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Characteristics of traditional Chinese medicine use for children with allergic rhinitis: A nationwide population-based study

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ABSTRACT

Objectives: Allergic rhinitis (AR) is a common allergic disorder in children, some of whom seek complementary treatments, including acupuncture and Chinese herbs. Little, however, is known about the treatment of pediatric AR with traditional Chinese medicine (TCM). To characterize TCM use in pediatric AR, we conducted a nationwide population-based study.
Methods: We screened one million randomly sampled beneficiaries of the National Health Insurance Program in Taiwan from 2002 to 2010 to identify children <18 years of age with newly diagnosed allergic rhinitis (ICD-9 code 477.9). The subjects were categorized according to their use of TCM.
Results: We identified 97,401 children newly diagnosed with AR for inclusion in the study. Among these children, 63.11% ($N = 61,472$) had used TCM. There were significantly more TCM users than non-users among school-age children and adolescents ($P < 0.001$). Most (99.1%) pediatric TCM users received Chinese herbal remedies (99.1%); only 0.9% received acupuncture or manipulative therapies. Xin-Yi-Qing-Fei-Tang (Magnolia Flower Lung-Clearing Decoction) was the most frequently prescribed TCM formulation (23.44%), and the most commonly prescribed single herb was Chan-Tui (*Periostracum cicadae*; 13.78%). Regarding syndrome differentiation (ZHENG) according to TCM theory, prescriptions for the Cold Syndrome exceeded those for the Hot Syndrome throughout the year in Taiwan.
Conclusions: We found that approximately two-thirds of pediatric AR patients were prescribed TCM treatments in Taiwan. Further research is warranted to examine the efficacy and safety of TCM for pediatric AR patients.

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1. Introduction

Allergic rhinitis (AR) is a global problem affecting 400 million people worldwide that usually develops early in childhood [1]. In 2002, the prevalence of pediatric AR in central Taiwan, as established by the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire, was 27.59% [2]. The cumulative 12-month prevalence in a 2005 ISAAC study of 10- to 12-year-old children in central Taiwan was even higher, at 43% [3]. Comorbidities such as asthma are common in children with AR,

Abbreviations: CAM, complementary and alternative medicine; AR, allergic rhinitis; NHIRD, National Health Insurance Research Database; TCM, traditional Chinese medicine; ICD-9-CM, the International Classification of Diseases, 9th Revision, Clinical Modification.

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supporting the view that the upper and lower airways are united in their functions [4]. The increasing prevalence of AR and its impact on asthma create a significant burden, not only in Taiwan but also worldwide [5].

Many children with allergic disorders seek help from complementary and alternative medicine (CAM) [6]. The current mainstay treatments for pediatric AR include oral antihistamines and nasal corticosteroids [1,7]. Clinical evidence for efficacy of sublingual immunotherapy in children is also growing [8]. However, some patients experience poor control or are concerned about the side effects of these conventional treatments [9]. Several large-scale studies, including the ISAAC study [10] and the National Health Interview Survey (NHIS) [11], the Allergies, Immunotherapy, and Rhinoconjunctivitis (AIRS) survey [12] in the United States, have addressed pediatric AR issues, but comprehensive information regarding the use of traditional Chinese medicine (TCM) for pediatric AR has been lacking. Our previous questionnaire-based survey found that 34.4% of patients with rhinitis had used TCM [13]. In Taiwan, Japan, Korea and China, TCM is popular and is regarded as both an alternative and a mainstay therapy for some diseases [14]. We previously found in a population-based epidemiological study that a very high percentage (57.95%) of children with asthma used TCM [15]. Our recent nationwide study also found that AR was one of the four most common diseases for which children in Taiwan visited TCM clinics [16].

