The Effect of Educational and Modifying Intervention on Asthma Control among Adolescents: a Randomized Clinical Trial

Soheila Zarei[1], Leila Valizadeh[1*], Nemat Bilan[2]

[1] *Department of Pediatric Nursing, Faculty of Nursing and Midwifery, Tabriz University of Medical Sciences, Tabriz, Iran*
[2] *Department of Pediatric, Faculty of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran*

ARTICLE INFO	ABSTRACT
Article type: Original Article *Article History:* Received: 6 Jun. 2012 Accepted: 15 July. 2012 ePublished: 26 Feb. 2013 *Keywords:* Clinical trial Asthma Adolescent Triggers Education Modification	*Introduction:* Controlling over allergens and environmental irritants is one of the essential elements of controlling asthma. Asthma control in adolescents is a challenge. The current study was performed with the goal of investigating the effect of an educational and modifying intervention about asthma triggers on asthma control among adolescents. *Methods:* The current study was a randomized clinical trial. 60 adolescents of 12-18 years of age participated in this study. The participants were randomly divided into the two control and experimental groups. The Juniper's Asthma Control Questionnaire was completed by the adolescents before and 5 weeks after the intervention. Training sessions, planning for modification of asthma triggers and telephone follow-up were performed in the experimental group. *Results:* There was a significant difference between the asthma control score before and after the intervention in the control and experimental groups. The asthma control status improved in the experimental group. In other words, the educational interventions to modify asthma triggers were effective in improving asthma control. *Conclusion:* Since this intervention method can improve the asthma control in adolescents, it is recommended that adolescents directly participate in such programs about asthma triggers and the education become less parent-centred. Moreover, the necessity of such an intervention in clinics and outpatient clinics is emphasized.

Introduction

Asthma is the most common chronic illness during childhood and adolescence world-wide.[1,2] the prevalence of this illness in children and adolescents around the world is about 5-10%.[3] It is the first cause for absence from school and third cause for hospitalization of children under the age of 15.[1] In Iran, the prevalence of asthma in children has been reported to be 2.7-35.4% and the mean prevalence of symptoms of asthma has been reported to be 13.14%.[4]Regarding the prevalence of asthma Iran is considered among countries with moderate rate, but the important issue is that this is the most prevalent chronic illness in the country.[5] The highest rate of mortality of asthma occurs in children between the ages 11-17 years.[1] In adolescents, in addition to diagnosis, acceptance of the disease, and adherence to treatment is very weak, and this is why they are considered as one of the high-risk groups.[6]

Although there has been much progress in the management of asthma, still the rate of illness, mortality, absence from school and society, poor sport performance, frequent visits to the emergency room, and hospitalization of adolescents have increased. This shows a poor control of the illness.[2] Parents are less capable of managing asthma

in adolescents and expect them to be more responsible for the management of their disease. However, adolescents' incompetence in adherence to treatment has been frequently reported. Poor adherence to treatment in adolescents has been attributed to the development of the feeling of invincibility and their preference to maintain a feeling of normality.[7]

International guidelines on asthma management have emphasized that one of the primary goals of asthma treatment is asthma control. Control of asthma means to minimize the day and night symptoms of asthma and reduce bronchospasm and minimize the use of short-acting medications against bronchospasm. It also includes the reduction of the risk of life-threatening symptoms and morbidity of asthma over a long period of time.[3] The National Asthma Education and Prevention Program guidelines 2007 emphasizes four main components of asthma control, which consist of (1) assessment and monitoring of asthma severity, (2) medication, (3) environmental triggers, and (4) training patients and their families.[8] Control of allergens and environmental triggers is one of the essential components of asthma control and the method of treatment is based it, which necessitates the identification of allergens and training of patients and their families.[9] Therefore, asthma management requires certain skills in several aspects, which consist of symptoms detection, identification and avoidance of asthma triggers, correct and consistent use of peak flow meterand appropriate use of medication.[10]

