

Wheezing in Chinese schoolchildren: disease severity distribution and management practices, a community-based study in Hong Kong and Guangzhou

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Summary

Background Asthma is a common chronic disease and information on its management practices at the community level is helpful in identifying problems and improving asthma care.

Objective To assess the severity status and management of the asthma symptom of wheeze of children at the community level in Hong Kong (HK) and Guangzhou (GZ).

Methods Cross-sectional study of children aged 10 years using the International Study of Asthma and Allergic disease in Childhood (ISAAC Phase II protocol). Asthma management and lung function were assessed in 178 (98 from HK and 80 from GZ) randomly selected children with wheeze over the past 12 months.

Results Eighty-three percent, 11%, 6% and 0% of children suffered from intermittent, mild persistent, moderate persistent and severe persistent asthma, respectively, according to the frequency of their symptoms. Addition of spirometric parameter only changed the asthma severity classification in 2.8% of children. Medications were used by 30.6% and 71.3% of children for wheeze in HK and GZ, respectively. In HK, inhaled β_2 -agonist (73.3% among the drug users) was the commonest medication used followed by inhaled corticosteroid (ICS) (23.3%). In GZ, inhaled β_2 -agonist was used by 75.4% of children, but use of ICS (26.3%), oral β_2 -agonist (26.3%), oral theophylline (45.6%), oral ketotifen (36.8%) and oral steroid (35.1%) were also common. ICS was only used by 11.4% of children with persistent asthma. Ten percent and 18.7% of children in HK and GZ, respectively, had emergency department visits, while 16.3% and 11.6% of children in HK and GZ, respectively, had missed school secondary to asthma over the past 1 year.

Conclusions Most children in the community had intermittent asthma and addition of lung function to symptoms did not significantly affect classification of asthma severity. Significant morbidity was seen even in this group of children with mostly intermittent and mild persistent asthma.

Keywords asthma management, children, Guangzhou, Hong Kong, lung function

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Introduction

Asthma is a common chronic disease world-wide and its prevalence is increasing in many regions [1–3]. The International Study of Asthma and Allergic disease in Childhood (ISAAC) showed that the 12-month prevalence of wheeze in teenagers in the Asia-Pacific region is only half of that reported in Western Europe, with 8.0% vs. 16.7% [4]. Despite a lower prevalence when compared with other regions, the problem of asthma is still significant in Hong Kong (HK) with about 10% estimated to have the disease [5]. In the Asia-Pacific region, 15% of teenagers were troubled by exercise-induced symptoms during the past 12 months [6]. Asthma

mortality rates in areas like HK and Japan are similar to those reported in western countries [6].

The optimal treatment of asthma has been described by both local and international guidelines [7]. Despite the existence of guidelines for the diagnosis and management of asthma for more than a decade, deviations from published guidelines are frequent and practice patterns vary widely in treating asthma. Studies suggested that a substantial proportion of children with asthma did not have their symptoms adequately controlled [8, 9]. Most of the previous studies on asthma management pattern were performed by the surveying physicians, reviewing the prescribing records from large databases or from doctors' records [10–14]. These studies gave important information on the physician's understanding and treatment of asthma. However, these data did not necessarily reflect the situation at the community level. Children with asthma may be using the medications prescribed differently from that of the advice given by

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doctors or even using alternative therapies. In spite of that, information of asthma management in children in the community level has been scarce, particularly in China. This information at the community level is important as it truly reflects how the children in the community are managing their asthma symptoms. This allows problems to be identified and possibly tackled.

This study is a community-based study conducted within the framework of the Phase II ISAAC study [15]. Symptoms of wheezing, objective assessment of lung function including spirometry and bronchial challenge, and the management of asthma symptoms in children were assessed in HK and Guangzhou (GZ), two large cities in the southern part of China. Information included the use of medications and use of other alternative therapies, and visits to doctors, emergency services and hospitalizations were collected. The aim of this study is to assess the asthma severity status and management of the asthma symptom of wheeze in these two communities.