Descriptions of AR symptoms have been reported in the ancient Chinese literatures, and there are a number of classic formulae used in the TCM practice. From a TCM standpoint, AR is as a result of pernicious external pathogenic processes invading the lungs and affecting Qi of the lung, spleen and kidney. According to the Western medicine, these AR patients are considered to have the same disease, whereas in the view of TCM, they could be further categorized into two subtypes (TCM Syndromes; "ZHENG" in Chinese), the Cold Syndrome and the Hot Syndrome in the acute stage, based on an overall medical examination of symptoms [17]. Those with the Cold Syndrome present with a watery running nose, cold extremities, and a pale tongue, while those who with Hot Syndrome present with more or less sticky yellowish nasal discharge, thirst, and an erythematous tongue. TCM doctors prescribe different herbal formulas for the Hot and Cold Syndromes. AR patients in remission stages received consolidation treatment for the tonification of Qi. Therefore, the prescriptions for AR patients are difficult to standardize as a monotherapy. In light of the large pediatric population using TCM for AR [16], it is necessary to conduct a large-scale, population-based, pharmaco-epidemiologic analysis to investigate the characteristics and potential use of TCM for pediatric AR patients.

In Taiwan, the National Health Insurance program has reimbursed the costs of TCM since 1996. TCM is frequently used in Taiwan and is regarded as one of the mainstream therapies. In Taiwan, many of the public hospitals and university-affiliated teaching hospitals have TCM clinics. Taiwan installed TCM programs in higher education and has a pioneering TCM education program (8-year M.D. program) integrating Western and Chinese medicine together to nurture skilled TCM professionals since 1958. Graduates are proficient in their knowledge of Western and Chinese medicine, and the majority achieves dual licensures in Western and Chinese medicine after passing their board exams. There are also another post-baccalaureate TCM programs (5-year M.D. program) where graduates are qualified for only TCM board exam. 93.7% of Taiwanese hospitals/clinics are contracted with the National Health Insurance Program. By the end of 2010, approximately 23 million beneficiaries (nearly 99.89% of the Taiwanese population) were enrolled [18]. All claims data are stored in the National Health Insurance Research Database (NHIRD) and are available for academic research. This platform is suitable for evaluating the use of TCM treatments. To explore TCM use in children with AR, we analyzed a cohort of one million randomly sampled beneficiaries from the NHIRD.

2. Methods

2.1. Data source

This study analyzed datasets from the NHIRD of Taiwan. The National Health Insurance Program was launched in 1995 and has provided Western medical inpatient and outpatient services since that time; a TCM outpatient service followed in 1996 [18]. We retrieved data from the NHIRD (Longitudinal Health Insurance Database 2000; LHID 2000) from 1,000,000 randomly sampled persons who had enrolled in 2000. All of the data for enrollees from 2000 to 2010 were de-identified and further scrambled by the National Health Research Institutes in Taiwan before release, to avoid violating the privacy of the patients or healthcare providers. The Institutional Review Board of the China Medical University and Hospital approved this study (CMU-REC-101-012).

2.2. Study subjects

The sampled cohort was screened to identify the 227,056 subjects who were <18 years of age (Fig. 1). The International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes were used exclude children without AR (N = 95,452), leaving only the subjects with AR (ICD-9-CM code: 477.9). Children diagnosed with AR before the end of 2001 (N = 34,653) were also excluded, ensuring that all of the subjects had been newly diagnosed with AR after 2002. Overall, 97,401 children were included in the study cohort. Children who visited the TCM service between 2002 and 2010 were defined as TCM users (N = 61,472), while children with no TCM visit records were defined as non-TCM users (N = 35,929). Comorbidities of AR were identified by their ICD-9-CM codes (asthma ICD-9: 493; and atopic dermatitis ICD-9: 691). The prescribed Chinese herbal remedies were categorized according to their therapeutic actions and indications: the Cold Syndrome, the Hot Syndrome and the tonification of Qi. Monthly distributions of the Cold and Hot Syndromes were analyzed by comparing the monthly usage of their respective prescriptions.

