

## ORIGINAL ARTICLE

# The Effect of Paediatric Asthma Education Programme (PAEP) on Use of Inhaler and the Health-related Quality of Life of Asthmatic Children Caregiver in Hospital Universiti Sains Malaysia

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## ABSTRACT

**Introduction:** Children with asthma in Malaysia was found that not properly treated. Asthma also has been reported that affect students' performance at school. Nowadays patient education is known as the best way to improve asthma management. This study aimed to determine the effect of the Paediatric Asthma Education Program (PAEP) focusing on the technique of using the inhaler and the change in the quality of life for asthmatic children. **Methods:** The study consisted of one group pretest-posttest intervention study in Hospital USM, Kelantan. The respondents were 78 parents of asthmatic children, aged between 8 to 12 years old. Inhaler technique skill scores were assessed using a checklist and the Paediatric Quality of Life Inventory (PedsQL) questionnaires were given to be answered by the parents at the clinic setting. The parents were then given a date to attend PAEP and reassessed two months later for post-intervention. The analysis for skill scores of inhaler technique and PedsQL was done by using a paired t-test. **Results:** Mean age for children with asthma was 9.31 years. The mean skill scores for the inhaler technique increased from 3.43 to 7.13 for the metered-dose inhaler (MDI) with a spacer. There was a significant improvement in the inhaler use skill scores ( $p$ -value < 0.001). PedsQL pre-intervention mean scores were 75.8%, and post-intervention 82.8%. ( $p$ <0.001). **Conclusion:** The PAEP has been shown to improve parental understanding of inhaler technique skills and objectively enhancing the quality of life among asthmatic children.

**Keywords:** Asthma, Education, Parents of asthmatic children, Quality of life

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## INTRODUCTION

Asthma is known as a heterogeneous condition characterized by paroxysmal or persistent symptoms such as dyspnoea, chest tightness, wheezing, and cough with a background of chronic persistent inflammation and/or structural changes associated with variable airflow limitation and airway hyper-responsiveness (1). 4.5% of adults and 7.1% of children have asthma in Malaysia (2). Studies reported that the prevalence of asthma in primary and secondary school children was 9.4% (3) in Kota Bharu and 13.8% in Kuala Lumpur respectively (4). Studies in Malaysia have reported that

children with asthma were not getting proper treatment (5).

Most parents of asthmatic children had considerable misconceptions about the safety of inhaled corticosteroids and the use of inhalers (6). The statement that parents had a poor understanding and use of medications was supported by a previous study (7). Learning the correct use of metered-dose inhalers (MDI) could indirectly reduce the number of clinics and hospital visits. To improve asthma management among children, it will be beneficial to provide education to their parents (6). Patient education is said to have an important part in the success of asthma management at home.

Furthermore, asthma also affects children's academic performance in less obvious ways (8). Episodes of missed sleep are associated with behavioral problems

(9). In comparison with children with no asthma symptoms, children with constant asthma symptoms significantly have behavior problems (10). Asthmatic children may endure a variety of functional deterioration such as avoidance of social activities, limited social participation, and deterioration in school function (11). In terms of school absenteeism, students with asthma were reported that have regular school absenteeism compared to non-asthmatic children (12). The less severe asthma symptoms led to less likelihood of parents seeking treatment for their children. Poor asthma control indirectly disrupts the children's ability to get enough sleep, diminishing the ability to concentrate in the class, reducing in school's physical activities, and thus affecting their quality of life. Sleep arousal at night might affect children's school performance, attendance, and also parents' work performance (13). It is crucial for parents who have asthmatic children to have a good understanding so that better care and quality of life could be achieved. Extensive literature has reported on the importance of asthma education programs (6,14).

Nowadays patient education was known as the best action for asthma management (15). The education programme demonstrated positive outcomes in terms of improving asthma knowledge, asthma control, inhaler technique, caregiver's quality of life, and patient satisfaction (7). Asthma education was reported to have improved knowledge about the diseases and reduce asthma morbidity among asthmatic children (16,17). Thus this study aims to determine the effect of the Paediatrics Asthma Education Programme (PAEP) on the technique of using inhalers and health-related quality of life in children with asthma when it is imparted to their parents.

