

# Survey of the Clinical Practice of Physicians in the Management of Asthma in Taiwan

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**SUMMARY** Asthma is a common problem with a prevalence rate increasing every year. However, not all asthmatic patients receive appropriate treatment, partly due to the disease entity or patients' compliance, and partly due to physicians' knowledge and disposition in terms of treatment. This study was designed to investigate the current status of asthma treatment among clinicians in different practice settings, particularly regarding the acceptance of and adherence to asthma treatment guidelines and asthma patient education. Questionnaires were distributed by randomized sampling to doctors throughout the entire country. The questionnaire had six parts, measuring the following: 1) the use of different kinds of medication in the treatment of asthma; 2) adherence to asthma treatment guidelines; 3) the use of inhaled corticosteroids as part of management; 4) the use of peak flow meters in monitoring asthma; 5) relative efficiency in treating asthma; and 6) the use of a referral system, from general practitioners to specialists. There were 531 respondents out of 1,000 questionnaires distributed. The results revealed the following: 1) 20.2% of physicians use oral corticosteroids for maintenance therapy; 2) 31.8% of physicians do not follow asthma treatment guidelines; 3) 77.2% of physicians use inhaled corticosteroids for maintenance therapy (physicians in medical centers and regional hospitals use inhaled corticosteroids more frequently than private practitioners); 4) 51% of doctors do not use peak flow meters to monitor asthma symptoms because of prohibitive costs; 5) approximately 80% of clinicians have confidence in dealing with asthma problems; and 6) 29.2% of general practitioners do not refer patients to asthma specialists unless there is poor control or a need for further evaluation. Adherence to asthma treatment guidelines is poor, and such guidelines need to be popularized or simplified. There are still many discrepancies among doctors at different levels of hospitals. Re-education and review of asthma knowledge is necessary to keep clinical practitioners at the forefront of standard practice.

Over the past 30 years, the prevalence rate of pediatric asthma has increased in Taiwan, i.e. from 1.3% in 1974 to 14.7% in 2002,<sup>1,2</sup> and its incidence has been more prominent in urban areas than in the suburbs. Yet, it is difficult to ascribe one definite cause to this worldwide phenomenon. Moreover, asthma remains a significant medical problem and a growing healthcare economic issue for individuals and to society. According to the data from the Bu-

reau of National Health Insurance in Taiwan, it costs almost \$19.6 billion NTD (approximately \$57.6 mil-

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lion USD) per year to administer asthma medication, not to mention other related expenses such as diagnostic examinations and education. Barach *et al.*<sup>3</sup> found that a lack of appropriate diagnosis and communication between patients and physicians was one of the primary reasons leading to mortality in asthma.<sup>3</sup> In order to promote high-quality asthma care, the Global Initiative for Asthma (GINA) issued asthma treatment guidelines in 1993, revising them in 2002. The guidelines emphasized that asthma education is not only for patients or caregivers, but also for primary physicians, nurses and pharmacists.<sup>4</sup> Many countries have published asthma management guidelines with the aim of standardizing and improving management. The Taiwan Asthma Guidelines was published in 2000 to fit the country's cultural considerations. The guidelines are used to ensure that all members of the healthcare team are aware of the treatment goals. However, most doctors are still unaware of the guidelines and seldom follow the recommendations set forth.<sup>5</sup>

Asthma is a fatal disease if not well controlled. Early treatment and establishment of a treatment plan, proper administration of medication, and monitoring of disease activity can decrease the economic costs, duration of hospitalization and mortality rate. Many studies have focused on pharmacotherapy, genetics, and asthma education to reduce the morbidity in asthma. Physicians play a much more important role in the treatment team because their attitudes and asthma knowledge can influence treatment outcomes. They need a critical amount of asthma knowledge, skill and patience to educate patients, in light of wide variations in asthma management reported from a large survey on the practice behaviors of physicians.<sup>6</sup>

Doerschug and coworkers<sup>7</sup> also surveyed 108 physicians, including specialists, generalists, fellows and residents from the departments of allergy, pulmonology, general medicine, and family medicine, regarding their knowledge of asthma based on the National Heart Lung and Blood Institutes (NHLBI) asthma guidelines. Although asthma specialists and fellows scored higher on asthma knowledge than other primary care physicians, the authors suggested that all physician groups could benefit from continuing medical education focused on asthma guidelines. According to hospital accredita-

tion classification criteria in Taiwan, hospitals are classified as medical centers, regional hospitals or community hospitals based on facility integrity, staffing number, training capacity, and bed number. Currently, asthmatic patients can visit any level of hospital without referral. Going forward, it will be interesting to examine the practice patterns of physicians towards asthma in different practice settings in Taiwan.

