a week and a month after the education ($p < 0.001$). Training with SMS or email promoted the knowledge of parents about the side effects of chemotherapy in children with ALL.

Keywords- *Distance Education; leukemia; chemotherapy complication*

I. Introduction

Acute lymphoblastic leukemia (ALL) is the most common malignancy in children worldwide accounting for about 75 percent of childhood cancers. This type of leukemia accounts for about 30 percent of all childhood malignancies [1, 2]. Also, it is common in 3-8 year old children [3-5].

In the last 20 years, scientific advances in the areas of screening, early diagnosis as well as regular and scientific treatment have reduced mortality and lead to longer survival of the patients with leukemia [6, 7]. Furthermore, the goal of treatment is increasing patients' life expectancy, improving their abilities to maintain an appropriate level of life [3].

The cancer patients are in need of home care due to their chronic condition [8]. Educating parents in the field of leukemia and its complications increases the quality of care to the affected children. Moreover, verbal training is not feasible because of parents' involvement with their cancer children, job or family responsibilities and considerable distance from the

hospital. Distance learning with the help of new technologies and Internet is a flexible way in which people individually and virtually can participate in various courses while distance and time are not effective in educational process [9, 10]. Today, educational activities can be done in accordance with patient's need at any time and place with the help of wireless communication technologies such as mobile phones [11, 12].

By using Short Message Service (SMS), new field of its application in health care has been provided on a wide demographic scale [13, 14]. For example, the effective use of SMS technology has been approved in various studies including educating patients with diabetes [13-16].

In addition to mobile phones, studies have also shown that the use of email has been effective in increasing healthy behaviors [17]. Since comparing learning via mobile phone and email is not well documented in the field of health care, the present study has been designed and carried out with the aim of comparative investigation of the effect of education via mobile

phone text messaging and e-mail on parents' knowledge of children with leukemia undergoing chemotherapy.

II. Materials and Methods

The present study was conducted on parents of children with ALL, referred to Amir Oncology hospital affiliated to Shiraz University of Medical Sciences for follow-up treatment of their children. The study was approved by the institutional ethics committee and the parents of patients signed written informed consent. The sample size of 30 individuals was determined by NCSS statistical software. The number was increased to 38 individuals due to attrition rate. The sampling method was convenience sampling. Inclusion criteria included having literacy of parents or at least one of them, having access to e-mail or mobile phone or both of them, having a child under treatment, but not more than five sessions of chemotherapy and parents have not previously received planned and official education about the subject. Exclusion criteria included patient's dead, patient's unwillingness to continue cooperation with the research, and lack of receiving all messages for any reason. The research concentrated on the five most common side effects of chemotherapy. These 5 side effects include nausea and vomiting, diarrhea, constipation, anorexia, stomatitis or oropharynx inflammation.

The parents received 74 SMS in the form of five categories of above mentioned complications within 10 weeks and 4 days. These parents received each message twice. This means that 2 messages were sent to them per day for 74 days. Parents who had e-mail in addition to mobile phone received educational materials related to the side effects of nausea and vomiting (15 messages) and the side effect of stomatitis (14 messages) via SMS and in the meantime received educational materials related to the side effects of diarrhea (15 messages), constipation (13 messages) and anorexia (17 messages) via e-mail. The duration and frequency of received educational messages in this group was similar to the first group. The data collection tool was pre and post-test. The questionnaire was prepared to measure the parents' knowledge about how to care for leukemic children undergoing chemotherapy in order to prevent the side effects or help to reduce or even eliminate the side effects (if happen). In order to prepare the questionnaire, first books and articles in this field were studied and then the questionnaire was provided with regard to the studies, educational content and advice from experts.

The questionnaire consisted of three parts. The first part of the questionnaire included 28 demographic items. The second part contained 49 questions related to parental knowledge about the prevention of side effects of chemotherapy and caring for children undergoing chemotherapy and the third part comprised two open-ended questions about comparing the two methods of education. Demographic information included items such as age, education level, occupation of parents, number of children, birth order, child's age, household income, history of chemotherapy, family history of cancer and

chemotherapy, receiving or lack of receiving any previous education, the time of diagnosis and frequency of hospitalization. The second part contained parent's knowledge of caring for children undergoing chemotherapy. The maximum score was 10 for nausea - vomiting and diarrhea complications, 8 for constipation, 12 for anorexia and 9 for the complication of stomatitis. The scores were computed as mean and standard deviation of 49 answers to 49 questions and with a scale of 10. Therefore, the minimum and maximum score of each side effect was respectively zero and 10.

