

# Monitoring and treatment practices of childhood asthma in Singapore: a questionnaire study

Tan C, Wong B, Goh D Y, Van Bever H P

## ABSTRACT

**Introduction:** Asthma is the most common chronic disease in children in Singapore. More than 20 percent of children will have been diagnosed with asthma by the age of 15 years. Most children are seen in the primary care setting, thus it is of value to study the management practices, especially of general practitioners, with comparison to gold standards. The aims of the study were to investigate: (a) Methods of monitoring asthma control; (b) Practices in managing acute exacerbations; and (c) Choice of therapy in maintenance treatment.

**Methods:** 2,100 questionnaires consisting of 35 questions were sent by post to general practitioners and various paediatric doctors throughout Singapore. 173 valid responses were received and results were compared to the 2006 Global Initiative for Asthma guidelines.

**Results:** 76.3 percent of respondents were general practitioners. 89.1 percent did not use symptom score cards/diaries. 37.6 percent did not use peak-flow meters/spirometers. 83.8 percent used a short-acting beta-agonist in acute exacerbations, but only 41.0 percent used oral corticosteroids in outpatients. A significant number used long-acting beta-agonists (LABA) in combination with inhaled steroids (29.5–41.6 percent) or as monotherapy (5.8–8.7 percent) for maintenance treatment. 91.3 percent never used immunotherapy in practice.

**Conclusion:** Greater usage of diaries/score cards can be encouraged along with objective peak flow/spirometry measurements. Management of acute exacerbations is appropriate but corticosteroids are under-prescribed by most doctors. LABA continues to be prescribed for maintenance despite a lack of established safety

profile for infants, along with recommendations that they only be used selectively in patients poorly-controlled by medium-dosage inhaled corticosteroids.

**Keywords:** asthma, childhood asthma, corticosteroids, inhaled corticosteroids, long-acting beta-agonists

*Singapore Med J 2009;50(1):54-61*

## INTRODUCTION

Asthma is the most common chronic disease among children and affects over 300 million people worldwide, according to the World Health Organisation.<sup>(1)</sup> This figure has been cited to be increasing by up to 50% a decade.<sup>(2)</sup> Its prevalence in children has been described to be generally between 3.9% and 30.6%,<sup>(3)</sup> with Singapore figuring at around 8.9%<sup>(4)</sup> in school-going children. In fact, in older children in the 12-15 year age group, it was reported that up to 27.4% of these children had been diagnosed before with asthma in their childhood.<sup>(5)</sup> Thus, as a chronic disease, it undoubtedly has a significant disease burden in the global paediatric population. The Asia Pacific Association of Paediatric Allergy, Respiriology and Immunology (APAPARI) first convened in 1997,<sup>(6)</sup> and represents a collective of Asian healthcare professionals who take a special interest in the above-mentioned fields. The following study reflects the results of the Singapore wing of an Asia Pacific-wide study on the monitoring and management of asthma in the paediatric population.

It is well known that the majority of paediatric asthma cases are seen in the primary care setting, with only more severe cases being referred to secondary or tertiary paediatric centres. In Singapore, this is anecdotally the case as well, with a large proportion of our doctors being in private general practice. Therefore, it is of value to examine the practice patterns of these doctors in particular, as they manage their patients based on their personal experience and continued readings of medical literature, and not being governed by the numerous peer-directed protocols in a hospital-based practice. This was compared to the

Yong Loo Lin  
School of Medicine,  
National University  
of Singapore,  
10 Medical Drive,  
Singapore 117597

