

# The Effect of SMS-Based Education on Sleep Knowledge of Mothers of Primary School Students: A Single-Blind Randomized Controlled Trial

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## Abstract

**Background:** Sleep-deprivation in children decreases the quality of life and endangers health. Increasing mother's level of awareness can help improve the children's sleep schedule and avoid many associated problems.

**Objectives:** This study aimed to investigate the effect of SMS-based education on the level of sleep knowledge in mothers with 7-12 years old children.

**Methods:** In this single-blind randomized controlled trial, 13 governmental primary schools in Tabriz (Iran) in 2016 (7 girls' schools and 6 boys' schools) were randomly selected among the primary schools, using cluster sampling approach. Then, the mothers of sleep-deprived students were randomly divided into intervention and control groups by using RAS. Both of the groups took a pretest on sleep knowledge by PSKI and then, mothers in the intervention group received education through sending SMS. Finally, all of the participants took again the posttest in two time intervals including a week and three months after the intervention. A number of 92 mothers (experiment = 47, control = 45) completed all of the three phases of the research and the data were analyzed using SPSS ver13.

**Results:** The results showed that the difference between the scores obtained in the first and the second measurements of sleep knowledge in the experimental group was significantly different from that of the control group [mean between-group difference of 5.98 within 95% CI of 3.56 to 8.41 ( $P < 0.001$ )]. The difference of sleep knowledge scores between the third and first measurements in the experimental group was also significantly different from that of the control group [mean between-group difference of 4.09 within 95% CI of 1.44 to 6.74 ( $P < 0.003$ )].

**Conclusions:** The use of SMS-based education is a constant and efficient educational approach for increasing mothers' level of knowledge about children's sleep health.

**Keywords:** SMS, Sleep, Knowledge, Mothers, Children

## 1. Background

Sleep is one of the most basic human needs that has a great effect on human's physical and mental health as well as quality of life and is regarded as an important factor in health (1). Sleep affects children's emotional development, cognitive performance, learning and concentration insofar as sleep deprivation decreases the quality of life and threatens physical, mental, social, and emotional health (2). Different studies indicate that contrary to the general perception, sleep deprivation is highly prevalent among school children (3). Sleep quantity is lower than normal in 7-12 years old children (3-5) and prevalence of sleep disorders in children is reported to be about 25 percent (6). In Iran, the results of studies showed that sleep disorders are

the most prevalent behavioral complaints among children that involve them in symptoms such as attention and concentration deficit, memory disorder and learning disabilities (7).

Children do not have a proper understanding of the need for sleep and their sleep schedule is dependent to a great extent on family's schedule (8). Moreover, their sleep time is not adjusted in accordance with school start-time; they rest according to family's culture and planning in different times of the day for various reasons without considering the appropriate time for sleep. As a result, they often suffer from a degree of sleep deprivation (9). Parents, especially mothers, can more effectively participate in child-care because of the constant communication (10); in most families the mother has the greatest role in nurturing the

child (11).

Nurses have an influential role in improving the general level of health in the society (12) and are the most important people who can convey the required knowledge and information to the society (13). Nurses are in a specific and unique position to help with new knowledge about sleep and health promotion (14).

In order to raise people's awareness, a powerful instrument is required which should be timely, low-cost, quick, and reliable (15). The traditional classroom education is no longer effective enough, because it is reliant on certain time and place and cannot provide the real and appropriate context for learning. Thus, over recent decades, many educational systems tried to improve learning in a short time by employing modern technologies (16). Mobile phone technology is an Information and Communications technology (ICT) that, like other communication technologies, has emerged in the field of education and is presented as mobile phone-based education (17). The use of mobile phone in education can improve the learning process (18). Using mobile phones facilities for learning purposes allows people to access and use information anytime and anywhere they want; thanks to this technology, learners do not need to spend time and money to go to a certain learning location (19).

Studies show that the use of SMS in education is greeted by people (20, 21).

The results of studies indicate that children's sleep problems and their sleepiness are associated with parents' sleep duration (22) and their level of awareness (23), and parents can play the role of a positive change and therapeutic factor in resolving children's behavioral problems (24) It has also been stated that SMS-based education is presented as a distance, effective, low-cost, simple, and attractive education (25).

## 2. Objectives

Accordingly, due to ease of access of all families especially most mothers to cell phone and considering the fact that no research has been conducted in Iran to improve mothers' sleep knowledge, this study aimed to assess the effectiveness of SMS-based education in increasing mothers' sleep knowledge. This study can introduce SMS-based education as an effective, efficient, and low-cost approach in educating sleep knowledge. It also can take a step towards increasing mothers' awareness about principles and the ways to improve the sleep status of their 7 - 12 years old children.

