

ORIGINAL ARTICLE

The association between tobacco and the risk of asthma, rhinoconjunctivitis and eczema in children and adolescents: analyses from Phase Three of the ISAAC programme

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ABSTRACT

Background Exposure to parental smoking is associated with wheeze in early childhood, but in 2006 the US Surgeon General stated that the evidence is insufficient to infer a causal relationship between exposure and asthma in childhood and adolescents.

Aims To examine the association between maternal and paternal smoking and symptoms of asthma, eczema and rhinoconjunctivitis.

Methods Parents or guardians of children aged 6–7 years completed written questionnaires about symptoms of asthma, rhinoconjunctivitis and eczema, and several risk factors, including maternal smoking in the child's first year of life, current maternal smoking (and amount) and paternal smoking. Adolescents aged 13–14 years self completed the questionnaires on these symptoms and whether their parents currently smoked.

Results In the 6–7-year age group there were 220 407 children from 75 centres in 32 countries. In the 13–14-year age group there were 350 654 adolescents from 118 centres in 53 countries. Maternal and paternal smoking was associated with an increased risk of symptoms of asthma, eczema and rhinoconjunctivitis in both age groups, although the magnitude of the OR is higher for symptoms of asthma than the other outcomes. Maternal smoking is associated with higher ORs than paternal smoking. For asthma symptoms there is a clear dose relationship (1–9 cigarettes/day, OR 1.27; 10–19 cigarettes/day, OR 1.35; and 20+ cigarettes/day, OR 1.56). When maternal smoking in the child's first year of life and current maternal smoking are considered, the main effect is due to maternal smoking in the child's first year of life. There was no interaction between maternal and paternal smoking.

Conclusions This study has confirmed the importance of maternal smoking, and the separate and additional effect of paternal smoking. The presence of a dose–response effect relationship with asthma symptoms suggests that the relationship is causal, however for eczema and rhinoconjunctivitis causality is less certain.

The effect of environmental tobacco smoke exposure (ETS) on respiratory health has been of interest for many years. In 2006 the US Surgeon General concluded that 'the evidence is sufficient to infer a causal relationship between secondhand smoke exposure from parental smoking and the

Key messages

What is the key question?

- What is the association between maternal and paternal smoking and symptoms of asthma, eczema and rhinoconjunctivitis?

What is the bottom line?

- This study has confirmed the association of maternal smoking, and identified a separate and additive association between paternal smoking and the risk of symptoms of asthma, eczema and rhinoconjunctivitis.

Why read on?

- The results of this large study (over 570 000 children and adolescents in 53 countries) were consistent throughout the world and were independent of the income of the country.

onset of wheeze illnesses in early childhood' and 'that the evidence is suggestive but not sufficient to infer a causal relationship between secondhand smoke exposure from parental smoking and the onset of childhood asthma'.¹ While a recent systematic review and meta-analysis has quantified the strength of the associations,² the data come predominantly from developed countries. The importance of the age of exposure to ETS is not well established, nor is the relative importance of maternal and paternal smoking.

In contrast with the number of studies examining the association of ETS with asthma, there are fewer studies examining the association between ETS and either eczema or rhinoconjunctivitis, and these have provided conflicting results.

The aims of this study were to examine the association between maternal and paternal smoking and symptoms of asthma, rhinoconjunctivitis and eczema, to assess the relative importance of maternal and paternal smoking, to look for consistency in these findings from many different countries, including developing countries, and to determine if there is a dose–response effect, which if present would support a causal relationship.

METHODS

International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three is a multicentre, multicountry, cross-sectional study of children (aged 6–7 years) and adolescents (aged 13–14 years) chosen from a random sample of schools in a defined geographical area. The parent or guardian completed the questionnaire for the children and for the adolescents the questionnaire was self-completed. The methods have been described in detail previously.³

Outcomes

Current wheeze was identified by a positive response to the question: 'Has your child/have you had wheezing or whistling in the chest in the past 12 months?'

Severe asthma symptoms were identified by fulfilling one or more of the following criteria:

1. Four or more attacks of wheezing in the past 12 months.
2. Sleep disturbance due to wheezing occurring one or more nights per week in the past 12 months.
3. Wheezing limiting speech to one or two words at a time between breaths in the past 12 months.

Asthma (the diagnosis) was defined as a positive response to the question: 'Has your child/have you *ever* had asthma?'

Current rhinoconjunctivitis was identified by a positive response to each of the following questions:

1. In the past 12 months has your child/have you had a problem with sneezing, or a runny or blocked nose when he/she did not have a cold or the flu?
2. If yes, has this nose problem been accompanied by itchy watery eyes?

Current eczema was identified by a positive answer to each of the following questions:

1. Has your child/have you ever had an itchy skin rash, which was coming and going for at least 6 months?

2. If yes, has your child/have you had this itchy rash at any time in the past 12 months?
3. If yes, has this itchy rash at any time affected any of the following places—the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears, or eyes?

The prevalence of wheeze and asthma is higher in children with rhinoconjunctivitis and eczema,⁴ and this might account for the association between parental smoking and eczema and rhinoconjunctivitis; therefore, the risk of symptoms of eczema and rhinoconjunctivitis in the absence of current asthma symptoms was also examined.

In addition, a video questionnaire of asthma symptoms was administered to the adolescents. The video question used was the sequence on current wheeze at rest defined as a positive response to the question: 'Has your breathing been like this in the past year?' The video asthma questionnaire was validated against the written questionnaire.⁵

Explanatory variables

The following questions were used to assess smoking by the parents of the subjects. For children aged 6–7 years:

1. Does your child's mother (or female guardian) smoke cigarettes?

If yes, about how many cigarettes does the child's mother (or female guardian) smoke each day?

2. Does your child's father (or male guardian) smoke cigarettes?
- If yes, about how many cigarettes does the child's father (or male guardian) smoke each day?

3. Did your child's mother (or female guardian) smoke cigarettes during your child's first year of life?

For adolescents aged 13–14 years:

1. Does your mother (or female guardian) smoke cigarettes?
2. Does your father (or male guardian) smoke cigarettes?

Table 1 Association between tobacco smoking by the parents and symptoms of asthma, eczema and rhinoconjunctivitis at 6–7 and 13–14 years of age

Symptom	Tobacco question	Age group	
		6–7 years	13–14 years
Current wheeze	Current paternal smoking	1.17 (1.12 to 1.21)	1.20 (1.15 to 1.24)
	Current maternal smoking	1.28 (1.22 to 1.34)	1.32 (1.26 to 1.37)
	Mother smoked first year of life	1.36 (1.29 to 1.43)	*
Current wheeze (video)	Current paternal smoking	*	1.22 (1.15 to 1.29)
	Current maternal smoking	*	1.41 (1.32 to 1.49)
Severe asthma symptoms	Current paternal smoking	1.23 (1.16 to 1.30)	1.26 (1.20 to 1.32)
	Current maternal smoking	1.32 (1.24 to 1.41)	1.38 (1.31 to 1.45)
	Mother smoked first year of life	1.44 (1.33 to 1.55)	*
Asthma ever	Current paternal smoking	1.11 (1.06 to 1.15)	1.08 (1.04 to 1.12)
	Current maternal smoking	1.26 (1.20 to 1.32)	1.20 (1.16 to 1.25)
	Mother smoked first year of life	1.34 (1.27 to 1.42)	*
Current eczema symptoms	Current paternal smoking	1.09 (1.04 to 1.13)	1.19 (1.14 to 1.25)
	Current maternal smoking	1.15 (1.09 to 1.21)	1.22 (1.16 to 1.28)
	Mother smoked first year of life	1.20 (1.13 to 1.27)	*
Current rhinoconjunctivitis	Current paternal smoking	1.08 (1.04 to 1.13)	1.15 (1.11 to 1.19)
	Current maternal smoking	1.12 (1.06 to 1.18)	1.20 (1.15 to 1.25)
	Mother smoked first year of life	1.17 (1.10 to 1.24)	*
Eczema without wheeze	Current paternal smoking	1.06 (1.01 to 1.11)	1.15 (1.09 to 1.20)
	Current maternal smoking	1.10 (1.03 to 1.17)	1.12 (1.05 to 1.18)
	Mother smoked first year of life	1.11 (1.04 to 1.19)	*
Rhinoconjunctivitis without wheeze	Current paternal smoking	1.04 (0.99 to 1.09)	1.11 (1.07 to 1.16)
	Current maternal smoking	1.05 (0.98 to 1.12)	1.11 (1.06 to 1.16)
	Mother smoked first year of life	1.05 (0.98 to 1.13)	*

Data are OR (95% CI) and are adjusted for gender, language, region and Gross National Income (GNI) category.