2.3. Statistical analysis

The statistical analyses used SAS software, version 9.2 (SAS Institute, Inc., Cary, NC, USA). The data analysis consisted of descriptive statistics, including the frequency of prescriptions for TCM users stratified by the patients' demographic characteristics, the indications for prescribing TCM, and the most frequently prescribed herbal formulas and single herbs for treating pediatric AR. Primary indications were classified according to their ICD-9-CM codes. The diagnoses were coded according to the ICD-9 and were grouped into distinct broad disease categories. Comparisons of TCM users with non-TCM users employed univariate analysis. The relationships between the categorical variables and the differences between TCM users and non-TCM users were examined by Pearson's χ^2 tests: a P-value <0.05 was considered statistically significant.

3. Results

3.1. Demographic characteristics of study subjects

From 2002 to 2010, 97,401 pediatric patients were newly diagnosed with AR. Among these children, 61,472 had used TCM (63.11%) for AR, and 35,929 (36.89%) had not (Table 1). There were

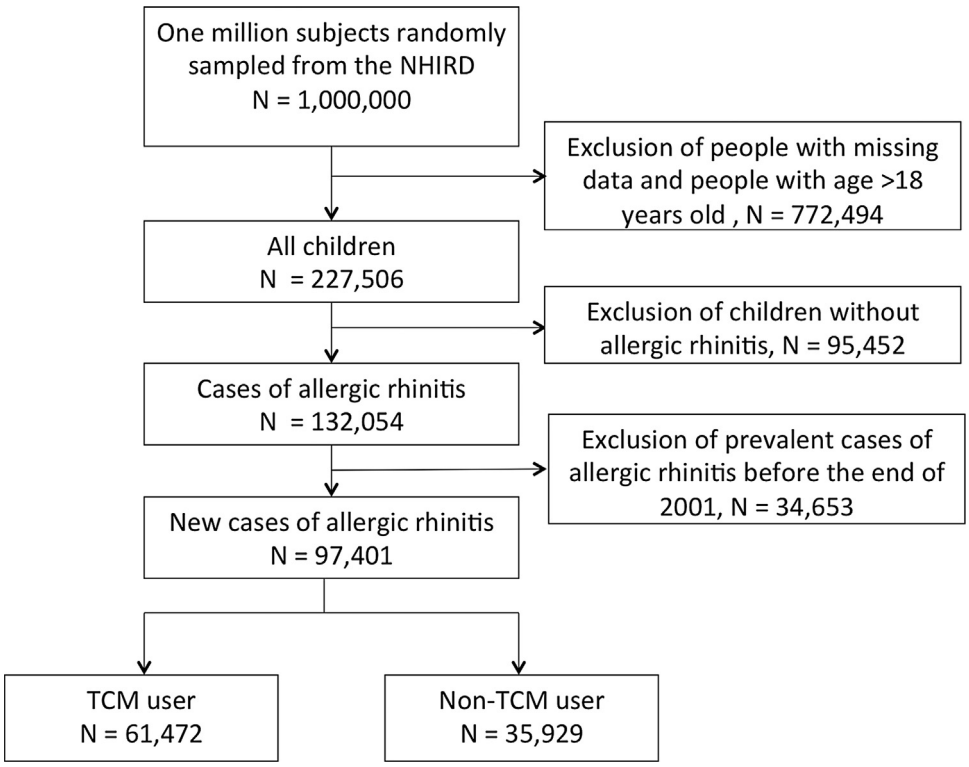

Fig. 1. Flow recruitment chart of subjects from the one million random samples obtained from the National Health Insurance Research Database (NHIRD) of Taiwan.

no significant differences in TCM use between boys and girls. School-age children and adolescents were more likely to be TCM users. The prevalence of allergic co-morbidities was high in the study subjects. There were significantly more children with asthma, atopic dermatitis or both among the non-TCM users, compared to the TCM users (all $P < 0.0001$). Among the TCM users, 32.3% visited TCM outpatient clinics 1–3 times, and 23.40% visited >20 times. Most of the TCM users visited local clinics rather than hospitals (Table 2).

