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ORIGINAL ARTICLE

IL-17 polymorphisms and asthma risk: a meta-analysis of 11 single nucleotide polymorphismsYan Jin, MD¹, Zaichun Deng, MD², Chao Cao, PhD², and Longxiang Li, MD¹¹Department of Respiratory Disease, Taizhou Municipal Hospital, Taizhou, China and ²Department of Respiratory Medicine, Affiliated Hospital of School of Medicine, Ningbo University, Ningbo, China**Abstract**

Objective: There has been significant interest in the association between asthma and the polymorphisms of IL-17A and IL-17F for a period of time. This work aims to present a clearer relationship between asthma and the polymorphisms of IL-17A and IL-17F. **Method:** Searches were performed in Medline, EMBASE, and the Chinese National Knowledge Infrastructure (CNKI) databases. Pooled odds ratios (ORs) and 95% confidence intervals (CIs) were calculated to assess the relationship between polymorphisms of IL-17A and IL-17F and asthma. **Results:** Nine studies comprising 3650 asthmatics and 3370 controls were included in this meta-analysis for all single nucleotide polymorphisms (SNPs) (2–6 per SNP). Our study examined the polymorphisms of IL-17F rs1889570 (C/T) (CC versus TT: OR = 0.55, 95%CI = 0.41–0.75; CT versus TT: OR = 0.54, 95%CI = 0.40–0.72; CC/CT versus TT: OR = 0.55, 95%CI = 0.42–0.72; CC versus CT/TT, OR = 1.83, 95%CI = 1.39–2.41), IL-17A rs4711998(A/G) (AA/AG versus GG: OR = 0.67, 95%CI = 0.46–0.98), and IL-17A rs3819024(A/G) (AA versus GG: OR = 1.77, 95%CI = 1.39–2.25) and found they were significantly related to the risk of asthma. **Conclusion:** Our systematic review showed that IL-17F rs1889570(C/T), IL-17A rs4711998(A/G) and IL-17A rs3819024(A/G) may be potential risk factors for asthma susceptibility.

Keywords

Asthma, IL-17A, IL-17F, meta-analysis, polymorphism

History

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Introduction

Asthma is traditionally regarded as an eosinophilic airway inflammatory disease, which is mediated by allergen-activated T helper type-2 (Th2) cells and proinflammatory cytokines [1,2]. Glucocorticoids are still considered the most effective anti-asthma therapy. However, patients with severe asthma are resistant to steroid use. Mounting evidences suggests that neutrophils are important effector cells in asthma, as the main inflammatory cell in steroid-resistant asthma is neutrophil [2,3].

Interleukin-17A (IL-17A) and IL-17F are two members of the IL-17 gene family. They play a crucial role in the regulation of asthma and are candidate genes for asthma. IL-17A has been shown to drive neutrophils in asthma, while steroid-resistant asthmatics have been found to produce higher IL-17A than healthy controls [4,5]. The recently discovered cytokine IL-17F is also increasingly identified in the airways of allergic asthma patients [6]. In addition, IL-17A and IL-17F are both located on chromosome 6p, of which the genomic region has been linked to asthma and the asthma-related phenotype in multiple genome scans [7,8]. Several epidemiological studies have investigated the

influence of IL-17A and IL-17F polymorphisms on asthma risk. To comprehensively illustrate the relationship between IL-17A and IL-17F polymorphisms and asthma, a meta-analysis is presented herein including all eligible case-control studies.

Material and methods**Identification and eligibility of relevant studies**

Searches were performed in Medline, EMBASE, and the Chinese National Knowledge Infrastructure (CNKI), for all papers published before December 2014 using the search terms: (“Interleukin-17” OR “IL-17”) AND (“gene” OR “polymorphism” OR “genetic variant”) AND (“asthma” OR “allergic asthma” OR “Bronchial asthma” OR “chronic airway inflammation”). All eligible studies were retrieved, and their bibliographies were checked for other relevant publications. Only published studies with full-text articles were included.

Inclusion and exclusion criteria

The included studies had to meet the following criteria: (a) published in English or in Chinese, (b) used a case-control design, (c) contained available genotype frequency, and (d) had sufficient published data for estimating an odds ratio (OR) with 95% confidence interval (CI). The main reasons for

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exclusion of a study were (a) no usable data reported, (b) no case–control group, (c) duplicates of a previous publication, and (d) repeated publication.

