

## Effect of Mobile-Based Education versus Booklet-Based Education on Mothers' Knowledge and Practice towards their Children with Bronchial Asthma

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### Abstract

Bronchial asthma is a major public health issue that affects children all over the world, with varying levels of prevalence and severity. **Aim:** To compare the effect of mobile-based education versus booklet-based education on mothers' knowledge and practice towards their children with bronchial asthma. **Design:** A quasi-experimental research design was used to achieve aim of the study. **Setting:** The study was conducted in Pediatric Chest Outpatient Clinic at Sohag University Hospital. **Subjects:** A purposive sample of 230 mothers of asthmatic children was included (115 in the experimental group were taught using mobile Whats app application and 115 in the control group were taught using a booklet). **Four tools were used: Tool I** A structured interviewing questionnaire including two parts. Part (1): Demographic data of the mothers and part (2): Demographic data of the asthmatic children, **Tool II** Asthma Trigger Inventory, **Tool III** Asthma Knowledge Questionnaire, and **Tool IV** Asthma Self-Management Questionnaire. **Results:** The knowledge and practice of both mobile-based and booklet-based groups regarding bronchial asthma were low pre-program implementation. The mobile-based education groups showed an improvement in their total level scores of knowledge and practice one month after mobile-based education versus booklet-based education implementation compared to booklet-based education groups, with highly significant differences ( $p < 0.001$ ). Less school absenteeism was associated with improved practice of mothers. There were statistically significant correlations between total knowledge and self-management scores. **Conclusion:** Mobile-based education was more effective in improving mothers' knowledge and practice about bronchial asthma management than booklet-based education. **Recommendations:** Health care providers can use mobile-based educational methods for mothers of asthmatic children to promote their health.

**Keywords:** Bronchial asthma, Children, Booklet, Mobile-based education, Mothers' knowledge, and practice.

### Introduction

Bronchial asthma is a major public health issue that affects people all over the world, with varying levels of prevalence and severity. Asthma frequency among youngsters has risen dramatically in the previous two decades. Bronchial asthma is estimated to impact about 300 million people, with a prevalence ranging from 7.7% to 15%. Many studies on asthma prevalence have been conducted in Egypt. In Upper Egypt, it ranged from 6.2 percent to 46.1 percent, while in Cairo, it was 46.1 percent (CDC National Center for Health Statistics, 2018).

Asthma is caused by a complex interaction of environmental and genetic factors, which results in airway inflammation and bronchial

airflow limitation, which leads to functional and structural changes in the airways such as bronchoconstriction, airway hyper-responsiveness, mucosal edema, mucus plug formation, and finally airway remodeling. However, the pathophysiology of asthma is still a mystery (Alavinezhad & Boskabady, 2018). Asthma is the third greatest cause of hospitalization and one of the main reasons for school absences among children under the age of 15. As a result of this problem, teachers' assessments of their social, psychological, and educational requirements are insufficient or low (Pearson et al., 2018).

Antibiotic use by children is influenced by mothers' knowledge and practices (Alrafiah et al., 2017). As a result, determining parents' perspectives is critical to comprehending the

hurdles to appropriate antibiotic usage in public schools (**Havens & Schwartz, 2016**). Mothers who are properly educated on public health issues gain a better understanding of topics such as antibiotic resistance, viral infections, and how to prevent the negative repercussions of antibiotic misuse. Providing adequate education based on the most recent scientific concepts is one way to reach the required degree of learning and satisfaction (**Zeinali et al., 2016**).

Mobile media is quickly displacing books and traditional media, and health education is adapting to this shift. According to surveys, the majority of worldwide own used Android-powered smartphones (**Sarabadani et al., 2019**). Studies show that mobile-based interventions are effective in improving health outcomes because they are advantageous in terms of programming flexibility and variety (i.e., they are multifunctional), and they can provide high-quality information and personal support 24 hours a day at a low cost to both the user and the health care provider (**Eskandari et al., 2019**).

National and international standards emphasize that education is the cornerstone of asthma management. Furthermore, by boosting asthma knowledge and modifying behavior, it has been highlighted as a vital component of any asthma management strategy. Most underdeveloped countries have recently become less cognizant about asthma. Parents of asthmatic children often have a poor grasp of the disease and how to treat it, which may add to the need for hospitalization (**Gajanan et al., 2016**).

Mothers who are aware of their child's illness can identify it and correct symptom perception which is an important part of asthma management and control. Controlling asthma requires asthma education for both children and their mothers. The goal of asthma education is to assist children and their caregivers get the knowledge and skills they need to recognize when their asthma is getting worse, take appropriate action, and stay motivated to avoid triggers and stick to their treatment plan (**Coelho et al., 2018**).

The majority of asthma morbidity is thought to be due to factors such as denial of a

chronic condition, lack of understanding about the disease process and drug use, lack of awareness of inhaler use, and poor self-management. Many studies throughout the world have looked at the impact of patient education and shown that each of the above components can be addressed through asthma education. As a result, patient education has become an important part of asthma management for people of all ages. Because of the rising prevalence of asthma, improved awareness of self-management, and growing interest in learning theories, the efficacy, and importance of educational and behavioral treatments for asthma have grown. However, the impact of asthma patient education in Egypt is understudied (**Clarke et al., 2017**).

#### **Significance of the study:**

Caregiver Education is an essential aspect of the nurses' duty during the management of pediatric chronic diseases as children having chronic conditions require ongoing monitoring. Bronchial asthma is a type of chronic bronchitis that affects millions of people around the world. Globally, asthma affects about 300 million people, according to the World Health Organization (WHO). By 2025, it is anticipated to reach 400 million people, with 250,000 deaths each year (4). Asthma affects 8.2% of infants in Egypt, with males (1.2:1) outnumbering females (**Tarraf et al., 2018**).