The validity of the questionnaire was confirmed by content validity. The reliability of the questionnaire was measured using KR-20. The reliability coefficient was considered 0.76. In this study, the teaching instrument was a personal computer (PC) which sent text messages by using an automatic SMS sender app and an internet SMS panel. The software was designed and implemented using C# and MS SQL server 2008 R2. This software has been developed to provide information for Persian language users.

The questionnaire was completed by interviewing samples. Then the educational intervention program was implemented for 10 weeks and 4 days. The subjects could contact the researcher through provided mobile phone number for getting advice and further education. The measuring instrument was completed by interviewing the subjects during one week and one month after the intervention. Despite the regularity of educating program and encouraging the cases to continue their cooperation with the researcher, some of them withdrew for many reasons such as fatigue of follow-up treatment, unwillingness to spend more time in the research (n=4) and other personal reasons (n = 2). Also, 2 cases were removed due to lack of receiving all the text messages and educational content from the study. Therefore, the study was performed on 30 individuals.

Statistical analysis

The data analysis was performed using Statistical Package for Social Sciences (SPSS version 15). The descriptive results were described in the form of frequency, mean and standard deviation and the results were provided using t-test (Independent samples T-Test), One-way ANOVA, Spearman correlation coefficient (Spearman's rho), Paired sample T-test and Fisher exact test. P value < 0.05 was considered statistically significant. Subjects' responses to open-ended questions of the questionnaire were classified, compared and analyzed in order to investigate their views and their perception about the efficiency and the effectiveness of education.

III. Results

This study showed that 73.3% (n= 22) of the subjects were not living in the city. They came from neighboring provinces to follow-up treatment of their children. 43.3% (n= 13) of the

mothers had literacy (reading and writing), and the rest had higher levels of education. The majority of the fathers (13 out of 30 or 43.3%) had educational levels from diploma to BA or BSC degree.

Twenty-nine (96.7%) of mothers were housewives and 15 (50%) of fathers were self-employed. Twenty-one (70%) of the subjects had no family history of cancer. Sixty percent (n= 18) of subjects had 1 or 2 children and 6.6% (n= 2) of them had more than four children. Nineteen (63.3%) subjects had received no education related to the side effects of chemotherapy and also no education on how to take care of children under chemotherapy. 36.6% (n=11) of them got little information from doctor or nurse. However, they believed that the received information was insufficient. The researcher also recognized the need for education programs for them in an interview. The mean age of mothers, fathers and children in the study was 33.6 ± 6.19 , 39.03 ± 8.13 and 7.73 ± 5.11 years, respectively. More than half of the patients (n=16, 53.3%) were male. 24 out of 30 subjects (80%) received no chemotherapy before and the rest had received only 1 to 5 sessions of chemotherapy. 76.6% (n = 24) of the subjects had no e-mail.

The average knowledge score of parents on caring for complications of chemotherapy was 15 ± 8.38 out of 49 before the intervention. One-way ANOVA, independent t-test and Spearman correlation coefficient were used for analyzing the data. The results showed that there was no statistically significant relationship between the mean score of general knowledge of the subjects and demographic variables such as location, education, occupation, age, family history of cancer, number of children, history of chemotherapy, previous education, having or not having email and family income before the intervention.

The score of managing chemotherapy side effects and the education time is considered in table 1. The result of paired t-test indicated significant difference between score of the subjects before education and one week and one month after it ($P < 0.001$).

According to the findings of Table 2, paired t-test confirmed an increase in the mean score of the subjects' knowledge about any side effects of nausea and vomiting, diarrhea, constipation, anorexia, and stomatitis caused by chemotherapy in one week and one month after the intervention ($P < 0.001$).

Higher score was statistically significant in managing tips on diarrhea, constipation and anorexia that had been taught via e-mail to the parents in comparison with score on the 2 other side effects which had been taught via SMS in table 3.

Paired T- test confirmed difference in the mean score of educating via e-mail in comparison with educating via short messages in a week after the intervention ($P = 0.017$) and in a month after the intervention ($p = 0.003$) (see table 4).