3.2. Frequency of TCM visits by major disease category

We analyzed the reasons for all TCM visits during the study period by their ICD-9-CM codes (Table 3). The most common reason for TCM visits by Taiwanese children was respiratory system disease (45.97%), principally for AR treatment. Herbal remedies accounted for 79.27% of all TCM use; 20.73% consisted of acupuncture or manipulative therapies. Nevertheless, TCM treatments for children with AR mostly used herbs (161,737 of 163,153 visits, 99.1%) rather than acupuncture (1415 of 163,153 visits, 0.9%).

3.3. TCM prescription patterns for pediatric AR

The ten most commonly prescribed TCM herbal formulas and single herbs are listed in Tables 4 and 5, respectively. They were

Table 1
Demographic characteristics of TCM and non-TCM users among children with allergic rhinitis from 2002 to 2010 in Taiwan.

Characteristics	2002–2010		*P* value
	TCM users *N* (%)	Non-TCM users *N* (%)	
No. of cases	61,472 (63.11)	35,929 (36.89)	
Gender			0.17
Female	28,034 (45.60)	16,550 (46.06)	
Male	33,438 (54.40)	19,379 (53.94)	
Age, years			<0.0001
Infant and Toddler, 0–2	8538 (13.89)	11,001 (30.62)	
Preschool, 3–5	15,755 (25.63)	9889 (27.52)	
School age, 6–12	24,635 (40.08)	9484 (26.40)	
Adolescence, 13–18	12,544 (20.41)	5555 (15.46)	
Comorbidity			
Asthma	21,102 (34.33)	13,090 (36.43)	<0.0001
Atopic dermatitis	16,242 (26.42)	12,634 (35.16)	<0.0001
Asthma & atopic dermatitis	8276 (13.46)	5923 (16.49)	<0.0001

TCM: traditional Chinese medicine

Table 2
Demographic characteristics of TCM users among children with allergic rhinitis in Taiwan during 2002–2010.

Characteristics of TCM users	2002–2010 TCM users *N* (%)
Number of total TCM outpatient clinical records	1,033,332
Number of personal outpatient visits	
1–3	19,839 (32.30)
4–6	9187 (14.96)
7–10	7565 (12.32)
11–20	10,299 (16.76)
>20	14,543 (23.40)
Accreditation level of hospital	
Hospitals	84,368 (8.16)
Local clinics	948,964 (91.83)
Location of medical institution	
Taipei branch bureau	249,244 (24.12)
Northern branch bureau	124,422 (12.04)
Middle branch bureau	317,929 (30.77)
Southern branch bureau	172,124 (16.66)
Kao-Ping branch bureau	154,560 (14.96)
Eastern branch bureau	15,053 (1.46)

TCM: traditional Chinese medicine

Table 3
Frequency of TCM visits by major disease category (according to the 9th ICD codes) in children with allergic rhinitis from 2002 to 2010 in Taiwan.

Major disease category	ICD-9-CM code range	Number of visits, *N* (%)		
		Chinese herbal remedies	Acupuncture or manipulative therapies	Total of TCM
Infectious and parasitic disease	001–139	2325 (0.28)	24 (0.01)	2349 (0.23)
Neoplasms	140–239	312 (0.04)	20 (0.01)	332 (0.03)
Endocrine, nutritional and metabolic diseases	240–279	2264 (0.28)	4 (0.00)	2268 (0.22)
Mental disorders	290–319	2971 (0.36)	3642 (1.70)	6613 (0.64)
Disease of nervous system and sense organs	320–389	6142 (0.75)	7096 (3.31)	13,238 (1.28)
Diseases of circulatory system	390–459	893 (0.11)	266 (0.12)	1159 (0.11)
Diseases of respiratory system	460–519	473,200 (57.77)	1849 (0.86)	475,049 (45.97)
Allergic rhinitis	477	161,737	1416	163,153
Asthma	493	3812	26	3838
Diseases of digestive system	520–579	84,035 (10.26)	585 (0.27)	84,620 (8.19)
Dyspepsia	5368	19,872	24	19,896
Functional digestive disorders	564	18,733	70	18,803
Diseases of genitourinary system	580–629	24,608 (3.00)	103 (0.05)	24,711 (2.39)
Diseases of skin and subcutaneous tissue	680–709	35,033 (4.28)	202 (0.09)	35,235 (3.41)
Atopic dermatitis	691	1792	0	1792
Diseases of musculoskeletal system and connective tissue	710–739	5523 (0.67)	32,425 (15.13)	37,948 (3.67)
Symptoms, signs, and ill-defined conditions	780–799	176,994 (21.61)	939 (0.44)	177,933 (17.22)
Injury and poisoning	800–999	2554 (0.31)	166,825 (77.86)	169,379 (16.39)
Others[a]		2228 (0.27)	270 (0.13)	2498 (0.24)
Total		819,082 (79.27)	214,250 (20.73)	1,033,332