## MATERIALS AND METHODS

### Survey instrument

A questionnaire was developed to evaluate physicians' disposition in treating asthmatic patients and their practice in using treatment guidelines.<sup>8</sup> The questionnaire had six parts, measuring the following: 1) the use of different kinds of medication in the treatment of asthma; 2) adherence to treatment guidelines; 3) the use of inhaled corticosteroids as part of management; 4) the use of peak flow meters in monitoring asthma; 5) the relative efficiency in treating asthma; and 6) the use of a referral system, from the general practitioner to the asthma specialist.

The survey instrument was pilot tested with seven qualified asthma specialists. Its reliability was assessed by specialists' responses to the questionnaire (Cronbach alpha = 0.9). The content validity was assessed by correlating the answers to the questions by the specialists (Cronbach alpha = 0.89).

### Samples

The questionnaires were applied to a randomized sampling of doctors throughout the entire country. In order to acquire a sample with a 95% confidence level within 5% error, we mailed 1,000 questionnaires to the physicians listed and registered with the Department of Health. All of the physicians were engaged in primary care (i.e. general practice, family practice, internal medicine or pediatrics) and/or asthma specialties.

### Data analysis

Differences in the responses between the physician groups were assessed by a *chi*-square test and ANOVA test. Logistic regression analyses strati-

fied by physician type were also used to determine the use of peak flow meters and education. All of the analyses were performed using SPSS 10.0.

**RESULTS**

One-thousand questionnaires were mailed throughout the entire country. A total of 531 (53.1%) questionnaires were returned, completely filled out with valid responses, including 81.5% males and 18.5% females. Most of the doctors (85.4%) were below 50 years of age. The basic demographic characteristics are presented in Table 1.

**Using inhaled corticosteroids for chronic asthma**

Only 66.7% of the respondents considered that inhaled corticosteroids were one of the long-term controllers of asthma. Corticosteroids were pre-

scribed as maintenance therapy in 81.0%. However, 20.5% of physicians considered inhaled corticosteroids as a quick reliever for acute asthma attacks (Table 2). It was also found that 52.5% of doctors prescribed the oral-form of corticosteroids as a long-term treatment medication, along with 20.2% prescribing it for long-term control.

Regarding physicians' prescriptions in different practice settings, 82.2% of physicians in regional hospitals and 89.8% of physicians in medical centers used inhaled corticosteroids for chronic asthma treatment (Table 2). This is 4.3-fold (95% confidence interval [CI]: 2.1-8.8;  $p < 0.001$ ) and 7.1-fold higher than for private practitioners (95% CI: 2.8-18.0;  $p < 0.001$ ), respectively. Furthermore, doctors who performed asthma education for patients preferred to use inhaled corticosteroids for maintenance therapy (odds ratio [OR]: 2.2; 95% CI: 1.2-

**Table 1** Characteristics of the respondents

		Number	Percentage
<b>Gender</b>	Male	433	81.5%
	Female	98	18.5%
<b>Age (years)</b>	26-30	20	3.8%
	31-35	86	16.2%
	36-40	133	25%
	41-45	142	26.7%
	46-50	73	13.7%
	51-55	42	7.9%
	56-60	17	3.2%
	61-65	12	2.3%
	66-70	1	0.2%
<b>Practice setting</b>	Above 71	5	0.9%
	Medical center	137	25.8%
	Regional hospital	135	25.4%
	Community hospital	90	16.9%
	Private practice clinic	169	31.8%
<b>Specialty</b>	Internist	220	41.4%
	Chest physician	48	9.0%
	Allergist	46	8.7%
	General pediatrician	112	21.1%
	Family doctor	82	15.4%
	Otolaryngologist	13	2.4%
	Other	10	1.9%
	<b>Subspecialty for asthma</b>	Yes	94
	No	437	82.3%
<b>Total</b>		<b>531</b>	

**Table 2** The use of inhaled corticosteroids of physicians in different practice settings

Conditions prompting the prescription of inhaled corticosteroids	Practice setting (physician number)*				Total
	PP (169)	CH (90)	RH (135)	MC (137)	
<b>During asthma attack</b>	21 (12.4%)	21 (23.3%)	28 (20.7%)	39 (28.5%)	109 (20.5%)
<b>Poor response to bronchodilators</b>	31 (18.3%)	25 (27.8%)	40 (29.6%)	17 (12.4%)	113 (21.3%)
<b>As a long-term controller</b>	129 (76.3%)	67 (74.4%)	111 (82.2%)	123 (89.8%)	430 (81.0%)
<b>No idea</b>	21 (12.4%)	3 (3.3%)	9 (6.7%)	3 (2.2%)	36 (6.8%)

\* PP = primary practitioner, CH = community hospital, RH = regional hospital, MC = medical center.