Methods

This cross sectional study was conducted from 1997 to 1998 in HK and GZ where GZ is situated approximately 200 km north of HK. The study was approved by the ethics committees of the participating institutions. Informed parental consent was obtained from parents or guardians before the study was carried out. Random samples of schoolchildren were recruited for the study using primary schools as sampling units as described previously [16]. Students of grade 5 of the participating schools were selected for the study and these children were about 10 years of age. A written questionnaire was completed by the parents of the children following the ISSAC Phase II protocol [15].

We surveyed a total of 3110 and 3565 children in HK and GZ, respectively, with the parental questionnaire. The ISAAC Phase II questionnaire asked for information on demography, symptoms of wheeze, asthma, rhinitis and eczema, along with various possible risk factors, including immunization history, family history of allergic diseases and environmental exposure during the peri-natal period and at the time of the survey. The participation rate for the questionnaire in HK and Guangzhou was 97% and 92%, respectively, as described in our previous study [17]. Among those with the parental questionnaire, 80–100 current wheezers were randomly selected in each region. Current wheeze was defined as having had a wheezing attack one or more times over the past 12 months. In this sub-sample, questionnaires on their asthma management were completed by the parents or guardians (Appendix 1). The questionnaire contained questions on the use of medications, including western medications and other traditional therapies. Health-care utilizations like emergency department visits, hospitalizations and visits to doctors for wheezing or asthma attack in the past 12 months were also surveyed. In addition, parents were asked whether their children had a written asthma management plan and a home peak flow meter.

In this sub-sample, skin prick test (SPT), spirometry and bronchial challenge test were performed with consent. SPT was performed as described in the previous study [17].

Subjects with one or more positive reactions were considered atopic. Lung function test (forced expiratory volume in 1 s (FEV₁) and forced vital capacity was measured (Vitalograph, Model S, Buckingham, UK) according to the American Thoracic Society standards [18]. Bronchial challenge test with methacholine was performed according to the protocol by Yan et al. [19]. Bronchial hyper-responsiveness (BHR) was defined as having a provocation dose of methacholine causing a 20% decrease in FEV₁ from baseline (PD₂₀) at a dose $\leq 7.8 \mu\text{mol}$.

The severity of asthma was classified with modification to the Global Initiative for Asthma (GINA) guidelines according to the children's frequency of symptoms alone or symptoms together with lung function [7]. As the ISAAC questionnaire surveyed the frequency of wheeze over the past 12 months instead of at weekly intervals as in the GINA guideline, modification of the GINA symptom classification was used in this study: children with less than 4 times of wheeze over the past 12 months were regarded as having intermittent asthma, 4–12 times wheeze as mild persistent asthma and more than 12 times wheeze as moderate persistent asthma. The nocturnal symptoms and lung function criteria for classification were the same as in the GINA guidelines. Nocturnal symptoms of ≤ 2 times a month, > 2 times a month, > 1 time a week and frequent were classified as intermittent, mild persistent, moderate persistent and severe persistent asthma, respectively. Regarding lung function, children with FEV₁ $\geq 80\%$ predicted were classified as having intermittent or mild persistent asthma depending on their symptoms. Children with FEV₁ 60–80% and $\leq 60\%$ predicted were considered to have moderate persistent and severe persistent asthma, respectively. The presence of one feature of severity was sufficient to place the child in that category. The classification of asthma severity is illustrated in Table 1.

Data were analysed by the Statistical Package of the Social Science (SPSS) Statistical software for Window, Version 10.0 (SPSS Inc, Chicago, IL, USA). Descriptive statistics and figures were presented as mean $\pm$ SD unless otherwise stated. Categorical data were compared using χ^2 tests. A *P*-value of

Table 1. Classification of asthma symptoms by clinical features

Intermittent asthma
Wheeze 1–3 times over the past 12 months
Nocturnal wheeze not more than 2 times per month
FEV ₁ $\geq 80\%$ predicted
Mild persistent asthma
Wheeze 4–12 times over the past 12 months
Nocturnal wheeze more than twice a month
FEV ₁ $\geq 80\%$ predicted
Moderate persistent asthma
Wheeze ≥ 12 times over the past 12 months
Nocturnal wheeze more than once a week
FEV ₁ or PEF 60–80% predicted
Severe persistent asthma
Wheeze ≥ 12 times over the past 12 months
Frequent nocturnal wheeze
FEV ₁ $\leq 60\%$ predicted

The presence of one feature of severity was sufficient to place the child in that category.