The impact of applying the two instruments (email and SMS) to increase knowledge of all parents (n = 30) is included in

Table 5. By using independent t-test, the difference in the mean score before and a week later ($P = 0.0036$) and also before and one month after the intervention ($p = 0.017$) in educating via e-mail was higher than educating via SMS.

It's noteworthy that Fisher exact test did not show any relationship between having an e-mail and mother's educational level ($P = 0.156$) and that of fathers ($P = 0.36$)

IV. Discussion

The data analysis showed that the mean score of parents before the intervention was 15 ± 8.38 out of 49. In other words, the average score of parents before the intervention was less than 1/3 out of 49 score which indicated the low level of knowledge. Therefore, the index showed the need for education of the parents. The study of Hashemi et al (2010) and Wangberg (2006) also showed the importance of educational interventions to increase knowledge of parents [16, 18]. The necessity of providing education for parents of children with leukemia is apparent in the study of Mary Kutty, et al, (2014) [19]. It can be concluded that increase in scores of the subjects is only caused by the effective implementation of educational program [15, 20].

According to table 1 and 2, paired t-test confirmed the increase in parents' awareness one week and one month after the intervention via SMS and email ($P < 0.001$). The results are in line with the results of further studies on the effectiveness of education to increase awareness of patients and their families about other chronic diseases. Moreover, the study of Hashemi et al (2010) showed an increase in awareness of experimental group immediately and two months after the intervention comparing with control group by using face-to-face education technique for 3 months ($P = 0.001$) [18].

Norianda et al study (2015) demonstrated that awareness of parents and quality of life of affected children increased after the intervention ($P = 0.012$) [21]. However, the method of distance learning via email and SMS as a means of education was used in the present study. Phone use in education and care not only reduces costs and facilitates access to effective care, but also improves the relationship between patients and care providers as well as removes barriers of space and time [15].

The results are consistent with other studies which indicate the effectiveness of education by mobile phone text message on increasing awareness of patients with type I and type II diabetes [14, 16] as well as affecting the self-control of asthma patients [22]. Other studies have also shown that the use of SMS in educating people is innovative, low cost, and effective method. This accessible technology can be useful in larger health plans [13]. In the study of Parizad et al (2013), the mean score of self-care in the intervention group compared with the control group after distance education statistically increased [15]. Thus, according to these findings, it can be inferred that educating via SMS and e-mail can affect awareness of parents.

According to the findings of Table 3, the scores of parents educated by email in comparison with the score of parents educated via SMS were numerically higher. Paired t-test confirmed higher mean scores- in the parents with email-before and after the intervention in those three side effects compared with the 2 side effects which were taught by SMS both in a week ($p=0.017$) and a month ($P=0.003$) after the intervention (Table 4). Moreover, independent- t test confirmed the higher scores of parents taught by e-mail compared with parents taught by SMS in a week after the intervention ($P=0.036$), and a month later ($P=0.017$). The fisher's exact test also showed no relationship between having e-mail and the mothers or fathers educational levels ($P=0.156$, $P=0.364$). Therefore, it can be inferred that the impact of education through e-mail was more than education via SMS services.

However, due to small sample size of those who had e-mail, caution should be taken in generalizing the results. So, it is suggested a larger sample size should be studied for generalizing the outcomes in future studies. Black et al (2008) study also revealed that lifestyle interventions via email are low-cost and affordable to cover a large population and cause significant improvement in important health parameters [17]. Other studies also confirmed the effectiveness of computer-based education or education via e-mail [23, 24].

However, in a study conducted with the aim of comparing the impact of face-to-face education with distance education via SMS, no statistically significant difference between the two groups was reported. But the researchers found that educating via SMS due to saving time and ease of access was more appropriate than face to face education [25].

In this study, reviewing and classifying the subjects' responses to open-end questions showed that both education via SMS and e-mail were useful in increasing parents' knowledge. Most parents found educational texts interesting and motivating; so, these findings are in line with the Alipour et al (2012) study [26]. The parents believed that SMS were short, accessible and available everywhere. Therefore, these results are in line with Wangberg study (2006) [16]. Many parents required for education about other side effects of chemotherapy in excess of 4 mentioned side effects. Therefore, this issue should be considered in later studies and the design of educational content system should be based on patient needs. Nonetheless, some parents who had received educational contents via SMS reported some restrictions such as phone low memory to store all messages or the inability to print them out. These results are in line with Wangberg research (2006) [16].