The nature of asthma, possible exacerbating factors, the mechanism of action, mode of administration, and possible adverse effects of the medications employed should all be obvious to mothers of children with asthma. They should be given written instructions for administering drugs during acute asthma attacks, and they should be aware of the indications of failing control that indicate the need for immediate medical assistance. As children with asthma grow older, they should be encouraged to take on more responsibility for their care (**Earle & Weiss, 2017**).

The fundamental problems with advanced forms of education are a lack of flexibility, mobility, and adaptability to learners' information and education needs whenever and wherever they arise. Some of the issues are solved by the capabilities of mobile education.

The paper presents the basic characteristics, benefits, and existing challenges to that new and most flexible form of learning. The integration and combination of collaborative learning characteristics and mobile technology functionalities are discussed. A strategic solution for the development of learning types and the integration of advanced technologies in various forms of education is presented. So, that the study was conducted to compare the effects of mobile-based education versus booklet-based education on mothers' knowledge and practice towards their children with bronchial asthma

### **Aim of the study**

To compare the effect of mobile-based education versus booklet based education on mothers' knowledge and practice towards their children with bronchial asthma through:

- Assessing mothers' knowledge regarding bronchial asthma.
- Assessing mothers' practice regarding bronchial asthma.
- Designing and implementing a mobile-based education versus booklet-based education based on the mothers' needs.
- Finding out the correlation between socio-demographic characteristics of the mothers and their children with knowledge and asthma management.
- Evaluate the effect of mobile-based education versus booklet-based education on mothers' knowledge and practice towards their children with bronchial asthma.

### **Research hypothesis:**

**H 1:** Mothers' knowledge and practice regarding bronchial asthma will be improved in both mobile and booklet groups after implementing the mobile-based education versus booklet-based education.

**H 2:** Education through mobile will be more effective in improving the mothers' knowledge and practice regarding bronchial asthma than the booklet-based education group.

### **Subjects and Method**

#### **Research design:**

A quasi-experimental research design was used to achieve the aim of the study. It is used for establishing the cause-and-effect relationship between an independent and dependent variable. It does not rely on random assignment. Instead, subjects are assigned to groups based on non-random criteria (Creswell, 2012).

#### **Setting:**

The study was conducted in Pediatric Chest Outpatient Clinic at Sohag University Hospital, Egypt. This setting was selected due to the high prevalence of asthmatic patients and also it serves the biggest region of the population. This setting consists of a single room with diagnostic and examination sections. In addition, there was a waiting area for women's entry, where researchers interviewed the participants in order to implement implementing the mobile-based education versus booklet-based education. It started from 9 a.m. until 12 p.m.

#### **Subjects:**

#### **Sample size calculation:**

The sample size was calculated based on 18.3% of parents who correctly answered more than 60% of the questions in a similar study conducted by Zhao et al (2013), using 95% confidence interval and a 5% margin of error, the sample size was estimated to be 230 and adjusted to 260 to compensate for incomplete forms. The sample size was calculated by using open Epi epidemiologic calculator. A non-random, convenience sampling technique was used to obtain the sample.

A purposive sample of 230 mothers of asthmatic children was included (115 in the experimental group were taught using a mobile application and 115 in the control group was taught using a booklet) from a population who have met the inclusion criteria within six months and received education from the previously mentioned setting. The inclusion criteria for mothers as the following: aged 18-40 years, mothers were the primary caregiver that accompanied with the child their age less than 12 years were in the hospital and agreed to

participate in this study. Exclusion criteria as follows: mothers of nonasthmatic children and mothers of asthmatic children who are not willing to participate in the study.

#### Data collection tools:

Four tools were used to collect the data of the study as the following:

**Tool (I): A structured interview questionnaire** was developed by the researchers after reviewing the related literature and research studies; it included two parts:

**Part (1):** It included 5 items related to demographic data of mothers such as age, educational level, occupation, residence and sources of information

**Part (2):** It included 5 items related to demographic data of asthmatic children and asthma history such as gender, age, duration of asthma, school absenteeism, and children's asthma severity.

#### Tool (II) Asthma Trigger Inventory:

Asthma Trigger Inventory (ATI): It was adopted by **Ritz et al., (2018)**. The ATI consists of 31- item self-report inventory. It was designed to assess Triggers of asthma. It was translated into Arabic language using the back-translation technique on six subscales with 3 to 10 items each: psychological factors (e.g., stress at home, being angry), animal allergens (e.g., animal hair, cats), pollen allergens (e.g., pollen from trees, pollen from grass), physical activity (e.g., running, climbing flights of stairs), infection (e.g., colds, flu), and air pollution/irritants (cigarette smoke, perfume). Psychological trigger items referred to daily life emotions and stress, rather than diagnostic criteria of psychopathology.

**Tool (III): Asthma Knowledge Questionnaire (AKQ):** Arabic version of AKQ was adopted from **Alreshidi, (2015)**, who adapted the English version from **Al-Motlaq and Sellick, (2011)**. The instrument consists of 24 questions (23 true/false items and one open-ended question) including general data about asthma, triggers, symptoms, and asthma treatment, and management. The domains of the AKQ are well constructed with

evidence of construct and discriminate validity, high internal consistency of items, and test-retest reliability.

#### Scoring system:

The Asthma Knowledge Questionnaire (AKQ) is scored as follows: The total knowledge score was 24 degrees, with one point given for each correct answer and zero for each incorrect answer for each area of knowledge. The scores of the questions were added together, and the total score was divided by the number of items. These results were then translated to a percentage score. If the percent score was 60 percent or higher, the total knowledge was considered satisfactory, and if it was less than 60 percent, it was considered unsatisfactory **Alreshidi, (2015)**.

**Tool (IV): Asthma Self-Management Questionnaire (ASMQ) (Mancuso et al., 2009):** It was used by the researchers to reflect mothers' practices to assist their children in asthma management. ASMQ measures management using preventive strategies, inhaler use, differences between maintenance and rescue medications, and use of peak flow meters. It was translated into the Arabic language using the back-translation technique. It consisted of 16 optional questions measuring protective awareness, proper use of inhalers, medicines (rescue and control), and the use of peak flow meters (it takes about 5 minutes when self-administered, or 8–10 minutes when questioned). However, because peak flow meters are not in common use in Egypt, thus the two items related to the use of this device were removed. Therefore, we had 14 questions only.