Different triggers can irritate and cause airway obstruction and asthma. These triggers differ from one person to another.[11]The most important factor in diagnosis and control of asthma is the identification of asthma triggers. Nevertheless, little attention has been directed to developing systematic methods of identifying the types of triggers.[12]The appropriate management of asthma and

reduction of the risk of environmental triggers can reduce the frequency and severity of asthma symptoms.[13]

In addition to identification of asthma triggers, which is an essential factor in comprehensive asthma management programs in asthma guidelines,[8] self-care is also an important factor in asthma control and the most effective method of controlling this disease is through self-control programs.[1] Training is an important component of care program for asthma patients. For the long-term control of the illness, in addition to medication and anti-allergy treatment, avoidance of asthma triggers is necessary.[14] Therefore, educational and modifying interventions on asthma triggers must be implemented separately for each individual. This can improve asthma control.[15-17]

Effective training of patients plays an important role in the improvement of self-care skills and asthma control.[10] The effect of class based educational interventions on knowledge, attitude, self-efficacy, quality of life and self-care of adolescent asthma patients has been studied.[6,18,19] Other studies investigated the effect of peer education programs on self-efficacy, attitude and quality of life of adolescents.[20,21] The content of this training has been specifically in school and involved no follow up.

In a systematic review in studies from 1998 to 2009, from the 50 clinical trials only 2 studies investigated environmental changes (avoidance of asthma triggers), neither of which studied adolescents.[22] One of these studies investigated the effects of education of mothers with a history of asthma and infants at risk of asthma, and the prevalence of asthma during the first two years of life of infants.[23] The second intervention investigated the effects of environmental intervention with home visits on infants with asthma.[24]

A study was conducted on the importance of home visits by nurses in the investigation of infants with problematic severe asthma. The goal of this study was to evaluate and identify potentially modifiable factors in

asthmatic children.[25]Another study was performed on the quality of life of children of 7-15 years of age before and after training of the use of the peak flow meter in clinics; the dates were obtained from parents.[26]

An overview of published studies in respect to asthma training programs for children showed that most subjects of the interventions consisted of children of different ages and not just adolescents. Most of these interventions were school-based, through peers, or with the participation of the parents but placed no emphasis on asthma triggers. Most interventions were educational, and contradictory results were reported for their outcome. Individual modification of triggers followed by telephone support has not been considered in studies on asthma in adolescents. The preferred approach in children has not been fully determined; however, there have been suggestions of withdrawal from parent-centred training of adolescents with asthma. Moreover, in asthma control studies, criteria such as reduction of activity restrictions, the number of attacks, emergency room visits, hospitalization, number of days of absence from school and improvement in pulmonary function have been considered for the assessment of asthma control.[22,27,28] There are no before-after empirical studies with a control group available on educational interventions and with assessment of self-reporting asthma control in adolescents.

Nurses as medical team members have the most contacts with patients. Education is an important element of the treatment program, which increases knowledge and modifies the way of life and living environment of patients. Therefore, education is an important function of nurses. Furthermore, the lack of a research based on standard care in adolescents with asthma, and the growth and developmental needs of this period of life make such a study necessary.[29] Considering the importance of this issue, and the limited number of studies on identification and modification of asthma triggers in

adolescents in outpatient clinics in different countries and Iran, carrying out such a study seemed necessary. Therefore, the current study was undertaken with the goal of investigating the effect of educational and modifying intervention, in respect to asthma triggers, on asthma control in adolescents referring to pulmonary clinics.

Materials and methods

The current study was a randomized clinical trial. The study environment was pediatric pulmonary clinics and the Sheikh Alryys Clinic of Tabriz, Iran. The inclusion criteria of the study were adolescents of 12 to 18 years of age, diagnosed with asthma a year or more earlier, resident of Tabriz, moderate and severe asthma diagnosed by a physician and literacy. The exclusion criteria included other acute illnesses, gastroesophageal reflux, rhinitis, sinusitis and mental problems.