## MATERIALS AND METHODS

### Samples

This study was based on a quasi-experimental study design. Parents with asthmatic children were recruited from the paediatric clinic in Hospital Universiti Sains Malaysia (HUSM), Kubang Kerian, Kelantan. Inclusion criteria were: parents of asthmatic children aged between 8 to 12 years old; the children who came for asthma appointment in the preceding year; the children who were on daily asthma medication; parents who have access to a telephone; the primary caregiver who capable to speak, read, write and known Malay or English language. Children with other health problems (heart disease, cancer, diabetes, or other chronic conditions); or parental refusal or unconsented; and illiterate parents were excluded. The sample size was determined by PS Software and statstodo.com sample size calculator based on the result from the previous study (18). Based on the sample size calculation, 78 participants were needed after considering 20% dropout.

## Instruments

### Inhaler technique checklists

The skills score for the inhaler technique was determined by using a checklist. The checklist consisted of several steps on the technique of using the inhaler. One mark was given on each correct step during the demonstration; whereas for the incorrect step, zero marks were given. A higher score indicates greater skill in using the inhaler.

Three inhaler technique checklists were depending on the inhaler types. First, for the metered-dose inhaler (MDI) with spacer, our checklist was adapted from the previous MDI checklist (18) which was available in Malay and consisted of eight steps. Second, for MDI without a spacer, our checklist was also adapted from the previous checklist (18) which consisted of eight steps.

Third, for dry powder inhalers, our checklist was adapted from a checklist for the Turbohaler technique (19) with some modification. This checklist consists of six steps and has been used for Asian studies, including in Malaysia. However, this checklist was in English and not available in Malay; therefore, the translation process was done by the researcher and the first draft was sent to three paediatrics experts for revision and comment. The correction was made following reconciliation and the finalized checklist was completed for use.

### Pediatric Quality of Life Inventory (PedsQL)

Quality of life (QoL) was measured by using the validated 23-item parent's proxy report on Paediatric Quality of Life Inventory (PedsQL) (20). A validated parent's proxy report on the paediatric quality of life questionnaire in the Malay language (21) was used in this study. The reliability of the Malay version was considered very good as the Cronbach's alpha was ranged from 0.65 to 0.85 (21).

PedsQL comprises a parallel child self-report and parent proxy report. Child self-report is based on the perception of the child's internal states while the parent proxy report reflects the child's observable behaviours. The report generates a 5-scale of scores in four domains: physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items) (21 p. 590). Each item is reverse-scored and linearly transformed to a 0-100 scale (21 p. 590). The scores were classified <25 as bad QoL, 25 to <50 as fair QoL, 50 to <75 good QoL, and 75-100 very good QoL.

### Description of Intervention

The development of the Paediatric Asthma Education Program (PAEP) was based on the clinical practice guideline for the management of childhood asthma from the Academy of Medicine, Malaysia. According to the guideline, an asthma education package should include an explanation of the disease and treatment, recognition

of sign and symptoms of asthma, avoiding trigger factors and understanding the causal mechanism of the disease; information about medications including the role of each medication, dosages, timing, and technique of using delivery devices; instruction on self-management; written asthma action plan and education on exercise (1).

Thus, based on these suggestions, the targeted PAEP module would cover the definition, causes, pathophysiology, sign and symptoms, treatment, prevention, asthma action plan, and demonstration of inhaler technique. The PAEP module was delivered through a short informative lecture using a 60-slide PowerPoint presentation and brochures with diagrams and pictures to foster better understanding. The slides used needed to be clearly visible font sizes; suitable graphics and color of the slide to gain participant attention. The brochures were designed to explain the asthma action plan and how to use the inhaler. The module also emphasized the correct practical aspect of inhaler demonstration by the parents. This education program would be completed within two hours period.

PAEP focused on a small group of parents (maximum 20 parents) to allow sharing of experience, feedback on techniques, and exchanging of ideas when handling their asthmatic child. The researcher was served as the educator during the PAEP program. The educator was able to impart a focused learning experience due to the small number of participated parents.

#### **Development of the Module for the Paediatric Asthma Education Program**

A literature review was first carried out to construct the draft for the PAEP module. The draft was sent to three experts with paediatric asthma experience for content review, comment, and suggestion. The experts were a paediatrician, a paediatric lecturer, and a paediatric nurse. Suggested corrections were done based on and the suggested comments. The amended module was later revised by similar experts for confirmation.