Tan C, MBBS  
House Officer

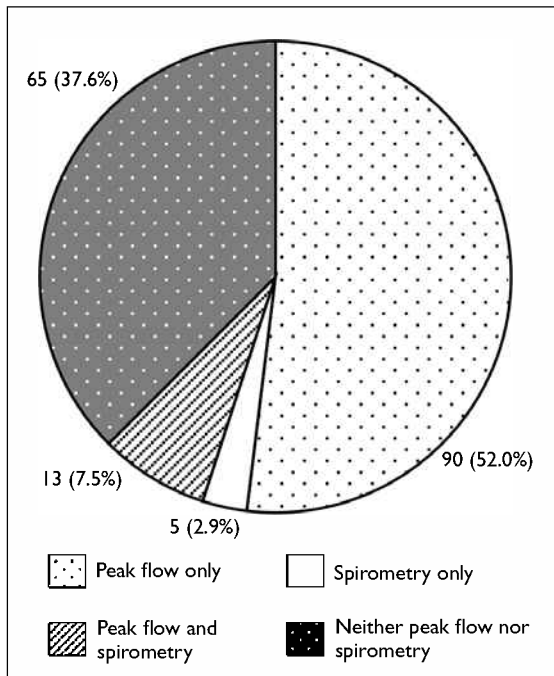
Wong B, MBBS  
House Officer

Department of  
Paediatrics

Goh D Y, MMed,  
FRCPCH, FCCP  
Associate Professor  
and Head

Van Bever HP,  
MD, PhD  
Professor and  
Senior Consultant

Correspondence to:  
Prof Hugo Van Bever  
Tel: (65) 6772 4420  
Fax: (65) 6779 7486  
Email: paevbhps@  
nus.edu.sg



**Fig. 1** Pie chart shows breakdown by number and percentage of usage of peak flow meters and/or spirometers.

gold standard of management in the global community. Worldwide direction is taken from the Global Initiative for Asthma (GINA) group that produces yearly updates<sup>(7)</sup> and guidelines on asthma management based on current peer-reviewed research direction. Local clinical practice guidelines<sup>(8)</sup> also look closely to these updates for guidance. The direction of this study was therefore to compare current practices by Singaporean doctors against accepted gold standards. The aims of this study on doctors seeing a paediatric patient population were:

- To describe the ways doctors monitor asthma (objective and descriptive methods).
- To describe the methods used in managing acute asthma attacks, particularly with regard to choice and usage of drugs.
- To describe the maintenance treatment of asthma in different age groups and the factors prompting its initiation.

## METHODS

The study was performed via a questionnaire in the format of a booklet containing 30 questions, which covered monitoring, acute treatment and maintenance treatment of childhood asthma. Respondents were asked to indicate their demographical profile and answer questions based on their monitoring of asthma. For treating acute asthma, respondents were asked to rank their drugs of choice as well as select their various patterns of corticosteroid use. For maintenance treatment of asthma, respondents were again

**Table 1. First-line drugs in acute asthma.**

Drug	Frequency (%)
Nebulised salbutamol/terbutaline every 20 mins	105 (60.7)
Salbutamol inhaler with spacer	40 (23.1)
Nebulised ipratropium bromide with/without fenoterol	17 (9.8)
Other treatment	5 (2.9)
Subcutaneous adrenaline every 20 mins	2 (1.2)
Subcutaneous salbutamol/terbutaline every 20 mins	2 (1.2)
Oral corticosteroids	1 (0.6)
Intravenous aminophylline	0 (0.0)
Intravenous/intramuscular corticosteroids	0 (0.0)

asked to rank their drugs of choice for children of different age groups as well as select their criteria for initiating maintenance treatment. The questions are reproduced in Appendix 1.

2,100 of these booklets were distributed by post to general practitioners and hospital-based doctors who treat paediatric patients in Singapore. Replies were collected in the form of anonymous self-addressed stamped envelopes returned to the investigators. This was done during the period of April–June 2007. Data was then tabulated by two investigators with cross-checking of results, and this was subsequently analysed with the Statistical Package for Social Sciences version 13.0 (SPSS Inc, Chicago, IL, USA). Descriptive statistics were generated, and various cross-tabulations and tables were produced.