A two-part questionnaire was used for data collection. In addition to researcher-made demographic information questionnaire, the Juniper's Asthma Control Questionnaire (2000)[30] was also used, which are scored on a 0 to 6 point scale. Low scores show a better control of asthma. A written permission was obtained from the original editor of the tool in order to use it in the current study. It was translated and the accuracy of the translation was investigated and confirmed, in terms of the coordination between the English and Persian texts, by two people with a Master's degree in English, and two experts in the related field, who were familiar with the English language. Content validity was investigated by 10 nursing and medical professors and their comment were applied. Reliability was calculated using Cronbach's alpha in 10 adolescents with asthma. Cronbach's alpha for the questionnaire was 0.82.
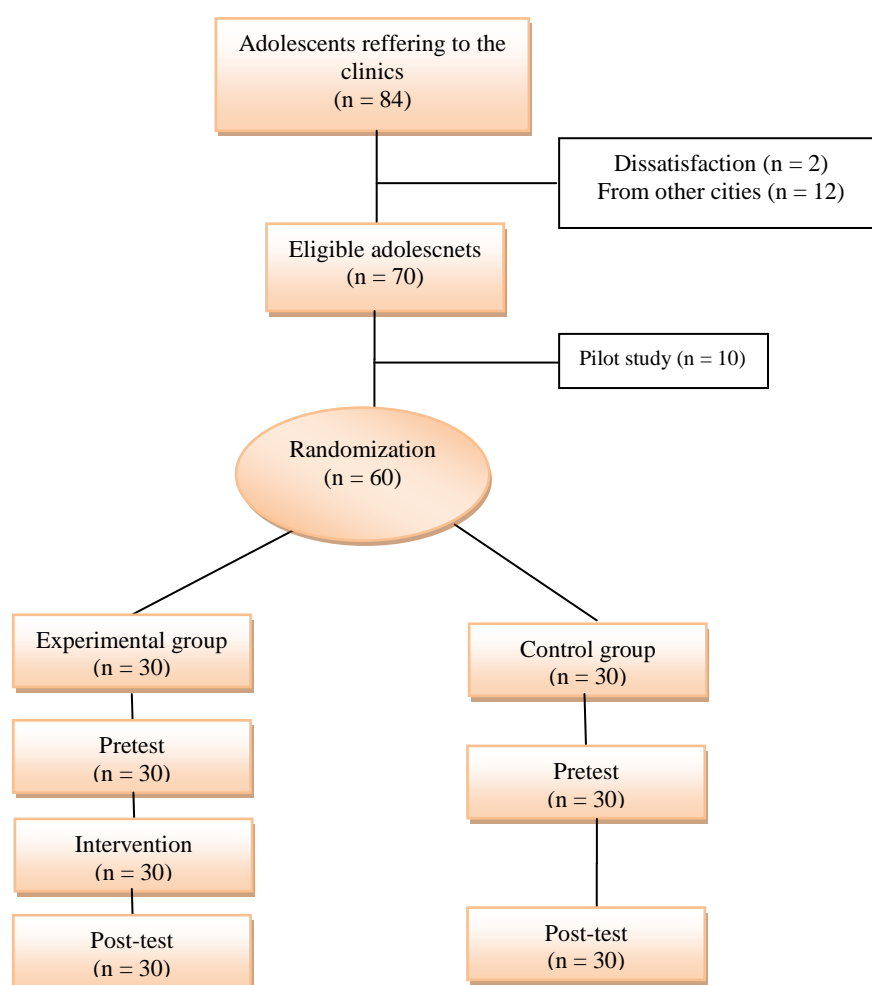
The researcher obtained the necessary licenses from the Research Council and the Ethics Committee of Tabriz University of Medical Sciences and Tabriz Health Care

Services (code 9051) confirmed the study and an introduction letter from Tabriz University of Medical Sciences International Branch of Aras was sent to the head of the pulmonary clinics. The sampling was done during July to August 2011. The researcher chose the participants from pulmonary clinics by considering the inclusion criteria of the study and after explaining the study and its goal to the adolescents and their parents. The confidentiality of the information was explained and informed consent was obtained from the adolescents and their parents who wanted to participate in the study.

The pilot study was conducted on 10 eligible adolescents with asthma referring to the above mentioned clinics. In the asthma control variables, the mean and standard deviation were calculated as -0.55 ± 0.68 in the control group and -1.86 ± 0.68 in the experimental group. Considering the power as 0.8, the sample size was determined 15 participants for each group. In order to increase the validity of the findings and considering the potential loss, this was increased to 30 participants. 60 adolescents participated in the current study. Figure 1 shows the study method.