*Data not collected.

To assess the presence of a dose–response relationship, the number of cigarettes smoked were categorised as 0, 1–9, 10–19 and 20+ per day. In addition, combinations of maternal and paternal smoking were examined for both age groups, and combinations of maternal smoking in the child's first year of life and current maternal smoking were examined in the 6–7-year age group.

Study sample

For the 6–7-year age group, data were submitted to the ISAAC International Data Centre (IIDC) from 165 centres in 65 coun-

tries with 421 543 participants. There were 21 centres in 16 countries (32 732 children) excluded as the response rate was <60% or there were <1000 participants. There were a further 69 centres in 38 countries (168 404 children) that did not include the risk factor questionnaire. The final risk factor dataset for the younger age group comprised 75 centres from 32 countries with 220 407 children.

For the adolescent group, data from 242 centres in 98 countries with 814 837 participants were submitted to the IIDC. There were nine centres from six countries (16 152 adolescents) excluded as the response rate was <70% or there were <1000 participants.

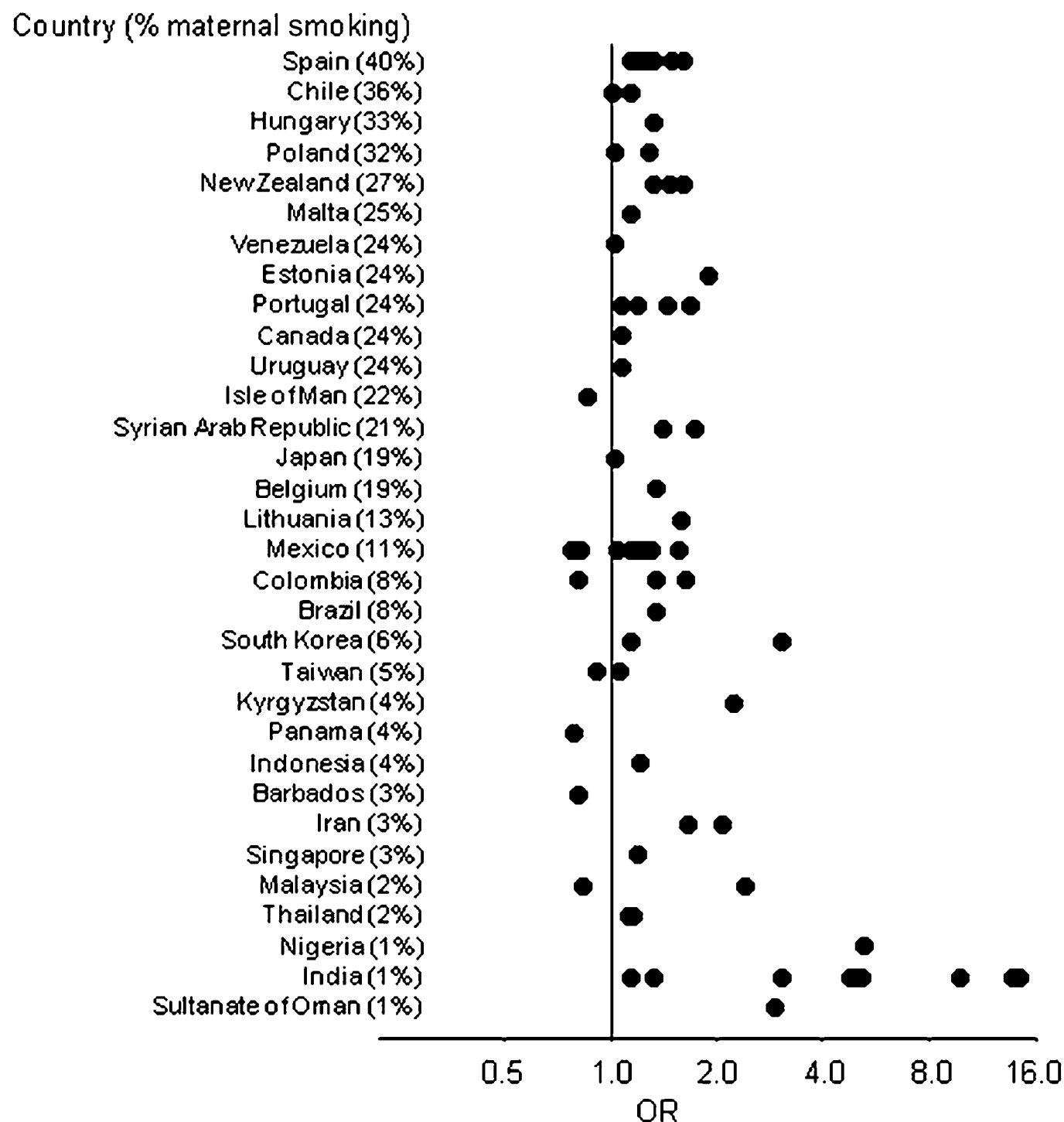


Figure 1 ORs for the association between current maternal smoking and current wheeze by country in children aged 6–7 years. For every country, the percentage of children exposed to maternal smoking is stated in brackets.

There were a further 111 centres from 59 countries (437 086 adolescents) that did not include the risk factor questionnaire. Four centres did not collect data on current maternal and paternal smoking. The final risk factor dataset for the older age

group comprised 118 centres from 53 countries with 350 654 adolescents.

In addition, some centres did not collect data on specific risk factor questions or the response rate to the specific question was