Content validity was again evaluated by the three different experts. Face validity was done gauged by using the Education Tool's Evaluation Questionnaire to ten parents to assess the lecture and the brochures. Face validity assessment concentrates on slides' appearance and content understanding. Similar to the brochures, the assessment was made related to the content, language, frequency of brochure usage, and the illustrations utilized. The ten parents who were recruited during the evaluation phase of the PAEP module and were not involved in the intervention study. The majority of these parents (90%) gave positive responses and felt that PAEP was interesting and engaging with regards to the content, pictorial graphics, fonts, colors in both slides and brochures. 80% of parents also ranked the presentation as "interesting" and the information

included as adequate. However, the parents prefer to use short sentences (50%) and asking for more graphics in the slides (40%) to enhance their understanding. Subsequently, the PAEP module was modified based on these inputs and feedbacks.

#### **Data Collection**

The data collection process was divided into three phases: pre-intervention, PAEP intervention, and post-intervention.

##### **Phase 1: Pre-intervention**

Parents were screened prospectively according to the agreed criteria. They were approached in an outpatient setting before the enrolment for this study. The purpose of the study was explained to the parent by the researcher. Informed consent was obtained before their involvement as the study subject. All the basic demographic information was taken, parents were asked to demonstrate their inhaler technique and subsequently completing the Paediatric Quality of Life Inventory (PedsQL) questionnaire. Following that they were given an invitation to attend the Paediatric Asthma Education Program (PAEP) at an arranged date.

##### **Phase 2: Paediatric Asthma Education Programme (PAEP) Intervention**

The purpose of the programme was explained to the parents. Intervention includes a two-hour of short informative lecture, distribution of brochures, followed by bilateral interactive session before the practical session. Parents were taught the correct technique of using the inhaler. After that, parents were open to discussion about asthma. Finally, parents were explained about the post-test process.

##### **Phase 3: Post-intervention**

The second assessment was conducted after a two-month interval. Each parent was given a similar set of PedsQL questionnaire by mail with readily available envelop and stamp to return to the researcher. A phone call will be done if parents did not post back the questionnaire. Regarding the asthma inhaler skills, the assessment was made by scoring the checklist by the researcher through a phone call. Marks were given for each correct technique explained by parents.

#### **Ethical Approval and Authority Permission**

Ethical approval for this study was obtained from the Universiti Sains Malaysia (USM) Human Research Ethics Committee (USM/JEPeM/140381). Request for permission to conduct a study among parents with asthmatic children from Hospital Universiti Sains Malaysia (HUSM) was also approved (HUSM/11/020/Jld.6).

#### **Statistical Analysis**

The data entry and statistical analysis were performed using IBM Statistical Package for the Social Sciences

version 20.0 (SPSS 20.0). The normal distribution of data was initially checked by the histograms and Kolmogorov-Smirnov test. Descriptive statistics were used to examine the distribution of study variables. The data were then analyzed using a paired t-test to compare the means between pre-and post-intervention.

## RESULTS

The total number of participating parents during pre-intervention was 78. Unfortunately, eight parents were excluded from the analysis because of non-attendance for PAEP (n=5) and unreturned questionnaire (n=3). Finally, 70 parents were involved in this study.

### Demographic Characteristics

Table 1 shows the demographic characteristics and asthma status of 78 asthmatic children and their parents in this study. The characteristics of children include gender, age, years of having asthma, other diseases, allergy, types of inhaler, ward admission due to asthma, emergency visit due to asthma, asthma severity, and asthma control. Over half of the children were male (n=45, 55.1%). The mean age was 9.31 years (SD=1.453) with the majority of the children involved were 8 years

**Table 1: Frequency distribution of children's and parents' characteristic (n=78)**

Children characteristic	Frequency (Percent %)	Mean (year)
<b>Gender</b>		
Female	35 (44.9)	
Male	43 (55.1)	
<b>Age</b>		9.3
8	35 (44.9)	(SD = 1.50)
9	12 (15.4)	
10	13 (16.7)	
11	8 (10.3)	
12	10 (12.8)	
Years of having asthma		5.6
		(SD = 2.50)
<b>Allergy</b>		
Yes	44 (56.4)	
No	34 (43.6)	
<b>Types of inhaler</b>		
Metered dose inhaler with spacer	62 (79.4)	
Metered dose inhaler without spacer	11(14.1)	
Turbohaler	5 (6.4)	

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**Table 1: Frequency distribution of children's and parents' characteristic (n=78)**