Data extraction

Two investigators reviewed all of the eligible articles independently according to the aforementioned inclusion criterion. The results were compared, and disagreements were resolved by discussion and consensus. The information extracted following our initial screening was as follows: the first author's surname, year of publication, ethnic descent of the study population (Caucasian/Asian), definition of case, age, characteristics of controls, the numbers of eligible cases and controls, and genotype distributions in cases and controls.

Statistical analysis

The observed genotype frequencies and expected genotype frequencies in controls were measured using a Hardy–Weinberg equilibrium (HWE). Stratified analyses were performed on ethnicity, age, and sources of control. The strength of the association between IL-17A and IL-17F polymorphisms and asthma risk was assessed by OR and 95%CI. The significance of the combined OR was determined by the Z-test, in which $p < 0.05$ was judged as statistically significant. Four different ORs were calculated by employing the homozygote comparison, the heterozygote comparison, the dominant genetic model, and the recessive model. In the meanwhile, the relationship between allele frequency of each single nucleotide polymorphism (SNP) and frequency of asthma was studied. The χ^2 -based Q statistical test was used for the assessment of heterogeneity between studies, which was considered significant for $p < 0.1$ [9]. A random-effects model was applied to examine heterogeneity [10]. Otherwise, the fixed-effects model was performed [11]. Sensitivity analysis was also used to assess the stability of the results. All analyses were performed with Stata (Version 10.0, Stata Corporation, College Station, TX) and Review Manager (version 5.0.16, The Cochrane Collaboration, Baltimore, MD) using two sided p values.

Results

Characteristics of studies

Three-hundred twenty-one potentially relevant studies were identified using the above-mentioned search terms. Two-hundred forty-nine articles were excluded based on title and abstract, leaving 72 studies for further screening. Finally, nine epidemiological studies were analyzed in our meta-analysis, including eight studies of Asian descent and one study of European descent. Detailed steps for screening the literature are shown in Figure 1.

The characteristics of these included studies are summarized in Table 1. Of the nine studies, the selected population of one case–control study was divided into two groups due to certain reasons and this study could be deemed as two separate studies. Four studies were conducted with adults, three with children, and one with both the adults and children. However, one study did not describe the age of participants. In these studies, six studies containing 1956 asthma cases and

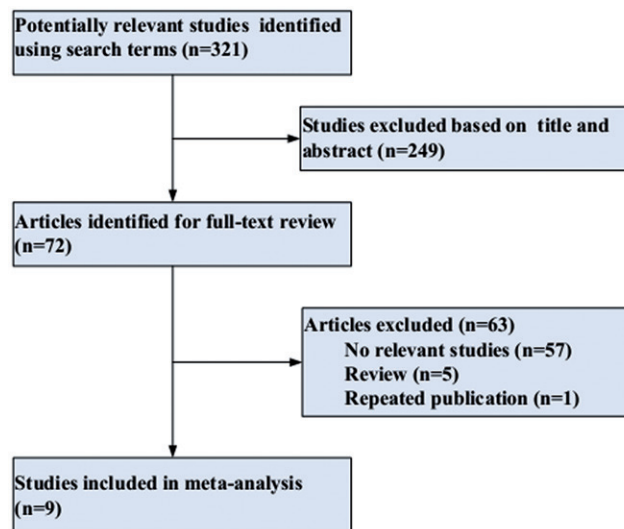


Figure 1. Flow diagram of the literature search and trial selection process.

2124 controls were related to IL-17F rs763780(T/C) [12–17], three studies containing 1140 asthmatics and 1232 controls were related to IL-17F rs1266828(T/C) [14,15,18], two studies containing 856 asthmatics and 983 controls relating to IL-17F rs1889570(C/T) [14,16], two studies containing 515 asthma cases and 633 controls were related to IL-17F rs13209590(A/G) [13,18], two studies containing 271 asthmatics and 273 controls were related to IL-17F rs2397084(A/G) [12,17], three studies containing 1694 asthma cases and 1246 controls were related to IL-17A rs8193036(C/T) [18–20], three studies containing 965 asthma cases and 1044 controls were related to IL-17A rs4711998(A/G) and 3819024(A/G) [18–20], two studies containing 678 asthma cases and 827 controls were related to IL-17A rs3804513(A/T), rs1974226(A/G), and rs3819025(G/A) [18,19], and three studies containing 939 asthmatics and 934 controls were related to IL-17A rs2275913(G/A) [17,19,20]. With the exception of IL-17A rs1974226(A/G), all the aforementioned IL-17F and IL-17A polymorphisms were analyzed in this systematic review and conformed to HWE. Due to the limited number of studies, only rs763780(T/C) and rs1266828(T/C) were explored in both Asians and Caucasians, the others discussed above were based on the studies in Asian population (Table 2).