FEV₁, forced expiratory volume in 1 s; PEF, peak expiratory flow.

<0.05 was considered as significant. Determinants of use of asthma medication were assessed by logistic regression analysis. Variables that were considered relevant (gender of the child, education level of parents, parental history of asthma, history of hospitalization or emergency department visits, doctor's diagnosis of asthma, atopy, BHR and asthma severity) were entered into the model.

Results

A total of 178 children with wheeze in the preceding 12 months were investigated in HK and GZ. The demographics and asthma severity of the subjects are shown in Tables 2 and 3, respectively. The age of the children was 10.5 ± 0.5 years (range 9.0–12.7) and there were more boys than girls. The prevalence rates of physician-diagnosed asthma in children with wheeze in the past 12 months were 64.3% and 72.5% in HK and GZ, respectively. BHR was present in 56.1% of the children in HK and 76.3% of the children in GZ who had current wheeze.

Most of the respondents were atopic and all except five had a normal lung function ($FEV_1 > 80\%$ predicted). Wheeze was generally not frequent as the majority (62.2% in HK and 81.3% in GZ) of children had less than four wheezing attacks over the past 1 year. Nocturnal symptoms were present in 28%

Table 2. Demographic data of the children surveyed

	HK	GZ
Wheeze in the past 12 months	Yes ($n = 98$)	Yes ($n = 80$)
Mean age (mean $\pm$ SD)	10.7 ± 0.6	10.3 ± 0.3
Gender (M/F)	64/34	55/25
Diagnosed asthma	63 (64.3)	58 (72.5)
Lung function ($FEV_1\%$ predicted)		
> 80% predicted	92	77
60–80% predicted	2	3
< 60% predicted	0	0
Children with BHR*	55 (56.1)	61 (76.3)
Atopy†	63 (64.3)	77 (96.3)‡
Frequency of wheeze in the last 12 months		
1–3	81 (82.7)	69 (86.3)
4–12	11 (11.2)	9 (11.2)
≥ 12	6 (6.1)	2 (2.5)
Frequency of wheeze at night in the last 12 months		
No nocturnal wheeze	67 (68.4)	55 (67.8)
≤ 2 Times a month	28 (28.6)	17 (21.3)
> 2 times a month	0 (0)	0 (0)
> 1 Time a week	2 (2.0)	3 (3.8)
Frequent	0 (0)	0 (0)
Wheezing severe enough to limit the child's speech to one or two words at a time between breaths in the last 12 months		
Yes	9 (9.2)	5 (6.2)
No	88 (89.8)	71 (88.8)
Children having allergic rhinitis	75 (76.3)	53 (66.3)
Children having eczema	27 (27.6)	16 (20.0)‡

Data are presented as n (%) unless stated otherwise.

*Bronchial hyper-responsiveness (BHR) was defined as having a provocation dose of methacholine causing a 20% decreased in forced expiratory volume in 1 s (FEV_1) from baseline (PD_{20}) at a dose $\leq 7.8 \mu\text{mol}$. †Defined as a positive skin prick test (weal diameter ≥ 3 mm greater than control) to at least one of eight common aeroallergens. ‡ $P < 0.05$ when children in Hong Kong (HK) and Guangzhou (GZ) were compared.

of the children over the past 12 months. Over 80% of children had intermittent asthma classified according to symptoms with or without FEV_1 data (Table 3). Only five children (two in HK and three in GZ) were graded to a higher level of asthma severity when lung function parameter was added to symptoms. There was no statistically significant difference in the asthma severities between the subjects in HK and GZ.