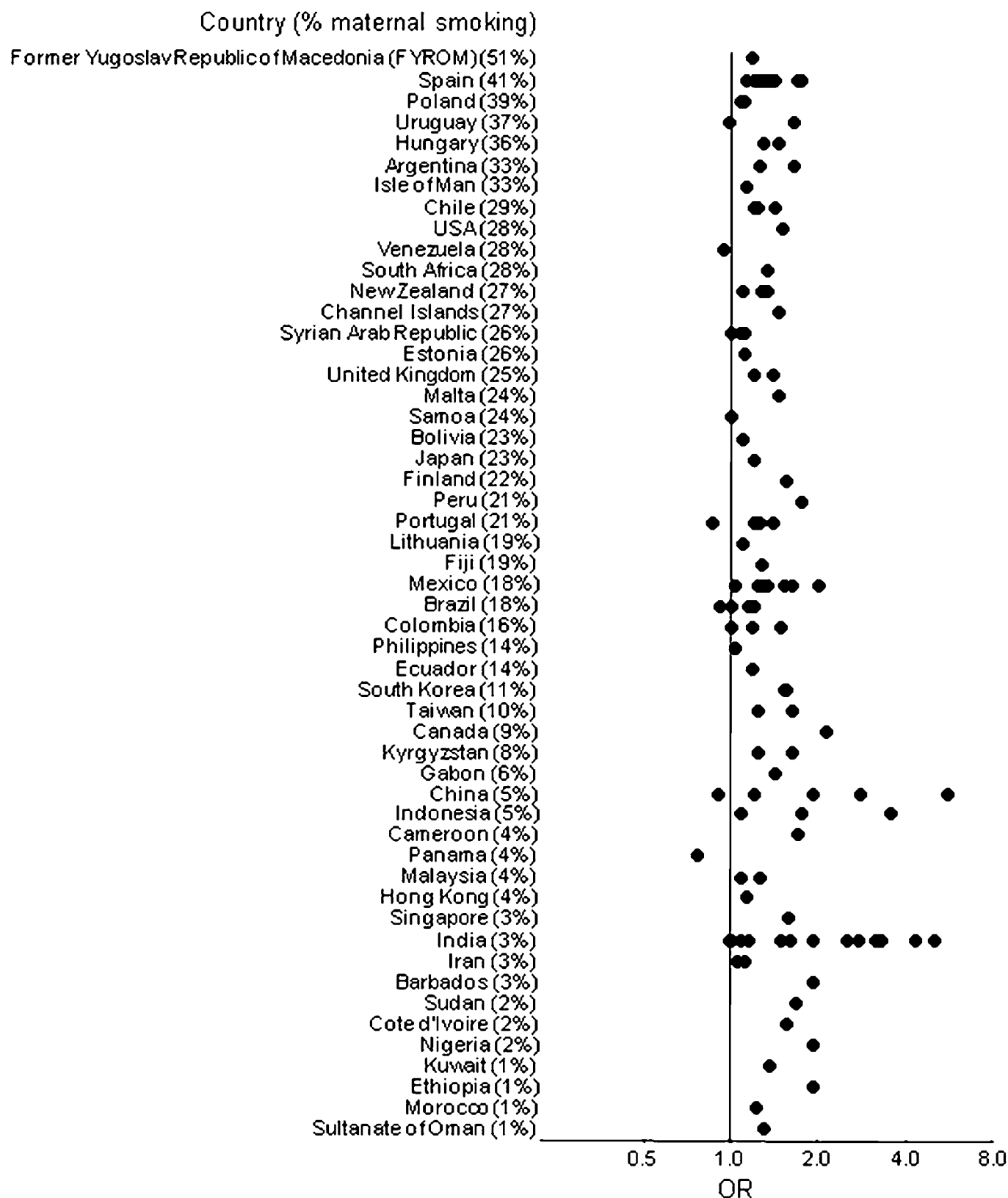


Figure 2 ORs for the association between current maternal smoking and current wheeze by country in adolescents aged 13–14 years (Tokelau excluded). For every country, the percentage of children exposed to maternal smoking is stated in brackets.

<70%. For the 6–7-year age group the following number of centres were excluded: current maternal smoking=1, current paternal smoking=2, mother smoked in child's first year of life=3, amount smoked by mother=5, and amount smoked by father=6; and for the 13–14-year age group: current maternal smoking=1 and current paternal smoking=10.

Statistical analysis

To be included in the analysis, centres had to assess at least 1000 subjects (except Tokelau which was a complete country study) and to have a response rate of >60% for the children and >70% for the adolescents. Centres with minor deviations from protocol were included in the analyses and identified by the use of a footnote in the ISAAC publications.^{6–8} Odds ratios (ORs) were calculated with generalised linear mixed models, with a binomial distribution and logit link, and with centres being modelled as a random effect. Analyses were adjusted for gender, region of the world, language and gross national income. The regression models allowed for the sampling by schools by scaling the size of the sample by the design effect.

No imputation was done for missing data, as previous analyses had shown that little or no bias was introduced by limiting the multivariate analyses to children with complete data.⁹

To assess whether being in two smoke exposure groups, relative to being in one or the other, resulted in disproportionately high risk, the relative excess risk due to interaction and its 95% CIs were calculated.¹⁰

The population-attributable risk of current asthma symptoms for maternal smoking was calculated with the Mantel-Haenszel approach, with the adjusted relative risk (RR) and the proportion of subjects who were exposed.¹¹

RESULTS

Exposure values (6–7-year age group: current maternal smoking, current paternal smoking and mother smoking in first year of the child's life; 13–14-year age group: current maternal smoking and current paternal smoking) and prevalence values (current symptoms of asthma, rhinoconjunctivitis and eczema) by centre are shown in online tables 1 (6–7 years old) and 2 (13–14 years old).

Table 1 shows the association between smoking by the parents and symptoms of asthma, rhinoconjunctivitis and eczema at 6–7 and 13–14 years of age. Smoking is associated with an increased risk of symptoms of asthma, eczema and rhinoconjunctivitis. Figures 1 and 2 show the adjusted ORs for the association between current maternal smoking and asthma symptoms for each age group by country and table 2 shows

these associations by region. The ORs are higher for asthma outcomes than for symptoms of rhinoconjunctivitis and eczema. The magnitude of the ORs associated with symptoms of eczema and rhinoconjunctivitis are similar, but weaker than that seen with asthma outcomes. The ORs for the 6–7-year age group are very similar to those for the 13–14-year age group. In all analyses but one current maternal smoking is associated with higher ORs than current paternal smoking; the exception is symptoms of eczema without wheeze in the 13–14-year age group. In all the 6–7-year age group analyses maternal smoking in the child's first year of life is associated with higher ORs than current maternal smoking. Furthermore, in both age groups severe symptoms of asthma are associated with higher ORs than current wheeze or asthma.

The association between all the smoking variables and symptoms of eczema without current asthma symptoms in both age groups are significant. The association between the smoking variables and symptoms of rhinoconjunctivitis without current asthma symptoms is significant for the 13–14-year age group, but not for the younger age group, although the point estimates are elevated.

For asthma in the 6–7-year age group (current wheeze, severe symptoms and asthma) there is clear evidence of a dose–response effect for current smoking by the mother and father (table 3). For example, the more cigarettes the mother currently smokes, the higher the risk of severe asthma symptoms (1–9 cigarettes/day, OR 1.27; 10–19 cigarettes/day, OR 1.35; 20+ cigarettes/day, OR 1.56). A dose–response effect is not seen with symptoms of eczema and rhinoconjunctivitis.

The risk of all outcome variables is greater when the mother only smokes than when the father only smokes (except for symptoms of rhinoconjunctivitis without wheeze in the 13–14-year age group) (table 4). When both the mother and father smoke the risk is increased by the expected amount; that is, the increased risk is almost exactly the same as that obtained by multiplying the OR when the mother only smokes with that when the father only smokes. There is no evidence of an interaction between these variables.

Table 5 examines the association between the combinations of smoking in the child's first year of life and current maternal smoking and symptoms of asthma, rhinoconjunctivitis and eczema. Maternal smoking in the first year of the child's life only is associated with greater risk of all symptoms than current maternal smoking only, although there is also an effect of only maternal smoking currently. Unexpectedly maternal smoking in the first year of life and currently is not associated with a further increase in risk compared with that seen with smoking in the first year of the child's life. There is a significant negative relative

Table 2 The association between current maternal smoking and current asthma symptoms by region in children aged 6–7 and 13–14 years

Region	Age group 6–7 years		Age group 13–14 years	
	Centres (n)	OR (95% CI)	Centres (n)	OR (95% CI)
Africa	1	5.31 (0.79 to 35.79)	10	1.37 (1.01 to 1.86)
Asia-Pacific	11	1.18 (1.00 to 1.40)	18	1.39 (1.19 to 1.63)
Eastern Mediterranean	6	1.48 (1.20 to 1.83)	8	1.28 (1.05 to 1.55)
Indian subcontinent	14	4.07 (2.39 to 6.95)	16	2.22 (1.56 to 3.16)
Latin America	17	1.13 (1.02 to 1.25)	27	1.32 (1.22 to 1.42)
North America	2	1.00 (0.75 to 1.34)	3	1.79 (1.35 to 2.37)
Northern and Eastern Europe	6	1.45 (1.26 to 1.67)	10	1.29 (1.14 to 1.45)
Oceania	4	1.44 (1.29 to 1.62)	8	1.21 (1.07 to 1.38)
Western Europe	13	1.27 (1.17 to 1.38)	17	1.30 (1.20 to 1.40)

Data are OR (95% CI) and are adjusted for gender, language and GNI category. Cuernavaca did not collect data on current maternal smoking in both age groups.