#### Scoring system:

The scores for the tool were calculated as follows: one point was assigned to each preferred response, all the points were summed to generate the raw score range 0–14 and the raw score was transformed to range from 0 to 100, with higher scores showing a more self-management understanding of asthma. The awareness, as in previous studies, was classified into the following levels: a. Good (ASMQ > 75 transformed), b. adequate

(transformed ASMQ = 50–75) and c. Poor (transformed ASMQ < 50).

### **Tools validity and reliability:**

Tools of data collection were reviewed by five experts; three experts in pediatric nursing and two experts in the community health nursing field, who test the content validity of the instruments and judge its clarity, comprehensiveness, relevance, simplicity, and accuracy. Modifications were made according to the panel judgment to ensure sentence clarity and content appropriateness. The Cronbach's alpha coefficient test was used to assess the internal consistency reliability of the validated tools. It was 0.89 for tool (I), ranging from 0.81 to 0.94 for tool (II), 0.87 for tool (III), and 0.89 for tool (IV).

### **Ethical considerations:**

An official approval was obtained for conducting the study from the Ethical Research Committee of the Faculty of Nursing. An official letter explaining the purpose of the study was obtained from the faculty dean of nursing to the medical and nursing directors of the chosen facility to carry out the study and collect the necessary data. The aim of the study was explained to the mothers. The researchers obtained an oral consent from mothers after informing them about their rights to participate, refuse, or withdraw at any time. Confidentiality of any obtained information and anonymity were assured. Mothers were told that their information would be kept private and only utilized for research.

### **A pilot study**

A pilot study was conducted on 10% (23 mothers) of the total sample to test the clarity and feasibility of the research process. No modifications were carried out to develop the final form of the tools. Mothers who were in the pilot were excluded from the research study.

### **Field work:**

The study was carried out through six months which extent from the beginning of August 2019 until the end of January 2020, according to the following phases:

### **A) Assessment phase:**

This phase encompassed interviewing of the mothers to collect baseline data. The study included 230 mothers. The researchers collected data from mothers who attended previously selected settings three days/ a week from 9 A.M to 1 P.M on the morning shift (Sunday and Monday). Approximately, 50-60 minutes were taken to complete each interview tool. The researchers met mothers individually at the waiting area present at previously selected settings and explain the aim of the study after introducing themselves to mothers. The data collection tools were distributed to the studied mothers twice; (1) pre-test to assess their knowledge and practices before implementing Mobile-based education versus booklet-based education (2) Post-test to assess mothers' knowledge and practices after implementing the educational program.

In this study, mobile-based education and booklet-based education were considered as independent variables, and mothers' knowledge and practice were considered as dependent variables. In booklet-based education, mothers were interviewed face to face to collect data pre and post-program implementation.

In the mobile Whats App application, the mothers were interviewed face to face during pre-intervention for collecting data, and then the education was given through the mobile Whats App group by taking telephone numbers of the mothers and adding them to the group. The researchers used the online Google form spreadsheet to design the online questionnaire and begin the research. The researchers joined the link of an online questionnaire and collect the telephone numbers of the studied sample in the first interview with the mothers during their visit to the previously selected setting to take care of their children. Before filling the online questionnaire, mothers were informed about the objectives, nature, and expected outcomes of the study. All the data collected were gathered to compare the effect of mobile-based education versus booklet-based education on mothers' knowledge and practice towards their children with bronchial asthma.

## B) Planning

Based on baseline data obtained from actual assessment of the studied mothers after reviewing of the related literature, the researchers designed a manual booklet about bronchial asthma in children using the Arabic language. It was printed out regarding the mothers' size and distributed to all mothers in the booklet group post-assessment. This booklet was contained illustrative colored pictures and the main points of each training session.

Mothers in the Whats App group were educated using the same educational content as in the booklet group but using YouTube film presentation, audio, animation; figures to demonstrate the educational material. Mothers in the Whats App group can access software on an android phone (education was at home or their workplace).

### **Designed booklet about bronchial asthma in children:**

**Aim of the booklet:** The general goal is to equip mothers with knowledge and practice regarding bronchial asthma in children.

#### **Specific objectives:**

- To improve the studied mothers' knowledge and practice regarding bronchial asthma
- To help mothers to know signs of bronchial asthma.
- To help mothers in assessing and managing bronchial asthma.

### **The contents of the booklet: It included two parts:**

#### **I -Theoretical part:**

- Introduction to bronchial asthma.
- Definition of bronchial asthma.
- Asthma triggers
- Types of bronchial asthma
- Signs and symptoms of bronchial asthma.
- Methods of avoidance of asthma triggers
- Importance of adherence to medication use.
- Mothers' role in asthma management.

#### **II- Practical part:**

- The technique of inhaler use

## C) Implementation

Both the mobile-based education and booklet-based education groups had similar educational content regarding bronchial asthma. The educational content was presented in the form of text and picture in the booklet and in the form of text, picture, and video in the mobile application and was simplified in such a way that it was as clear and understandable as possible for all participants. The content used in the two educational methods was collected based on the learning objectives set for the two groups.

Mothers completed the tools in the pre-test. The researcher also provided a phone number to them to answer questions about the educational content. The mobile-based education groups used the mobile phone application for 2–4 weeks, and the booklet-based education groups used the educational booklet for the same interval. During the 2–4-week intervention, three text messages were weekly sent to the subjects in both groups to instruct the use of the mobile Whats App application and booklet. In the post-test, the questionnaire was completed again through a telephone call by all the subjects.