The drug therapies are shown in Fig. 1. Thirty percent ($n = 30$) and 71.3% ($n = 57$) of children in HK and GZ, respectively, were using medications for controlling wheezing. Most children used the medications on an as-needed basis. Among the children with medication use for wheeze, 82.6% in HK and 91.2% in GZ used medications when they had wheezy attacks. Only 8.7% and 22.8% of children in HK and GZ, respectively, used asthma medications on a regular basis. Inhaled β_2 -agonist was the most common medication used by

Table 3. Asthma severity (by symptoms only and by symptoms and lung function)

Asthma severity	Intermittent	Mild persistent	Moderate persistent	Severe persistent
HK ($n = 98$)				
Symptoms and lung function	79 (80.6)	12 (12.2)	7 (7.1)	0 (0)
Symptoms only	81 (82.7)	11 (11.2)	6 (6.1)	0 (0)
GZ ($n = 80$)				
Symptoms and lung function	64 (80.0)	9 (11.3)	7 (8.8)	0 (0)
Symptoms only	67 (83.8)	9 (11.3)	4 (5)	0 (0)

HK, Hong Kong; GZ, Guangzhou.

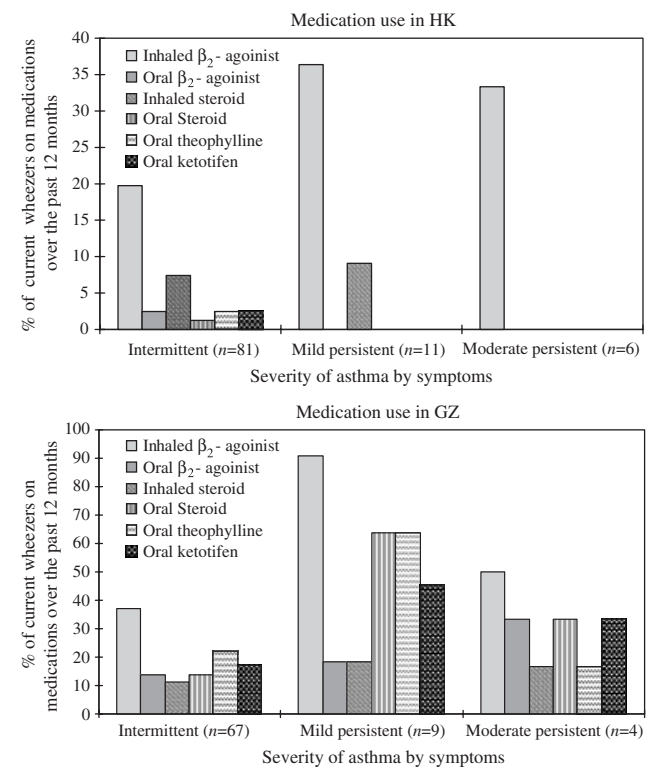


Fig. 1. Drug therapies for current wheezers in Hong Kong (HK) and Guangzhou (GZ).

Table 4. Management practices of children with current wheeze in Hong Kong (HK) and Guangzhou (GZ)