Quantitative synthesis

IL-17F rs763780(T/C), rs1266828(T/C), rs1889570(C/T), rs13209590(A/G) and rs2397084(A/G)

The relationship between polymorphisms and asthma risk was assessed as shown in Tables 2 and 3. Overall, the analysis demonstrated that the IL-17F rs1889570(C/T) polymorphism was a significant risk factor for asthma under all the tested models (homozygote, heterozygote, dominant model, and recessive model) (CC versus TT: OR = 0.55, 95%CI = 0.41–0.75, $p = 0.0001$; CT versus TT: OR = 0.54, 95%CI = 0.40–0.72, $p < 0.0001$; CC/CT versus TT: OR = 0.55, 95%CI = 0.42–0.72, $p < 0.0001$; CC versus CT/TT, OR = 1.83, 95%CI = 1.39–2.41, $p < 0.0001$, Figure 2). And the frequency of C allele was also showed to be significantly related to the

Table 1. Study characteristics of included studies in this meta-analysis.

Author	Year	Ethnicity	Age	SNP studied	Asthma definition	Source of controls	Sample size	HWE
Bazzi [12]	2011	Asian	Not described	rs17880588; rs17878530; rs763780; rs11465553; rs2397084	Not described	Healthy controls	100/102	0.56; 0.96; 0.11; 0.96; 0.39
Qian [13]	2012	Asian	Adults	rs763780; rs13209590	Questionnaire(clinical and family history), physical and laboratory examination, SPT, spirometry, Global Initiative for Asthma guidelines	Healthy controls	318/352	0.10; 0.14
Kawaguchi [14]	2006	Asian	Adults	rs1889570; rs1266828; rs7771511; rs766748; rs763780	Symptom, Spirometry, bronchial hyper-responsiveness	Healthy controls	432/435	0.76; 0.88; 0.41; 0.64; 0.08
Ramsey [15]	2005	Caucasian	Adults	rs1266828; rs722323; rs11465553; rs763780; rs641701	Physician-diagnosed asthma	Healthy controls	511/516	0.97; 0.64; 0.41; 0.28; 0.33
Jin [16]	2011	Asian	Adults	rs1889570; rs763780	ATS criteria	Healthy controls	424/548	0.24; 0.83
Maalmi [17]	2014	Asian	Children	rs763780; rs2397084; rs2275913	Clinical symptom, lung function test	Healthy controls	171/171	0.52; 0.07; 0.09
Wang [18]	2012	Asian	Children and adults	rs4711998; rs8193036; rs3804513; rs1974226; rs13192563; rs7758579; rs11966760; rs10807439; IL17A rs3819024; rs1892280; rs3819025; rs13209590; rs7771466; rs1266828; rs669161	Symptom, Spirometry, ACT	Healthy controls	197/281	0.37; 0.79; 0.59; <0.05; 0.22; 0.10; 0.82; 0.09; 0.29; 0.77; 0.87; 0.14; 0.50; 0.53; 0.35
Wang [19]	2009	Asian	Children	rs4711998; rs8193036; rs3819024; rs2275913; rs3819025; rs8193038; rs3804513; rs1974226; rs3748067	Clinical history, Symptom, Spirometry	Healthy controls	481/546	0.54; 0.89; 0.63; 0.62; 0.78; 0.09; 0.05; <0.05; 0.26
Wang [19]	2009	Asian	Children	rs8193036	Clinical history, Symptom, Spirometry	Healthy controls	729/202	0.60
Wang [20]	2011	Asian	Children	rs4711998; rs8193036; rs3819024; rs2275913	2006 GINA children asthma diagnosis criteria	Healthy controls	287/217	0.38; 0.39; 0.94; 0.79

HWE: Hardy-Weinberg equilibrium.

Table 2. Genotype frequencies of IL-17F and IL-17A polymorphisms in asthma.