## RESULTS

181 questionnaires were returned, a response rate of 8.62%. There were 173 respondents with valid results. 104 (60.1%) respondents were male, and 68 (39.3%) were female. The majority (52.0%) were within the 31–45 year age group. 30.6% were 46–55 years of age, and 11.6% were 56–65 years of age. 132 (76.3%) were general practitioners, while 25 (14.5%) were general paediatricians. The 132 general practitioners mostly worked in private clinics, while only five worked in a polyclinic and two in private hospital settings. The general paediatricians were evenly divided between private hospitals, university hospitals and private clinics.

The vast majority never (50.9%) or seldom (38.2%) used symptom score cards or diaries to monitor childhood asthma. 52.0% used only peak flow meters, while a significant number (37.6%) used neither peak flow meters nor spirometers (Fig. 1). Of the 103 respondents that did use peak flow meters, 49 (47.6%) seldom used it while 40 (38.8%) used it frequently. Only 18 respondents used spirometers, and of these, ten (55.6%) seldom used it while six (33.3%) used it frequently.

**Table II. First-line maintenance treatment of asthma.**

Drug	Frequency (%)		
	Infants	Preschoolers	Older children*
Inhaled corticosteroids	63 (36.4)	80 (46.2)	73 (42.2)
LABA + inhaled corticosteroid	51 (29.5)	53 (30.6)	72 (41.6)
Montelukast	22 (12.7)	19 (11.0)	14 (8.1)
LABA	14 (8.1)	15 (8.7)	10 (5.8)
Others (ketotifen, zaditen, short-acting beta-agonist)	13 (7.5)	5 (2.9)	3 (1.7)

\* 6–16 years of age

LABA: long-acting beta-agonist

The most popular first-line drugs in managing asthma were nebulised short-acting beta-agonists, salbutamol inhaler with spacer, and nebulised ipratropium bromide, respectively (Table I). Of those 105 doctors using nebulised salbutamol/terbutaline, 41 (39.0%) used salbutamol inhaler with spacer as a second-line treatment and 33 (31.4%) used oral corticosteroids as a third-line treatment. Of those 40 doctors using a salbutamol inhaler as a first-line treatment, the most common second- and third-line drugs were nebulised salbutamol/terbutaline (26, 65.0%) and oral corticosteroids (12, 30.0%), respectively.

On considering admission to hospital for acute asthma, most respondents indicated personal clinical judgment (148, 85.5%) and no improvement after salbutamol nebulisation (150, 86.7%) as relevant criteria. Few used a scoring system, such as Wood's asthma score (11, 6.4%). Slightly more doctors considered administering inhaled corticosteroids in an outpatient setting (104, 60.1%) frequently or always, as compared to systemic corticosteroids (71, 41.0%). 127 (73.4%) doctors chose prednisolone as a first choice steroid, while 37 (21.4%) chose hydrocortisone.

In the maintenance treatment of asthma, across all age groups, the most commonly-used first-line drug was uniformly inhaled corticosteroids (Table II). Combinations of a long-acting beta-agonist (LABA) and inhaled corticosteroids were uniformly the second most popular drug. Maintenance treatment was frequently used by most doctors in treating preschoolers (108, 62.4%) and older children (112, 64.7%). In contrast, most doctors seldom (78, 45.1%) or never (37, 21.4%) applied maintenance treatment to infants. As a criteria to start maintenance treatment, most respondents listed frequency of symptoms (99, 57.2%) or severity of symptoms (62, 35.8%) as their most important criterium. Only 8 (4.6%) listed severity of lung function disturbance as their most important criterium. The vast majority (158, 91.3%) of doctors never used immunotherapy in asthma management. 2.9% of respondents believed immunotherapy was not available locally.