*Asthma severity		HK, total No.(%) (n = 98)	GZ, total No.(%) (n = 80)
No. of visits to a doctor for regular follow-up of wheezing or asthma			
0	Intermittent	71 (72.4%)	60 (75.0%)
	Mild persistent	7 (7.1%)	9 (11.0%)
	Moderate persistent	4 (4%)	4 (5.0%)
1–4	Intermittent	10 (10.2%)	3 (3.8%)
	Mild persistent	3 (3.1%)	0 (0%)
	Moderate persistent	2 (2.0%)	0 (0%)
≥ 4	Intermittent	0 (0%)	0 (0%)
	Mild persistent	1 (1.0%)	0 (0%)
	Moderate persistent	0 (0%)	0 (0%)
No. of regular follow-ups by respiratory specialist for wheezing or asthma			
0	Intermittent	77 (78%)	54 (67.5%)
	Mild persistent	10 (10.2%)	9 (11.3%)
	Moderate persistent	6 (6.1%)	4 (5.0%)
1–4	Intermittent	4 (4.1%)	2 (2.5%)
	Mild persistent	1 (1.0%)	0 (0%)
	Moderate persistent	0 (0%)	0 (0%)
> 4	Intermittent	0 (0%)	1 (1.3%)
	Mild persistent	0 (0%)	0 (0%)
	Moderate persistent	0 (0%)	2 (2.5%)
No. of visits to a doctor for wheezing or asthma			
0	Intermittent	46 (46.9%)	35 (43.8%)
	Mild persistent	4 (4.1%)	3 (3.8%)
	Moderate persistent	6 (6.1%)	4 (5.0%)
1–4	Intermittent	34 (34.7%)	21 (26.0%)
	Mild persistent	5 (5.1%)	3 (3.8%)
	Moderate persistent	0 (0%)	0 (0%)
≥ 4	Intermittent	1 (1.0%)	6 (7.5%)
	Mild persistent	2 (2.0%)	3 (3.8%)
	Moderate persistent	0 (0%)	0 (0%)
No. of visits to a specialist for wheezing or asthma			
0	Intermittent	80 (81.6%)	63 (7.8%)
	Mild persistent	11 (11.2%)	9 (11.3%)
	Moderate persistent	5 (5.1%)	4 (5.0%)
1–3	Intermittent	1 (1.0%)	1 (1.3%)
	Mild persistent	0 (0%)	0 (0%)
	Moderate persistent	1 (1.0%)	0 (0%)
Visited psychiatrist or psychologist for wheezing or asthma			
Intermittent		2 (2.0%)	0 (0%)
	Mild persistent	0 (0%)	1 (1.3%)
	Moderate persistent	0 (0%)	0 (0%)
Possessed home peak flow meter			
Intermittent		3 (3.1%)	2 (2.5%)
	Mild persistent	0 (0%)	0 (0%)
	Moderate persistent	0 (0%)	0 (0%)
Used an asthma management plan			
Intermittent		8 (8.2%)	6 (7.5%)
	Mild persistent	2 (2.0%)	2 (2.5%)
	Moderate persistent	0 (0%)	2 (2.5%)
Use of traditional therapy for wheeze			
Intermittent		6 (6.1%)	26 (32.5%)
	Mild persistent	1 (1.0%)	6 (7.5%)
	Moderate persistent	0 (0%)	1 (1.3%)

Table 5. Morbidity of current wheezers in Hong Kong (HK) and Guangzhou (GZ)

*Asthma severity		HK (n = 98)	GZ (n = 80)
Admitted to hospital because of wheezing or asthma			
1 Time	Intermittent	5 (5.1)	0 (0)
	Mild persistent	1 (1.0)	0 (0)
	Moderate persistent	0 (0)	0 (0)
2 or more times	Intermittent	1 (1.0)	0 (0)
	Mild persistent	0 (0)	0 (0)
	Moderate persistent	0 (0)	0 (0)
Total No. with admissions		7 (7.1)	0 (0)
Attended emergency because of wheezing or asthma			
1 Time	Intermittent	5 (5.1)	3 (3.8)
	Mild persistent	1 (1.0)	2 (2.5)
	Moderate persistent	2 (2.0)	0 (0)
2 Times	Intermittent	2 (2.0)	2 (2.5)
	Mild persistent	0 (0)	4 (5.0)
	Moderate persistent	0 (0)	0 (0)
> 2 Times	Intermittent	0 (0)	4 (5.0)
	Mild persistent	0 (0)	0 (0)
	Moderate persistent	0 (0)	0 (0)
Total No. with emergency visits		10 (10.2)	15 (18.7)
School missed because of asthma			
1–5 Times	Intermittent	12 (12.2)	6 (7.5)
	Mild persistent	3 (3.1)	3 (3.8)
	Moderate persistent	1 (1.0)	0 (0)
> 5 Times		0 (0)	0 (0)
		16 (16.3)	9 (11.3)

Data are presented as the absolute numbers (%).