4.0;  $p = 0.013$ ). Doctors who followed asthma treatment guidelines also prescribed inhaled corticosteroids more frequently (OR: 4.3; 95% CI: 2.3-7.7;  $p < 0.001$ ).

### Asthma education

Nearly 80% of physicians performed asthma education whenever treating asthmatic patients. In this group, 56.3% of asthma education was performed by the doctors themselves and 25% by nurses. The rest of the physicians administered asthma education by videos or booklets. The source of asthma knowledge for physicians was mostly from textbooks (82.7%). Only 37.9% of this group based their teachings on the government-mandated treatment guidelines, while approximately 47.5% based their practice on their own past personal experiences.

Although most of the physicians gave asthma education in practice, only 67.4% of the physicians in regional hospitals did the same, though it was not significantly lower than for doctors in other settings (OR: 0.6, 95% CI: 0.4-1.1;  $p = 0.09$ ). Pediatricians had a higher propensity for conducting asthma education in clinics (OR: 3.7; 95% CI: 1.8-7.5). Allergologists and asthma specialists had an even higher propensity (97.8%) for conducting asthma education than for other groups (74.3%), with an odds ratio of 13.3 (95% CI: 3.1-6.2;  $p < 0.001$ ).

### Treatment guidelines

The Taiwan Asthma Treatment Guidelines, based on the GINA guidelines, was announced by

the government in 2000. From this survey, 31.8% of physicians have not been following the treatment guidelines. It was also found that 28.4% of all physicians did not know that there were asthma treatment guidelines to follow. Up to 42.0% of the physicians did not have the guidelines at hand. Some of these doctors considered the guidelines too complicated to practice. The data in different practice settings are summarized in Table 3.

Around 71% to 74% of physicians in different practice settings followed the treatment guidelines, although only 52.6% of physicians in regional hospitals followed in kind.

Physicians who followed the treatment guidelines also prescribed inhaled corticosteroids for chronic treatment more frequently (OR: 4.2; 95% CI: 2.3-7.7;  $p < 0.001$ ), and taught patients to use peak flow meters to monitor their daily symptoms (OR 4.7; 95% CI: 2.8-7.8;  $p < 0.001$ ).

### Using peak flow meters

Generally, 51.2% of all respondents did not use peak flow meters to monitor patients' daily symptoms. In this group, 12.1% of doctors did not know how to use peak flow meters, while some physicians considered them useless in clinical practice (7.0%). The physicians who gave asthma education in the clinics were more likely to suggest using peak flow meters (OR: 4.7; 95% CI: 2.5-9.0;  $p < 0.001$ ).

It was also noted that doctors in community hospitals would use peak flow meters less often (OR: 0.4; 95% CI: 0.3-0.8;  $p = 0.003$ ) than doctors in