Variables	No.	Cases/controls	Homozygote		Heterozygote		Dominant model		Recessive model	
			OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p
IL-17F rs763780(T/C)	6	1956/2124	2.03 [0.38, 10.91]	0.41	1.98 [0.38, 10.17]	0.42	2.04 [0.38, 10.84]	0.40	0.49 [0.09, 2.61]	0.40
Caucasian	1	511/516	0.14 [0.01, 2.76]	0.20	0.12 [0.01, 2.49]	0.17	0.14 [0.01, 2.73]	0.19	7.11 [0.37, 138]	0.19
Asian	5	1445/1608	3.41 [1.39, 8.35]	0.007	3.71 [1.46, 9.38]	0.006	3.49 [1.42, 8.57]	0.006	0.29 [0.12, 0.70]	0.006
IL-17F rs1266828(T/C)	3	1140/1232	0.89 [0.62, 1.30]	0.56	0.94 [0.65, 1.38]	0.77	0.92 [0.64, 1.33]	0.66	1.09 [0.75, 1.56]	0.66
Caucasian	1	511/516	0.91 [0.55, 1.52]	0.72	1.11 [0.66, 1.87]	0.69	0.99 [0.60, 1.63]	0.97	1.01 [0.61, 1.66]	0.97
Asian	2	629/716	0.88 [0.51, 1.51]	0.64	0.78 [0.44, 1.37]	0.39	0.85 [0.49, 1.45]	0.54	1.18 [0.69, 2.02]	0.54
IL-17F rs1889570(C/T)	2	856/983	0.55 [0.41, 0.75]	0.0001	0.54 [0.40, 0.72]	<0.0001	0.55 [0.41, 0.72]	<0.0001	1.83 [1.39, 2.41]	<0.0001
Asian	2	856/983	0.55 [0.41, 0.75]	0.0001	0.54 [0.40, 0.72]	<0.0001	0.55 [0.41, 0.72]	<0.0001	1.83 [1.39, 2.41]	<0.0001
IL-17F rs13209590(A/G)	2	515/633	2.16 [0.71, 6.56]	0.18	2.12 [0.19, 23.72]	0.54	2.34 [0.19, 29.26]	0.51	0.43 [0.03, 5.34]	0.51
Asian	2	515/633	2.16 [0.71, 6.56]	0.18	2.12 [0.19, 23.72]	0.54	2.34 [0.19, 29.26]	0.51	0.43 [0.03, 5.34]	0.51
IL-17F rs2397084(A/G)	2	271/273	0.52 [0.02, 16.39]	0.71	0.50 [0.07, 3.58]	0.49	0.53 [0.02, 13.93]	0.70	1.88 [0.07, 49.44]	0.70
Asian	2	271/273	0.52 [0.02, 16.39]	0.71	0.50 [0.07, 3.58]	0.49	0.53 [0.02, 13.93]	0.70	1.88 [0.07, 49.44]	0.70
IL-17A rs8193036(C/T)	4	1694/1246	1.09 [0.68, 1.73]	0.73	0.89 [0.65, 1.20]	0.44	1.01 [0.76, 1.36]	0.93	0.99 [0.74, 1.32]	0.93
Asian	4	1694/1246	1.09 [0.68, 1.73]	0.73	0.89 [0.65, 1.20]	0.44	1.01 [0.76, 1.36]	0.93	0.99 [0.74, 1.32]	0.93
IL-17A rs4711998(A/G)	3	1694/1246	0.73 [0.51, 1.04]	0.08	0.66 [0.46, 0.96]	0.03	0.70 [0.49, 1.00]	0.05	1.43 [1.00, 2.03]	0.05
Asian	3	1694/1246	0.73 [0.51, 1.04]	0.08	0.66 [0.46, 0.96]	0.03	0.70 [0.49, 1.00]	0.05	1.43 [1.00, 2.03]	0.05
IL-17A rs3819024(A/G)	3	1694/1246	1.77 [1.39, 2.25]	<0.00001	0.95 [0.76, 1.18]	0.63	1.22 [1.00, 1.49]	0.05	0.82 [0.67, 1.00]	0.05
Asian	3	1694/1246	1.77 [1.39, 2.25]	<0.00001	0.95 [0.76, 1.18]	0.63	1.22 [1.00, 1.49]	0.05	0.82 [0.67, 1.00]	0.05
IL-17A rs2275913(G/A)	3	1668/1136	1.14 [0.86, 1.52]	0.36	1.20 [0.93, 1.54]	0.16	1.15 [0.91, 1.47]	0.24	0.87 [0.68, 1.10]	0.24
Asian	3	1668/1136	1.14 [0.86, 1.52]	0.36	1.20 [0.93, 1.54]	0.16	1.15 [0.91, 1.47]	0.24	0.87 [0.68, 1.10]	0.24
IL-17A rs3804513(A/T)	2	1407/1029	1.45 [0.08, 26.19]	0.8	1.27 [0.08, 20.45]	0.86	1.41 [0.08, 25.05]	0.81	2.21 [0.59, 8.21]	0.24
Asian	2	1407/1029	1.45 [0.08, 26.19]	0.8	1.27 [0.08, 20.45]	0.86	1.41 [0.08, 25.05]	0.81	2.21 [0.59, 8.21]	0.24
IL-17A rs3819025(G/A)	2	1407/1029	0.88 [0.49, 1.59]	0.68	0.83 [0.45, 1.53]	0.56	0.87 [0.48, 1.56]	0.64	1.15 [0.64, 2.06]	0.64
Asian	2	1407/1029	0.88 [0.49, 1.59]	0.68	0.83 [0.45, 1.53]	0.56	0.87 [0.48, 1.56]	0.64	1.15 [0.64, 2.06]	0.64