### ***Mobile-based education versus booklet-based education:***

Mobile-based education versus booklet-based education was achieved through four sessions per month at the rate of one session per week of one hour to an hour and a half in the previously selected setting. The educational program was applied for the studied mothers in ten groups. Each group included nearly 13 mothers. The main topics of the program were knowledge and practice of bronchial asthma. The theoretical part included mothers' knowledge regarding bronchial asthma such as; introduction about bronchial asthma, definition of bronchial asthma, asthma triggers, types of bronchial asthma, signs, and symptoms of bronchial asthma, medications, and mothers' role in asthma management. The practical part contained items about methods of avoidance of asthma triggers, technique of inhaler use, importance of adherence to medication use, and measures to be taken if the child develops acute wheezing breathlessness with a cough in the middle of the night at home.

### Evaluation:

Evaluation of mothers' knowledge and practice was done after one month of the program implementation, using the same pre-test tools that were evaluated according to the same method of scoring system.

### Statistical analysis:

The collected data were organized, categorized, tabulated and analyzed using SPSS (version 19). Qualitative data were expressed as frequency and percentage. Numerical data were expressed as mean and standard deviation as appropriate. The Chi-square and Two-Sample Kolmogorov-Smirnov tests were used to look at the homogeneity of demographic characteristics. The subscales of knowledge and practice were compared using the U test and analysis of covariance (ANCOVA). The ANCOVA was run with the assumptions in mind, correcting the influence of pre-test scores as a covariate variable, and then comparing the adjusted means.  $P < 0.05$  was considered as the level of significance.

### Results

**Table (1)** showed the characteristics of the studied mothers. It was noticed in the mobile-based education group that, 58% of the studied mothers were in the age range from 20 < 30 years with the mean age of  $27.4 \pm 2.3$ . Concerning educational level, 57% of them had secondary education, 67% of mothers were housewives, and 72% of mothers were living in urban areas. While in the booklet-based education group, it was noticed that, 60% of the studied mothers were in the age range from 20 < 30 years with the mean age of  $28.2 \pm 2.1$ . Concerning educational level, 53% of them had secondary education, 63% of mothers were housewives, and 70% of mothers were living in urban areas

**Table (2)** portrayed that, the mean age of children was  $6.36 \pm 2.62$  in the mobile-based education group and  $6.57 \pm 3.63$  in the booklet-based education group. Regarding the duration of disease, the mean was  $3.78 \pm 2.22$  in the mobile-based education group and  $3.78 \pm 2.22$  in the booklet-based education group. Mean school absence day was  $1.98 \pm 1.2$  in the mobile-based education group and  $2.58 \pm 1.3$  was in the booklet-based education group. Child asthma

severity was mild in 37% of the mobile-based education group, while 39% of the studied mothers in the booklet-based education group, while it was severe in 9% and 9.5% of the studied children in the mobile-based education and booklet-based education groups respectively.

Regarding asthma triggers among the studied asthmatic children, **table (3)** illustrated that, cold illness, passive smoking, air pollution, sports, dust mites were the most common triggers in the current study among the mobile-based education (94%, 93%, 92%, 90%, 57%) respectively and booklet-based education groups (92%, 90%, 85%, 83%, 63%) respectively.

**Figure (1)** revealed that, the main sources of obtaining information among the studied mothers was doctors (53%) followed by friends (20%), then, family (17%), T.V (6%), and the least source was mass media (4%).

**Table (4)** clarified that, there was a significant difference between the mobile-based education and booklet-based education groups of the studied mothers regarding total level scores of knowledge one month after program implementation ( $p < 0.001$ ). The majority of mothers in both mobile-based education and booklet-based education groups (76% and 83%, respectively) showed unsatisfactory knowledge before program implementation. In addition, mobile-based education groups showed an improvement in total level scores of knowledge, with the majority becoming satisfactory one month after program implementation compared to booklet-based education groups (92% & 67%, respectively).

**Table (5)** illustrated that, there was a significant difference between the mobile-based education and booklet-based education groups of the studied mothers' total score of practices regarding bronchial asthma management one month after program implementation ( $p < 0.001$ ). Before the educational program, only 10% had good practice and 64% of mothers had poor practice in mobile-based education group. After program implementation, it is found that the majority of mothers (92%) had good practice while mothers who had adequate practice were

8% and none of them had poor practice. In Booklet-based education group, only 21% had adequate practice and 79% of mothers had poor practice before the educational program. After program implementation, it is noticed that the majority of mothers (23%) had good practice and 60% had adequate practice, while mothers who had poor practice were 17%.

**Table (6)** demonstrated that, there was a statistically significant negative correlation between the mother's management score and disease duration. There were statistically significant negative correlations between total knowledge and child's absenteeism days. There were statistically significant negative

correlations between self-management scores and child's absenteeism days. There were statistically significant negative correlations between total knowledge and self-management scores.

**Table (7)** reflected that, there were statistically significant correlations between total knowledge and mothers' occupation. There were statistically significant correlations between mothers' occupation and management scores. There were statistically significant correlations between total knowledge and their education. There was a statistically significant correlation between total knowledge scores and their residence.

**Table (1):** Distribution of the studied mothers according to their demographic characteristics (n=230)

Items	Mobile-based education (n=115)		Booklet-based education (n=115)		x <sup>2</sup>	P-value
	No.	%	No.	%		
<b>Mothers' age</b>						
- 20 < 30	67	58.0	69	60	0.674	0.5 NS
- 30 ≤ 40	48	42.0	46	40		
<b>Mean ± SD</b>	27.4±2.3		28.2±2.1			
<b>Mothers' education</b>						
-Primary education	23	20.0	25	22	0.765	0.7 NS
-Secondary education	66	57.0	61	53		
-University education	26	23.0	29	25		
<b>Occupation:</b>						
-Working	38	33	43	37	0.873	4.28 NS
- Housewives	77	67	72	63		
<b>Residence:</b>						
-Urban	83	72	80	70	0.572	1.7 NS
-Rural	32	28	35	30		

**Not Significant (NS) P>0.05**

**Table (2):** Distribution of the studied asthmatic children regarding their demographic data and asthma history (n=230).