Table 3 Association between amount currently smoked by the parents and symptoms of asthma, eczema and rhinoconjunctivitis at 6–7 years of age

Symptom	Current paternal smoking			Current maternal smoking		
	1–9 cigarettes	10–19 cigarettes	20+ cigarettes	1–9 cigarettes	10–19 cigarettes	20+ cigarettes
Current wheeze	1.06 (1.00 to 1.12)	1.15 (1.08 to 1.22)	1.27 (1.19 to 1.35)	1.25 (1.17 to 1.34)	1.29 (1.20 to 1.38)	1.44 (1.31 to 1.59)
Severe asthma symptoms	1.05 (0.96 to 1.15)	1.22 (1.12 to 1.34)	1.42 (1.30 to 1.56)	1.27 (1.15 to 1.40)	1.35 (1.22 to 1.50)	1.56 (1.36 to 1.80)
Asthma ever	1.03 (0.97 to 1.10)	1.11 (1.04 to 1.18)	1.18 (1.11 to 1.26)	1.18 (1.09 to 1.27)	1.29 (1.20 to 1.40)	1.37 (1.24 to 1.52)
Current eczema symptoms	1.08 (1.02 to 1.15)	1.04 (0.97 to 1.11)	1.11 (1.04 to 1.20)	1.17 (1.08 to 1.26)	1.13 (1.04 to 1.23)	1.15 (1.02 to 1.30)
Current rhinoconjunctivitis symptoms	1.04 (0.98 to 1.11)	1.06 (0.99 to 1.13)	1.10 (1.03 to 1.18)	1.18 (1.09 to 1.27)	1.02 (0.94 to 1.11)	1.14 (1.02 to 1.28)
Eczema symptoms without wheeze	1.08 (1.01 to 1.16)	1.01 (0.94 to 1.09)	1.02 (0.94 to 1.11)	1.07 (0.98 to 1.17)	1.11 (1.00 to 1.22)	1.08 (0.94 to 1.25)
Rhinoconjunctivitis symptoms without wheeze	1.04 (0.97 to 1.12)	0.98 (0.91 to 1.07)	1.00 (0.92 to 1.09)	1.07 (0.98 to 1.17)	0.92 (0.82 to 1.03)	1.05 (0.90 to 1.21)

Data are OR (95% CI) and are adjusted for gender, language, region and GNI category. Reference group is 0 cigarettes per day.

excess risk due to interaction, which indicates that the risk of symptoms from the combined exposure is less than one would have expected.

Population attributable risk (PAR) for the various exposures is given in online table 3. The PAR for current maternal smoking and the various asthma outcomes in both age groups range from 5.6% to 7.1%. Figure 3 shows the PAR for maternal and paternal smoking. For example, if the prevalence of maternal smoking is 20% and paternal smoking is 25%, the PAR is 8%.

DISCUSSION

Main findings

This study has shown that parental smoking is associated with an increased risk of diagnosis and symptoms of asthma, eczema and rhinoconjunctivitis in childhood. The magnitude of the association is greater for current smoking by mothers than fathers, which may be due to children and adolescents spending more time in the presence of their mothers than their fathers. However, smoking by the mother and the father are both important.

When we examined 'severe asthma symptoms', which is clinically more meaningful, the magnitude of the ORs was even greater than that seen with current wheeze. This result reinforces the role of ETS in the severity of asthma symptoms. Furthermore, this suggests that ETS is related to asthma rather

than just trivial wheeze or other respiratory symptoms. The magnitudes of the relative risks observed in this study are modest, although consistent with other meta-analyses examining these relationships. However, given how prevalent smoking is in some countries, ETS exposure is an important contributor to the burden of asthma and allergies in those countries. If maternal smoking is causally related to asthma then it might account for 5–7% of asthma cases in the world.

Maternal smoking in the child's first year of life was associated with a greater risk of symptoms for all outcome categories than current maternal smoking. Furthermore the magnitude of the risk associated with exposure to both smoking in the first year of life and current smoking was not greater than those who were only exposed to smoking in the first year of life. This indicates that early exposure to ETS is especially important. However, it needs to be recognised that we did not collect exposure data on smoking in pregnancy. As smoking in pregnancy and the first year of the child's life are highly correlated, it is possible that maternal smoking in the child's first year of life is a marker for smoking in pregnancy and that this is the more important factor. This study is not able to elucidate this.

We showed clear evidence of a dose–response effect for current maternal and paternal smoking on all the asthma outcomes; that is, the more the mother or father smoked, the greater the likelihood that the child or adolescent would develop

Table 4 Association between combinations of smoking by the parents and symptoms of asthma, eczema and rhinoconjunctivitis at 6–7 and 13–14 years of age

Symptom	Mother only smokes	Father only smokes	Mother and father smoke	RERI
6–7 years				
Current wheeze	1.31 (1.22 to 1.41)	1.13 (1.08 to 1.18)	1.37 (1.29 to 1.45)	−0.071 (−0.182 to 0.040)
Severe asthma symptoms	1.31 (1.18 to 1.46)	1.19 (1.11 to 1.27)	1.46 (1.34 to 1.59)	−0.042 (−0.205 to 0.121)
Asthma ever	1.28 (1.19 to 1.38)	1.07 (1.02 to 1.12)	1.29 (1.22 to 1.38)	−0.057 (−0.168 to 0.054)
Current eczema symptoms	1.15 (1.06 to 1.24)	1.07 (1.02 to 1.12)	1.19 (1.11 to 1.27)	−0.029 (−0.136 to 0.078)
Current rhinoconjunctivitis symptoms	1.13 (1.04 to 1.23)	1.07 (1.02 to 1.12)	1.16 (1.09 to 1.24)	−0.035 (−0.141 to 0.070)
Eczema symptoms without wheeze	1.06 (0.97 to 1.16)	1.03 (0.98 to 1.09)	1.13 (1.05 to 1.22)	0.040 (−0.075 to 0.155)
Rhinoconjunctivitis symptoms without wheeze	1.08 (0.98 to 1.19)	1.04 (0.98 to 1.09)	1.06 (0.98 to 1.15)	−0.052 (−0.173 to 0.069)
13–14 years				
Current wheeze	1.27 (1.19 to 1.36)	1.13 (1.07 to 1.18)	1.43 (1.36 to 1.51)	0.040 (−0.066 to 0.146)
Current wheeze (video)	1.38 (1.25 to 1.52)	1.17 (1.10 to 1.25)	1.50 (1.39 to 1.63)	−0.046 (−0.203 to 0.111)
Severe asthma symptoms	1.28 (1.18 to 1.39)	1.16 (1.09 to 1.23)	1.57 (1.47 to 1.67)	0.128 (−0.004 to 0.260)
Asthma ever	1.16 (1.09 to 1.23)	1.04 (0.99 to 1.08)	1.21 (1.16 to 1.28)	0.021 (−0.064 to 0.107)
Current eczema symptoms	1.20 (1.10 to 1.30)	1.17 (1.10 to 1.23)	1.33 (1.24 to 1.42)	−0.040 (−0.160 to 0.080)
Current rhinoconjunctivitis symptoms	1.15 (1.08 to 1.23)	1.12 (1.07 to 1.17)	1.27 (1.21 to 1.34)	0.000 (−0.092 to 0.093)
Eczema symptoms without wheeze	1.16 (1.06 to 1.27)	1.16 (1.10 to 1.23)	1.18 (1.10 to 1.27)	−0.139 (−0.266 to −0.012)
Rhinoconjunctivitis symptoms without wheeze	1.06 (0.99 to 1.13)	1.10 (1.05 to 1.15)	1.18 (1.11 to 1.25)	0.022 (−0.068 to 0.113)

Data are OR (95% CI) and are adjusted for gender, language, region and GNI category. Reference group is neither parent smokes. RERI, relative excess risk due to interaction between the two smoking exposures.

