

BRIEF COMMUNICATION

Characteristics of traditional Chinese medicine use in children with asthma: a nationwide population-based study

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Abstract

Asthma is a chronic inflammatory airway disease accounting for severe morbidity and mortality in children. To determine the characteristics of traditional Chinese medicine (TCM) used to treat pediatric asthma, we conducted a nationwide population-based study by analyzing a cohort of one million randomly sampled patients from the beneficiaries of the National Health Insurance Program in Taiwan from 2002 to 2010. Children under 18 years of age with newly diagnosed asthma (ICD-9-CM code: 493, $N = 45\,833$) were enrolled, and 57.95% ($N = 26\,585$) of them had used TCM. The number of TCM users was significantly more than that of non-TCM users in school-age children. The most commonly prescribed TCM formula is Ding-chuan-tang, or Xing-ren (Semen Armeniacae Amarum) for the single herb. Our study is the first to reveal characteristics and prescription patterns of the use of TCM in children with asthma. Further research is needed to elucidate the efficacy and safety of these Chinese herbal products.

Asthma is one of the most common chronic diseases of childhood. Although there are some international studies on pediatric asthma such as the International Study of Asthma and Allergies in Childhood (ISAAC) (1), there is a lack of large-scale investigations on the use of traditional Chinese medicine (TCM) to treat asthma. Clinical studies on TCM formulas such as Mai-men-dong-tang, Ding-

chuan-tang, and anti-asthma herbal medicine intervention (ASHMI) have demonstrated substantial evidences of efficacy and safety in patients with asthma (2). However, the variety of TCM formulas and herbs makes it difficult to choose a suitable candidate for laboratory or clinical investigations.

In Taiwan, the National Health Insurance (NHI) program covers nearly all of Taiwanese inhabitants since 1996. All claims data were collected in the National Health Insurance Research Database (NHIRD). Traditional Chinese medicine services including Chinese herbal products (CHPs), acupuncture, and manipulative therapies provided by licensed TCM doctors in the outpatient setting are covered by the NHI (3).

Abbreviations

CHP, Chinese herbal products; ICD-9-CM, International Classification of Disease, 9th revision, Clinical Modification; NHI, National Health Insurance; NHIRD, National Health Insurance Research Database; TCM, traditional Chinese medicine.

To characterize the characteristics of TCM use in children with asthma, we analyzed a randomly sampled cohort of one million beneficiaries from the NHIRD during 2002–2010.

Methods

This study used data from the NHIRD in Taiwan. At the end of 2010, approximately 99.89% of the total 23 million Taiwanese population were enrolled (3). In this study, a cohort of one million patients was assembled by a random sample of all beneficiaries of the NHI program. The sampled population was representative of all NHI beneficiaries.

The study subjects were selected in the following manner. Of the one million randomly selected individuals enrolled in the NHI from January 1, 2002, to December 31, 2010, there were 227 056 persons under the age of 18. Children without asthma ($N = 162\,826$) were excluded, limiting the subjects to asthmatic (ICD-9-CM code: 493) patients only. Children diagnosed with asthma before the end of 2001 ($N = 18\,847$) were also excluded to ensure that all subjects had been newly diagnosed after the year 2002. After these criteria were applied, 45 833 study subjects were included in the study cohort. Children with a record of at least one TCM outpatient clinical visit between 2002 and 2010 were defined as TCM users ($N = 26\,558$), while children with no recorded TCM outpatient visits during this period were defined as non-TCM users ($N = 19\,275$). The CHPs were further categorized according to their therapeutic actions and indications based on TCM theory (4).

Data analysis consisted of descriptive statistics, including the frequency of prescriptions for TCM users stratified by patients' demographic characteristics and the most frequently prescribed herbal formulas and herbs for treating pediatric asthma. Primary indications were classified according to their ICD-9-CM codes. The data were analyzed using SAS software, version 9.2 (SAS Institute Inc., Cary, NC, USA).