## DISCUSSION

The response rate for this study was low. This may have led to a degree of response bias in the results, with some studies showing that likely respondents were mostly younger, have smaller patient loads and had relevant postgraduate qualifications in general practice.<sup>(9-11)</sup> A good proportion of doctors used peak flow meters in monitoring asthma. These figures are comparable to similar studies from Japan (58%),<sup>(12)</sup> Taiwan (41.9%),<sup>(13)</sup> and moderately less than the 75% usage reported in the United States.<sup>(14)</sup> However, a significant third of respondents neither used peak flow meters nor spirometers for this purpose. A study performed in Taiwan similarly had a large number of respondents not using these methods.<sup>(15)</sup> Some major reasons cited include not knowing how to use the devices or considering them of little use. Poor patient compliance and education may be an issue to be addressed in the local population. The vast majority either did not or sparingly used diaries or score cards for monitoring asthma. This intervention was suggested in the GINA guidelines,<sup>(7)</sup> as the use of diary cards have been shown to give a good overview of symptoms.<sup>(16)</sup> In contrast, however, several studies in children with asthma have shown either over-reporting of medication compliance or lack of adherence to diary writing,<sup>(17-19)</sup> thus this method may have limited utility in a busy local practice.

In terms of management of an acute asthma exacerbation, most doctors acted appropriately in accordance with GINA guidelines by administering a short-acting beta-agonist.<sup>(7)</sup> This result is also similar to practices in other nations with established medical care.<sup>(20-22)</sup> A large-scale review did not show the any superiority of continuous nebulisation vs. intermittent beta-agonists with spacer.<sup>(23)</sup> Thus, perhaps convenience and ease of use become higher considerations. It is encouraging that 40%–60% of doctors prescribed oral or inhaled<sup>(24)</sup> corticosteroids in the outpatient setting. These have been shown to decrease hospitalisation and relapse rates in large reviews.<sup>(25,26)</sup> However, these figures are still low and more should be done to encourage doctors to prescribe short-

term steroids in acute asthma. A confounding reason for this could be that the local clinical practice guidelines<sup>(8)</sup> (at the time of study withdrawn for updating), stated that they have to be used selectively and carefully because of undesirable potential side effects; this is in contrast to GINA guidelines,<sup>(7)</sup> which encouraged the use in all but the mildest of attacks. Short courses of oral steroids have been shown to have minimal side effects in children,<sup>(27)</sup> yet are similarly under-prescribed elsewhere.<sup>(28,29)</sup> Patient/parental education must be given more emphasis as steroid use is thought to be synonymous with growth retardation in the local culture. With regard to the strong reliance on clinical judgment on deciding the need for hospital admission, this is not an unreasonable practice especially in the light of the complexity of alternative methods in the hurried acute setting.

In the maintenance treatment of asthma, most doctors prescribed inhaled corticosteroids or a combination of this with an inhaled LABA. Although inhaled corticosteroids are encouraged by the GINA guidelines,<sup>(7)</sup> the use of LABA is not recommended for most asthmatic children, especially as a monotherapy. It is only recommended for a select group of patients as an add-on treatment if their symptoms are not sufficiently controlled by medium dosages of inhaled corticosteroids. This is a matter of concern. As a monotherapy, it has limited application,<sup>(30,31)</sup> and may not actually decrease exacerbation rates,<sup>(32)</sup> yet is given to up to 8.6% of children alone. Furthermore, no major trials have established a safety profile in children under the age of five years for LABA. Thus, doctors should adapt their prescribing practices accordingly until more research data is available. A smaller number prescribe antihistamines, which although appropriate for treatment of other symptoms of the atopic triad, is not recommended for asthma by itself. Montelukast is similarly not recommended as a monotherapy. More studies need to be done on the actual amount of follow-up for asthmatic children by primary care practitioners, as this may affect prescribing practices. Anecdotally, primary care follow-up is inconsistent as compared to hospital specialist outpatient care, although this must be confirmed objectively before further conclusions could be drawn.