Children characteristic	Frequency (Percent %)	Mean (year)
<b>Ward admission due to asthma</b>		
Yes	36 (46.2)	
No	42 (53.8)	
<b>Emergency department visit due to asthma (last 6 months)</b>		
Yes	49 (62.8)	
No	29 (37.2)	
<b>Severity of asthma</b>		
Intermittent	46 (59.0)	
Mild persistent	28 (35.9)	
Moderate persistent	4 (5.1)	
<b>Asthma control (after using preventer)</b>		
Control	73 (93.6)	
Partially control	5 (6.4)	
<b>Parents characteristic</b>		
<b>Gender</b>		
Female	63 (80.8)	
Male	15 (19.2)	
<b>Age</b>		39.7
		(SD = 6.90)
<b>Ethnicity</b>		
Malay	76(97.4)	
India	1(1.3)	
Chinese	1(1.3)	
<b>Education level</b>		
Primary school	5 (6.4)	
Secondary school	52 (66.7)	
College / university	21 (26.9)	
<b>Monthly income</b>		
Low income	56 (71.8)	
Moderate income	11 (14.1)	
High income	11 (14.1)	
<b>Family members who are smoker</b>		
Yes	40 (51.3)	
No	38 (48.7)	
<b>History of asthma</b>		
Yes	56 (71.8)	
No	22 (28.2)	

old (44.9%). On average, these children had 5.56 years of having the disease. 44 children (56.4%) reported by the parents to have an allergy, while the other 34 (44.6%) did not have any allergy to food, animal, or home environment. The majority of the asthmatic children

in this study used metered-dose inhaler (MDI) (n=73, 93.6%) compared to Turbohaler (n=5, 6.4%). Most of the children (n=73, 93.6%) had good asthma control after the commencement of preventive medication. The parents' characteristics as presented in Table I include gender, age, ethnicity, education level, monthly income, the family member who smokes, and history of asthma. Most parents involved were female (n=63, 80.8%) and Malay ethnic (n=76, 97.4%). Most families have low monthly income (n=56, 71.8%), the rest was between moderate and high (n=11, 14.1%). Over half of the family members were smokers (n=40, 51.3%) as reported by parents. Most of the parents (n= 56, 71.8%) reported a family history of asthma.

### Skill Scores of Inhaler Technique

The technique of using metered-dose inhaler (MDI) with spacer was assessed and scored by 62 parents, but only 53 parents completed the study. MDI without spacer was scored to 11 parents but only six parents completed the study. The turbohaler technique was scored on all five parents who used the medication.

Table II shows the mean score obtained by the parents before and after attending PAEP. There was a significant improvement in the technique of using MDI with spacer even after a single intervention session. There was a statistically significant increase between pre-intervention (mean=3.43, SD=1.48) to post-intervention (mean=7.13, SD=0.92,  $p<0.001$ ). The mean increase in skill scores in handling MDI with spacer was 3.69 with a 95% confidence interval ranging from 3.26 to 4.13. The pre-intervention result showed that only two parents were able to score full marks 8/8 in MDI with spacer

**Table II: Comparison of the means of the Metered dose inhaler with spacer in each repeated measurements (n = 53)**

Variables	Mean (SD)		Mean diff (95% CI)	t-stat (df)	P-value
	Baseline	After 8 weeks			
Metered dose inhaler with spacer	3.43 (1.48)	7.13 (0.92)	3.69 (3.26,4.13)	16.9 (52)	< 0.001

\*paired t test

technique, the majority of parents (83.3%) scored 4/8 and below. After attending PAEP 6.8% of the parents scored a minimum of 5/8 while the other 93.1% get 6/8 – 8/8 scores after PAEP.

Table III shows the analysis of parents' correct steps in using MDI with a spacer. The parents showed an overall improvement two months after PAEP. Unfortunately, steps number four and six were the least improved. During pre-intervention, the number of parents that perform each step correctly was low, with the highest score of 75.5% in step five. After attending PAEP, the results showed improvement in all eight steps. Compared to the other steps, step four still the least score (pre-intervention 9.4%, post-intervention 84.9%).