Results

Among the 45 833 newly diagnosed asthmatic patients, 57.95% ($N = 26\,585$) had used TCM (Table 1). Demographic characteristics of these TCM users versus non-TCM users were listed in Table 1. For school-age children and adolescents, the number of TCM users was significantly more than that of non-TCM users ($P < 0.001$). The data from 420 058 TCM visits in the TCM user group from 2002 to 2010 were used for further analysis. Approximately 65% of the TCM users had more than three visits during the study period. Local clinics provided the majority of TCM services (90.14%). The most common modality of TCM treatment was CHPs (344 050 visits; 81.9%), while the remaining visits yielded treatments with acupuncture or manipulative therapies (76 008 visits; 18.09%). Diseases of the respiratory system were the most common indication for TCM use by TCM users (49.2%), followed by diseases diagnosed by symptoms/signs (23.33%) and gastrointestinal diseases (9.07%).

Table 1 Characteristics of traditional Chinese medicine (TCM) and non-TCM users in children with asthma

Characteristics	2002–2010	
	TCM users <i>N</i> (%)	Non-TCM users <i>N</i> (%)
No. of cases	26 558 (57.95)	19 275 (42.05)
Gender		
Female	11 355 (42.76)	8448 (43.83)
Male	15 203 (57.24)	10 827 (56.17)
Age, y*		
Infant and toddler, 0–2	4904 (18.47)	5978 (31.01)
Preschool, 3–5	10 405 (39.18)	7897 (40.97)
School age, 6–12	8923 (33.6)	4236 (21.98)
Adolescence, 13–18	2326 (8.76)	1164 (6.04)
Comorbidity		
Allergic rhinitis (AR)*	22 112 (83.26)	13 309 (69.05)
Atopic dermatitis (AD)*	9896 (37.26)	7933 (41.16)
AR and AD*	8676 (32.67)	5979 (31.02)
Number of personal TCM outpatient visits		
1–3	9483 (35.73)	
4–6	3941 (14.84)	
7–10	3138 (11.82)	
11–20	4118 (15.52)	
>20	5864 (22.09)	
Accreditation level of hospital		
Hospitals	41 448 (9.86)	
Local clinics	378 610 (90.14)	
Frequency of TCM visits by major disease category		
Diseases of respiratory system	206 657 (49.2)	
Chronic sinusitis	3584	
Allergic rhinitis	65 909	
Asthma	3931	
Symptoms, signs, and ill-defined conditions	80 665 (19.2)	
Diseases of digestive system	31 278 (7.45)	

* P value between TCM users and non-TCM users < 0.001 .

Details of the most commonly prescribed Chinese herbal formulas and single herbs for treating pediatric asthma are provided in Table 2. Among the most common herbal formulas are Ding-chuan-tang (26.93%) and Maxing-gan-shi-tang (13.87%), which are used to treat the Hot Syndrome. Xiao-qing-long-tang (24.92%) and Su-zi-jiang-qi-tang (7.76%) are used to treat the Cold Syndrome. Other formulas have different therapeutic actions and indications for comorbidities, tonification of Qi, or releasing the exterior. Of the ten most common single herbs prescribed by TCM doctors, Xing-ren (Semen Armeniacae Amarum; 13.54%) was the most frequently prescribed, followed by Gan-cao (Glycyrrhizae Radix; 11.84%) and Bei-mu (Fritillariae Bulbus; 11.59%).

Discussion

Our study is the first to analyze comprehensive characteristics of TCM use and prescription patterns of CHPs for children

Table 2 Ten most common herbal formulas and single herbs prescribed by traditional Chinese medicine (TCM) doctors for the treatment of children with asthma from 2002 to 2010 in Taiwan