Table 5 Association between combinations of maternal smoking in the child's first year of life and current smoking and symptoms of asthma, eczema and rhinoconjunctivitis at 6–7 years of age

Symptom	First year of life only	Current only	Both times	RERI
Current wheeze	1.38 (1.24 to 1.53)	1.23 (1.14 to 1.32)	1.39 (1.31 to 1.47)	−0.218 (−0.432 to −0.004)
Severe asthma symptoms	1.36 (1.17 to 1.58)	1.21 (1.09 to 1.34)	1.48 (1.36 to 1.61)	−0.093 (−0.405 to 0.219)
Asthma ever	1.41 (1.27 to 1.56)	1.20 (1.11 to 1.30)	1.37 (1.28 to 1.45)	−0.247 (−0.462 to −0.031)
Current eczema symptoms	1.19 (1.06 to 1.33)	1.11 (1.03 to 1.20)	1.21 (1.13 to 1.29)	−0.089 (−0.293 to 0.114)
Current rhinoconjunctivitis symptoms	1.18 (1.05 to 1.33)	1.07 (0.99 to 1.16)	1.16 (1.09 to 1.24)	−0.097 (−0.299 to 0.106)
Eczema symptoms without wheeze	1.13 (0.99 to 1.29)	1.10 (1.01 to 1.20)	1.11 (1.02 to 1.20)	−0.086 (−0.317 to 0.145)
Rhinoconjunctivitis symptoms without wheeze	1.08 (0.93 to 1.25)	1.03 (0.94 to 1.13)	1.03 (0.94 to 1.12)	−0.123 (−0.343 to 0.096)

Data are OR (95% CI) and are adjusted for gender, language, region and GNI category. Reference group: mother non-smoker for first year of child's life and non-smoker now. RERI, relative excess risk due to interaction between the two smoking exposures.

asthma symptoms. The presence of a dose–response effect is strong evidence for a causal relationship.

We found a weak but consistent association between ETS and symptoms of eczema. A dose–response effect relationship was not seen between amount smoked and symptoms of eczema. In contrast to asthma, there have been fewer studies of the association between smoking and eczema. Smoking has been shown to increase the risk in adults in Sweden,¹² but not in Norway.¹³ In children aged 3 years, in utero and postnatal exposure were not associated with eczema¹⁴ nor was an effect seen in children aged 0–12 years.¹⁵ However, in a study of children aged 6 years an increased risk of eczema was associated with urinary cotinine levels.¹⁶

Finally we found that the association between ETS and symptoms of rhinoconjunctivitis was even weaker and for many of the analyses did not reach statistical significance. Furthermore, a dose–response relationship was not seen between the amount smoked and symptoms of rhinoconjunctivitis. Studies examining the association between smoking and rhinoconjunctivitis are also conflicting. One study reported a reduced risk of rhinoconjunctivitis for adult smokers and their children.¹⁷ Another showed a decreased risk of hayfever in adolescents who were exposed to tobacco in utero.¹⁸ However, in the ISAAC Phase Two Study there was an increased risk of rhinoconjunctivitis in children aged 9–11 years who had been exposed to maternal smoking during pregnancy.¹⁹

Strengths and limitations

The strengths of this multicentre study were its power, size and multinational nature. The younger age group comprised 75 centres from 32 countries with 220 407 children and the adolescent group comprised 118 centres from 53 countries with

350 654 adolescents. As a result, we established the consistency of the association of ETS with the presence of asthma and other allergic disorders in various populations with different prevalences of asthma and allergies, different exposure levels and different cultures and economic development. Many previous studies have been conducted in developed countries and the meta-analyses reflect this.² This study extends the meta-analyses by including many countries that are less developed and markedly increased the size and number of the studies examining these relationships. We mainly used self-reported symptoms rather than doctors' diagnoses to avoid major diagnostic differences related to access to medical care, language and medical practice. Publication bias has been avoided in this study as the data from each centre in the study were included.

Limitations of this study also need to be considered. The outcomes and exposures were assessed by questionnaire, which were completed by the parents for the younger age group and by the participants in the adolescent age group. Although it is likely that the parent who completed the questionnaire would be more accurate about their own tobacco use than that smoked by the other parent, we did not record which parent completed the questionnaire. This might lead to misclassification, which would reduce the chance of identifying associations, but is unlikely to result in any systematic bias. Selection bias is also unlikely as the response rate from centres included in these analyses was high.

The major limitation was absence of data on smoking by the participants themselves. Smoking by 6–7 year olds is unlikely, but is more likely in the adolescents. Adolescents who smoke are at greater risk of wheezing than those who had never smoked.²⁰ However, there was consistency of findings across the two age groups, which suggests this potential bias is not important.

Implications

The association of ETS with asthma fulfils the criteria for a causal relationship.²¹ The association is moderately strong; the results were generally consistent across each of the centres; and a dose–response relationship was seen for asthma, but not eczema and rhinoconjunctivitis.

Conclusion

In summary, this study has confirmed the importance of maternal smoking, especially early in the child's life, and the separate and additional effect of paternal smoking. The presence of a dose–response effect relationship with symptoms of asthma suggests that the relationship may be causal. However, for eczema and rhinoconjunctivitis causality is less certain.

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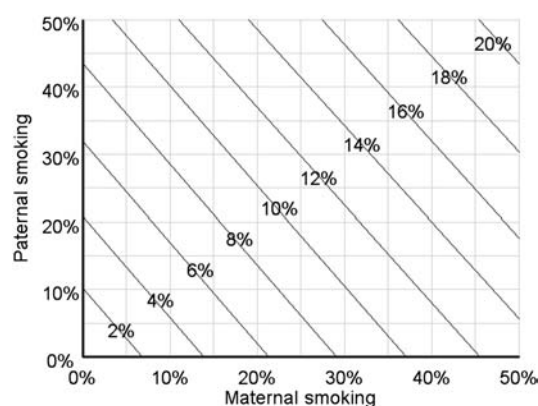


Figure 3 The population attributable risk for current wheeze for the combinations of the prevalence of maternal and paternal smoking assuming they are independent.

Contributors EAM is a member of the ISAAC International Data Centre, ISAAC Steering Committee member, led the analysis and wrote the first draft. RB is a member of the ISAAC Steering Committee, regional coordinator for North America, and advised on the manuscript. UK is a member of the ISAAC Steering Committee, regional coordinator for Western Europe, and advised on the manuscript. SM is a member of the ISAAC Steering Committee, regional coordinator for Eastern Mediterranean, and advised on the manuscript. JO is a member of the ISAAC Steering Committee, regional coordinator for Africa, and advised on the manuscript. All authors approved the final submitted manuscript.

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Competing interests None.

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APPENDIX 1

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Web table 1: Exposure and prevalence values by centre, 6-7 year age group.