Table 3. Allele frequencies of IL17A and IL17F SNP and their association with asthma.

Variables	Allele	Allele frequency	
		OR (95%CI)	p
IL-17F rs763780(T/C)	T versus C	1.05 [0.80, 1.39]	0.71
Caucasian		0.99 [0.65, 1.50]	0.96
Asian		1.08 [0.77, 1.53]	0.66
IL-17F rs1266828(T/C)	T versus C	0.96 [0.84, 1.11]	0.60
Caucasian		0.89 [0.73, 1.08]	0.23
Asian		1.05 [0.86, 1.27]	0.64
IL-17F rs1889570(C/T)	C versus T	0.81 [0.70, 0.93]	0.003
Asian		0.81 [0.70, 0.93]	0.003
IL-17F rs13209590(A/G)	A versus G	1.16 [0.91, 1.49]	0.23
Asian		1.16 [0.91, 1.49]	0.23
IL-17F rs2397084(A/G)	A versus G	0.68 [0.16, 2.92]	0.60
Asian		0.68 [0.16, 2.92]	0.60
IL-17A rs8193036(C/T)	C versus T	1.12 [0.89, 1.41]	0.34
Asian		1.12 [0.89, 1.41]	0.34
IL-17A rs4711998(A/G)	A versus G	0.96 [0.83, 1.11]	0.61
Asian		0.96 [0.83, 1.11]	0.61
IL-17A rs3819024(A/G)	A versus G	1.31 [1.02, 1.68]	0.03
Asian		1.31 [1.02, 1.68]	0.03
IL-17A rs2275913(G/A)	G versus A	1.20 [0.89, 1.61]	0.22
Asian		1.20 [0.89, 1.61]	0.22
IL-17A rs3804513(A/T)	A versus T	1.09 [0.87, 1.37]	0.46
Asian		1.09 [0.87, 1.37]	0.46
IL-17A rs3819025(G/A)	G versus A	1.02 [0.84, 1.23]	0.88
Asian		1.02 [0.84, 1.23]	0.88

frequency of asthma (C versus T: OR = 0.81, 95%CI = 0.70–0.93, $p = 0.003$, Table 3). Nevertheless, statistically significant differences were not observed for rs763780(T/C), rs1266828(T/C), rs13209590(A/G), and rs2397084(A/G), as shown in Figures 2 and 3. In the stratified analysis of rs763780(T/C) and rs1266828(T/C) by ethnicity, only rs763780(T/C) were observed to be significantly associated with asthma in Asian population in all the tested model, we observed (TT versus CC: OR = 3.41, 95%CI = 1.39–8.35, $P = 0.007$; TC versus CC: OR = 3.71, 95%CI = 1.46–9.38, $P = 0.006$; TT/TC versus CC: OR = 3.49, 95%CI = 1.42–8.57, $p = 0.006$; TT versus TC/CC, OR = 0.29, 95%CI = 0.12–0.70, $p = 0.006$). Taken together, it was determined that IL-17F rs1889570(C/T) which was explored in Asian population and rs763780(T/C) among Asians but not Caucasians might be potential factors for the assessment of asthma susceptibility.