## 3. Methods

The present study was a single-blinded, randomized, controlled clinical trial. As soon as the required approval was received from the research ethics committee of Tabriz University of Medical Sciences (Reference number TBZMED.REC.1394.18), and the study was registered in Iran registry of clinical trials (IRCT201407088315N10), the effect of SMS-based education on mothers' sleep knowledge was investigated in Tabriz in 2016. The research population included mothers of primary school students who were studying in different educational districts of Tabriz in 2016. In order to determine the sample size, basic information including the mean and standard deviation was acquired from a preliminary pilot study with 30 participants. Considering a 95% confidence level and a power of 0.8 for a double-tailed test, and expecting 10 percent difference in sleep Knowledge of mothers, the sample size of 52 was calculated for each group. Since the dropout rate for experimental studies is expected to be 10 percent, the number of participants for each group increased to 57. However, the sample size raised more again due to employing a non-face to face intervention and follow-up design for the study. Thus, all the mothers (n = 206) of screened children with sleep deprivation included in this study (103 in each group). The inclusion criteria applied for mothers were as follows: having a child (male or female) studying in primary schools of Tabriz city during the year 2016, confirmed sleep-deprivation in the child based on two-week sleep record (total sleep time less than 585 minutes in 7 year olds, less than 570 minutes in 8 year olds, less than 555 minutes in 9 year olds, less than 540 minutes in 10 year olds, less than 530 minutes in 11 year olds, and less than 510 minutes in 12 year olds) (26), willingness to participate in the research, possession of a mobile phone, literacy of mother (passing at least middle school), not being a member of medical sciences society (i.e. being a physician, nurse, faculty member, ...), and having no physical or mental disease. The exclusion criteria were: not giving a missed call after receiving the messages to verify they received and saw the message (maximum for half of the messages).

In order to provide the sample, after receiving permission from the department of education, East Azerbaijan province, 13 public primary schools (7 girls' schools and 6 boys' schools) were randomly selected among the primary schools of Tabriz, using cluster sampling approach (followed by the simple random sampling method). Then, the researcher referred to each school, explained the study objectives, asked the school principal's permission to give a demographic information questionnaire and a two-week sleep record form (with instruction) to each 7 - 12 years old student to be filled by their mothers at home. After

two weeks, the questionnaires were collected and all of the mothers who met the inclusion criteria were invited to attend the school session to be explained about the study objectives. Mothers who were willing to participate in the study signed an informed written consent. Finally, 206 mothers who met the inclusion criteria entered the study. Next, random allocation sequence was generated using the random allocation software (RAS) to allocate 103 participants to the intervention group and 103 participants to the control group). Mothers were blinded to group assignment. Mothers in the intervention group were given a message by researchers to start receiving educational messages for a month while they were not aware of their group.

### 3.1. Data Collection

Data gathering tool contained three parts: I- personal information questionnaire (including mother and child's age, child's gender, mother's level of education, occupation, existence of known chronic disease and mother's mobile phone number), II-Parents' Sleep Knowledge Inventory (PSKI), and III- two-week sleep record.

Parents' sleep knowledge inventory (PSKI) constructed by Schreck KA and Richdale AL (27) was employed to complete the sleep knowledge information. PSKI is a self-reporting questionnaire that investigates parents' knowledge about children's sleep and includes 64 questions, out of which 18 questions associated with 7 - 12 years old children were selected. The questions are close-ended multiple choice with 4 options for each question. The answers are graded as follows: one point for each correct answer, minus one point for each incorrect answer, and zero point for unanswered questions. The total scores range from -18 to +18.

The mothers recorded the sleep and awake-time of their children for two weeks using the two-week sleep record (28). They were guided to fill out the forms in this way: leave the boxes blank for the time period over which the child is awake and fill them for when he/she is sleeping; when your child fell asleep mark the pertinent box with a down-arrow (↓) and when he/she woke up (either in the morning or after a nap) mark the box with an up-arrow (↑). Finally, the sleep-deprived children were identified by calculating their average sleep times and comparing them with normal values.

To verify the scientific validity of the study instruments, its face and content validity was examined. First, a forward-translation of PSKI and Two week sleep record was provided and then 12 faculty members of Tabriz University of Medical Sciences assessed and confirmed the validity of face and content. Also, they proved the educational SMS-based sentences related to child sleep health. Moreover, to

verify the reliability of the questionnaire, it was first completed by mothers of 15 students. Then, Cronbach's Alfa was used to measure the reliability of the PSKI part that gave the coefficient of 0.69. Intra-class correlation coefficient (ICC) was used for the two-week sleep record and the reliability coefficient of 0.79 was obtained at a 95 percent confidence interval.