Centre Name	N	Current Maternal Smoking	Current Paternal Smoking	Maternal Smoking in the First Year	Current Wheeze	Current Symptoms of Rhino- conjunctivitis	Current Symptoms of Eczema
Africa							
Nigeria							
Ibadan	2396	1.3	3.8	1.4	5.6	3.6	5.0
Region total	2396	1.3	3.8	1.4	5.6	3.6	5.0
Asia-Pacific							
Indonesia							
Bandung	2503	3.5	4.2	1.9	2.8	3.6	3.7
Japan							
Fukuoka	2958	18.8	58.0	14.4	18.2	10.6	0.0
Malaysia							
Alor Setar	3786	2.8	46.9	7.5	5.7	4.2	12.7
Kota Bharu	3110	1.8	52.0	7.6	4.3	4.2	12.9
Singapore							
Singapore	5389	2.6	32.9	1.8	10.2	8.7	8.9
South Korea							
Provincial Korea	4258	6.3	67.8	1.4	5.6	8.6	10.9
Seoul	1760	4.8	65.7	1.1	6.5	9.0	12.0
Taiwan							
Taipei	4832	4.7	45.6	3.1	9.8	24.2	6.7
Taoyuan	3293	5.3	54.4	4.0	7.6	19.3	8.7
Thailand							
Bangkok	4209	2.0	32.0	2.3	15.0	13.4	16.9
Chiang Mai	3106	1.8	29.7	2.1	7.8	6.2	16.3
Region total	39204	4.7	44.1	4.1	8.8	10.8	10.1
Eastern Mediterranean							
Iran							
Rasht	3057	2.5	34.5	2.5	15.3	2.4	3.0
Tehran	3008	2.8	33.8	3.2	8.6	1.9	1.1
Malta							
Malta	3795	24.9	38.9	16.9	14.9	8.9	4.0
Sultanate of Oman							
Al-Khod	4130	0.6	19.4	0.5	8.4	7.0	4.2
Syrian Arab Republic							
Lattakia	2373	22.7	55.5	18.8	4.7	4.0	2.4
Tartous	2734	19.8	56.1	16.3	5.7	5.0	2.7
Region total	19097	11.6	37.7	9.0	10.0	5.2	3.0
Indian Sub-Continent							
India							
Bangalore	2959	0.2	19.4	0.3	5.7	3.8	3.9
Davangere	3043	0.5	10.8	0.3	3.4	1.8	1.1
Jaipur	2545	4.0	20.7	3.2	5.6	8.4	6.2
Jodhpur	2114	0.4	7.3	0.3	2.4	2.9	0.9
Kottayam	2619	0.8	24.6	0.3	23.0	8.6	2.3
Lucknow	3000	0.7	17.1	0.6	3.5	4.8	2.5
Mumbai (16)	2865	0.3	4.2	0.5	2.5	2.1	1.8
Mumbai (18)	4862	0.3	10.9	0.5	4.7	3.5	2.4
Mumbai (29)	1833	1.0	28.8	6.4	3.8	2.6	1.7
Nagpur	4294	0.3	8.3	0.3	3.8	2.7	3.0
New Delhi (7)	3706	1.0	21.7	1.2	6.0	4.5	4.2
Pimpri	3838	2.0	13.6	2.0	4.7	4.1	2.7
Pune	2711	0.8	8.9	1.0	4.0	1.8	2.0
Rasta Peth	3147	1.0	13.0	1.2	3.8	2.9	3.1
Region total	43536	0.9	14.4	1.1	5.4	3.8	2.8
Latin America							
Brazil							
Salvador	1069	8.3	13.8	5.2	17.3	16.7	6.1
Chile							
Punta Arenas	3052	37.6	39.1	20.7	17.5	11.2	12.1
South Santiago	3075	33.9	39.2	18.8	14.7	13.7	14.8

Centre Name	N	Current Maternal Smoking	Current Paternal Smoking	Maternal Smoking in the First Year	Current Wheeze	Current Symptoms of Rhino- conjunctivitis	Current Symptoms of Eczema
Colombia							
Barranquilla	3209	6.0	11.5	5.0	15.2	15.4	20.9
Bogotá	3256	12.8	19.9	7.6	10.0	15.6	14.3
Cali	3005	6.1	14.1		17.3	16.7	7.3
Mexico							
Ciudad Victoria	2603	6.7	24.3	3.5	8.6	6.7	2.3
Ciudad de México (1)	3205	19.4	27.8	11.3	6.8	16.2	8.7
Ciudad de México (3)	3493	12.0	26.3	6.2	3.6	17.8	8.8
Cuernavaca	2579			16.1	8.4	7.2	4.0
Mexicali Valley	2568	11.1	22.1	7.7	8.8	11.3	5.4
Monterrey	3030	10.3	32.6	5.7	8.4	8.2	4.1
Mérida	2896	12.4	23.8	6.2	12.7	13.5	8.2
Toluca	3235	13.4	25.5	5.5	5.9	7.3	5.4
Villahermosa	2678	7.5	16.7	4.0	10.0	13.9	6.1
Panama							
David-Panamá	2942	3.8	10.9	2.5	22.7	11.7	14.4
Uruguay							
Paysandú	1512	23.5		16.9	22.6	6.7	7.9
Venezuela							
Caracas	2999	24.1	25.4		20.0	20.4	12.4
Region total	50406	14.0	21.9	7.8	12.3	13.0	9.4
North America							
Barbados							
Barbados	2759	3.3	13.2	2.2	19.5	6.4	9.2
Canada							
Saskatoon	1255	23.5	24.1	24.6	18.2	10.8	12.0
Region total	4014	9.6	16.6	9.2	19.1	7.8	10.1
Northern & Eastern Europe							
Estonia							
Tallinn	2385	24.1	42.0	11.1	9.6	4.2	11.5
Hungary							
Svábhegy	2451	32.9	42.5	18.6	6.6	5.3	4.7
Kyrgyzstan							
Bishkek	3146	4.3	51.3	2.2	5.2	5.8	1.7
Lithuania							
Kaunas	2772	13.4	48.1	5.0	6.6	3.8	3.0
Poland							
Kraków	2497	30.8	43.1	18.9	14.5	14.5	10.4
Poznan	1999	33.4	45.7	21.1	12.5	11.1	12.9
Region total	15250	21.8	45.8	11.9	8.8	7.2	6.8
Oceania							
New Zealand							
Auckland	3541	25.2	29.3	22.2	22.4	11.0	14.3
Bay of Plenty	2150	40.0	33.7	36.9	23.7	11.3	13.8
Christchurch	3315	22.0	21.4	20.2	22.3	12.9	18.5
Nelson	1867	22.1	24.2	21.9	20.2	9.3	11.6
Region total	10873	26.6	26.9	24.4	22.2	11.4	15.0
Western Europe							
Belgium							
Antwerp	5645	18.6	26.9		7.5	5.8	11.6
Isle of Man							
Isle of Man	1096	22.0	23.7	21.4	14.4	8.3	12.6
Portugal							
Funchal	1819	16.3	41.0	10.6	11.0	9.2	10.0
Lisbon	2477	26.7	42.0	17.7	14.2	10.0	10.2
Portimao	1069	31.4	44.8	19.1	13.2	7.9	8.0
Porto	2464	23.7	46.1	15.6	10.0	7.4	8.5
Spain							
A Coruña	3016	38.3	41.1	31.2	12.9	10.7	7.3
Asturias	3193	40.1	41.3	34.7	11.6	10.3	6.5
Barcelona	3002	34.2	39.5	24.5	8.5	4.0	4.0

Centre Name	N	Current Maternal Smoking	Current Paternal Smoking	Maternal Smoking in the First Year	Current Wheeze	Current Symptoms of Rhino- conjunctivitis	Current Symptoms of Eczema
Spain <i>cont.</i>							
Bilbao	3157	40.2	43.0	34.9	12.4	8.9	6.8
Cartagena	2948	45.8	49.8	33.8	11.1	8.1	4.5
Madrid	2347	39.0	44.4	30.8	9.4	11.1	6.0
Valencia	3398	43.3	44.9	34.6	9.3	7.5	5.9
Region total	35631	32.7	40.2	23.1	10.6	8.2	7.7

Web table 2: Exposure and prevalence values by centre, 13-14 year age group.