IL-17A rs8193036(C/T), rs4711998(A/G), rs3819024(A/G), rs2275913(G/A), rs3804513(A/T), and rs3819025(G/A)

As shown in Table 2, rs4711998(A/G) was found to be closely associated with asthma risk under the dominant model (AA/AG versus GG: OR = 0.67, 95%CI = 0.46–0.98, $p = 0.03$). Moreover, the homozygote genotype of rs3819024(A/G) was also identified as a potential risk factor for asthma in the comparison with the heterozygote variant genotype (AA versus GG: OR = 1.77, 95%CI = 1.39–2.25, $p < 0.00001$, Figure 2) and the frequency of A allele was found to be significantly related to the frequency of asthma (A versus G : OR = 1.31, 95%CI = 1.02–1.68, $p = 0.03$, Table 3). However, there was no significant association for rs8193036(C/T), rs2275913(G/A), rs3804513(A/T), rs3819025 (G/A) and asthma susceptibility were discovered. On account of the

limited number of studies and the distinct lack of studies examining the Caucasian population, no further racial subgroup analysis was conducted.

Discussion

Although several studies have examine the correlation between IL-17F and IL-17A polymorphisms and asthma risk, to the best of our knowledge, this meta-analysis is the first systematic review that examined the effect of these polymorphisms on asthma. Data from these studies showed the importance of the IL-17F rs1889570(C/T), IL-17A rs4711998(A/G), and IL-17A rs3819024(A/G), which were found in studies of Asian population, plus rs763780(T/C) among Asians but not Caucasian in the pathogenesis of asthma and in the assessment of asthma susceptibility. However, none of the other SNPs that were examined part of our meta-analysis appeared to have any association with asthma.

It is well known that numerous cytokines and chemokines participate in the development of asthma. In recent years, numerous studies have explored the mechanism of asthma pathogenesis with particular attention given to confounding symptoms and poor response to asthma therapy. Currently, there are more than 100 studies that link the frequency or severity of asthma to cytokine and gene polymorphisms [21], such as IL-4 and IL-13. Among these cytokines, the pathogenesis of asthma has been attributed to IL-17F and IL-17A in many murine and human studies. Laan et al. [22] and Nembrini et al. [23] showed that IL-17F and IL-17A persuasively induce CXC chemokines and neutrophil responses in murine asthma models. Bullens et al. [24] and Linden et al. [25] found that severe asthmatics with particularly high levels of IL-17A in BALF have increased infiltration of neutrophils. Besides, IL-17F was also observed as higher in asthma patients than in healthy controls [12]. Nevertheless, some published studies have reported the opposite effect of the IL-17F and IL-17A in the murine asthma model. Therefore, there is a significant need for more studies to confirm these findings and provide theoretical foundations for human asthma studies: in particular, gene studies may show the association between SNPs and asthma risk more directly. While it is a daunting task to identify it for the number of relevant study is insufficient and there is only little functional information. To date, several studies have shed light on the relationship between IL-17F and IL-17A polymorphisms and asthma, among these studies, the authors explored the SNPs in different groups of distinct age range, population, and obtained even the completely opposite results. For example, Jin et al. [16] found that rs1889570(C/T) was a positively associated factor with asthma risk, but not rs763780(T/C), which was completely contrary to Kawaguchi's [14]. Maalmi et al. [17] recently performed the experiments and investigated that rs763780(T/C) could influence asthma risk. In our meta-analysis, we indicated that IL-17F rs1889570(C/T), IL-17A rs4711998(A/G), and IL-17A rs3819024(A/G) may be potential risk factors for asthma, whereas inclusive results were yielded for lack of more precise analysis of this relationship.

As a systematic review, some limitations of this meta-analysis should be acknowledged. First, the small sample size