### 3.2. Intervention

In the first phase of the research, mothers in two groups personally completed a copy of parents' sleep knowledge inventory (PSKI) as a pretest. The educational content about children's sleep was prepared from authentic scientific references after reviewing an extensive body of texts. The educational texts were sent through SMS to mothers in the intervention group every night at 8 o'clock for one month. The mothers were told to avoid sharing the messages to other mothers and just give the researcher a missed call to ensure that they successfully received the message. Those mothers who did not give missed call for half of the messages were omitted from the study. In the second phase, a week after the intervention ended, the PSKI was completed once again by mothers personally as a posttest. A number of 126 participants including 58 mothers in the control group and 68 in the intervention group succeeded in completing the second phase and 80 mothers were omitted due to not giving the missed calls or not being accessible or unwillingness to continue their participation in follow-up. In the third phase, three months after the intervention, mothers personally completed the PSKI again and at the end, 92 participants including 45 mothers in the control group and 47 in the intervention group successfully completed the third phase of the research while 34 mothers left the study because of unwillingness (Figure 1). In order to motivate the participants to fill out the questionnaires, they received some gifts and the benefits of the research were thoroughly explained to them. The control group also received the educational contents at the end of the study.

### 3.3. Data Analysis

The data were analyzed by using SPSS version 13. Normality of the quantitative data was confirmed using skewness and kurtosis; also all variables had normal distribution. Mothers' knowledge scores were calculated using the indices including frequency, mean, and standard deviation and then, the following tests were performed: independent t-test to compare mothers' knowledge scores between the groups before the intervention, repeated measures ANOVA to compare the difference in sleep knowledge scores before the intervention and a week and three