[a] Others include ICD-9-CM code range 280–289, 630–677, 740–759, 760–779, and missing/error data.

Table 4
Ten most common herbal formulas prescribed for the treatment of pediatric allergic rhinitis from 2002 to 2010 in Taiwan.

Herbal formula	English name	Therapeutic actions and indications	Frequency of prescription, *N* (%)	Average daily dose (g)	Average duration of prescription (days)
Xin-Yi-Qing-Fei-Tang	Magnolia Flower Lung-Clearing Decoction	The Hot Syndrome	37,916 (23.44)	3.57	7.45
Xiao-Qing-Long-Tang	Minor Green-Blue Dragon Decoction	The Cold Syndrome	34,467 (21.31)	3.66	7.83
Xin-Yi-San	Magnolia Flower Powder	The Cold Syndrome	29,507 (18.24)	3.85	7.93
Cang-Er-San	Xanthium Powder	The Hot Syndrome	27,246 (16.85)	3.28	7.17
Ge-Gen-Tang	Pueraria Decoction	The Cold Syndrome	14,449 (8.93)	3.79	7.82
Yu-Ping-Feng-San	Jade Wind-Barrier Powder	Tonification of Qi	13,603 (8.41)	3.15	7.58
Bu-Zhong-Yi-Qi-Tang	Center-Supplementing Qi-Boosting Decoction	Tonification of Qi	13,408 (8.29)	3.50	7.82
Gui-Zhi-Tang	Cinnamon Twig Decoction	The Cold Syndrome	9528 (5.89)	4.03	7.52
Xiang-Sha-Liu-Jun-Zi-Tang	Costusroot and Amomum Six Gentlemen Decoction	Tonification of Qi	8659 (5.35)	2.71	9.34
Ma-Xing-Gan-Shi-Tang	Ephedra, Apricot Kernel, Licorice, and Gypsum Decoction	The Hot Syndrome	8649 (5.35)	3.13	7.10

Table 5
Ten most common single herbs prescribed for the treatment of children with allergic rhinitis from 2002 to 2010 in Taiwan.

Single herb	Latin pharmaceutical name	Frequency of prescription, *N* (%)	Average daily dose (g)	Average duration of prescription (days)
Chan-Tui	Periostracum Cicadae	22,294 (13.78)	0.85	7.41
Gan-Cao	Radix Glycyrrhizae	19,046 (11.78)	0.59	7.44
Cang-Er-Zi	Fructus Xanthii	14,880 (9.20)	0.94	7.49
Bai-Zhi	Radix Angelicae Dahuricae	14,858 (9.19)	0.95	7.59
Yu-Xing-Cao	Herba Houttuyniae	12,986 (8.03)	0.94	7.16
Fang-Feng	Radix Saposhnikoviae	12,173 (7.53)	0.88	7.56
Jing-Jie	Herba Schizonepetae	11,885 (7.35)	0.94	7.24
Jie-Geng	Radix Platycodonis	11,035 (6.82)	0.89	7.18
Xin-Yi	Flos Magnoliae	10,983 (6.79)	1.01	7.29
E-Bu-Shi-Cao	Herba Centipedae	10,346 (6.40)	0.91	7.36