**Table III : Parents' performance in handling metered dose inhaler with spacer pre and post-intervention (n=53)**

Steps	Pre - Intervention n (%)	Post - Intervention n (%)	P- value <sup>a</sup>
1. Remove cap of inhaler	33 (62.2)	53 (100.0)	<0.001
2. Shake inhaler	25 (47.2)	48 (90.6)	<0.001
3. Insert inhaler to spacer	33 (62.3)	53(100.0)	<0.001
4. Hold correctly in horizontal way	5 (9.4)	45 (84.9)	<0.001
5. Activate inhaler for once only	40 (75.5)	52 (98.1)	0.007
6. Slow and deep inspiration	8 (15.1)	47 (88.7)	<0.001
7. Breathe normally for 5 to 6 times	30 (56.6)	53 (100.0)	<0.001
8. Hold for 1 minute for the next puff	8 (15.1)	49 (92.5)	<0.001

<sup>a</sup>McNemar's Test

Table IV shows the analysis of parent's correct steps in using the metered-dose inhaler. Only 11 children used this type of inhaler. There were only six parents who completed the study. The other five parents did not complete the study. During pre-intervention, parents that can perform the correct steps were low, with the highest score in step one (83.3%). Results after two months

**Table IV: Parents' performance in handling the metered dose inhaler pre and post-intervention (n=6)**

Steps	Pre - Intervention n (%)	Post - Intervention n (%)
1. Remove cap of inhaler	5 (83.3)	6 (100.0)
2. Shake inhaler	4 (66.7)	6 (100.0)
3. Hold correctly in horizontal way	2 (33.3)	5 (83.3)
4. Exhale fully prior to inhalation	2 (33.3)	6 (100.0)
5. Tilt back head prior to inhalation	4 (66.7)	6 (100.0)
6. Inspiration slowly and deeply	5(83.3)	6 (100.0)
7. Hold breath for 5 to 10 seconds after inhalation	2 (33.3)	6 (100.0)
8. Hold for 1 minute for the next puff	2 (33.3)	6 (100.0)

<sup>a</sup> McNemar's Test



post-intervention showed significant improvement in all eight steps.

Table V shows the analysis of parent's correct steps in using Turbuhaler. Only five children were reported by their parents to use this type of inhaler. All five parents completed the study. Parents showed overall improvement at two months after attending PAEP. Unfortunately, steps number four and five were the least improved. During pre-intervention, parents that can

**Table V: Parents' performance in handling the turbuhaler pre and post-intervention (n=5)**

Steps	Pre - Intervention n (%)	Post - Intervention n (%)
1. Remove cap	2 (40.0)	5 (100.0)
2. Loading the inhaler in the upright position.	0 (0.0)	5 (100.0)
3. Rotate grip anti-clockwise then back until a click is heard	5 (100.0)	5 (100.0)
4. Exhalation (but not through Turbuhaler)	0 (0.0)	4 (80.0)
5. Inhale forcefully and deeply	1 (20.0)	4 (80.0)
6. Breath holding for 10 seconds	0 (0.0)	5 (100.0)

McNemar's Test

perform correct step were low, with the highest score in step three (100%). Results after post-intervention showed significant improvement in all six steps.

### Children's Quality of Life

A paired-samples t-test was conducted to evaluate the impact of the intervention on parents' scores for their children's quality of life. Table VI shows the mean values obtained by the parents at baseline and two months after PAEP. There was a statistically significant increase in PedsQL scores from pre-intervention (mean=75.88, SD=16.00) to post-intervention (mean=83.21,

**Table VI: Comparison of the means of the PedsQL in each repeated measurements (n = 70)**

Variables	Mean (SD)		Mean diff (95% CI)	t-stat (df)	P-value
	Baseline	After 8 weeks			
PedsQL	75.88 (16.00)	83.21 (12.58)	7.32 (5.36,9.29)	69	0.001
Physical functioning	74.77 (19.46)	82.00 (15.45)	7.23 (4.86,9.60)	69	0.001
Emotional functioning	76.71 (20.74)	88.14 (16.48)	11.42 (4.86,9.60)	69	0.001
Social functioning	82.78 (19.27)	85.64 (16.43)	2.85 (0.52,5.18)	69	0.017
School functioning	69.92 (18.52)	77.78 (15.09)	7.85 (4.90,10.80)	69	0.001

\*paired t test

SD=12.58),  $t(69)=7.43$ ,  $p<0.05$  (two-tailed)). The mean increase in PedsQL scores was 7.32 points with a 95% confidence interval ranging from 5.36 to 9.29.