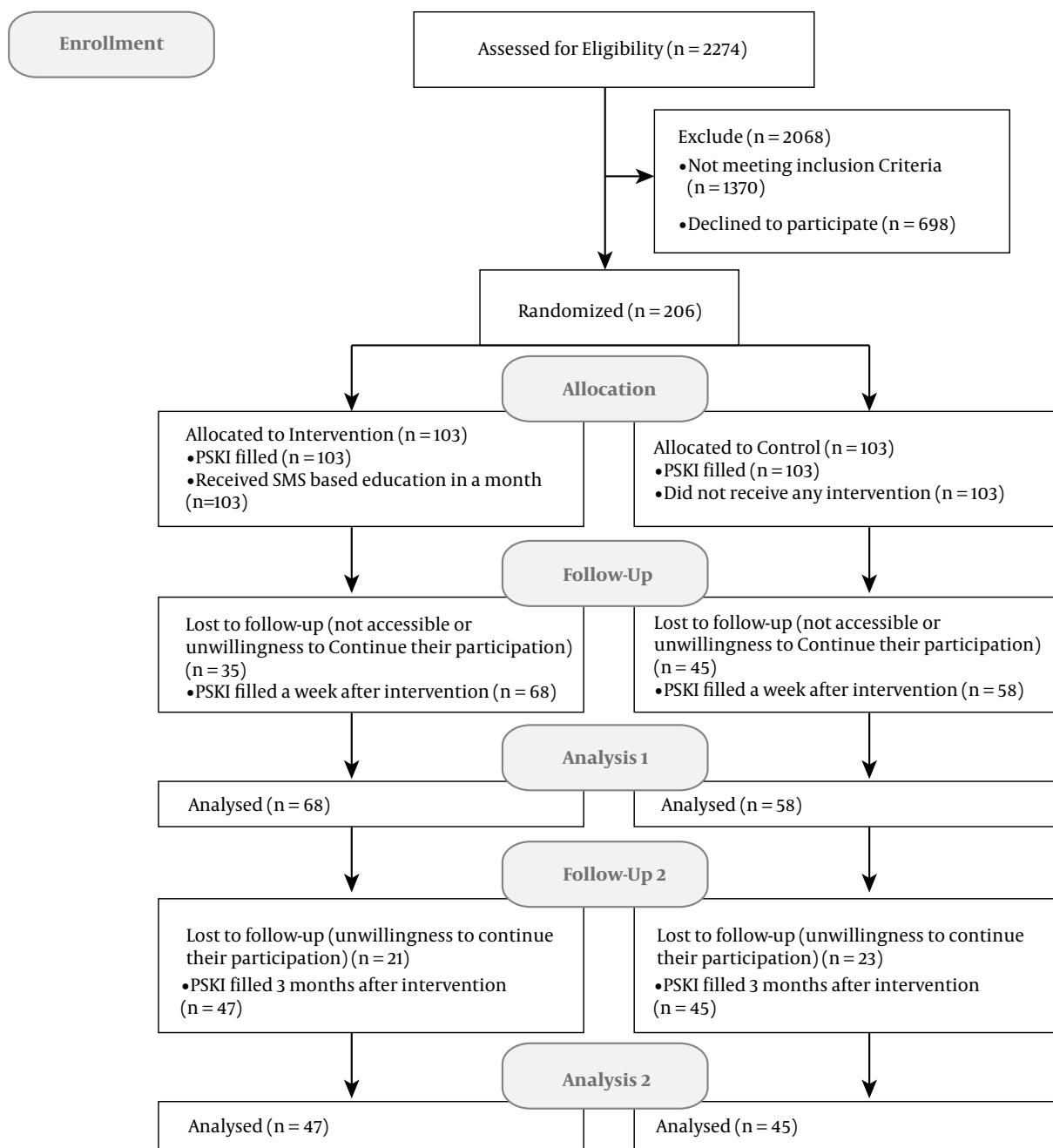


Figure 1. Flow Chart of the Study

months after the intervention in each group, and analysis of covariance to examine the differences in the two groups and to adjust for the effect of confounding variables. In order to compare the sleep knowledge scores (before the intervention, a week and three months after the intervention) in each group, repeated measures ANOVA

was used and in case of a significant difference, Sidak post-hoc test was employed. The assumption of sphericity (consistency of correlations) was evaluated by Mauchly's test and in case of validation or violation, assumed sphericity or Greenhouse-Geiser correction were employed, respectively. Mauchly's test validated sphericity in both interven-

tion and control groups. The significance level was  $P < 0.05$ .

#### 4. Results

The comparison of demographic variables of mothers whom left the study with ITT showed that there is no significant difference between two groups ( $P > 0.05$ ). The demographic variables are described for participants who completed the first and second phases. The comparison showed that there is no significant difference between the intervention and control groups in terms of demographic variables (Table 1).

The results of independent t-test showed that before the intervention, there was no significant difference between the groups in terms of sleep knowledge scores ( $P = 0.608$ ). In the intervention group, RMANOVA indicated that the differences in sleep knowledge scores were significant ( $P < 0.001$ ), Sidak post-hoc test indicated that the differences between the first and the second measurements ( $P < 0.001$ ) as well as between the first and the third measurements ( $P = 0.001$ ) were significant; but the difference between the second and the third measurements was not significant ( $P > 0.05$ ). In the control group, RMANOVA indicated that the differences in sleep knowledge scores were not significant ( $P = 0.964$ ) (Table 2).

Analysis of covariance was used to examine the effect of the intervention (compared to the standards) on variables in the two groups. The difference between the scores obtained in the first and the second measurements of sleep knowledge in the experimental group was significantly different from that of the control group. The difference between the scores of the third and the first measurements of sleep knowledge was also significantly different in the experimental group compared to the control group (Table 3). The results of the analysis of covariance showed that these between-group differences in terms of the scores obtained in the second and the first measurements ( $P < 0.001$ ) and also in the scores of the third and the first measurements ( $P < 0.005$ ) remained significant even after adjusting for the standards or potential confounding variables.

#### 5. Discussion

The results of the present study showed that SMS-based education had positive effects on increasing mothers' sleep knowledge. This finding is similar to the results of researches that reported the effectiveness of SMS-based approach in education. The results of Ismail et al.'s (29) study show that education of college students through SMS is an effective educational method that makes access

information convenient in any place at any time. This result is in conformity with the views of Ramos and Cavus who showed in their studies that education with SMS is effective (30, 31). In another study, Ismail et al. (32) indicated that SMS enhanced the effectiveness of learning and made education easy, effective, and beneficial; but there was a problem with this method that provides less interaction between the educator and the learner. The findings of a study showed that those students who were educated in medication issues with the help of the SMS achieved better scores compared to those who were educated through lectures and their level of satisfaction was also higher (33). Kennedy et al. (34) showed that education through SMS increased motivation in university students and it was also more attractive.

The findings of Lu's study on the effectiveness of second language education with the help of SMS and paper-based education, conducted on 30 high school students for two weeks, showed that the students in the group educated with concise and regular short messages learned more new words compared to the students in the group with rather more detailed contents on paper. On the other hand, some factors including technological limitations, unfamiliar presentation and students' learning activities may prevent the students from reading the messages (35). Moreover, many studies that investigated the effectiveness of education through SMS in learning a foreign language emphasized the effectiveness of this method (36-38).