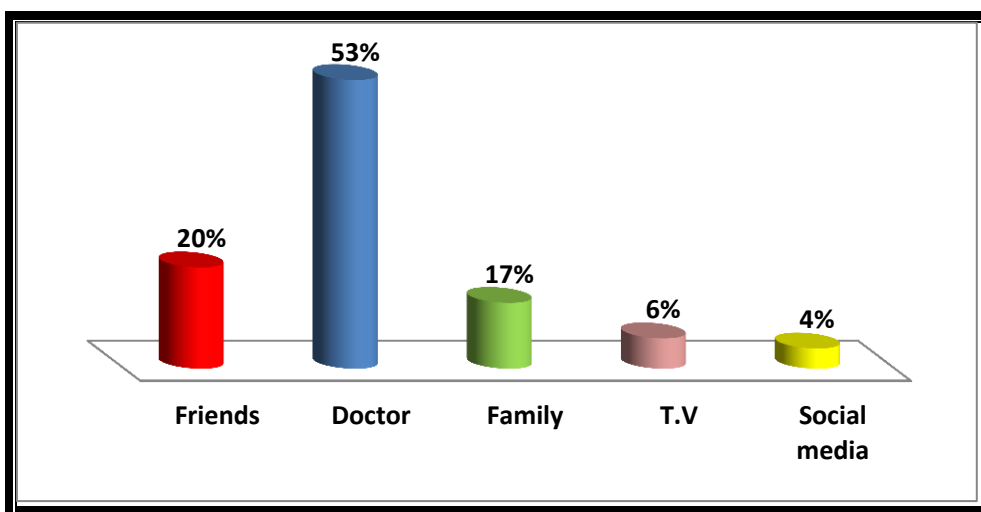
Items	Mobile-based education (n=115)		Booklet-based education (n=115)		x <sup>2</sup>	P-value
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD		
<b>Child's age</b>	6.36±2.62		6.57±3.63		0.674	0.5 NS
<b>Duration of disease</b>	3.78±2.22		3.78±2.22		0.775	0.7 NS
<b>Child's school absenteeism</b>	1.98±1.2		2.58±1.3		0.885	0.8 NS
<b>Child's asthma severity</b>						
- Intermittent	28	24	26	22.5	0.978	0.7 NS
- Mild	43	37	45	39		
- Moderate	34	30	33	29		
- Severe	10	9	11	9.5		

**Not Significant (NS) P>0.05**



**Table (3):** Distribution of the studied asthmatic children regarding their Asthma triggers (n=230).

Triggers	Mobile-based education(n=115)		Booklet-based education(n=115)	
	No.	%	No.	%
- Cold or respiratory illness	108	94	106	92
- Passive smoking	107	93	103	90
- Pollution	106	92	98	85
- Air Sports	103	90	95	83
- Seasonal	49	43	54	47
- Dust mites	65	57	72	63
- Strong smells or perfume	37	32	34	30
- Flowers	31	27	23	20

**Figure (1):** Distribution of the studied mothers regarding their sources of information (n= 230)**Table (4):** Comparison between mobile versus booklet-based education groups of the studied mothers regarding their total level scores of knowledge (pre and post- program implementation).

Knowledge level	Mobile-based education(n=115)				Booklet-based education(n=115)				x <sup>2</sup>	P-Value
	Pre education		Post one month of education		Pre education		Post one month of education			
	No	%	No.	%	No.	%	No.	%		
- Satisfactory	28	24	108	92	20	17	77	67	48.173	<0.001**
- Unsatisfactory	87	76	7	8	95	83	38	33		

\*\* Highly statistically significant differences (P-value <0.001)

**Table (5):** Comparison between mobile versus booklet-based education groups of the studied mothers' practices regarding bronchial asthma management (pre and post-program implementation).

Management of asthma	Mobile-based education (n=115)				Booklet-based education (n=115)				x <sup>2</sup>	P-Value
	Pre education		Post one month of education		Pre education		Post one month of education			
	No	%	No.	%	No	%	No.	%		
<b>Poor</b> (Transformed ASMQ <75)	74	64	0	0	91	79	19	17	39.594	<0.001**
<b>Adequate</b> (Transformed ASMQ 50-75)	30	26	9	8	24	21	69	60		
<b>Good</b> (Transformed ASMQ >75)	11	10	106	92	0	0	27	23		

ASMQ: Asthma Self-Management Questionnaire

\*\* **Highly statistically significant differences (P-value <0.001)**

**Table (6):** Correlation between demographic data of children, asthma history, total knowledge, and asthma management

Variables		Total knowledge	Self-management percentage score
Age	R	0.076	0.207
	P	0.379	0.057
Duration of disease	R	0.139	-0.007
	P	0.105	0.934
Child' absenteeism days	R	-0.34*	-0.41**
	P	0.002	0.001
Asthma severity	R	0.14	0.15
	P	0.34*	0.25
Self-management score	R	-.178- *	-
	P	.037	-

**Table (7):** Correlation between demographic data of mothers, total knowledge, and asthma management

Variables		Total knowledge	Self-management percentage score
Age	R	0.074	0.207
	P	0.373	0.057
Occupation	R	0.34*	0.41**
	P	0.002	0.001
Education	R	0.13	0.14
	P	0.034*	0.24
Residence	R	.179 *	-
	P	.036	-

## Discussion

This study aimed to compare the effect of mobile-based education versus booklet-based education on mothers' knowledge and practice towards their children with bronchial asthma.

The finding of the current study revealed that cold illness, passive smoking, air pollution, sports, dust mites were the most common triggers in the current study among the mobile-based education and booklet-based education groups. These results are similar to the findings of the study done by **Tareq et al., (2020)** who

studied "Compliance of Egyptian Mothers to Asthma Controllers" and found that the most common asthma triggers among the studied patients were stress, cold illness, air pollution, sports, clutter, and gasoline.