Data collection was conducted using the questionnaire in the control and experimental groups before and 5 weeks after intervention. First, the adolescents completed the demographic questionnaire. Then, for one week, the Asthma Control Questionnaire was daily completed at home. After the

Figure 1. Study method flowchart

completion of data collection in the pre-intervention period, the educational intervention was performed in the experimental group, using the asthmatic children booklet. Considering the age range of the participants, they were placed into two groups of 12-15 and 16-18 years of age and the educational sessions were designed based on it. Delay in or failure to come to the sessions at the determined time was expected; therefore, this was controlled through phone call reminders by the researcher.

The intervention consisted of four sessions on the asthma triggers and their types, methods of determining triggers, and methods of control and avoidance of triggers through lectures, discussion, and questions and answers using slides and educational booklets. During the additional session, the asthma triggers of each adolescent in the experimental group were individually identified and the necessary measures to control it were planned with the adolescents' partnership. During each session, there was a 20-30 minute lecture and 10-15 minutes of discussion and answering of questions. Each adolescent of the experimental group was asked to identify, the triggers present in their living place, outside their home and in their school based on the triggers identification form. In the individual session, the necessary recommendations for the modification and controlling of these triggers were given. After the culmination of the sessions, two follow up phone calls were made for the implementation of the modification program. Four weeks after the intervention, the questionnaire was completed again.

The questionnaire has seven items. Responses for first item included (Never, once, 2-3 times, 4-5 times, 6-7 times, many times, was awake all night), second item(No symptoms, very mild, mild, moderate, moderately severe, severe, extremely severe),third item(No limitations, very low, low, medium, high, very high, completely limited), 4th item(No shortness of breath, very low, low, medium, relatively high, high, very high), 5th item(Never, rarely, low, medium, occasionally, most of the time, all the time), 6th item(Zero, 1-2 puff, 3-4 puffs, 5-8, 9-12, 13-16, more than 16 puffs) and 7th(< 50%, 50-59%, 60-69%, 70-79%, 80-89%, 90-95%, >95%). In all items, the score ranged from 0 to 6.

Other participants of this study had routine treatment and interventions, and were given the educational booklet, identification form. Modification methods of asthma triggers were explained to them after the study. The data were recorded in SPSS software version 13 (SPSS Inc., Chicago, IL, USA) and the results were extracted using descriptive statistics, Student's t-test, and chi-square test.

Results

The demographic characteristics showed no significant difference between the control and experimental groups (Table1). Asthma control was significantly better in adolescents in intervention group (Table 2). A statistically significant difference between the amounts of change in asthma control of the two groups was found, whereas a worsening asthma control was observed in the control group (Table 3). In Asthma Control Questionnaire, lower scores represent a better state. In the current study the changes showed that the intervention was effective in the improvement of asthma control.

Discussion

Asthma control plays an important role in the management of asthma. One of the reasons of failure to control over asthma can be related to lack of knowledge of triggers and the failure to avoid them. Therefore, the current study was conducted in order to investigate the effects of educational and modifying interventions on asthma control in adolescents referring to pulmonary clinics of Tabriz, Iran in 2011. The current study showed that educational and modifying intervention on asthma triggers improved asthma control in adolescents. A significant difference between the amounts of change in

asthma in the two groups was observed in favour of experimental group. A sudden change in temperature, cold weather, occurred during the interval between the data collection before and after the intervention. This confounding factor caused a worsening of asthma control in all subjects, but was clearly observed in the control group. The researchers believe that this further proves the importance of educational and modifying interventions for preventing the worsening of asthma control status in adolescents.