The smaller number of infants selected for maintenance treatment could be a result of diagnostic difficulty. A wheeze from a viral infection is hard to discriminate from a first asthmatic episode in infants.<sup>(33,34)</sup> Furthermore, peak flow meters and other objective measures are not possibly used in this age group. A high index of clinical suspicion is often required, otherwise it may lead to asthma being under-diagnosed and under-treated until these infants are older and asthma is confirmed. The low usage of immunotherapy is an

avenue that can be further explored. Reasons for this could possibly include prohibitive costs especially in a primary care setting, as well as a lack of knowledge about specific therapies available. However, a study has reported that long-term use of sublingual immunotherapy can actually translate into overall cost savings if indirect costs due to symptom relief are considered.<sup>(35)</sup> More awareness should be raised to private general practitioners on this up-and-coming avenue of treatment.

This study appropriately reached out to the target spectrum of doctors with a comprehensive questionnaire. More specific questions, such as those surveying specific usage of asthma action plans as well as correlation between management and severity, can be included in future follow-up research. Measures can also be taken to improve the response rate of the study, which would include the sending out of reminder letters to all participants at specific intervals, the use of telephone follow-ups, or specific token incentives. In conclusion, childhood asthma in Singapore is generally well managed in comparison with the gold standard. However, more needs to be done with regard to increasing the prescription of corticosteroids for acute exacerbations, holding back on LABAs for most children (especially in infants and as a monotherapy), as well as to increase physician awareness of new advances in immunotherapy.

## REFERENCES

1. Asthma. World Health Organisation Factsheet; May 2008. No 307. Available at: [www.who.int/mediacentre/factsheets/fs307/en/index.html](http://www.who.int/mediacentre/factsheets/fs307/en/index.html). Accessed December 2, 2008.
2. Braman SS. The global burden of asthma. *Chest* 2006; 130:4S-12S.
3. Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: ISAAC. The International Study of Asthma and Allergies in Childhood (ISAAC) Steering Committee. *Lancet* 1998; 351:1225-32.
4. Yang KS, Ng TP, Kwang YP, et al. Prevalence of childhood asthma and control in children assessed in a pilot school-based intervention programme in Singapore. *J Paediatr Child Health* 2007; 43:353-8.
5. Wang XS, Tan TN, Shek LP, et al. The prevalence of asthma and allergies in Singapore; data from two ISAAC surveys seven years apart. *Arch Dis Child* 2004; 89:423-6.
6. Asia Pacific Association of Paediatric Allergy, Respiriology and Immunology [online]. Available at: [www.apapari.org](http://www.apapari.org). Accessed December 2, 2008.
7. Global Strategy for Asthma Management and Prevention. Global Initiative for Asthma [online]. Available at: [www.ginasthma.org](http://www.ginasthma.org). Accessed May 17, 2007.
8. Management of Asthma. Ministry of Health Clinical Practice Guidelines (Singapore) 2002: 30-43.
9. Armstrong D, Ashworth M. When questionnaire response rates do matter: a survey of general practitioners and their views of NHS changes. *Br J Gen Pract* 2000; 50:479-80.
10. Cockburn J, Campbell E, Gordon JJ, Sanson-Fisher RW. Response bias in a study of general practice. *Fam Pract* 1988; 5:18-23.