"Xin-Yi-Qing-Fei-Tang" (Magnolia Flower Lung-Clearing Decoction; 23.44%), followed by "Xiao-Qing-Long-Tang" (Minor Blue-green Dragon Decoction; 21.31%), "Xin-Yi-San" (Magnolia Flower Powder; 18.24%), "Cang-Er-San" (Xanthium Powder; 16.85%) and "Ge-Gen-Tang" (Pueraria Decoction; 8.93%). The single herbs most frequently prescribed for pediatric AR were: Chan-Tui (*Periostracum cicadae*; 13.78%), Gan-Cao (*Radix glycyrrhizae*; 11.78%), Cang-Er-Zi (*Xanthii fructus*; 9.20%), Bai-Zhi (*Radix angelicae dahurica*; 9.19%) and Yu-Xing-Cao (*Herba houttuyniae*; 8.03%).

3.4. Monthly distribution of the Cold and Hot Syndromes

Diagnoses in Western medicine are usually based on patients' clinical symptoms and laboratory data. The TCM diagnostic system differs in that the diagnosis, ZHENG (TCM syndrome), is a thorough analysis according to TCM symptoms and signs. Therefore, patients with the same disease by Western medical criteria could have different TCM ZHENG diagnoses and might be prescribed different TCM treatments [17].

The subjects' prescription patterns were further divided into two groups, according to the indications for the TCM formula. Patients who received Xiao-Qing-Long-Tang, Xin-Yi-San, Ge-Gen-Tang and Gui-Zhi-Tang were treated for the Cold Syndrome; patients who received Xin-Yi-Qing-Fei-Tang, Gang-Er-San, and Ma-Xing-Gan-Shi-Tang were treated for the Hot Syndrome (Table 4). The monthly distributions of prescriptions for the Hot and Cold Syndromes are shown in Fig. 2. We found that the numbers of TCM prescriptions were higher during the winter (November, December, January) (Fig. 2A). In addition, TCM formulas for the Cold Syndrome were more frequently prescribed throughout the four seasons (Fig. 2B).

4. Discussion

AR is a chronic airway disease that usually requires long-term medical treatment. Our current study comprehensively analyzed the usage of TCM in pediatric AR population, which is so far the largest sample size regarding the TCM use. We have also identified the unique TCM utilization pattern in Taiwan, where Western medicine and TCM have been both reimbursed by the National Health Insurance Program. This study provides not only useful information for complementary and integrative treatment but also some added value to the current treatment strategies.

In general, approximately 20% of children visited TCM clinics in Taiwan [16]. In the present study, 63.11% of the subjects had used TCM, more than the general pediatric population. Widespread of TCM use for pediatric AR might be due to a few reasons. First, TCM has been used in Asian countries for centuries and has been perceived as safe. The possible side effects of anti-allergic treatments in Western medicine have been an important issue in pediatrics [19]. Second, this is not due to the lack of family physicians or specialists in Taiwan. Until 2012, there are approximately 59,017 Western medical doctors and 5556 board-certified TCM doctors serving 23 million people in Taiwan. Among them, there are 2049 otorhinolaryngologists, 4180 pediatricians, and 5829 family medicine physicians. Third, the long history of TCM usage in Chinese populations and basic concepts of TCM, such as "Yin and Yang," and "Qi and Blood," having long been part of Chinese culture and lifestyle. Fourth, the insurance coverage for TCM treatments might also play a significant role. It costs approximately 15 US dollars co-payment to receive 1-month prescription of Chinese herbs under the National Health Insurance Program [20,21]. If AR could be controlled or treated by TCM, it will largely reduce the burden of economics, absence of school days and quality of life in patients with AR.