*Severity classified according to symptoms.

children with wheeze (22 out of 30, 73.3% among the drug users), followed by inhaled corticosteroids (ICSs) (seven out of 30, 23.3%) in HK. In GZ, inhaled β_2 -agonist (43 out of 57, 75.4%) was most commonly used by children with wheeze over the past 12 months, followed by ICS (15 children, 26.3%), oral bronchodilator (15 children, 26.3%), oral theophylline (26 children, 45.6%), oral ketotifen (21 children, 36.8%) and oral steroid (20 children, 35.1%). There were no reports of regular use of systemic steroids.

Management practices for current wheezers are shown in Table 4. Most children did not have regular follow-up for their wheezing problem. Only 16.3% of children in HK and 3.8% of children in GZ had regular follow-up by a doctor. Even fewer had regular follow-up by a respiratory specialist (5.1% and 6.3% in HK and GZ, respectively). Only two children each in HK and GZ had a home peak flow meter for monitoring asthma or wheezing symptoms. Asthma management plan was available in 10.2% and 12.5% of the children with current wheeze in HK and GZ, respectively. All subjects who had asthma management plan had a physician-diagnosed asthma. The use of asthma management plan for those children with physician-diagnosed asthma was 15.9% and 17.2% in HK and GZ, respectively. Forty-three percent and 41.3% of children visited a doctor for wheezing in HK and GZ, respectively. Only 5.1% of children in HK and 2.5% of children in GZ visited a respiratory specialist for the same

problem. Children in GZ were more likely to receive traditional and alternative therapies when compared with children in HK (7.1% in HK and 41.2% in GZ, $P < 0.001$). Traditional and alternative therapies used included visits to chiropractors, acupuncturists or herbalists.

Despite having normal lung function and infrequent symptoms, 7.1% of children in HK had been admitted to a hospital with wheezing or asthma, and 10.2% and 18.8% of children in HK and GZ had emergency department visits in the preceding 12 months. During the same period, 16% of children in HK and 11.3% of children in GZ had missed school 1–5 times as a result of wheezing or asthma (Table 5).

Among those children with hospital admissions or emergency department visits over the past 12 months, only one out of 11 children in HK and one out of 15 children in GZ were on regular ICS therapy. Regular follow-up by doctor and asthma management plan was only available in a minority of these children (three had regular follow-up by the doctor, one had asthma management plan in HK; no children had regular asthma follow-up and one child had asthma management plan in GZ). History of hospitalization or emergency department visits, doctor's diagnosis of asthma, presence of BHR and increasing asthma severity were significant determinants of use of anti-asthma medications (Table 6). Increase in one level of asthma severity was related to 2.7-fold chance of using medications for wheezing.

Table 6. Determinants of medication use for children with current wheeze in both Hong Kong and Guangzhou

	Adjusted OR	95% CI	P-value
Sex			
Male	1.69	0.72–3.98	0.23
Female	1.0		
Standard of education of parents†			
High	1.38	0.59–3.21	0.46
Low	1.0		
Parental asthma			
Yes	0.60	0.18–1.99	0.40
No	1.0		
History of hospitalization or emergency department visits			
Yes	5.93	1.44–24.44	0.01*
No	1.0		
Doctor's diagnosis of asthma			
Yes	4.36	1.76–10.78	0.001*
No	1.0		
Atopy			
Yes	1.65	0.41–6.65	0.48
No	1.0		
BHR			
+	2.60	1.03–6.57	0.04*
–	1.0		
Asthma severity by symptoms (increase level of severity)	2.69	1.14–6.31	0.02*

Adjusted for observed effect of all variables presented in the table using logistic regression analysis. All reference categories had an OR of 1.0 and asthma severity was a continuous variable.

OR, odds ratio; CI, confidence interval; BHR, bronchial hyper-responsiveness.

* $P < 0.05$. †High = finished secondary school for either parent of the child.