11. Barclay S, Todd C, Finlay I, Grande G, Wyatt P. Not another questionnaire! Maximizing the response rate, predicting non-response and assessing non-response bias in postal questionnaire studies of GPs. *Fam Pract* 2002; 19:105-11.
12. Makino S, Furusho K, Ohta K, Mukoyama T. A survey on awareness and utilization of new asthma management guidelines in Japan. *J Asthma* 2003; 40:701-8.
13. Yeh KW, Chen SH, Chiang LC, Chen LC, Huang JL. Survey of asthma care in Taiwan: a comparison of asthma specialists and general practitioners. *Ann Allergy Asthma Immunol* 2006; 96:593-9.
14. Finkelstein JA, Lozano P, Shulruff R, et al. Self-reported physician practices for children with asthma: are national guidelines followed? *Pediatrics* 2000; 106:886-96.
15. Yeh KW, Chiang LC, Chen SH, Huang JL. Survey of the clinical practice of physicians in the management of asthma in Taiwan. *Asian Pac J Allergy Immunol* 2006; 24:1-8.
16. Reznik M, Sharif I, Ozuah PO. Classifying asthma severity: prospective symptom diary or retrospective symptom recall? *J Adolesc Health* 2005; 36:537-8.
17. Butz AM, Donithan M, Bollinger ME, Rand C, Thompson RE. Monitoring nebulizer use in children: comparison of electronic and asthma diary data. *Ann Allergy Asthma Immunol* 2005; 94:360-5.
18. Berg J, Dunbar-Jacob J, Rohay JM. Compliance with inhaled medications: the relationship between diary and electronic monitor. *Ann Behav Med* 1998; 20:36-8.
19. Bender B, Wamboldt FS, O'Connor SL, et al. Measurement of children's asthma medication adherence by self report, mother report, canister weight, and Doser CT. *Ann Allergy Asthma Immunol* 2000; 85:416-21.
20. Phin S, Oates RK. Variations in the treatment of childhood asthma. *Med J Aust* 1993; 159:662-6.
21. Vichyanond P, Hatchaleelaha S, Jintavorn V, Kerdsomnuig S. How pediatricians manage asthma in Thailand. *Pediatr Pulmonol* 2001; 32:109-14.
22. Civelek E, Sekerel BE. Management of childhood asthma: physicians' perspective in Turkey. *Pediatr Allergy Immunol* 2004; 15:372-5.
23. Cates CJ, Crilly JA, Rowe BH. Holding chambers (spacers) versus nebulisers for beta-agonist treatment of acute asthma. *Cochrane Database Syst Rev* 2006; CD000052
24. Edmonds ML, Camargo CA Jr, Pollack CV Jr, Rowe BH. Early use of inhaled corticosteroids in the emergency department treatment of acute asthma. *Cochrane Database Syst Rev* 2003; CD002308.
25. Rowe BH, Spooner C, Ducharme FM, Bretzlaff JA, Bota GW. Early emergency department treatment of acute asthma with systemic corticosteroids. *Cochrane Database Syst Rev* 2000; CD001490.
26. Smith M, Iqbal S, Elliott TM, Everard M, Rowe BH. Corticosteroids for hospitalised children with acute asthma. *Cochrane Database Syst Rev* 2003; CD002886.
27. Ducharme FM, Chabot G, Polychronakos C, Glorieux F, Mazer B. Safety profile of frequent short courses of oral glucocorticoids in acute pediatric asthma: impact on bone metabolism, bone density, and adrenal function. *Pediatrics* 2003; 111:376-83.
28. Elizur A, Bacharier LB, Strunk RC. Pediatric asthma admissions: chronic severity and acute exacerbations. *J Asthma* 2007; 44:285-9.
29. Alshehri M. The under-use of steroids for children with asthma in southwestern Saudi Arabia. *J Egypt Public Health Assoc* 2002; 77:469-78.
30. Nelson HS, Weiss ST, Bleecker ER, Yancey SW, Dorinsky PM. The Salmeterol Multicenter Asthma Research Trial: a comparison of usual pharmacotherapy for asthma or usual pharmacotherapy plus salmeterol. *Chest* 2006; 129:15-26.
31. Bisgaard H. Long-acting beta(2)-agonists in management of childhood asthma: A critical review of the literature. *Pediatr Pulmonol* 2000; 29:221-34.
32. Bisgaard H. Effect of long-acting beta2 agonists on exacerbation rates of asthma in children. *Pediatr Pulmonol* 2003; 36:391-8.
33. Lin YZ, Huang FY. Infantile wheezing and bronchodilator treatment. *Acta Paediatr Taiwan* 2005; 46:3-5.
34. Wright AL. Epidemiology of asthma and recurrent wheeze in childhood. *Clin Rev Allergy Immunol* 2002; 22:33-44.
35. Berto P, Passalacqua G, Crimi N, et al. Economic evaluation of sublingual immunotherapy vs symptomatic treatment in adults with pollen-induced respiratory allergy: the Sublingual Immunotherapy Pollen Allergy Italy (SPAI) study. *Ann Allergy Asthma Immunol* 2006; 97:615-21.