**Table 3** The practice of caring for asthmatic patients for physicians of different workplace environments

Physicians' practice	Physicians (%) in different practice settings				
	All (yes%)	Primary practitioners	Community hospitals	Regional hospitals	Medical centers
<b>Use of peak flow meters to monitor symptoms</b>	48.8	52.1	37.8	40.7	60.0
<b>Reasons not used</b>					
<i>Too expensive</i>	38.6	45.7	41.1	31.3	32.7
<i>No time to instruct</i>	26.5	30.9	23.2	27.5	20.0
<i>Physicians do not know how to use</i>	12.1	14.8	5.4	17.5	7.3
<i>Patients do not want to learn</i>	22.1	29.6	21.4	16.3	18.2
<i>Never heard of it</i>	7.7	8.6	8.9	8.8	3.6
<i>Patients are stable</i>	5.9	7.4	8.9	1.3	5.5
<i>Not helpful</i>	7.0	6.2	3.6	11.3	5.5
<i>Other</i>	12.1	13.6	7.1	10.0	18.2
<b>Following asthma treatment guidelines</b>	68.2	73.4	74.4	52.6	71.5
<b>Reasons not followed</b>					
<i>Not known</i>	28.4	24.4	13.0	34.4	30.8
<i>Too complicated</i>	19.5	31.1	13.0	10.9	20.5
<i>Disagree with the guidelines</i>	1.8	-	13.0	-	-
<i>Has followed but with poor effect</i>	4.1	6.7	4.3	3.1	2.6
<i>Not available at hand</i>	42.0	42.2	43.4	46.9	28.2
<i>Other</i>	8.3	3.0	2.2	2.2	2.9
<b>Performing asthma education</b>	77.8	85.8	77.8	67.4	78.1
<b>Reasons not performed</b>					
<i>No payment</i>	2.5	8.3	-	2.3	-
<i>Patient not interested</i>	5.9	20.8	-	4.5	-
<i>No time</i>	38.1	70.8	40.0	29.5	25.0
<i>No staff</i>	43.2	54.2	55.0	61.3	-

other settings. Physicians' practice in different workplace environments is summarized in Table 3.

**Relative efficiency in treating asthmatic patients**

We used a six-scale score to evaluate the self efficacy of the physicians in different practice settings (1 = very confident to 6 = not confident). Overall, 82.9% of the physicians had the confidence to deal with asthma problems. The doctors in medical centers were more confident in the diagnosis of asthma, management of acute exacerbation, instruction in using peak flow meters and the establishment of action plans for asthmatic patients. Furthermore, we used the Spear Rank Correlation Coefficient to evaluate the competence of the physicians at different levels. The physicians at higher levels of referred

institutions were more competent in the diagnosis, management, instruction, and discussion of asthma. All of the physicians in different practice settings had equal competence in teaching patients appropriate inhalation techniques (Table 4).

**Referral of patients to specialists**

A total of 29.2% of physicians, ranging from 25.2% to 35.8% in different settings, had never referred a patient to a specialist. On the other hand, the major reason for referral was poor control (46.6%), followed by evaluation or laboratory examinations (45.7%). The doctors in medical centers had a 3.3-fold higher rate of referring asthmatic patients to specialists than those in regional, community or private hospitals (95% CI: 1.7-6.6; *p* =

**Table 4** The competence of physicians in dealing with asthma problems in different practice settings<sup>§</sup>

Self efficacy <sup>#</sup> of physicians in different practice settings	PP	CH	RH	MC	Spearman Rank Correlation Coefficient	p value
Making correct diagnosis of asthma	2.80 ± 1.39	2.10 ± 0.76	2.10 ± 0.76	1.85 ± 0.63	0.099	0.024*
Managing the condition in acute exacerbation	2.16 ± 1.0	2.06 ± 0.58	2.09 ± 0.77	1.81 ± 0.68	0.106	0.015*
Instructing and assisting in inhalation techniques	2.46 ± 1.04	2.17 ± 0.77	2.48 ± 1.38	1.96 ± 0.72	0.073	0.096
Instructing and assisting in the use of peak flow meters	2.56 ± 1.24	2.04 ± 0.70	2.85 ± 1.49	2.16 ± 1.0	0.09	0.04*
Building an action plan for asthmatic patients	2.50 ± 1.21	2.03 ± 0.72	2.79 ± 1.29	2.10 ± 0.75	0.117	0.008*

# Self efficacy score is from 1 (very confident) to 6 (not confident).

§ PP = primary practitioner, CH = community hospital, RH = regional hospital, MC = medical center.

\* Statistically significant.

0.001). Physicians who followed the treatment guidelines were less likely to refer patients (OR: 0.2; 95% CI: 0.1-0.4;  $p < 0.001$ ).

## DISCUSSION

To improve the general quality of care for asthma, not only should patients receive asthma education, but health care providers should also have correct asthma knowledge. To improve the prevailing picture of clinical practice and disposition towards asthma care, further training or continuing education programs is necessary. Although the return rate of the questionnaire was only 53.1%, the survey still covered all the different districts and doctors from different levels of institutions (medical centers, regional hospitals, community hospitals and primary care practitioners) based on stratified cluster random sampling. This study is the first report concerning physicians' attitudes and knowledge towards asthma care in Taiwan.