In PedsQL domains, improvements were found in all four domains which were physical functioning, emotional functioning, social functioning, and school functioning (Table VII). The pre-intervention scores showed that an average mean score for all items was 74.83 (SD=16.58), with the average score for each item ranging from 55.77 to 85.26. The highest score was "other kids not wanting to be his or her friend" (85.26, SD=22.22), followed by "taking bath or shower by him or herself" (83.97, SD=32.22). The next item with the middle score was "forgetting things" (76.28, SD=25.12). The lowest score was "missing school because of not feeling well" (55.77, SD=22.04).

**Table VII: Mean of Paediatric quality of life before and after PAEP (n = 70).**

Variables	Mean (SD)	
	Baseline	After 8 weeks
Walking more than one block	78.53 (27.24)	84.64 (21.40)
Running	62.18 (26.34)	68.92 (23.48)
Participating in sport activity or exercise	66.03 (28.19)	74.28 (22.90)
Lifting something heavy	76.28 (26.99)	82.14 (20.91)
Taking bath or shower by him or herself	83.97 (32.22)	90.35 (24.18)
Doing chores around the house	79.81 (26.74)	86.07 (22.77)
Having hurt or aches	68.91 (25.54)	85.00 (20.58)
Low energy level	68.91 (25.54)	83.21 (20.73)
Feeling afraid or scared	76.92 (26.65)	87.50 (19.38)
Feeling sad or blue	78.85 (23.52)	88.92 (17.87)
Feeling angry	70.19 (27.04)	85.71 (21.94)
Trouble sleeping	71.79 (26.53)	86.42 (20.27)
Worrying about what will happen to him or her	80.45 (23.71)	92.14 (16.23)
Getting along with other children	78.85 (31.48)	84.28 (23.76)
Other kids not wanting to be his or her friend	85.26 (22.22)	88.21 (19.37)
Getting teased by other children	84.62 (22.51)	85.71 (20.66)
Not able to things that children his or her age can do	83.65 (22.37)	87.50 (19.84)
Keeping up when playing with other children	78.53 (28.97)	82.50 (23.05)
Forgetting things	76.28 (25.12)	82.50 (22.25)
Pay attention in class	72.76 (32.02)	83.92 (21.29)
Keeping up with school work	72.76 (31.25)	82.14 (23.36)
Missing school because of not feeling well	55.77 (22.04)	63.21 (20.28)
Missing school to go to the doctor or hospital	65.38 (23.57)	70.36 (20.97)

The post-intervention scores for the PedsQL showed that the average mean score for all items was 84.90 (SD=13.09), with the average score for each item ranging from 63.21 to 92.14. The highest score was "worrying about what will happen to him or her" (92.14, SD=16.23), followed by taking bath or shower by him or herself (90.35, SD=24.18). The next item with the middle score was "getting teased by other children" (85.71, SD=20.66). The lowest score was "missing school because of not feeling well" (63.21, SD=20.28).

## DISCUSSION

Patients' education focusing on the correct use of inhalers is important in the prevention of asthma symptoms. The correct inhaler technique allows children to receive an adequate amount of medication while avoiding waste or over-medication. Learning the correct use of an inhaler at the onset of treatment could reduce the number of hospital visits for symptom exacerbations. These inhalers have many benefits to asthmatic patients, either assisting the patients to breathe easier or prophylactically preventing future respiratory symptoms.

Similar to a previous study (18), the majority of the parents in our study were still unfamiliar with the asthma medication and device despite their children's ongoing follow-up. One possible explanation is that during the busy follow-up visits at the paediatric clinic, the attending doctor could not spend more educational time with parents. Unusually, our study showed many parents were more familiar with oral asthma medication, not the inhaler. Parents have reported their refusal to administer inhalers to their children thinking that oral medication was more effective and their fear of addiction and dependency on the inhaler (22). Another study found that half of the parents were concerned about becoming addicted to inhalers and concerned about the side effects of inhaled steroids (6).

It was noted that these parents did not seek help during the clinical appointment even though they were struggling to give medications to their children. This shortfall was mainly due to short consultation time spent on education. The hospital follow-up visits were done in the afternoon, and unfortunately, most of the parents were rushing to go back to continue their work and avoid traffic jams after office hours. After attending PAEP the results showed significant improvement in all eight steps of technique in using the inhaler.