Discussion

This is the first study in both HK and GZ on the use of medications for wheezy children in the community together with measurement of objective parameters including spirometry and bronchial challenge. This study demonstrated how the symptom of wheeze was managed at the community level. Although majority of children in the community only had mild asthma, a large proportion still required urgent health care and missed school because of their disease.

Our analysis showed that the addition of FEV₁ criterion to symptom-based assessment would only change the asthma severity grading in five out of the 178 children (2.8%). In most published guidelines, asthma severity classification involved the use of lung function parameter [7, 20]. A previous study suggested in school-age children, reported symptoms by both the children and parent did not reliably correlate with lung function [21]. In another study, concordance between functional evaluation and clinical status was only found for moderate persistent asthma but not for intermittent and mild persistent asthma [22]. As symptoms might not correlate with lung function, it was believed that an objective parameter such as lung function might contribute to severity assessment. As most children assessed in this study had mild asthma and normal lung function, the addition of lung function criteria may not contribute too much to asthma severity classification.

It was found that a substantial number of children did not use medications for controlling their wheeze. Thirty percent of children in HK and 71% of children in GZ with current wheeze used medications for their symptoms, either as needed or regularly. The data in HK were similar to a German community in which <50% of the children with wheeze were using anti-asthmatic medications [23]. The medications used by the children in our study were mainly as an on-demand situation rather than as a regular preventive therapy. Even in the 11 children in HK and 15 children in GZ who required emergency department visits or hospitalizations for their wheeze, only one in each area was on preventive inhaled steroid therapy. Regular follow-up by doctor and use of asthma management plan were also very uncommon even among children with considerable morbidities. These findings were in concordance with those of other studies. The Asthma Insights and Reality in Europe study found that more patients had used quick-relief medication (63%) than ICS (23%) [9]. A similar finding was noted in the AIRIAP study, which showed that current use of quick-relief bronchodilator was 56.3% and ICS was 13.6% [8]. All these suggested that the under-usage of ICS is a common global problem.

In patients having intermittent asthma, treatment should be inhaled β_2 -agonist as required [7]. However, while these drugs were most commonly used by children classified as having mild intermittent disease in both cities, a substantial proportion also used oral bronchodilator, theophylline, ketotifen and even oral steroid as on-demand medications for wheezing. This was particularly so in GZ. This pattern of medication use may be because of a combination of preference for oral medications, cost consideration or ignorance by doctors and/or parents. This issue certainly needs to be addressed if one wants to improve asthma care in these two communities. The proportion of atopic wheezers in

HK was lower than that in GZ (64% vs. 96%), although more children in HK had hayfever and eczema. Our previous study demonstrated that environmental factors and diet may contribute to the difference in prevalence of asthma in different cities (HK, GZ and Beijing) of China [24]. It was uncertain whether the mechanism for wheeze differed between the populations in HK and GZ, and thus whether treatment differed.

Alternative and traditional therapies were not used commonly by children in HK (7.1%) with current wheeze. However, 41.2% of children in GZ used this form of therapy. The difference may be because of cultural difference between HK and GZ. In general, people in mainland China have high acceptance to herbal medicine and other alternative therapies like acupuncture. People in HK tend to be more westernized and prefer using western medicine for management of their diseases. Previous studies found that children with asthma using complementary therapy tended to have persistent asthma, be on high-dose ICS, had poorer control of their asthma symptoms and more frequent doctor visits [25]. At the community level, most of the children have intermittent asthma and that may be the reason why alternative therapy was not commonly used.

Even with intermittent asthma, children should have regular follow-up by medical practitioners to have their disease monitored [7]. At times of increasing severity, medications can be upgraded to prevent morbidities like missing schools, emergency department visits or hospitalizations. Despite reports saying that, for patients with asthma who were managed by allergists instead of generalists, the outcomes in regard to cancel activities, hospitalization and emergency department visits for asthma, quality of care ratings and physical functioning were significantly better [26], there is no absolute need for all children with asthma to be managed by allergists or pulmonologists. Nevertheless, follow-up by a medical practitioner is important and children should have their lung function monitored to assess any decline that would suggest on-going airway inflammation. However, regular follow-up was not practiced by most of these children in both HK and GZ. Perhaps, more education is needed for both parents and doctors to improve asthma care in the society.