**Appendix I****APAPARI: Questionnaire-based assessment on monitoring and treatment of childhood asthma**

The questionnaire is made up by 4 parts:

- A. Demographic data of the participant (doctor).
- B. Questions on monitoring childhood asthma.
- C. Questions on treating an acute asthma attack in children.
- D. Questions on maintenance treatment of childhood asthma in infants, preschoolers, and older children.

*Only 1 answer per question, unless otherwise indicated!*

**A. Demographic data of the participant (doctor)**

1. Country: \_\_\_\_\_
2. Female  Male
3. Age group:
 

< 30 years	<input type="checkbox"/>
31–45 years	<input type="checkbox"/>
46–55 years	<input type="checkbox"/>
56–65 years	<input type="checkbox"/>
> 65 years	<input type="checkbox"/>
4. I consider myself as a:
 

- general paediatrician	<input type="checkbox"/>
- paediatric pulmonologist	<input type="checkbox"/>
- paediatric allergist	<input type="checkbox"/>
- general practitioner	<input type="checkbox"/>
- pulmonologist (adults + children)	<input type="checkbox"/>
- allergist (adults + children)	<input type="checkbox"/>
- other: .....	<input type="checkbox"/>
5. I mainly work in a:
 

- polyclinic	<input type="checkbox"/>
- private hospital	<input type="checkbox"/>
- university hospital (tertiary hospital)	<input type="checkbox"/>
- other setting: .....	<input type="checkbox"/>

**B. Questions on monitoring childhood asthma**

6. Do you use symptom score cards (or diary cards) to monitor childhood asthma?
 

- Never	<input type="checkbox"/>
- Seldom	<input type="checkbox"/>
- Frequent	<input type="checkbox"/>
- Always	<input type="checkbox"/>
7. Do you use a peak flow meter or spirometer to monitor childhood asthma?
 

- Peak flow only	<input type="checkbox"/>
- Spirometry only	<input type="checkbox"/>
- Peak flow and spirometry	<input type="checkbox"/>
- Neither peak flow nor spirometry	<input type="checkbox"/>
8. How often do you use a peak flow meter?
 

- Never	<input type="checkbox"/>
- Seldom	<input type="checkbox"/>
- Frequent	<input type="checkbox"/>
- Always	<input type="checkbox"/>
9. How often do you use a spirometer?
 

- Never	<input type="checkbox"/>
- Seldom	<input type="checkbox"/>
- Frequent	<input type="checkbox"/>
- Always	<input type="checkbox"/>

**C. Questions on treating an acute asthma attack in children**

10. List your drug of choice in the treatment of an acute asthma-attack.  
(1: first choice; 2: second choice; etc).
  1. Subcutaneous adrenaline injection every 20 mins. ( )
  2. Subcutaneous injection of salbutamol/terbutaline every 20 mins. ( )
  3. Nebulised salbutamol or terbutaline in every 20 mins. ( )
  4. Intravenous push aminophylline. ( )
  5. Intravenous or intramuscular corticosteroids. ( )
  6. Salbutamol inhaler with spacer. ( )
  7. Nebulised ipratropium bromide with/without fenoterol. ( )
  8. Oral corticosteroids. ( )
  9. Other ..... ( )