Similarly, this result is corresponding with **Mersal & El-Awady, (2018)** who conducted a study at Zagazig city entitled "Evaluation of bronchial asthma educational package on asthma self-management among school-age children " and reported that, the most common triggers were: cold and flu, exhausting fumes, cigarette smoke, running, being angry, feeling

unhappy, and feathers from birds. Also, this finding is in harmony with **Ritz et al., (2018)** who carried out a study to assess perceived triggers of asthma and showed that air pollution/irritants, infections, animal allergens, climate-related triggers, and house dust were the most common triggers. Moreover, this finding is compatible with **Stridsman et al., (2017)** who conducted a study entitled "Asthma in adolescence affects daily life and school attendance" and found that poor air quality, poorly cleaned environment, allergens, strong fragrance, rebuilding projects, physical education, and stress were the most common triggers.

The results of the current study indicated that the main source of obtaining information among the studied mothers in mobile-based education and booklet-based education groups was doctors. The results agree with **Kutrani et al., (2019)** who carried out a study in the United States and Libya about "Assessment of parents perception concerning children care" and similarly, **Havens & Schwartz, (2016)** who studied "Identification of parents' perceptions of antibiotic use for individualized community education" and reported that, health care providers was the reliable source in providing information.

The results of the current study highlighted that, mothers in mobile-based education groups showed an improvement in total level scores of knowledge compared to booklet-based education groups, with the majority becoming satisfactory one month after program implementation. From the researchers' point of view, this result reflects the positive effect of mobile-based education over booklet-based education and the effectiveness of this educational method can be attributed to ease of access to educational content in the shortest time.

These results agree with **Niloofar et al., (2019)**, who studied "Comparing the effects of mobile-based education and booklet-based education on Iranian mothers' perception" and found that, mobile-based education could significantly improve the knowledge in the experimental group. Also, these findings are in the same context with **Lee et al. (2017)** who conducted a study about "The effects of

smartphone-based nebulizer therapy education on mothers' knowledge and confidence of performance in caring for children with respiratory disease" and concluded that education through smartphone applications could significantly improve the knowledge of mothers of caring for children with respiratory disease.

Similarly, these findings go in accordance with **AlKlayb et al., (2017)** who carried out a study in Saudi Arabia entitled "Comparison of the effectiveness of a mobile phone-based education program in educating mothers as oral health providers"; and **Alqarni et al., (2018)** who conducted a study entitled "Efficacy of a self-designed mobile application to improve child dental health knowledge among mothers and mentioned that, mobile educational method had a positive effect on knowledge improvement in other childcare areas. On the other hand, the results of the current study disagree with **Javadi Larijani et al. (2020)**, who studied "Designing and assessing the effectiveness of education through mobile application on knowledge, performance, and satisfaction of parents of children with renal disease" and found that, the knowledge of mothers of children with the renal disease did not improve within six weeks after education through a mobile application.

The results of the present study revealed that, there was a significant difference between the mobile-based education and booklet-based education groups of the studied mothers' total score of practices regarding bronchial asthma management one month after program implementation ( $p < 0.001$ ). From the researchers' point of view, the results of the effectiveness of this educational method might be attributed to the availability of educational content with no time and place constraints.

These results are consistent with **Ning et al., (2019)** who studied "An app-based intervention for caregivers to prevent unintentional injury among preschoolers" and found that there was a significant improvement in the practice of preschool children caregivers in preventing injury after an app-based education. Also, this finding is in harmony with **Roberts et al., (2019)** who studied "Mobile technology-based safety behavior change

intervention for parents" and reported that there was improving of mothers' practice in mobile-based educational interventions. Also, the results of the current study agree with the study conducted by **Christakis et al., (2012)**, who found that the use of an interactive website was effective in significantly improving the practice of mothers. The same result was reported by **Olivia Kim et al., (2019)**, who studied "Smartphone-based prenatal education for mothers with preterm birth risk factors" and found that mobile-based educational methods played an important role in raising mothers' practice about preterm birth risk factors. Moreover, this finding is coincided with **Han et al., (2019)** who studied "Development and effects of a mobile application for safety incident prevention among hospitalized Korean children" and noticed improved awareness during mobile-based educational interventions.

Conversely, this finding is contradicting with **Feil et al. (2018)** who conducted a study entitled "A randomized study of a mobile behavioral parent training application" and showed that the intervention through the mobile phone application could not significantly improve the behavior of mothers. Also, the result of the current study disagrees with **Kenyon et al. (2018)** who studied "Controller adherence following hospital discharge in high-risk children: A pilot randomized trial of text message reminders: and reported that, no significant difference in parental adherence to inhaled corticosteroid therapy in children with asthma after sending text messages compared with that of controls, which might be due to the lack of using audio-visual content and smaller sample size compared with the present study.

The results of the current study indicated that, there was a statistically significant correlation between total knowledge and self-management. It can be explained by the fact that mothers are uninterested in their treatment and require illness information, encouragement to ask questions, and general listening to and appreciating the patient's perspective on the disease. These results agree with the findings of the study done by **Sin et al., (2015)**, who studied in African American adolescents with asthma "Relationships of asthma knowledge, self-management, and social support" and

showed that asthma knowledge had a significant correlation with asthma self-management behaviors.

The results of the current study revealed that a statistically significant negative correlation between a mother's management score and disease duration. This result can be explained by that poor management of mothers regarding the care of asthmatic children may lead to an increase in the disease duration. This result is in the same line with **Tareq et al., (2020)** who found that there was an association between mothers' management and duration of disease among their asthmatic children

The results of the current study displayed statistically significant negative correlations between total knowledge and child's school absenteeism days and negative correlations between Self-management percentage score and child's school absenteeism days. From the researchers' point of view, it can be explained that inadequate knowledge and practice may be associated with and causes an increase in child's school absenteeism days. Similarly, **Tareq et al., (2020)** reported that a significant correlations was detected between total knowledge, management, and child's school absenteeism

This study showed that, there was a statistically significant correlation between total knowledge and mothers' occupation. It can be explained that mother who is working may be busy and not have enough time to gain information regarding the disease of their children. These results disagree with **Coelho et al., (2018)**, who carried out a study about "Curricular intervention increases adolescents' knowledge about asthma" and found no association between mother's occupation and knowledge level.