Major allergic disorders such as AR, asthma and atopic dermatitis were reported in other countries. However, there is so far a lack of the studies on the use of TCM in pediatric AR, even in Asian countries where TCM is popular. For example, the Tokyo study [22], the Taichung study [2], the Seoul study [23] and the Bangkok study [24] did not include investigations on TCM use. This is because that TCM use in children was not recorded in the ISAAC core questionnaires. Although medical insurance coverage of traditional medicine was installed in China since 1951, Taiwan since 1996, Korea since 1987 and Japan since 1976, respectively, each country has different (full or partial) coverage of various treatment modalities. Our study has the strength and novelty due to its unique large sample size in a country where both TCM and Western Medicine are covered. We feel that a future investigation on the comparison of different utilization patterns of traditional medicine in these Asian countries is necessary. To achieve this, large-scale database including traditional medicine and western medicine from other countries is a prerequisite.

Some Chinese herbal products have been reported to have anti-allergic and anti-inflammatory effects. However, the 2010 revision of the Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines did not recommend using either acupuncture or herbs for AR because the available evidence for efficacy was of low quality [7]. The latest meta-analysis of randomized, controlled efficacy studies from 1999 to 2011 concluded that TCM appeared to benefit patients with persistent AR [25]. In our study, we have identified a few TCM formulas and herbs that could be used as the consensus candidates for the treatment of pediatric AR. For example, a combination of Xin-Yi-San, Xiao-Qing-Long-Tang and Xiang-Sha-Liu-Jun-Zi-Tang in our candidate list reduced nasal symptoms and decreased the serum specific IgE, IFN-gamma and IL-5 of AR patients [26]. Xiao-Qing-Long-Tang and Ma-Xing-Gan-Shi-Tang have shown anti-inflammatory and immunomodulatory effects in animal models [27,28]. TCM theories regard AR as a condition that develops when the body does not produce sufficient-quality Qi relative to deficiencies in the internal organs. Therefore, approaches to tonify Qi are used to supplement these deficiencies. Bu-Zhong-Yi-Qi-Tang, Xiang-Sha-Liu-Jun-Zi-Tang and Yu-Ping-Feng-San are frequently

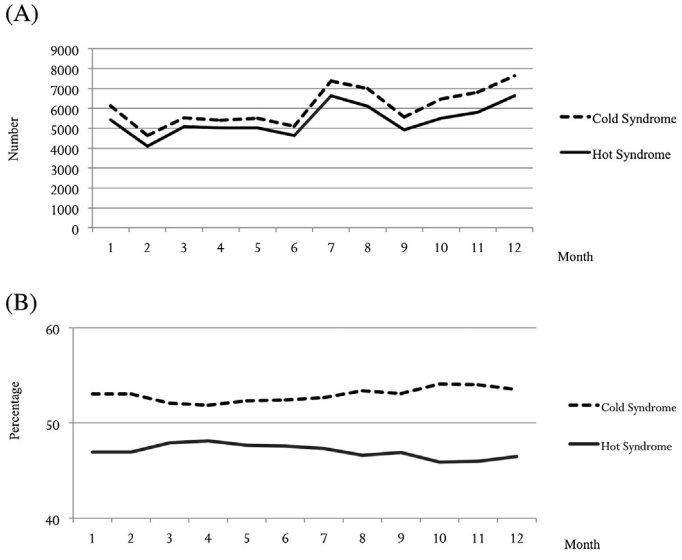

Fig. 2. Monthly distribution of the prescriptions for the Cold and Hot Syndromes. The number (A) and percentage (B) of TCM herbal formulas for treating the Cold Syndrome (dotted line) and the Hot Syndrome (solid line).

used in pediatric AR patients in remission, to restore the deficiencies of the internal organs. In a randomized, controlled study, Bu-Zhong-Yi-Qi-Tang significantly improved nasal symptom scores [29]. The total serum IgE and the IL-4 stimulated production of prostaglandin E2 and leukotriene C4 by polymorphonuclear neutrophils were also significantly suppressed in the Bu-Zhong-Yi-Qi-Tang group. Animal experiments have also shown that Yu-Ping-Feng-San could significantly decrease the serum concentration of antigen-specific antibodies in allergic mice [30]. Two of the ingredients of Yu-Ping-Feng-San, Radix Saposhnikoviae and Radix Astragali, were also the major ingredients of an effective herbal products, Biminne, for perennial AR [31]. Moreover, respiratory infections, seen as exterior evils in TCM, are important triggers of AR exacerbation. Therefore, exterior-releasing formulations, such as Ge-Gen-Tang [32], are also commonly used. In the present study, we have identified that Xin-Yi-Qing-Fei-Tang has been used most frequently but there is no high-quality clinical trial yet. A randomized, placebo-controlled, clinical trial to investigate its efficacy is warranted.