Analysis of each step for parents' skill in using an inhaler with spacer showed a better improvement after PAEP. A previous study reported step five (activate inhaler for once only), step six (slow and deep inspiration), and step seven (breathe normally for 5 to 6 times) showed less than 70% improvement after attending the education program (18). Step six (slow and deep inspiration)

was found to be the most common error in the inhaler technique (18). These steps are the most important part during inhalation of asthma medication to ensure that the medications are delivered into the lung. Our study showed that most of the steps improved after attending PAEP, with the lowest score being step four (hold correctly in a horizontal way) 84.9%.

The result of the Paediatric Quality of Life Inventory (PedsQL) showed significant improvement between pre-and-post-PAEP. The pre-intervention score has an average mean score for all items was 74.8 (SD=16.5) from a maximum possible score of 100. However, the post-intervention scores showed an increased mean score for all items 84.9 (SD=13.0). This score was higher than the scores on the same measurement in another study, which was 68.2 (SD=16.1) (24). Yet another study found parental perceptions of asthma control and quality of life also showed significant post-instructional improvement ( $p<0.01$ ) as compared to pre-instruction scores (24). Education programme have been shown to have a clinically relevant improvement in the quality of life and related morbidity in students with asthma (25,26).

In school functioning, parents reported lower scores on 'missing school because of not feeling well' and 'missing school to go to the doctor or hospital'. Asthma causes school absenteeism three times more compared to children without asthma (27). The result for PedsQL before PAEP showed the lowest score was "missing school because of not feeling well" (55.7, SD=22.0). It is well known that asthma affects children's activity of daily living and cause school problems. Several studies report that asthma has contributed to school absenteeism (6,12). When children experienced an asthma attack, they would skip school. A more serious asthma attack will lead to an emergency department visit. Absence from school will disrupt the process of learning and affects academic performance (12). The missing school could be overcome after the parental education program. The result after PAEP showed the score was increased to 63.2 (SD=18.9). Similar findings from previous studies showed that school absenteeism was decreased among the intervention group in comparison with the control group (8, 26).

In physical functioning, parents reported a lower score of "in-running", "participating in sports activity or exercise" and "low energy level". Parents were concerned that asthma may interfere with children's physical activity. Parents also reported that their children were advised not to be active in school activities since they have asthma. This finding was consistent with a previous study, that reported asthma influence on children's activities (23). After PAEP, the result for physical functioning showed significant improvement especially for the question "low energy level". The mean pre score was 68.9 (SD=25.5) while the mean post score was 83.2 (SD=20.7).

The highest score for PedsQL before PAEP was “other kids not wanting to be his or her friend”. There was a slight increment in the scores from pre-intervention (mean=85.2, SD=22.2) to post-intervention (mean=88.2, SD=19.3). There were no cultural differences between healthy and asthmatic children in terms of friendship. Children tend to play and socialize with everyone regardless of their health status. Furthermore, parents reported that most of their children do not have a problem in terms of playing with other children.

The PAEP was shown to have a better outcome than a shorter education program at the clinic. Parents were given the freedom to choose the available date for PAEP. Parents were well prepared, motivated, and ready to absorb new knowledge. PAEP also allowed parents to discuss the problems at home when handling their asthmatic children. Every parent was allowed to voice out any doubt and demonstrate the practical technique in the inhaler delivery to their children.

There were several limitations to this study. First, the PedsQL questionnaire asked the parents to rate the quality of life for children in the past one month. This can cause inaccurate findings due to recall bias. Similar to the retrospective data which posed some problems related to recall bias.

Time constraints have limited ability to assess inhaler technique in real-time, and this was done through phone call since most of the respondents have three-to-six-month appointment date. This has consumed the researcher’s valuable time before the completion of the study.

## CONCLUSION

The results revealed that the PAEP having a positive effect on children’s quality of life and the technique in giving inhalers for asthmatic children at Hospital USM. The implementation of the intervention, its contents, and delivery modes might have been the factors that had significantly contributed to the outcomes observed. Despite having minimum manpower and financial resources, this study has also provided various information on the usefulness of conventional lectures and brochures during the delivery of PAEP. Practically, parents should be asked to show how their understanding of inhaler technique. This should be a routine assessment in each appointment.

## ACKNOWLEDGEMENTS

My heartfelt appreciation for all who were directly involved in a research project: Parents with asthmatic children in Paediatric clinic Hospital USM. Universiti Teknologi Mara (UiTM) and the Ministry of Higher Education (SLAB study sponsor / SLAI).

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