Results of the current study revealed that, there was a statistically significant correlation was detected between total knowledge and mothers' education. This finding is in agreement with **Abdalla, (2017)**, who conducted a study in South of Gezira about "Knowledge, Attitude and Practices of Parents of Asthmatic Children about Asthma in Elwehda village" and concluded that the higher the level of education of mothers leads to increase in knowledge of symptoms. In

addition, the results of the present study match with **McCorkle, (2015)** who studied the relationships of self-efficacy of self-management of asthma and asthma self-management knowledge and stated that socioeconomic status and level of education markedly affects how patients take their treatment.

This study revealed that there was a statistically significant correlation between total knowledge and their residence scores. This finding is compatible with **McCorkle, (2015)**, who found that, rural residents had significantly associated with mothers' knowledge about asthma.

### Conclusion

Based on the findings of the current study, it can be concluded that, mobile-based education was more effective in improving mothers' knowledge and practice about bronchial asthma compared to booklet-based education.

### Recommendations

**In light of the current study results, the following recommendations are proposed:**

- The continuous health education program should be provided to improve knowledge and practices for mothers of asthmatic children.
- Replication of the current study on a larger probability sample is recommended for generalized results.
- A simplified illustrated booklet regarding asthma should be available to mothers as a reference.
- Pediatric nurses as health care providers can use mobile-based educational methods for mothers of asthmatic children to promote their health.
- Community health nurses can use mobile-based educational methods for different groups of society to promote health in various fields of community problems.
- In today's society, the use of a mobile phone is advisable, because mobile as the educational method can cover a large number of learners from different groups

in society and health care providers can use it to promote health in various fields.

### References

- Abdalla W. A. M. A. (2017):** Knowledge, Attitude and Practices of Parents of Asthmatic Children about Asthma in Elwehda village in South of Gezira Locality, Gezira State, Sudan (Doctoral dissertation, University of Gezira).
- Al Motlaq M. and Sellick K., (2011):** Development and validation of an asthma knowledge test for children 8–10 years of age. *Child: Care, health and development*; 37(1): 123- 128. 20.
- Alavinezhad A. and Boskabady M., (2018):** The prevalence of asthma and related symptoms in Middle East countries. *The Clinical Respiratory Journal*, 12 (3): 865-877.
- AlKlayb S. A., Assery, M. K., AlQahtani, A., AlAnazi, M., and Pani, S. C., (2017):** Comparison of the effectiveness of a mobile phone-based education program in educating mothers as oral health providers in two regions of Saudi Arabia. *Journal of International Society of Preventive & Community Dentistry*, 7(3), 110–115 [https://doi.org/10.4103/jispcd.JISPCD\\_95\\_](https://doi.org/10.4103/jispcd.JISPCD_95_)
- Alqarni A. A., Alfaihi H. M., Aseeri N. A., Gadah T., & Togoo R. A. (2018):** Efficacy of a self-designed mobile application to improve child dental health knowledge among parents, *Journal of International Society of Preventive & Community Dentistry*, 8(5), 424–430 [https:// doi. org/ 10. 4103/ jispcd. JISPCD\\_195\\_18](https://doi.org/10.4103/jispcd.JISPCD_195_18).
- Alrafiaah A. S., Alqarny M. H., Alkubedan H. Y., AlQueflie S., & Omair A. (2017):** Are the Saudi parents aware of the antibiotic role in upper respiratory tract infections in children? *Journal of Infection and Public Health*, 10(5), 579–585 [https:// doi. org/ 10.1016/ j.jiph.2017.01.023](https://doi.org/10.1016/j.jiph.2017.01.023).
- Alreshidi N. M. (2015):** The impact of a school-based, nurse-delivered asthma health education program on quality of life, knowledge, and attitudes of Saudi children with asthma (Doctoral dissertation, University of Salford).