Centre Name	N	Current Maternal Smoking	Current Paternal Smoking	Current Wheeze	Current Symptoms of Rhinoconjunctivitis	Current Symptoms of Eczema
Africa						
Cameroon						
Yaounde	2983	4.2	13.8	5.7	8.9	7.2
Cote d'Ivoire						
Urban Cote d'Ivoire	3342	1.6	13.9	19.3	27.6	18.2
Ethiopia						
Addis Ababa	3195	1.1	7.9	9.1	9.9	19.0
Gabon						
Port-Gentil	3166	5.9	22.2	10.2	16.5	14.3
Morocco						
Boulmene	1254	0.6	21.9	5.4	8.3	8.0
Casablanca	1777	1.7	32.8	16.0	28.1	23.0
Marrakech	1689	0.5	28.0	4.4	14.7	20.5
Nigeria						
Ibadan	3142	1.6	2.8	13.0	16.4	7.7
South Africa						
Cape Town	5037	27.9	42.3	20.3	20.7	13.3
Sudan						
Khartoum	2896	2.0	26.8	12.5	7.2	4.7
Region total	28481	6.9	21.6	12.8	16.3	13.3
Asia-Pacific						
China						
Beijing	3530	9.0	68.3	7.2	10.2	1.2
Guangzhou	3514	3.5	66.9	4.8	10.7	1.6
Tibet	2878	3.6	61.6	0.8	1.4	0.2
Tong Zhou	3542	6.8	73.9	1.0	3.3	0.5
Wulumuqi	3884	2.6	66.4	3.8	8.0	0.8
Hong Kong						
Hong Kong	3321	3.6	34.1	8.6	22.6	3.3
Indonesia						
Bali	2569	2.1	46.7	4.3	10.3	3.7
Bandung	2826	9.5	68.1	5.2	4.8	2.2
Semarang	2435	1.8	54.4	5.9	4.0	3.4
Japan						
Fukuoka	2520	22.7	57.1	13.0	17.6	0.0
Malaysia						
Alor Setar	2941	2.7	45.8	9.3	16.3	12.2
Kota Bharu	2989	4.4	58.2	5.8	12.5	8.5
Philippines						
Metro Manila	3658	14.0	47.9	8.4	11.0	7.8
Singapore						
Singapore	4217	3.2	30.7	11.4	16.5	9.2
South Korea						
Provincial Korea	7375	10.6		8.5	11.5	5.7
Seoul	2888	11.1		9.1	11.9	5.7
Taiwan						
Taipei	6378	10.7	51.7	7.0	17.8	4.1
Taoyuan	3190	8.1	54.6	4.8	14.6	4.5
Region total	64655	7.5	46.3	6.8	11.8	4.3
Eastern Mediterranean						
Iran						
Rasht	3004	1.7	34.1	15.6	7.2	4.5
Tehran	3119	4.0	36.0	10.9	12.3	4.3
Kuwait						
Kuwait	2882	1.4	34.5	7.6	10.7	6.1
Malta						
Malta	4136	24.3	36.6	14.6	20.9	5.4
Sultanate of Oman						
Al-Khod	3747	1.0	15.9	8.4	15.2	7.1

Centre Name	N	Current Maternal Smoking	Current Paternal Smoking	Current Wheeze	Current Symptoms of Rhinoconjunctivitis	Current Symptoms of Eczema
Syrian Arab Republic						
Aleppo	3063	17.9	54.4	5.1	14.6	4.1
Lattakia	3010	32.9	56.7	6.5	10.1	3.4
Tartous	2995	27.4	52.4	3.9	8.6	4.2
Region total	25956	13.9	39.3	9.3	12.9	5.0
Indian Sub-Continent						
India						
Bangalore	3440	0.9	21.6	11.8	10.5	5.6
Bikaner	3059	3.1	25.2	7.6	21.2	8.5
Borivali	1004	1.7	13.5	1.5	3.9	0.9
Chennai (3)	2181	1.4	35.6	3.5	5.6	1.2
Davangere	2945	0.0	9.8	6.8	1.0	1.4
Jaipur	3607	3.0	18.1	5.4	20.0	4.4
Jodhpur	2341	2.2	13.1	5.3	13.0	2.7
Kottayam	3685	8.9	24.2	15.4	13.2	9.3
Lucknow	3000	1.3	22.3	5.8	13.9	3.3
Mumbai (18)	2982	2.3	20.5	4.6	6.3	1.4
Mumbai (29)	1829	1.3	38.9	3.0	3.1	1.1
Nagpur	4150	1.3	15.5	3.0	4.9	2.8
New Delhi (7)	3469	2.5	29.7	5.3	11.6	3.5
Pimpri	3128	5.0	23.8	1.0	1.9	0.9
Pune	1983	3.1	17.8	2.8	5.1	2.1
Rasta Peth	3065	6.5	37.4	2.2	4.2	1.7
Region total	45868	3.0	22.8	5.8	9.3	3.5
Latin America						
Argentina						
Córdoba	3445	36.2	38.6	13.6	16.9	6.3
Salta	3000	30.1	38.9	12.5	20.9	8.0
Bolivia						
Santa Cruz	3257	23.4	35.1	13.5	22.4	21.1
Brazil						
Feira de Santana	1732	15.0	20.6	21.5	13.9	3.8
Nova Iguaçu	3185	24.6	23.1	11.8	8.8	4.1
Salvador	3020	14.2	19.0	24.6	21.1	5.1
Vitória da Conquista	1679	17.3	21.8	30.5	19.8	4.6
Chile						
Calama	1618	39.5	42.6	11.1	22.9	19.7
Chiloe	3000	35.0	36.0	16.9	19.1	9.8
South Santiago	3026	46.4	47.9	17.0	26.3	22.0
Colombia						
Barranquilla	3204	14.1	17.2	13.8	30.0	24.6
Bogotá	3830	20.5	23.4	8.5	22.3	12.1
Cali	3100	12.8	24.2	13.8	23.3	6.9
Ecuador						
Guayaquil	3082	13.8	32.8	15.5	23.9	13.3
Mexico						
Ciudad Victoria	3122	12.5	28.2	14.4	17.6	5.1
Ciudad de México (1)	3891	23.8	36.2	9.9	13.1	8.5
Ciudad de México (4)	2662	23.8	33.1	10.0	14.7	6.7
Cuernavaca	1431		27.5	11.6	7.1	2.8
Mexicali Valley	2988	22.8	26.9	4.6	28.1	2.8
Monterrey	3006	16.9	35.8	6.0	13.1	4.0
Mérida	3019	18.5	29.3	11.3	15.7	3.4
Toluca	3021	21.3	71.5	6.6	10.6	3.1
Villahermosa	3109	14.5	19.9	10.5	17.7	5.3
Panama						
David-Panamá	3183	3.7	10.8	22.9	11.7	14.5
Peru						
Lima	3022	20.9	30.4	19.6	18.7	10.5
Uruguay						
Montevideo	3177	43.2	41.1	17.9	10.6	5.2
Paysandú	1738	25.4	36.0	13.7	10.2	5.4