11. What are your criteria for admitting children with acute asthma?  
(You may tick more than one of the following options)
1. Based on Wood asthma score.
  2. Based on personal clinical judgment.
  3. No improvement after they received nebulisation with salbutamol.
  4. No improvement after two or three doses of salbutamol inhaler.
  5. No improvement after subcutaneous adrenaline.
  6. Other factors, such as home distance and travel time.
  7. Peak flow meter reading of less than 50% of standard mean.
  8. Low oxygen saturation (< 90%).
  9. Other reasons .....
12. Do you use intravenous aminophylline in the treatment of acute asthma?
- Never
  - Seldom
  - Frequent
  - Always
13. When you use intravenous aminophylline, do you monitor the theophylline level?
- In none of the patients
  - Only in patients with severe asthma
  - In all patients
  - Service is unavailable in my hospital/clinic
14. Do you administer systemic corticosteroids (not inhaled corticosteroids) in an outpatient setting (ER, polyclinic) in the treatment of acute asthma?
- Never
  - Seldom
  - Frequent
  - Always
15. Do you administer inhaled corticosteroids in an outpatient setting (ER, polyclinic) in the treatment of acute asthma?
- Never
  - Seldom
  - Frequent
  - Always
16. When do you use corticosteroids in patients admitted for asthma?
- In all admitted cases
  - In patients who develop symptoms of severe asthma
  - Never
17. From the following list, indicate from 1 to 5 your corticosteroid of choice in the treatment of acute asthma?  
(1: first choice, etc.)
- Hydrocortisone ( )
  - Prednisolone ( )
  - Methylprednisolone ( )
  - Dexamethasone ( )
  - Triamcinolone ( )
18. What is your duration of treatment with corticosteroids?
- Same dose for five days
  - Same dose for seven days
  - Tail down dosage over seven days
  - Tail down dosage over 14 days
  - Others: .....
19. Do you base oxygen therapy on pulse oximetry reading?
- Pulse oximetry service is unavailable
  - Only in cases of severe asthma
  - In all patients
20. Do you use antibiotics in the treatment of acute asthma?
- Never
  - Only in cases of pneumonia, otitis media or sinusitis
  - Only in cases of suspected pneumonia with or without fever
  - Only in severe asthma patients to prevent superinfection
  - In all patients seen in ER
  - In admitted patients only
21. Do you use high-dose inhaled corticosteroids in the treatment of acute asthmatic attacks?
- Never
  - Seldom
  - Frequent
  - Always

22. In your hospital, can you treat severe asthmatic attack with intubation or ventilatory support (at the ICU / PICU)?
- No, will require transfer of patient to a tertiary / university hospital
  - Yes, but outcome unfavourable
  - Yes, with results comparable to tertiary / university hospital
  - other: .....

**D. Questions on maintenance treatment of childhood asthma in infants, preschoolers and older children**

23. List your drug of choice in the maintenance treatment of asthma in infants.  
(1: first choice, etc).

- Montelukast ( )
- Inhaled corticosteroids ( )
- Long-acting beta-agonists ( )
- Long-acting beta-agonist + inhaled corticosteroid ( )
- Other: ..... ( )

24. List your drug of choice in the maintenance treatment of asthma in preschool children (< 6 years of age)  
(1: first choice, etc).

- Montelukast ( )
- Inhaled corticosteroids ( )
- Long-acting beta-agonists ( )
- Long-acting beta-agonist + inhaled corticosteroid ( )
- Other: ..... ( )

25. List your drug of choice in the maintenance treatment of asthma in older children (6–16 years)  
(1: first choice, etc).

- Montelukast ( )
- Inhaled corticosteroids ( )
- Long-acting beta-agonists ( )
- Long-acting beta-agonist + inhaled corticosteroid ( )
- Other: ..... ( )

26. How often do you use maintenance treatment in asthmatic infants?

- Never
- Seldom
- Frequent
- Always

27. How often do you use maintenance treatment in asthmatic preschoolers?

- Never
- Seldom
- Frequent
- Always

28. How often do you use maintenance treatment in asthmatic older children?

- Never
- Seldom
- Frequent
- Always

29. List the criteria that made you decide to start a maintenance treatment in asthmatic children.  
(1: most important criterion, 2: second, etc).

- Severity of the symptoms ( )
- Frequency of the symptoms ( )
- Severity of lung function disturbance ( )
- Severity of underlying allergy ( )
- Family history of asthma ( )
- Other: ..... ( )

30. Do you use specific immunotherapy (subcutaneous, sublingual) to treat asthma in children?

- Never
- Seldom
- Frequent
- Always
- Not available in my country