

# Asthma action plan: Is Peak Flow Monitoring Necessary in Asthmatic Children?

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## Background

Uncontrolled pediatric asthma remains prevalent. From the asthma survey, 36% of Thai children with asthma had acute exacerbations and shown up to the emergency room (ER). Written asthma action plan (WAAP) were recommended for self-management based on signs and symptoms and/or peak expiratory flow (PEF) monitoring, especially in patients with moderate-to-severe asthma. Previous study has demonstrated the benefit of using Ramathibodi’s WAAP along with PEF monitoring in decrements of ER visit, OPD unplanned visits, admission days, and school absence days. While the cost of peak flow meter is 900 bath, it’s not covered by the universal health coverage service. It is curious to analyze the cost benefit of the peak flow-based WAAP compared to the symptom-based WAAP.

## Methods

An open labelled, randomized controlled trial was conducted during November 2017 – July 2019. Children with asthma, aged 6 -18 years who have been treated with controller medications at least 1 month were recruited from the Pediatric Respiratory and Allergy unit, Ramathibodi hospital. Patients with other chronic lung diseases, heart diseases, or those who could not perform peak flow meter correctly were excluded. Demographic data, events of asthma exacerbations, health care system utilization and any expense relating to asthma exacerbations were recorded. Children were randomly allocated into 2 groups; the peak flow-based WAAP or the symptom-based WAAP by the block of four randomization. The follow up periods were at 0,1,3, and 6 months. The outcome variables of ER visits, OPD unplanned visits, admission days, school absence days and parent working absence days, direct medical cost and indirect medical cost between the 2 groups were analyzed, using standard descriptive statistics and cost benefit analysis.

Table 1 Patient’s characteristics

	PEF group (N=25)	Symptom group (N=24)	p-value
Gender, n(%)			
Male	18(72)	19(79.2)	0.560
Female	7(28)	5(20.8)	
Age (yr), mean±SD	8.8±3.07	9.67±2.96	0.320
Severity, n(%)			
Mild	14(56)	12(50)	0.467
Moderate	10(40)	10(41.7)	
Severe	1(4)	2(8.3)	
Age of ICS initiation, mean(min-max)	4(1-13)	4.5(1-13)	0.697
Control of asthma, n(%)			
Controlled	20(80)	21(87.5)	0.702
Partly controlled/uncontrolled	5(20)	3(12.5)	
Allergic rhinitis, n(%)	24(96)	24(100)	0.322
Income, n(%)			
< 30,000	7(28)	9(37.5)	0.592
30,001-60,000	7(28)	4(16.7)	
>60,001	11(44)	11(45.9)	

Table 2 After follow up 6 months

	PEF group N=25	Symptom group N=24	P-value
Asthma exacerbation (events)	19	39	N/A
Number of patients had Events	10(40%)	12(50%)	
ER visit	3	4	0.673
Number of patients had ER visits	2(8%)	3(12.5%)	0.667
OPD unplanned visit	2	3	1
Number of patients had OPD unplanned visits	2(8%)	3(12.5%)	0.667
Admission	0	0	N/A
Number of patients had admission	0	0	
School absence days	13	15	0.076
Number of patients had school absence	5(20%)	8(33.3%)	0.291
Patients’s parent working absence	4	9	1
Number of patients’s parent working absence	2(8%)	3(12.5%)	0.667

## Results

Sixty one subjects were recruited, with 6 children could not complete the follow up in each group, 25 children in the peak-flow based group and 24 children in the symptom-based group were analyzed. Most of the children were male, approximate half each group has mild severity. Eighty percent in the peak-flow based group and 87% in the symptom-based group had controlled asthma.

In the peak-flow-based group: 19 events of asthma exacerbation occurred in the peak-flow based group during a period of six months. Only 3 ER visits, 2 unplanned OPD visits, 13 school absence days and 4 parental working absence days occurred. In the symptom-based group: 39 events of asthma exacerbation occurred, leading to 4 ER visits, 3 unplanned OPD visits, 15 school absence days and 9 parental working absence days occurred. However, these findings has no significant statistical difference.

Our study could not demonstrated the benefit of using peak flow in WAAP in a 6-month period. However, using the return of investment formula(ROI), it can return to investment in 12.35 months.

Table 3 Cost effectiveness

Incidence per person	PEF group (N=25)	Symptom group (N=24)
ER visit per person	0.12	0.17
OPD unplanned visit per person	0.08	0.125
Parental working absence day per person	0.16	0.375

**Cost per person 900 bath**    ↓ ER visit 0.05 time  
 ↓ OPD visit 0.045 time  
 ↓ working absence 0.215 day

Table 4 Cost benefit analysis

Hospital perspective	PEF group (N=25)	Symptom group (N=24)
ER visit per person	0.12	0.17
Cost of ER per visit = 580.44*X2.6%**=595.53		
OPD unplanned visit per person	0.08	0.125
Cost of OPD unplanned per visit = 1,456*X2.6%** = 1,493.86		

Table 5 Cost benefit analysis

Patient perspective	PEF group (N=25)	Symptom group (N=24)
ER visit per person	0.12	0.17
Cost of ER per visit = 778.67*X2.6%**=798.91		
OPD unplanned visit per person	0.08	0.125
Cost of OPD unplanned per visit = 1,456*X2.6%** = 1,493.86		
Parental working absence day per person	0.16	0.375
Mean income per day = 1387.75		
Cost of transportation per visit = 363.33		

### Hospital perspective

$$\frac{(595.53 \times 0.05) + (1,493.86 \times 0.045)}{900} = 0.108$$

### Patient perspective

$$\frac{(798.91 \times 0.05) + (1,493.86 \times 0.045) + (1387.75 \times 0.215) + (363.33 \times 0.095)}{900} = 0.486$$

### Return to investment

$$\frac{1}{0.486} \times 6 = 12.35 \text{ months}$$

## Conclusions

We suggest to use at least symptom monitoring written asthma plan in all children with asthma. For PEF monitoring in WAAP depends on socio-economic status.