Most of the commonly prescribed single herbs have anti-allergic or anti-inflammatory effects in vitro or in vivo. *Periostracum cicadae* had been show to have antioxidant and anti-inflammatory activities [33]. Radix Glycyrrhizae could inhibit memory Th2 responses and reduce eosinophilic pulmonary inflammation, serum IgE levels, IL-4 and IL-13 levels [34]. Radix Angelicae Dahuricae decreased the IgE and histamine levels and improved the skin lesions in a dust mite-induced dermatitis murine model [35]. Fructus Xanthii exerted anti-AR effect by ameliorating the nasal symptoms and down-regulating IgE levels in AR rats [36]. Flos Magnoliae inhibited mast cell-derived histamine release in vitro [37]. These herbs are potential candidates for new drug development in the future.

Several randomized, controlled studies have reported that acupuncture improves symptoms or enhances the quality of life of patients with AR [38–40]. In a double-blind, randomized, placebo-controlled trial of acupuncture for the treatment of pediatric AR, 8-week acupuncture treatment was more effective than sham acupuncture in decreasing the symptom scores and increasing the symptom-free days [39]. In the Acupuncture in Seasonal Allergic Rhinitis (ACUSAR) trial conducted in Germany, acupuncture significantly improved disease-specific quality of life and antihistamine use [38,41]. However, very few of our study subjects used acupuncture, perhaps because most pediatric patients and their families would not tolerate the use of needles for AR treatment.

Seasonal change or temperature fluctuation has impact on allergic disorders, such as pediatric asthma [42]. We found that the numbers of TCM prescriptions were highest in the winter, and most of the patients suffered from the Cold Syndrome. The prevalence of the Cold/Hot Syndromes is constant throughout the year. An explanation for this lack of seasonality could be that most Taiwanese AR patients are perennial AR allergic to mites, instead of seasonal rhinitis [43] Patients with mite allergies are usually symptomatic throughout the year, but they can experience exacerbation in the winter. Unlike pollen allergies, our subjects rarely had seasonal flare-ups in the spring [44]. The Cold Syndrome and the Hot Syndrome are two key conditions of the TCM syndrome, and they are widely used in the diagnosis of diseases, including inflammation, infection, stress, and autoimmune disorders. The TCM diagnosis of the Hot Syndrome in AR patients more or less equates with a secondary microbial infection. Our results showed that a significant proportion of AR patients had the Hot Syndrome, but any correlation between the Hot Syndrome and microbial infection requires further investigation.

Our study had several limitations. First, the rates of TCM utilization might have been underestimated because we did not include TCM treatments that were not covered by the National Health Insurance Program, such as folk medicine, which can be directly purchased from pharmacies. However, prescriptions covered by the insurance were from board-certified TCM doctors and thus were more accurate and reliable treatment choices. Second, the NHRID does not allow for evaluation of patients' disease severity or TCM treatments' efficacy. Therefore, a relationship between disease severity and TCM utilization or prescription patterns could not be established. The wide use of TCM in pediatric AR and the limited evidence of efficacy indicate that further investigations of the efficacy and mechanisms of TCM treatments are needed. Our future studies will focus on the efficacy of this most popular TCM formula with the standardized assessment in a high-quality randomized, double-blinded, controlled clinical trial.

In conclusion, we found that approximately two-thirds of pediatric AR patients sought help from TCM in Taiwan. Our results should provide valuable information for pediatricians, otorhinolaryngologists, parents of children with AR and the government concerning the health care of children with AR. Further research is warranted to examine the efficacy and safety of TCM for pediatric AR patients.

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgments

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