A physician's diagnosis of asthma was found to predict the use of medication for wheezing in children in HK and GZ (odds ratio 4.36%, 95% confidence interval 1.76–10.78). Under-diagnosis of asthma had been reported in both children and adults [27–29]. In our study, children with current wheeze had a high prevalence of atopy and BHR; however, only 68.0% of them had physician-diagnosed asthma. Pauwells et al. [30], in a large multi-centre, double-blind clinical trial, found that in patients with mild persistent asthma, early intervention with inhaled budesonide could decrease the risk of severe exacerbation and improve asthma control. Our subjects with under-diagnosis of asthma and thus under-treatment probably accounted for the significant morbidity. History of hospitalization or emergency department visits was also found to predict the use of medications in children with wheeze. This was expected as they would more likely to seek treatment for their severe symptoms.

There were limitations for this study. The sample size of this study was small. In addition, parental questionnaire was used

for the assessment of the management of wheeze in children. The medical records of the children were not assessed. Although, the parents did the questionnaire at home, where they could be able to check with the medications, health records and school attendance records if available, recall bias was possible.

In conclusion, this study revealed the data on the reality of management of asthma symptoms in children in two communities, HK and GZ, in the southern part of China. Like many other regions in the world, childhood asthma is sub-optimally treated at the community level in HK and GZ. Despite the fact that most children in the community had intermittent or mild persistent asthma, morbidities like emergency department visits, hospitalizations and missing schools occurred not infrequently. Follow-up of wheezing by a medical practitioner was also not practiced for most children. Symptom-based classification of asthma severity appeared to be adequate for the community study as addition of spirometric parameter would not alter the severity classification significantly. Efforts should be made to improve the care of asthma children in these two communities. Education of parents and doctors on the chronic nature of asthma and proper current therapeutic concepts may help to improve the control of asthma in Chinese children.

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Appendix 1

Asthma management questionnaire

1. In the past 12 months, has your child used any medicine, pills, puffers or other medication for wheezing or asthma? Yes/No

If you have answered 'YES', then please name the medication(s):

'Western' medicines _____ _____ _____ _____	How often? When wheezy/regularly When wheezy/regularly When wheezy/regularly When wheezy/regularly	'regularly' means everyday for at least two months of the year
'Traditional' therapies _____ _____ _____ _____	When wheezy/regularly When wheezy/regularly When wheezy/regularly When wheezy/regularly	

2. In the past 12 months, has your child used any medicines, pills, puffers or other medications for wheezing or asthma before, during or after exercise?

If you have answered 'YES', then please name the medication(s):

'Western' medicines

'Traditional' therapies

3. Do you have a written plan which tells you how to look after your child's asthma? Yes/No

4. Does your child have a peak flow meter at home? Yes/No

5. In the past 12 months, how many visits your child made to any of the following health professionals for wheezing or asthma?

(a)	For a wheezy episode?	No. of times:
	Health worker	_____
	Nurse	_____
	Doctor	_____
	Hospital emergency department	_____
(b)	For regular 'check-up' for asthma?	No. of times:
	Health worker	_____
	Nurse	_____
	Doctor	_____
	Hospital emergency department	_____

6. In the past 12 months, how many times has your child been admitted to hospital because of wheezing or asthma? (none/1/2/ more than 2)

7. In the past 12 months, has your child been to any of the following for wheezing or asthma?

Acupuncturist	Yes/No	8. Has your child ever had an allergy injection to prevent or
Chiropractor	Yes/No	treat asthma? Yes/No
Homeopath	Yes/No	
Physiotherapist	Yes/No	9. In the past 12 months, how many days (or part days) of
Psychiatrist or psychologist	Yes/No	school has your child missed because of wheezing or
Social worker	Yes/No	asthma? (none/ 1–5/ 6–10/ more than 10)
Others	Yes/No	