Because of the lack of knowledge in the pathophysiology of asthma, the use of bronchodilators has not deferred mortality due to asthma.<sup>9</sup> The use of inhaled corticosteroids is presently a cornerstone in the treatment of inflammation in asthma. In a previous study on physicians in Thailand, oral beta agonist was the most preferred medication for chronic treatment; however, only 9.6% of pediatricians used inhaled corticosteroids in maintenance

therapy.<sup>10</sup> A similar finding was found in a survey in Pakistan.<sup>11</sup> However, in a survey of 512 office-based physicians in the United States, 85% of primary-care doctors prescribed inhaled corticosteroids for patients suffering from moderate persistent asthma, although 67% of the practitioners used such medication for mild persistent asthma.<sup>12</sup> In our survey, generally inhaled beta<sub>2</sub> agonist was considered the most frequently used medication for long-term control (68%), rather than the use of inhaled corticosteroids (66.7%). About 20% of physicians were even using oral corticosteroids for long-term control of asthma. The doctors at the higher levels of medical institutions prescribed more inhaled corticosteroids (90.0%) for long-term control of asthma. A total of 76.5% of primary practitioners prescribed inhaled corticosteroids for long-term control of asthma. This could be due in part because patients with more severe asthma visit medical centers directly, or partly because doctors at higher levels of medical institutions have more access to re-education courses.

In a national survey of practice behaviors, polling 2,998 physicians in the United States, there were wide variations in asthma management. Only 41% of physicians focused on inhalation techniques in the first visit.<sup>6</sup> In our past survey on moderately persistent asthma patients who used inhaled corticosteroids prescribed by doctors, only 17.4% of the patients continued use for long-term control.<sup>13</sup> We also found that the most frequent reason for physicians

who would not use inhaled corticosteroids for asthma was poor compliance and incorrect prescription of inhaled corticosteroids among asthmatic patients and their family. It was apparent that the percentage using inhaled corticosteroids was still below our expectation. There is presently a gap between physicians and patients concerning the issue of inhaled corticosteroids. It is thus very important to build a training program to re-educate general practitioners or to design refresher courses. We did not explore the treatment outcomes of patients in different practice settings, and this should be investigated further. Asthma education and communication with patients is important as well.

In a study of family practitioners, physicians reported that 68% of asthmatic patients had never performed spirometric testing, and 55% had never had a peak flow measurement.<sup>14</sup> This was similar to our survey. Physicians' compliance can influence the prescription of peak flow meters.<sup>15</sup> In a survey in Spain, only 33% of pediatricians used a peak flow meter in monitoring asthma. Doctors working in a hospital were more likely use the device than those working in healthcare centers. In our survey, the major reason for non-prescription was its price (US\$15, approximately). Nonetheless, even though it is not covered by any medical insurance, the price is affordable for the majority of patients in Taiwan. Although it has been shown that peak flow meter recordings are not consistently reproducible,<sup>16</sup> the use of a peak flow meter has still been an integral part of asthma treatment. Poor communication and education with patients is probably still the main reason.

The establishment of asthma treatment guidelines was published to promote the quality of asthma care by healthcare providers. The Taiwan Asthma Treatment Guidelines were published four years ago; however, only 68% of physicians have complied with the guidelines. Some doctors do not even know that there are guidelines released by the government. In a survey of pediatricians in the United States, it was found that 88% of doctors were aware of the asthma guidelines, and 81% of them reported having access to a copy of the guidelines. However, the self-reported rates of adherence to the guidelines was around 50%.<sup>17</sup> In previous studies in Taiwan, the adherence to asthma guidelines is sub-optimal for specialists in medical centers and re-

gional hospitals. Poor adherence to asthma guidelines may be due to doctors' behavior and patients' attitudes.<sup>18,19</sup> Disagreement by primary doctors with parts of the guidelines is a potential cause of poor adherence,<sup>20</sup> but in our survey, only 1.7% of the respondents disagreed with the guidelines. The continuing education of physicians should include asthma guidelines, along with public education of asthmatic patients.

Specialists and doctors at higher levels of institutions are relatively more efficient in terms of diagnosis and management of asthma. In other words, specialists have more competence in managing asthma problems than generalists.<sup>12</sup> However, home care and personal management of asthma is encouraged in the local community initially, and as such, it is not common to refer patients to a specialist.<sup>21</sup> Moreover, a referral system is not well established in Taiwan. People can visit any level of hospital without appointment or referral. If the doctors at community hospitals or primary practitioners were more competent, they could then afford good quality in asthma care as well.