Table 1. Distribution of demographic information of adolescents in control and experimental groups

	Control Group N (%)	experimental Group N (%)	P*
Gender			0.30
Girl	16 (53.3)	12(40)	
Boy	14(46.7)	18 (60)	
Education level			0. 51
Elementary	3 (10)	6 (20)	
Guidance	15 (50)	13 (43.3)	
High School	12 (40)	11 (36.7)	
History of allergies in adolescents			1
Yes	21 (70)	21 (70)	
No	9 (30)	9 (30)	
History of allergies in the family			0.59
Yes	12 (40)	10 (33.3)	
No	18 (60)	20 (66.7)	
History of asthma in the family			0.39
Yes	7 (23.3)	10 (33.3)	
No	23 (76.7)	20 (66.7)	
Absence from school			0.78
Yes	9 (30)	10 (33)	
No	21 (70)	20 (66.7)	
Age[†]	14.4 (2.4)	13.8 (2.3)	0.33
Duration of asthma[†] (years)	4.0 (3.0)	4.43 (3.2)	0.65
Number of days of absence from[†] school	1.70 (0.46)	1.66 (0.47)	0.78

* Valid percentage

**For age, duration of asthma and number of days of absence from school the t-test and for other variables the χ^2 test was used.

[†] Values are expressed as Mean (SD)

Expert panel report 3 (2007), it was stated that maximum asthma monitoring and control should be done, especially inpatients. With persistent moderate and severe asthma.[14] This control program may improve the relationship between the patient and care givers, and thus cause an increase in knowledge of the patient on the illness and asthma control. The most important issues of basic and baseline principles of asthma control are within the society. The most important issues are training health care providers, planning training programs for asthma (to patients and health care providers), use of outpatient follow-up care and long-term control of the illness instead of occasionally acute care. Nurses play an important role in gaining these goals. Nurses, who work in hospitals, clinics, schools, or doctors' offices, should use the most recent information to educated patients based on the diagnosis, influential factors, age,

education level, and cultural background of patients in order to prevent the occurrence of severe and dangerous asthma attacks.

Identification of triggers, which cause the onset of asthma symptoms in children, is the most important factor in the diagnosis and control of the disease.[12] Asthma triggers are factors, which cause the onset of the symptoms of the disease. Each individual with asthma can have different triggers.[31] Moreover, behaviour change in order to reduce the exposure of children to

Table 2. Asthma control (weekly) in adolescents of control and experimental groups' Pre-Post intervention

	Control Group				Experimental Group			
	Pre		Post		Pre		Post	
	Mean(SD)	CI (95%)	Mean(SD)	CI (95%)	Mean(SD)	CI (95%)	Mean(SD)	CI (95%)
1. How often were you woken by your asthma during the night?	0.65 (1.08)	0.25–1.06	1.22 (0.92)	0.87–1.56	0.61 (0.96)	0.25–0.97	0.21 (0.46)	0.04–0.39
2. How bad were your asthma symptoms when you woke up this morning?	1.11 (1.34)	0.61–1.61	1.40 (1.17)	0.96–1.84	0.90 (1.03)	0.51–1.28	0.09 (0.31)	-0.02–0.21
3. How limited were you in your activities today because of your asthma?	0.95(1.07)	0.55–1.35	2.56 (1.16)	2.13–3	1 (0.91)	0.66–1.34	0.20 (0.46)	0.02–0.38
4. How much shortness of breath did you experience today?	0.98 (1.13)	0.55–1.14	2.45 (1.20)	2–2.90	1.01 (1.27)	0.54–1.49	0.14 (0.34)	0.01–0.27
5. How much of the time did you wheeze today?	0.89 (1.37)	0.38–1.40	1.31 (0.98)	1.29–1.68	0.69 (1.21)	0.23–1.15	0.06 (0.25)	-0.02–0.16
6. How many puffs of bronchodilator you have used in the past 24 hours?	1.66 (0.61)	1.43–1.89	1.73 (0.44)	1.56–1.90	1.60 (0.62)	1.63–1.83	1.60 (0.74)	0.78–1.33
7.FEV1in respirometer	0.83 (0.94)	0.47–1.18	1.23 (1.04)	0.84–1.62	1.33 (1.66)	0.71–1.95	0.6 (0.89)	0.26–0.93

In all items and in forced expiratory volume in 1 second (FEV1), the score ranged from 0 to 6.