Centre Name	N	Current Maternal Smoking	Current Paternal Smoking	Current Wheeze	Current Symptoms of Rhinoconjunctivitis	Current Symptoms of Eczema
Venezuela						
Caracas	3000	28.2	29.0	15.4	24.9	7.2
Region total	80547	22.4	31.4	13.9	18.3	9.0
North America						
Barbados						
Barbados	2498	2.8	13.0	20.8	11.8	7.0
Canada						
Vancouver	2853	8.6	22.2	13.7	16.9	8.9
USA						
Sarasota	1245	28.4	28.0	18.6	15.2	4.4
Region total	6596	10.1	19.8	17.3	14.6	7.3
Northern & Eastern Europe						
Estonia						
Tallinn	3603	26.1	41.7	9.3	6.3	8.7
Finland						
Kuopio County	3051	21.6	32.6	19.0	15.5	15.6
Former Yugoslav Republic of Macedonia (FYROM)						
Skopje	3026	50.7	51.7	8.8	5.5	2.7
Hungary						
Svábhegy	4219	38.0	44.0	5.0	9.5	5.7
Szeged	2889	33.8	38.0	7.1	8.7	4.4
Kyrgyzstan						
Balykchi	1382	2.5	47.5	7.2	9.0	2.7
Bishkek	5048	9.4	49.5	8.0	8.2	2.9
Lithuania						
Kaunas	2723	19.2	47.7	6.7	4.6	1.8
Poland						
Kraków	2545	38.4	48.3	9.4	19.3	8.9
Poznan	1875	39.3	45.2	11.2	18.4	8.1
Region total	30361	27.9	44.6	9.0	9.9	6.1
Oceania						
Fiji						
Suva	3093	18.6		10.4	23.5	13.0
New Zealand						
Auckland	2870	26.6		22.5	18.8	8.9
Bay of Plenty	1976	35.7		20.6	15.3	8.1
Christchurch	3116	22.8		27.9	15.9	7.0
Nelson	2305	22.6		28.0	15.3	7.5
Wellington	3050	29.4		32.6	23.2	12.1
Samoa						
Apia	2986	24.1		5.8	21.2	13.8
Tokelau						
Tokelau	66	83.3		19.7	19.7	13.6
Region total	19462	25.4		20.9	19.4	10.3
Western Europe						
Channel Islands						
Guernsey	1248	26.8	28.0	26.5	16.3	11.2
Isle of Man						
Isle of Man	1716	33.0	32.0	31.2	20.2	11.1
Portugal						
Funchal	3161	18.9	41.8	9.0	8.7	4.5
Lisbon	3024	24.8	40.8	14.6	10.5	5.6
Portimao	1109	28.0	43.2	9.7	7.1	4.9
Porto	3336	22.9	43.9	13.1	10.3	5.3
Spain						
A Coruña	2979	39.5	40.1	15.2	17.8	4.9
Asturias	4184	42.1	45.7	15.5	18.0	3.4
Barcelona	3066	35.6	43.8	9.0	10.5	2.6
Bilbao	3401	40.5	41.0	13.7	14.5	4.0
Cartagena	3998	44.9	48.7	10.7	15.6	4.0
Madrid	2652	40.5	47.7	10.1	18.7	5.2
San Sebastián	1195	37.1	37.6	13.8	12.6	5.5

Centre Name	N	Current Maternal Smoking	Current Paternal Smoking	Current Wheeze	Current Symptoms of Rhinoconjunctivitis	Current Symptoms of Eczema
Spain <i>cont.</i>						
Valencia	3132	42.6	44.1	10.3	12.6	4.1
Valladolid	2944	42.9	45.8	8.2	17.1	4.5
United Kingdom						
Surrey/Sussex	5082	23.3	26.9	22.7	17.6	9.5
Wales	2501	28.3	25.1	27.5	12.7	10.6
Region total	48728	33.9	40.3	14.9	14.4	5.6

Web table 3: Population attributable risk (PAR, %) for 6-7 year and 13-14 year age groups

Symptom	Environmental question	PAR*	
		6-7	13-14
Current Wheeze	Current Maternal Smoking	6.3	6.8
Current Wheeze (Video)	Current Maternal Smoking		7.1
Current Symptoms of Severe Wheeze	Current Maternal Smoking	5.9	6.0
Asthma Ever	Current Maternal Smoking	6.8	5.6
Current Symptoms of Rhinoconjunctivitis	Current Maternal Smoking	3.8	4.5
Current Symptoms of Eczema	Current Maternal Smoking	3.8	3.5
Current Symptoms of Rhinoconjunctivitis Without Wheeze	Current Maternal Smoking	1.7	2.5
Current Symptoms of Eczema Without Wheeze	Current Maternal Smoking	2.5	1.7
Current Wheeze	Number of Cigarettes Smoked by Mother [†]	6.0	
Current Symptoms of Severe Wheeze	Number of Cigarettes Smoked by Mother [†]	5.4	
Asthma Ever	Number of Cigarettes Smoked by Mother [†]	6.4	
Current Symptoms of Rhinoconjunctivitis	Number of Cigarettes Smoked by Mother [†]	3.3	
Current Symptoms of Eczema	Number of Cigarettes Smoked by Mother [†]	3.2	
Current Symptoms of Rhinoconjunctivitis Without Wheeze	Number of Cigarettes Smoked by Mother [†]	1.1	
Current Symptoms of Eczema Without Wheeze	Number of Cigarettes Smoked by Mother [†]	1.9	
Current Wheeze	Current Paternal Smoking	4.0	0.2
Current Wheeze (Video)	Current Paternal Smoking		0.8
Current Symptoms of Severe Wheeze	Current Paternal Smoking	4.2	0.6
Asthma Ever	Current Paternal Smoking	4.2	-0.3
Current Symptoms of Rhinoconjunctivitis	Current Paternal Smoking	4.0	1.3
Current Symptoms of Eczema	Current Paternal Smoking	3.8	-0.6
Current Symptoms of Rhinoconjunctivitis Without Wheeze	Current Paternal Smoking	3.0	1.2
Current Symptoms of Eczema Without Wheeze	Current Paternal Smoking	3.6	-1.0
Current Wheeze	Number of Cigarettes Smoked by Father [†]	3.4	
Current Symptoms of Severe Wheeze	Number of Cigarettes Smoked by Father [†]	3.1	
Asthma Ever	Number of Cigarettes Smoked by Father [†]	3.5	
Current Symptoms of Rhinoconjunctivitis	Number of Cigarettes Smoked by Father [†]	3.2	
Current Symptoms of Eczema	Number of Cigarettes Smoked by Father [†]	3.4	
Current Symptoms of Rhinoconjunctivitis Without Wheeze	Number of Cigarettes Smoked by Father [†]	2.3	
Current Symptoms of Eczema Without Wheeze	Number of Cigarettes Smoked by Father [†]	3.3	
Current Wheeze	Maternal Smoking in 1st Year of Life	6.1	
Current Symptoms of Severe Wheeze	Maternal Smoking in 1st Year of Life	6.1	
Asthma Ever	Maternal Smoking in 1st Year of Life	7.1	
Current Symptoms of Rhinoconjunctivitis	Maternal Smoking in 1st Year of Life	3.1	
Current Symptoms of Eczema	Maternal Smoking in 1st Year of Life	3.4	
Current Symptoms of Rhinoconjunctivitis Without Wheeze	Maternal Smoking in 1st Year of Life	0.8	
Current Symptoms of Eczema Without Wheeze	Maternal Smoking in 1st Year of Life	1.9	

* Cells are blank when no data was collected for the specific combination of symptom and environmental question.

[†] PAR values are for combined 1-9 cigarettes, 10-19 cigarettes and 20 or more cigarettes categories.

[‡] PAR values are for combined maternal smoking in first year of life, current maternal smoking and both times categories.

[§] PAR values are for combined paternal smoking, maternal smoking and both parents categories.