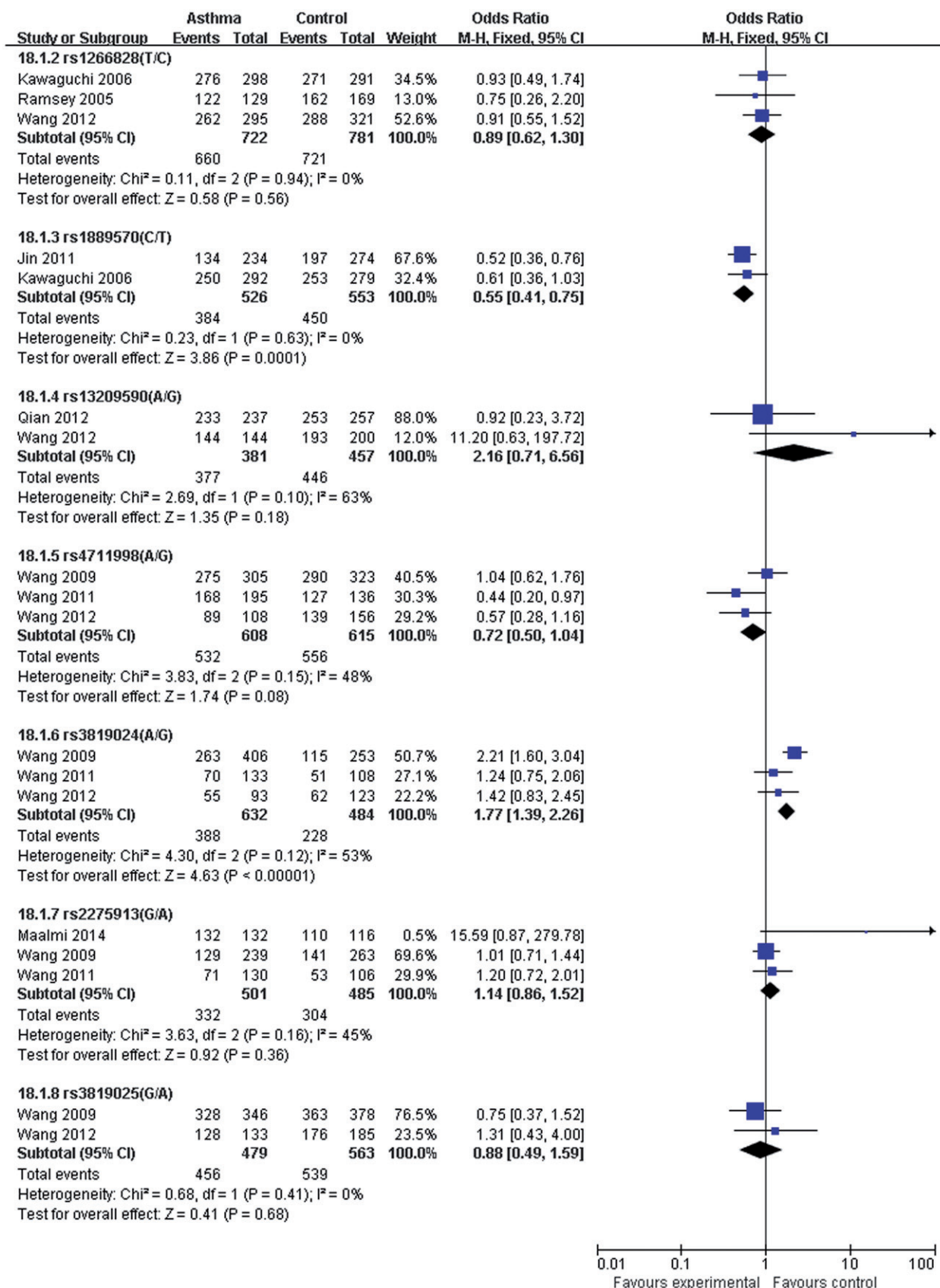


Figure 2. Meta-analysis with a fixed model for the ORs of asthma risk associated with IL-17F and IL-17A polymorphisms (CC versus TT).