Table 3. Comparison of asthma control and its changes Pre-Post intervention in the control and experimental groups

variable	Group	Time	Mean (SD)	CI (95%)[†]	P
Asthma control	Control	Pre	1.04 (0.72)	0.76–1.31	< 0.001
		Post	1.76 (0.81	1.46–2.07	
	Experimental	Pre	0.98 (0.63)	0.74–1.22	< 0.001
		Post	0.30 (0.34)	0.17–0.43	
Pre-post asthma control difference [*]	Control		0.72 (0.80)	0.42–1.03	< 0.001
	Experimental		-0.67 (0.57)	-0.89--0.46	

[*] In the Asthma Control Questionnaire lower scores represent a better state. [†]Confidence Interval

these triggers is an essential factor in controlling asthma.[14]

Empirical studies, with the before-after design and control group, on educational and modifying intervention of asthma triggers and assessment of asthma control by the Asthma Control Questionnaire were not available. Therefore, there was no comparable study to confirm or contradict the findings.

A review by Boyd et al. was conducted on 38 studies with a total of 7843 children and different subjects of educational interventions by professionals including nurses and health educators. This study showed that in many studies education causes a decrease in the number of emergency room visits and hospitalization in children and a one-quarter

reduction in the total number of emergency room visits and hospitalization.[27]

The results of the study by Shah et al., on the effect of a peer asthma education program on adolescents in grades 7 and 10, showed an increase in the mean pulmonary function score of both groups, but this was not due to the intervention. There was a significant decrease in the number days of absence from school in 10-year age students of the experimental group. However, the results for the grade-7 students were not significant.[21] The study by Watson et al. investigated the effect of interactive education of children and their families in small groups on asthma control after one year of follow-up. The results of this study showed a reduction in the number of emergency room visits and the use of oral steroids in addition to reduction in previous treatments. However, the increase in mean forced expiratory volume in 1 second (FEV1) after the intervention was not statistically significant.[28] The findings of the two studies, contrary to the current study, show a significant increase in the test (FEV1) in the experiment group.

The study by Butz et al., on the effect of an educational program by parents on rural children, showed a decrease in daily asthma symptoms in the experimental group.[32] In their study on the effect of a school based educational program on asthma symptoms, academic performance, and absence from school in children, Clark et al. showed a decrease in daily and night-time symptoms and absence from school.[33] In the study by Joseph et al., on the effect of internet-based self-management program of asthma in schools, a decrease was seen in daily and night-time asthma symptoms and days of absence from school.[34]

Magzamen et al. study, on a school-based asthma educational program in adolescents, showed a significant decrease in absence from school, number of emergency room visits and hospitalization after the intervention.[35] Furthermore, the study by Velsor-Friedrich et al., on the effect of school-based intervention on asthmatic children's self-care programs, showed no significant decrease in the number of days of absence from school, and also an increase in the number of emergency room visits in the experimental group in comparison to the control group.[36]

It is recommended that in future studies, the participants' home be visited for the identification and follow-up of modifications of asthma triggers, and be compared in terms of cost-effectiveness. The results of the current study can be used by planners and policy makers of the health care system in order to improve asthma control in adolescents and decrease emergency room visits and hospitalisation. Self-reporting may not represent the complete truth, which is due to the characteristics of questionnaire based measures. At the beginning of the study the study goals were explained in order to solve this issue. Moreover, the sudden change of weather, becoming cold, was an inevitable factor in this study. It is recommended that future studies be conducted in other seasons.

Conclusion

In the current study there was an improvement in the asthma control status of experimental group while in the control group the status worsened. The educational and modifying intervention to prevent asthma triggers was effective in the improvement of asthma control in adolescents. Therefore, it is recommended that adolescents directly participate in such programs, and that the education become less parent-centred. Moreover, the necessity of such an intervention in clinics and outpatient clinics is emphasized.

Ethical issues

None to be declared.

Conflict of interest

The authors declare no conflict of interest in this study.

Acknowledgments

We would like to thank the authorities of and our colleagues at the Sheikh Alryys Clinic of Tabriz, Iran and children's pulmonary clinic for their help and cooperation. We would also like to thank the participants and all who helped to conduct this study.