- CDC National Center for Health Statistics (2018): Asthma Prevalence, Health Care Use, and Mortality: the United States**, [cited]; Available from: <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/asthma03-05/asthma03-05.htm#fig1>.
- Christakis D. A., Garrison M. M., Lozano P., Meischke H., Zhou C., and Zimmerman, F. J. (2012):** Improving parental adherence with asthma treatment guidelines: A randomized controlled trial of an interactive website, *Academic Pediatrics*, 12(4), 302–311 <https://doi.org/10.1016/j.acap.2012.03.006>.
- Clarke J., Bourn S. and Skoufalos A., (2017):** An Innovative Approach to Health Care Delivery for Patients with Chronic Conditions. *Population Health Management*, 20 (1): 23-30.
- Coelho A. C. C., Machado C., Oliveira T. S., Santos T. N. N., Cruz Á. A. and Souza A., (2018):** Curricular intervention increases adolescents' knowledge about asthma: a randomized trial. *Jornal de Pediatria (Versão em Português)*, 94(3): 325-334.
- Creswell, J. W. (2012):** Educational research: Planning, conducting, and evaluating quantitative and qualitative research (4th Ed.). Boston, MA: Pearson.
- Earle B. and Weiss M. D., (2017):** *Bronchial Asthma Mechanism and Therapeutics*. 3rd ed. New York: Little Brown Company, p 11-13.
- Eskandari Z., Alipoor A., and Ramezankhani A. (2019):** The effect of mobile-based education on knowledge and behavior of pregnant mothers regarding risk factors signs in pregnancy, *Journal of Health in the Field*, 6(4), 20–27 <https://doi.org/10.22037/jhf.v6i4.23299> Persian.
- Feil E. G., Sprengelmeyer, P. G., and Leve, C. (2018):** A randomized study of a mobile behavioral parent training application, *Telemedicine, and E-Health*, 24(6), 457–463 <https://doi.org/10.1089/tmj.2017.0137>.
- Gajanan G., Padbidri V. S. and Chaudhury A., (2016):** Assessment of Knowledge and Attitude of Parents towards the Allergy and Bronchial Asthma in Their Children. *International Journal of Medicine and Public Health*; 6(3): 121-125.
- Han J., Oh, W. O., Park, I. T., and Lee, A. (2019):** Development and effects of a mobile application for safety incident prevention among hospitalized Korean children: A pilot study of feasibility and acceptability. *Journal of Pediatric Nursing*, 51, 69–76 <https://doi.org/10.1016/j.pedn.2019.09.022>.
- Havens L., and Schwartz M., (2016):** Identification of parents' perceptions of antibiotic use for individualized community education. *Global Pediatric Health*, 3, 1–7 <https://doi.org/10.1177/2333794x16654067>.
- Javadi Larijani F., Zolfaghari M., Mohammadi A., and Javadi Larijani, A. A., (2020):** Designing and assessing the effectiveness of education through mobile application on knowledge, performance, and satisfaction of parents of children with renal disease. *Journal of Pediatric Nephrology*, 8(4), 1–4 <https://doi.org/10.22037/jpn.v8i4.31840>
- Kenyon C. C., Gruschow S. M., Quarshie W. O., Griffis H., Leach M. C., Zorc J. J. and Feudtner C., (2018):** Controller adherence following hospital discharge in high-risk children: A pilot randomized trial of text message reminders. *Journal of Asthma*, 56 (1), 95–103 <https://doi.org/10.1080/02770903.2018.1424195>
- Kutrani H., Elhashmi H. A. S., Adam H. M., and Atiyah A. A. A. (2019):** Assessment of parents perception concerning children's antibiotic use by PAPA scale. *IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)*, 14(2), 20–26 <https://doi.org/10.9790/3008-1402.022.026>
- Lee J. M., Kim S. J., and Min H. Y., (2017):** The effects of smartphone-based nebulizer therapy education on parents' knowledge and confidence of performance in caring for children with respiratory disease, *Journal of Pediatric Nursing*, 36, 13–19 <https://doi.org/10.1016/j.pedn.04.012>.

- Mancuso C.A., Sayles W., and Allegrante, J.P., (2009):** Development and testing of the asthma self-management questionnaire. *Annals of Allergy, Asthma & Immunology*; 102(4): 294-302.
- McCorkle L., S., (2015):** A study of the relationships of self-efficacy of self-management of asthma and asthma self-management knowledge (Doctoral dissertation, Texas A&M University).
- Mersal F., A., and El-Awady S., (2018):** Evaluation of bronchial asthma educational package on asthma self-management among school-age children based on Orem's self-care model in Zagazig city.
- Niloofer T., Zahra E., Rasoul T., Zahra A., Houman H. and Hamid K., (2019):** Comparing the effects of mobile-based education and booklet-based education on Iranian mothers' perception on antibiotics: a quasi-experimental study *Journal of Pediatric Nursing* 61 (2020) 122–129
- Ning P., Cheng P., Schwebel D. C., Yang Y., Yu R., Deng J., Hu G., (2019):** An app-based intervention for caregivers to prevent unintentional injury among preschoolers: Cluster randomized controlled trial, *JMIR mHealth, and uHealth*, 7(8), Article e13519 <https://doi.org/10.2196/13519>.
- Olivia Kim U., Barnekow K., Ahmed S. I., Dreier S., Jones C., Taylor M. and Basir M. A. (2019):** Smartphone-based prenatal education for parents with preterm birth risk factors. *Patient Education and Counseling*, 102(4), 701–708 <https://doi.org/10.1016/j.pec.2018.10.024>
- Pearson W. S., Goates S. A., Harrykissoon S. D. and Miller S. A., (2018):** State-based Medicaid costs for pediatric asthma emergency department visits. *Prev Chronic Dis*;11:E108. *Pediatric Allergy and Immunology*; 10(2).
- Ritz T., Kullowatz A., Kannies F., Dahme B. and Magnussen H., (2018):** Perceived triggers of asthma: evaluation of a German version of the Asthma Trigger Inventory, *Respiratory medicine*; 102(3): 390-398.
- Roberts K. J., McAdams R. J., Kristel O. V., Szymanski A. M., & McKenzie, L. B., (2019):** Qualitative and quantitative evaluation of the make safe happen app: Mobile technology-based safety behavior change intervention for parents, *JMIR Pediatrics and Parenting*, 2(1), Article e12022 <https://doi.org/10.2196/12022>.
- Sarabadani J., Dehghani Tafti M., Labafchi A., & Javan Rashid, A., (2019):** Comparing training of " lasers in dentistry" by two mobile-based and booklet approach training methods in dentistry students, *Journal of Mashhad Dental School*, 43(3), 287–294 <https://doi.org/10.22038/JMDS.2019.13687> (Persian).
- Sin M. K., Kang D.H., and Weaver M., (2015):** Relationships of asthma knowledge, self-management, and social support in African American adolescents with asthma. *International journal of nursing studies*; 42(3): 307-313.
- Stridsman C., Dahlberg E., Zandén K. and Hedman L., (2017):** Asthma in adolescence affects daily life and school attendance—Two cross-sectional population-based studies 10 years apart. *Nursing open*; 4(3): 143- 148.
- Tareq H., Mohamed A., and Khalid A., (2020):** Compliance of Egyptian Mothers to Asthma Controllers, Volume 26 Issue 3.
- Tarraf H., Aydin O. and Mungan D., (2018):** Prevalence of asthma among the adult general population of five Middle Eastern countries: results of the SNAPSHOT program. *BMC Pulmonary Medicine*, 18 (1): 68-73.
- Zeinali F., Yousefi N., and Peiravian, F., (2016):** Parental self-medication with antibiotics in Iran, *Journal of Pharmacoeconomics and Pharmaceutical Management*, 2(3/4), 60–63 <https://jppm.tums.ac.ir/index.php/jppm/article/view/25>.