The study by Black and colleagues (2008) revealed that lifestyle intervention via email was useful and effective in improving health parameters [17]. However, the subjects with e-mail in this study believed that computer and e-mail were inaccessible and unavailable for all families compared with mobile technology. This issue in the study of Black et al

(2008) or other available studies has not been raised as constraints of education by email [17]. This difference between our subjects and other studies maybe related to limited access to personal computer and e-mail in our society

V. Conclusion

It can be concluded that the characteristics such as location, household income, age, education, employment status and other fundamental variables that may have an impact on the results, had no significant relationship with the knowledge of parents before the intervention. The results of showed that education with both methods either via phone message or via e-mail promotes knowledge of managing the side effects of chemotherapy treatment for parents of children with acute lymphoblastic leukemia. However, it seems that the impact of education through e-mail is higher than education via SMS.

Further studies with larger sample size are suggested in order to ensure the supremacy of educating via e-mail over educating via SMS. Also, it is recommended that selection of educational content is done by the discretion of parents. This means that the system should be designed in a way that each user by sending code of side effect receives the educational content related to the same side effect. Educational MMS also is among other items that should be considered in the development of the system.

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Table 1. Comparison of Mean score before and after the intervention (n =30)

Time	Before education	After One week	P-value	Before education	After One month	P-value
Score (mean ± SD)	15 ± 8.38	41.2 ± 3.72	001/0>	15 ± 8.38	36.5± 6.37	<0.001

Table 2. Comparison of the mean scores of different effects of chemotherapy before and after the intervention (n = 30)

Time Variable	Before education	After One week	After One month	P-value
Nausea and Vomiting	2.73 ± 1.99	8.30 ± 1.11	7.30 ±1.36	<0.001
Diarrhea	2.43 ± 1.83	8.46 ± 1.27	7.60 ±1.69	<0.001
Constipation	2.96± 1.95	6.96 ± 0.85	6.23±1.27	<0.001
Anorexia	4.26 ± 2.58	10.33 ± 1.21	9.13±1.90	<0.001
Stomatitis	2.60 ± 1.84	7.13 ± 1	6.23 ±1.33	<0.001

Table 3. Comparison of scores in parents with e-mail before and after education (n =6)

Knowledge score / Instrument and content of Education		Intervention A: pre-education B: After One week	Mean ± SD	Difference between the average scores	Intervention A: pre-education C: After one month	Mean± SD	Mean difference
SMS	Nausea and Vomiting	A	2.66± 1.50	4.5	A	2.66± 1.50	3.5
		B	7.16±0.4		C	6.16± 0.75	
E-mail	Stomatitis	A	2.83± 1.47	4.17	A	2.83± 1.47	2.67
		B	7 ± 0.63		C	5.50± 0.45	
	Diarrhea	A	1.83±1.60	7.83	A	1.83±1.60	7.5
		B	9.66± 0.51		C	9.33± 0.51	
	Constipation	A	2.16± 2.22	5	A	2.16± 2.22	4.67
		B	7.16± 0.75		C	6.83± 1.16	
Anorexia	A	3.16± 1.94	7.84	A	3.16± 1.94	6.84	
	B	11 ±0.89		C	10± 1.67		
		Intervention A: pre-education B: After One week	Mean ± SD	Difference between the average scores	Intervention A: pre-education C: After one month	Mean± SD	Mean difference
	Stomatitis	A	2.66± 1.50	4.5	A	2.66± 1.50	3.5
		B	7.16±0.4		C	6.16± 0.75	

Table 4. Comparison of the average scores of parents with email (N = 6)

Educational instrument	Mean ± SD	Time Interval	P-Value
SMS	4.56± 1.32	Before and one week after intervention	0.017
E-mail	6.87±2		
SMS	3.23±1.16	Before and one month after intervention	0.003
E-mail	6.34±2.2		

Table 5. Comparison of the average scores in all parents (n =30)

Statistics the educational instrument	Education time			
	Before and one week after Education Mean ± SD	P-Value	Before and one month after Education	P-Value
E-mail (n=6)	6.87 ± 2	.0036	6.34 ± 2.2	0.017
SMS (n=24)	4.98 ± 1.84		3.95 ± 2.02	