References

1. Hockenberry MJ, Wilson D. Wong's essentials of pediatric nursing. 8th ed. Philadelphia: Mosby/Elsevier; 2009.
2. Orrell-Valente JK, Jarlsberg LG, Hill LG, Cabana MD. At what age do children start taking daily asthma medicines on their own? Pediatrics 2008; 122(6): e1186-92.
3. Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention [Internet]. Canada: Global Initiative for Asthma; 2005 [cited 2012 may 12]. Available from: http://www. ginasthma.org/pdf/archived/GINAWorkshop05Clean.pdf/
4. Heidarnia MA, Entezari A, Moein M, Mehrabi Y, Pourpak Z. Prevalence of asthma symptom in Iran: a meta-analysis. Pejouhesh 2007; 31(3): 217-25.
5. Arash M, Shogi M, Tajvidi M. Assessing effects of asthma on patients' functional status and life. Journal of Urmia Nursing and Midwifery Faculty 2010; 8(1).
6. Fontamillas Shaw S, Hopp Marshak H, Dyjack DT, Neish CM. Effects of a classroom-based asthma education curriculum on asthma knowledge, attitudes, self-efficacy, quality of life, and self-management behaviors among adolescents. americanjournal of health education 2005; 36(3): 140-5.
7. Rhee H, Belyea MJ, Ciurzynski S, Brasch J. Barriers to asthma self-management in adolescents: Relationships to psychosocial factors. PediatrPulmonol 2009; 44(2): 183-91.
8. National Heart LaBI. Guidelines for the diagnosis and management of asthma (EPR-3) [Internet]. USA: National Heart LaBI; 2007 [cited 2012 May 14]. Available from: http://www .nhlbi. nih. gov/ guidelines/ asthma/
9. Williams PV, Schatz M, Leung DY. The Role of Allergens in Asthma. Paediatrics for parents 2009; 25(3-4): 22-4.
10. Bailey W, Apter AJ. What do patients need to know about their asthma? [Internet]. 2010[cited 2012 Jun 25]. Available from: http:// www. uptodate. com/ contents/ what-do-patients-need-to-know-about-their-asthma/
11. Middleton E. Allergy: principles & practice. 5th ed. Philadelphia: Mosby; 1998.
12. Wood BL, Cheah PA, Lim J, Ritz T, Miller BD, Stern T, Ballow M. Reliability and validity of the Asthma Trigger Inventory applied to a pediatric population. J PediatrPsychol 2007; 32(5): 552-60.
13. Evans R 3rd, Gergen PJ, Mitchell H, Kattan M, Kercsmar C, Crain E, Anderson J, Eggleston P, Malveaux FJ, Wedner HJ. A randomized clinical trial to reduce asthma morbidity among inner-city children: results of the National Cooperative Inner-City Asthma Study. J Pediatr 1999; 135(3): 332-8.
14. O'Connell Smeltzer SC, Bare BG, Hinkle JL, Cheever KH. Brunner and Suddarth's textbook of medical surgical nursing. 12th ed. Philadelphia: Lippincott Williams & Wilkins; 2009.
15. Alaniz KL, Nordstrand J. Camp Superteens. An asthma education program for adolescents. MCN Am J Matern Child Nurs 1999; 24(3): 133-7.
16. McGhan SL, Wells HM, Befus AD. The "Roaring Adventures of Puff": a childhood asthma education program. J Pediatr Health Care 1998; 12(4): 191-5.
17. Clark NM, Feldman CH, Evans D, Levison MJ, Wasilewski Y, Mellins RB. The impact of health education on frequency and cost of health care use by low income children with asthma. J Allergy Clin Immunol 1986; 78(1 Pt 1): 108-15.
18. Zografos KN. The Effects of an adolescent asthma education intervention on knowledge, intention, behavior, self-efficacy and self-consciousness [Dissertation]. Novato: Loma Linda University; 2007.
19. Pichora D. A program evaluation: Knowledge, attitudes, self-efficacy and quality of life in adolescents with asthma [Master Thesis]. Kingston: School of Nursing, Queens University Kingston Canada; 1997.
20. Gibson PG, Shah S, Mamoon HA. Peer-led asthma education for adolescents: impact evaluation. J Adolesc Health 1998; 22(1): 66-72.
21. Shah S, Peat JK, Mazurski EJ, Wang H, Sindhusake D, Bruce C, Henry RL, Gibson PG. Effect of peer led programme for asthma education in adolescents: cluster randomised controlled trial. BMJ 2001; 322(7286): 583-5.
22. Clark NM, Griffiths C, Keteyian SR, Partridge MR. Educational and behavioral interventions for asthma: who achieves which outcomes? A systematic review. J Asthma Allergy 2010; 3: 187-97.
23. Becker A, Watson W, Ferguson A, Dimich-Ward H, Chan-Yeung M. The Canadian asthma primary prevention study: outcomes at 2 years of age. J Allergy Clin Immunol 2004; 113(4): 650-6.
24. Bryant-Stephens T, Li Y. Outcomes of a home-based environmental remediation for urban children