TCM prescription	English name or Latin pharmaceutical name	Therapeutic actions and indications (4)	Frequency of prescription N (%)	Average daily dosage (g)	Average duration of prescription (day)
Herbal formulas					
Ding-chuan-tang	Panting-Stabilizing Decoction	The Hot Syndrome	1048 (26.93)	4.01	8.32
Xiao-qing-long-tang	Minor Green-Blue Dragon Decoction	The Cold Syndrome	970 (24.92)	3.33	12.52
Ma-xing-gan-shi-tang	Ephedra, Apricot Kernel, Licorice, and Gypsum Decoction	The Hot Syndrome	540 (13.87)	3.33	8.34
Xin-yi-san	Magnolia Flower Powder	Comorbidities (AR)	453 (11.64)	3.44	14.57
Xin-yi-qing-fei-tang	Magnolia Flower Lung-Clearing Decoction	Comorbidities (AR)	350 (8.99)	3.11	10.12
Su-zi-jiang-qi-tang	Perilla Fruit Qi-Downbearing Decoction	The Cold Syndrome	302 (7.76)	5	7.44
Cang-er-san	Xanthium Powder	Comorbidities (AR)	265 (6.81)	2.98	10.16
Xiang-sha-liu-jun-zi-tang	Costusroot and Amomum Six Gentlemen Decoction	Tonification of Qi	257 (6.60)	2.35	15.03
Yu-ping-feng-san	Jade Wind-Barrier Powder	Tonification of Qi	220 (5.65)	2.91	10.53
Ge-gen-tang	Pueraria Decoction	Releasing the exterior	191 (4.91)	3.32	16.33
Single herbs					
Xing-ren	Semen Armeniacae Amarum	Panting-calming	527 (13.54)	0.93	9.66
Gan-cao	Glycyrrhiza uralensis	Panting-calming	461 (11.84)	0.69	8.26
Bei-mu	Fritillariae Bulbus	Phlegm transformation	451 (11.59)	0.84	8.4
Yu-xing-cao	Houttuynia cordata	Anti-allergic effect	283 (7.27)	1.03	9.74
Jie-geng	Platycodonis Radix	Phlegm transformation	263 (6.76)	0.77	8.21
Ting-li-zi	Semen Lepidii Semen Desurainiae	Panting-calming	252 (6.47)	0.78	8.03
Wu-mei	Mume Fructus	Anti-allergic effect	225 (5.78)	0.65	10.27
Hou-po	Magnoliae Officinalis Cortex	Panting-calming	219 (5.63)	0.9	11.58
Chan-tui	Cicadae Periostracum	Anti-allergic effect	219 (5.63)	0.81	10.05
Sang-bai-pi	Mori Cortex	Panting-calming	195 (5.01)	0.76	7.91

with asthma using a nationwide population-based database. In the study cohort, 57.95% of the patients suffering from asthma had received TCM treatment. Studies on CAM use in children have found that children preferred herbal remedies over acupuncture (5). Most of the pediatric TCM users in our study also chose to receive CHPs.

Ding-chuan-tang, the most commonly prescribed herbal formula for pediatric asthma, was used to treat the Hot Syndrome. Ding-chuan-tang can inhibit bronchoconstriction and the migration of eosinophils into the airway (6). It also can improve airway hyper-responsiveness and clinical symptoms in children aged 8–15 years with mild-to-moderate persistent asthma (7). The second (Xiao-qing-long-tang) and third (Ma-xing-gan-shi-tang) most commonly prescribed herbal formulas for pediatric asthma have proven anti-inflammatory, anti-airway remodeling, and immunoregulatory effects in animal models (8, 9), but not in well-designed clinical trials. It is interesting to determine whether these formulas can benefit all asthma patients or only one specific type of asthmatic patients because, in TCM, they are used to treat different types of asthma (the Cold Syndrome *vs* the Hot Syndrome, respectively.)

Xing-ren (Semen Armeniacae Amarum), the most commonly prescribed single herb in this study, has anti-asthmatic activity by reducing airway hyper-responsiveness and inhibiting the Th₂ cells (10). Other frequently used single herbs have been reported to have anti-asthmatic activity (11–14). It is

important to integrate the result of our nationwide claims database with those yielded from other pharmacological/chemical screening databases (15) to select the potential herbs for the further investigations.

In conclusion, the use of TCM in children with asthma is popular in Taiwan. Our study provides a comprehensive list of CHPs to guide further high-quality studies in the determination of the safety and efficacy of TCM in children with asthma.

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Author contributions

HRY, PHL, and ASYL conceptualized the study. TPH and PHL performed the statistical analysis. TPH and HRY drafted the article. PHL and HRY finalized the article. SLY, HHC, and HRY contributed to the interpretation of the

TCM data. All of the authors read and approved the final article.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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