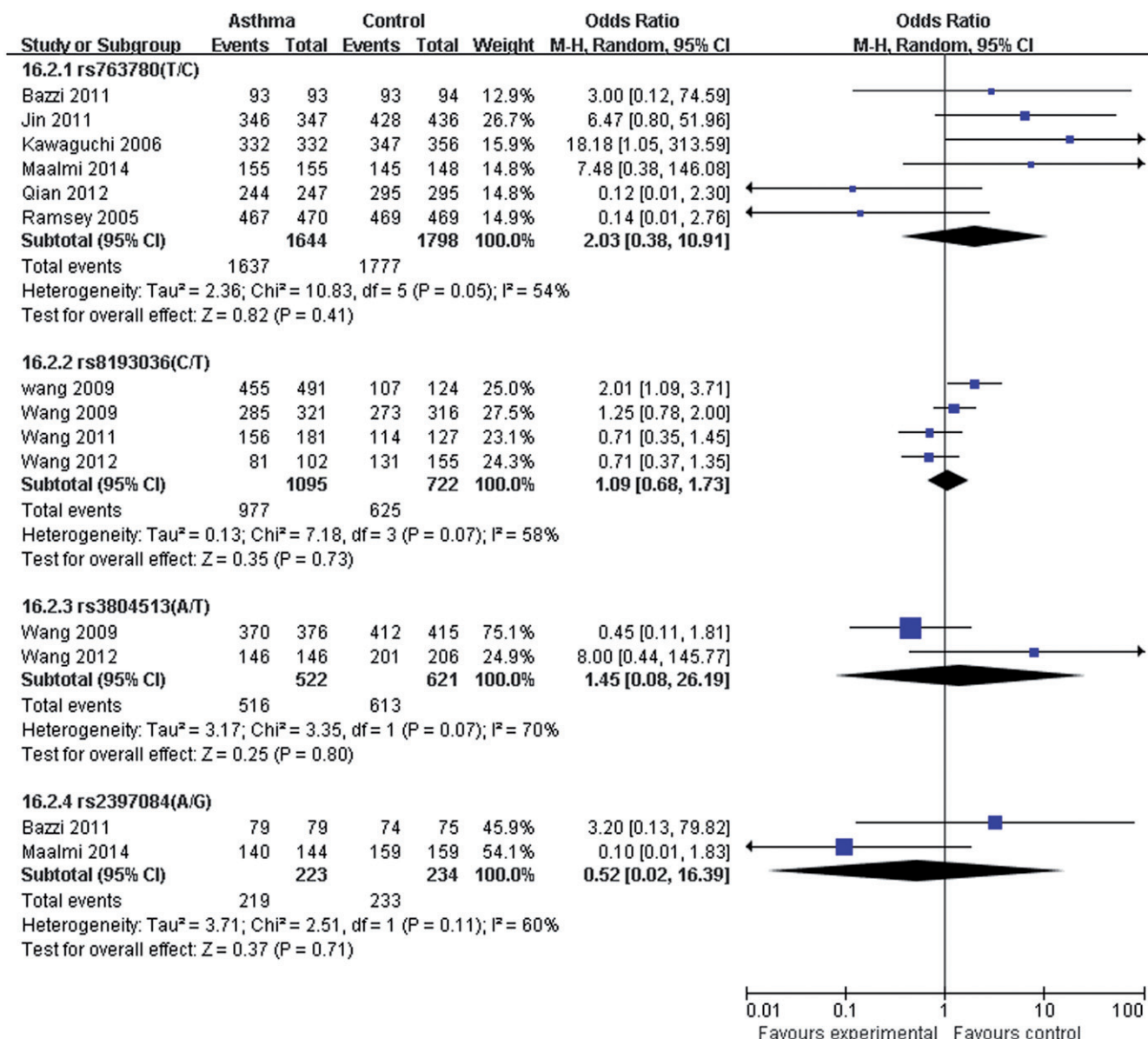


Figure 3. Meta-analysis with a random model for the ORs of asthma risk associated with IL-17F and IL-17A polymorphisms (CC versus TT).

in our analysis limits the extent to which a true association between the polymorphism and asthma risk can be affirmed. Second, there were restricted numbers of some studies, specifically for the Caucasian population. Third, individual information contained in some of these referred studies, for instance, the sex and age of participants and even the definition of asthma were unavailable in some instances, which may have limited further analysis. Nevertheless, our meta-analysis had some advantages. First, this is the first comprehensive meta-analysis to investigate the association between IL-17F and IL-17A polymorphism and asthma

susceptibility. Second, all the studies were searched and collected with caution and met our inclusion criterion with satisfaction. Third, our meta-analysis had conducted a full-scale research on all the available genotype frequency of IL-17F and IL-17A studies published to date.

Conclusion

In conclusion, our meta-analysis suggested that IL-17F rs1889570(C/T), IL-17A rs4711998(A/G), and IL-17A rs3819024(A/G) may regulate susceptibility to asthma risk.

Whereas IL-17F rs763780(T/C), rs1266828(T/C), rs13209590(A/G), and IL-17A rs8193036(C/T), rs3804513(A/T), rs3819025(G/A) do not appear to have any association with the risk of asthma. However, more robust studies that include multi-ethnic groups, larger population, and contain detailed analysis on age and sex are required to evaluate the implications of these SNPs of IL-17F and IL-17A for asthma and validate our findings.

Declaration of interest

The authors report that they have no conflicts of interest. The authors alone are responsible for the content and writing of the paper. This work was supported by a grant from the Natural Science Foundation of Ningbo (No. 2012A610257, Zaichun Deng).

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