In a study that examined the students' experiences of SMS-based education, the negative experiences were as follows: intrusion into personal time, culture of immediacy in texting, expenses and failure to understand the educational benefit. The positive feedbacks were with regard to the office experiences and the learning support; it was also suggested that the content of SMS-based education was based on the teacher's content.

One of the limitations of the current study was the 9 percent dropout in the study units at the 3-month follow-up phase that was reasonable due to the nature of studies with follow-up.

The strength of the current study was the use of SMS-based method in which, the learner is responsible for his/her learning; also this method leads to a better and deeper learning in the person. In fact, in this method people learn how to learn. As a result, this method can be introduced as an effective and efficient educational approach that saves energy, time, and expense and also leads to a deeper learning in people.

The results showed that the mean pretest-posttest difference of scores on sleep knowledge of mothers was higher in the intervention group than the control group. This difference was statistically significant that indicated

**Table 1.** Demographic Information of the Groups (Control Group n = 58 and Intervention Group, n = 68)

Variables	Intervention Group, No. (%)	Control Group, No. (%)	P Value
<b>Child's gender</b>			
Male	35 (51.5)	28 (48.3)	0.518 <sup>a</sup>
Female	33 (48.5)	30 (51.7)	
<b>Child's age<sup>b</sup></b>	9.1 ± 1.65	9.2 ± 1.45	0.589
<b>Mother's age<sup>b</sup></b>	35.2 ± 5.74	35.5 ± 4.10	0.335
<b>Mother's employment status</b>			
Employed	13 (19.1)	10 (17.2)	0.716 <sup>a</sup>
Housekeeper	55 (80.9)	48 (82.8)	
<b>Education</b>			
Middle school	10 (14.7)	5 (8.6)	0.314 <sup>a</sup>
High school	5 (7.4)	3 (5.2)	
Diploma (12 <sup>th</sup> grade)	36 (52.9)	35 (60.3)	
Associate degree	3 (4.4)	1 (1.7)	
Bachelor's degree	13 (19.1)	11 (19)	
Master's degree	1 (1.5)	3 (5.2)	
<b>Number of children</b>			
One child	21 (30.9)	17 (29.3)	0.695
Two children	43 (63.2)	38 (65.5)	
Three Children	4 (5.9)	3 (5.2)	

<sup>a</sup>Chi-square tests; [U+25AA] in independent t-test.

<sup>b</sup>Reported as mean ± SD.

**Table 2.** RMANOVA of Mean and Standard Deviation Related to Sleep Knowledge Scores in Three Measurements for Each Group

Time of Measurement Group	Before the Intervention	A Week after the Intervention	Three Months After the Intervention	P Value
<b>Intervention group</b>	-5.11 (3.97)	0.68 (6.07)	-1.06 (6.33)	< 0.001
<b>Control group</b>	-4.82 (3.97)	-5.02 (4.66)	-4.87 (4.98)	0.964

**Table 3.** Comparison of Changes in Sleep Knowledge Scores Between the Two Groups

Time of Measurement of the Sleep Knowledge Scores	Mean Between-Group Difference	95% CI for Difference	P Value
<b>second measurement - first measurement</b>	5.98	3.56 to 8.41	< 0.001
<b>third measurement - first measurement</b>	4.09	1.44 to 6.74	< 0.003

SMS-based education had positive effects on sleep knowledge of mothers.

Regarding the results of this investigation, it seems that using SMS-based education can be considered as an appropriate strategy to respond the needs of parents, provided that there is a properly planned SMS-based education system. Culture-making is also essential for employing this method. The future studies are needed to compare the ef-

fects of educational method of mobile phone short message with face to face method.

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## Footnotes

**Authors' Contribution:** Study concept and design: Leila Valizadeh, Zeynab Mousarrezai, Mohammad Asghari Jafarabadi and Parvaneh Aghajari; acquisition of data: Zeynab Mousarrezai; analysis and interpretation of data: Mohammad Asghari Jafarabadi; drafting of the manuscript: Leila Valizadeh, Zeynab Mousarrezai, Mahasti Alizadeh, Mohammad Asghari Jafarabadi and Parvaneh Aghajari; critical revision of the manuscript for important intellectual content: Leila Valizadeh and Zeynab Mousarrezai; administrative, technical and material support: Leila Valizadeh and Zeynab Mousarrezai; study supervision: Leila Valizadeh, Zeynab Mousarrezai, Mahasti Alizadeh, Mohammad Asghari Jafarabadi and Parvaneh Aghajari.

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