The increasing prevalence of asthma throughout the world indicates that more populations will suffer from this disease and at increasing economic costs. To provide good medical service is not only the asthma specialists' responsibility, but also of doctors in every practice setting, taking on the responsibility for basic and fundamental knowledge in caring for asthma patients they may encounter each day. More effort needs to be exerted in the review or re-education of physicians in order to improve the quality of asthma care.

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#### REFERENCES

1. Kao CC, Huang JL, Ou LS, See LC. The prevalence, severity and seasonal variation of asthma, rhinitis and eczema in Taiwan schoolchildren. *Pediatr Allergy Immunol* 2005; 16: 408-15.
2. Yan DC, Ou LH, Tsai TL, Huang JL. Increasing prevalence of asthma, rhinitis and atopic dermatitis among 13 to 14-year-old children in Taipei city: an ISAAC phase study. *Ann*

- Allergy Asthma Immunol 2005; 95: 579-85.
3. Barach EM. Asthma in ambulatory care: use of objective diagnostic criteria. *J Fam Med* 1994; 38: 161-5.
  4. Education and delivery of care. In: Global Initiative for Asthma. National Institutes of Health: National Heart, Lung, and Blood Institute, USA, 2002: pp. 81-92.
  5. Grilli R, Lomas J. Evaluating the message: the relationship between compliance rate and subject of a practice guideline. *Med Care* 1994; 32: 202-13.
  6. Wolle JM, Cwi J. Physicians' prevention-related practice behaviors in treating adult patients with asthma: result of national survey. *J Asthma* 1995; 32: 309-18.
  7. Doerschug KC, Peterson MW, Dayton CS, Kline JN. Asthma guidelines: an assessment of physician understanding and practice. *Am J Respir Crit Care Med* 1999; 159: 1735-41.
  8. 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.
  9. Sears MR, Taylor R. The beta<sub>2</sub> agonist controversy observations: explanation and relationship to asthma epidemiology. *Drug Saf* 1994; 11: 259-83.
  10. Vichyanond P, Hatchaleelaha S, Jintavorn V, Kerdsonnuig S. How pediatricians manage asthma in Thailand. *Pediatr Pulmonol* 2001; 32: 109-14.
  11. Hussain SF, Zahid S, Khan JA, Haqee R. Asthma management by general practitioners in Pakistan. *Int J Tuberc Lung Dis* 2004; 8: 414-7.
  12. Janson S, Weiss K. A national survey of asthma knowledge and practices among specialists and primary care physicians. *J Asthma* 2004; 41: 343-8.
  13. Chen SH, Yin TJC, Huang JL. An exploration of the skills needed for inhalation therapy in schoolchildren with asthma in Taiwan. *Ann Allergy Asthma Immunol* 2002; 89: 311-5.
  14. Fried RA, Miller RS, Green LA, Sherrod P, Nutting PA. The use of objective measures of asthma severity in primary care: a report from ASPN. *J Fam Pract* 1995; 41: 139-43.
  15. Mendenhall AB, Tsien AY. Evaluation of physician and patient compliance with the use of peak flow meters in commercial insurance and Oregon health plan asthmatic populations. *Ann Allergy Asthma Immunol* 2000; 84: 523-7.
  16. Eid N, Yandell B, Howell L, Eddy M, Sheikh S. Can peak expiratory flow predict airflow obstruction in children with asthma? *Pediatrics* 2000; 105: 354-8.
  17. Cabana MD, Rand CS, Becher OJ, Rubin HR. Reasons for pediatrician nonadherence to asthma guidelines. *Arch Pediatr Adolesc Med* 2001; 155: 1057-62.
  18. Kuo SH. Implementation of asthma guideline in Taiwan-the management in medical centers. *J Asthma* 2002; 39: 767-70.
  19. Wan KS, Chen LH, Lin YL. Evaluation of the consensus of the national asthma treatment guidelines in Taiwan. *Acta Paediatrica Taiwanica* 2002; 43: 140-3.
  20. Picken HA, Greenfield S, Teres D, Hirway PS, Landis JN. Effect of local standards on implementation of national guidelines for asthma: primary care agreement with national asthma guidelines. *J Gen Intern Med* 1998; 13: 659-63.
  21. Blancquaert IR, Zvagulis I, Gray-Donald K, Pless IB. Referral patterns for children with asthma. *Pediatrics* 1992; 90: 71-4.