with asthma. J Natl Med Assoc 2008; 100(3): 306-16.

25. Bracken M, Fleming L, Hall P, Van Stiphout N, Bossley C, Biggart E, Wilson NM, Bush A. The importance of nurse-led home visits in the assessment of children with problematic asthma. Arch Dis Child 2009; 94(10): 780-4.

26. Heidarzade M, Mosaiebi Z, Movahedian M, Ronasian F, Mousavi GHA, Ghaffarpasand I, Izadi SH, Nazar E. Quality of life in asthmatic children before and after using peak-flow meter device. Journal of Gorgan University of Medical Sciences 2011; 12(4): 18-23. (Persian)

27. Boyd M, Lasserson TJ, McKean MC, Gibson PG, Ducharme FM, Haby M. Interventions for educating children who are at risk of asthma-related emergency department attendance. Cochrane Database Syst Rev 2009 ; (2): CD001290.

28. Watson WT, Gillespie C, Thomas N, Filuk SE, McColm J, Piwniuk MP, Becker AB. Small-group, interactive education and the effect on asthma control by children and their families. CMAJ 2009; 181(5): 257-63.

29. Thal WR. Use of standards of care by nurse practitioners in providing care to adolescents with asthma at an academic nurse managed primary care clinic [Dissertation]. Tucson: The University of Arizona; 2010.

30. Juniper EF, O'Byrne PM, Ferrie PJ, King DR, Roberts JN. Measuring asthma control. Clinic questionnaire or daily diary? Am J Respir Crit Care Med 2000; 162(4 Pt 1): 1330-4.

31. Manchin III J, Yeager Walker M, Curtis CH, Bazzle NM, Slemp C, Barker J. A strategic plan for addressing asthma in west Virginia (2010-2014) [Internet]. West Virginia: Department of Health & Human Resources 2009; Available from: http://www.wvasthma.org/Portals/4/Final%20Strateg ic%20Plan%20for%20Website.pdf

32. Butz A, Pham L, Lewis L, Lewis C, Hill K, Walker J, Winkelstein M. Rural children with asthma: impact of a parent and child asthma education program. J Asthma 2005;42(10):813-21.

33. Clark NM, Brown R, Joseph CL, Anderson EW, Liu M, Valerio MA. Effects of a comprehensive school-based asthma program on symptoms, parent management, grades, and absenteeism. Chest 2004; 125(5): 1674-9.

34. Joseph CL, Peterson E, Havstad S, Johnson CC, Hoerauf S, Stringer S, Gibson-Scipio W, Ownby DR, Elston-Lafata J, Pallonen U, et al. A web-based, tailored asthma management program for urban African-American high school students. Am J Respir Crit Care Med 2007; 175(9): 888-95.

35. Magzamen S, Patel B, Davis A, Edelstein J, Tager IB. Kickin' Asthma: school-based asthma education in an urban community. J Sch Health 2008; 78(12): 655-65.

36. Velsor-Friedrich B, Pigott TD, Louloudes A. The effects of a school-based intervention on the self-care and health of African-American inner-city children with asthma. J Pediatr Nurs 2004; 19(4): 247-56.