Wheeze and asthma prevalence and related health-service use in white and south Asian preschool children in the UK

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Running head title

Asthma in south Asian preschool children in the UK

Abstract

Background: Epidemiological data for south Asian children in the UK are contradictory, showing a lower prevalence of wheeze, but a higher rate of medical consultations and admissions for asthma compared to white children. These studies have not distinguished different asthma phenotypes or controlled for varying environmental exposures.

Objective: To compare the prevalence of wheeze and related health-service use in south Asian and white preschool children in the UK, taking into account wheeze phenotype (viral and multiple wheeze) and environmental exposures.

Methods: A postal questionnaire was completed by parents of a population-based sample of 4366 white and 1714 south Asian children aged 1 to 4 years in Leicestershire, UK. Children were classified as having viral wheeze or multiple trigger wheeze.

Results: Prevalence of current wheeze was 35.6% in white and 25.5% in south Asian one year-olds (p<0.001), and 21.9% and 20.9%, respectively in children aged 2 to 4 years. Odds ratios (95% CI) for multiple wheeze and for viral wheeze, comparing south Asian with white children, were 2.21 (1.19-4.09) and 1.43 (0.77-2.65) in 2 to 4 year-olds after controlling for socioeconomic conditions, environmental exposures and family history. In one year-olds the respective ORs for multiple and viral wheeze were 0.66 (0.47-0.92) and 0.81 (0.64-1.03). Reported GP consultation rates for wheeze and hospital admissions were greater in south Asian children aged 2 to 4 years, even after adjustment for severity, but use of inhaled corticosteroids was lower.

Conclusions: South Asian 2 to 4 year-olds are more likely than white children to have multiple wheeze (a condition with many features of chronic atopic asthma), after taking into account ethnic differences in exposure to some environmental agents.

2

Undertreatment with inhaled corticosteroids might partly explain their greater use of health services.

Keywords

Asthma, Environment, Ethnic groups, Health-service use, Phenotype

Introduction

Epidemiological data about asthma in minority ethnic groups are conflicting.[1] A recent systematic review on ethnic variations in asthma frequency, morbidity and health-service use in the UK concluded with the paradox that the prevalences of wheeze and diagnosed asthma were lower in south Asian than white children aged 5 years and older, but that conversely medical consultations and hospital admissions were more common.[2] The review summarised only crude prevalence rates and did not consider the effects of treatment or potential heterogeneity between different south Asian ethnic groups. In addition, there is more than one phenotype of childhood asthma,[3-6] and there might be ethnic differences in their relative proportions. Episodic viral wheeze is a common transient non-atopic disorder in young children,[3, 5] whereas multiple-trigger wheeze, a phenotype which shares features with chronic atopic asthma is commoner in older children.[6]

The lower observed prevalence [2] contrasts with the hypothesis that migrants from tropical to temperate environments might be at higher genetic risk of allergic disease in general and atopic asthma in particular.[7] South Asians from the Indian subcontinent and East Africa together form the largest minority ethnic group in the UK.[8] We have shown that prevalence of wheeze and asthma in young south Asian women is strongly associated with young age at immigration, providing further evidence for the importance of early life events on the development of asthma.[9] We now report on the offspring of these women, for whom we had prospectively collected data on respiratory symptoms and environmental exposures from the first years of life. The objectives of this study were to compare the prevalence of and morbidity due to viral wheeze and multiple wheeze in south Asian and white preschool children, and to examine the

4

influence of environmental and socioeconomic factors and the utilisation of clinical

care.

Material and Methods

Setting and study population

We used the Leicestershire Health Authority Child Health Database, which includes the birth notification with mother's self-reported ethnic origin, religion, country of birth and language, to select an age-stratified random sample of white and south Asian (mother self-identified as Indian, Pakistani, Bangladeshi or other) children aged 1 to 4 years with complete birth records.[9-12] We oversampled south Asian children and under twos to increase precision.

Questionnaires

We mailed questionnaires, printed in English, to the children's parents and asked about the ethnic origin of the child and household language using a tick list. Current wheeze was assessed with a standard validated question.[13] We defined "viral wheeze" as attacks triggered exclusively by viral infections and "multiple wheeze" if children also wheezed with other triggers.[3, 10] There were questions on the frequency, severity and triggers of wheeze, asthma treatment and health care utilisation, environmental exposures such as air pollutants (tobacco smoke, cooking and heating devices), breastfeeding, pets, nursery care, number of siblings and other household members, and parental smoking and history of atopy. We measured socio-economic conditions at individual (duration of parental education, number of people per room, and single parenthood) and area level (Townsend score, 1991 census data). Four families accepted the offer of a phone interview in another language. The Leicestershire Health Authority Research Ethics Committee approved the study.

Statistical analysis

Analyses were performed with Stata, version 8.2 (Stata Corporation, Austin, Texas). There were less than 2% missing answers for most questions on symptoms. Missing and "don't know" answers were coded as "no" as sensitivity analyses showed that this did not influence the magnitude or direction of the findings.

We found evidence of heterogeneity between the effects of ethnicity and age on prevalence of asthma phenotypes, both in unadjusted and in fully adjusted models (likelihood ratio tests for interaction terms $p<0.01$). We therefore stratified our analyses by age (under 2 versus 2 years and older) and used multinomial logistic regression to compare the two phenotypes (viral and multiple wheeze) with non-wheezing children. All variables that were associated with prevalence of wheeze in univariable analysis ($p<0.05$), plus age, sex and ethnicity, were entered into multivariable models. For consistency of presentation, all factors associated with viral or multiple wheeze in either of the two age groups were included in both models. We also investigated if the association between different exposures and wheeze phenotypes differed by ethnic group, by performing stratified analyses and interaction tests. Results are presented as odds ratios (OR) with 95% confidence intervals (95% CI). The following sensitivity analyses were performed for all final models: including children with inconsistently reported ethnicity; not recoding missing data; including only the more homogeneous Gujarati-speaking subgroup; including only those who reported no problem understanding the questionnaire;[12] including only severe wheezers; and weighting analyses for oversampling of south Asians. All gave results very similar to the main analysis.

Results

We invited 6100 white and 2600 south Asian families to participate. After discounting
200 invalid addresses, 84% (4986/5954) of families where the mother was defined as
white and 72% (1825/2546) where the mother was defined as south Asian replied (this
equates to 16% of white and 29% of south Asian children aged 1-4 years born and
living in Leicestershire at the time). The mother's ethnicity on the Child Health
Database corresponded with that of the child in the questionnaire in 94% of south
Asians (1714) and in 88% of whites (4366). Only these 6080 children were included for
further analysis. All south Asian children were born in the UK. Of their mothers, 25%
(407) were born in the UK, 28% (445) in Africa, and 47% (756) in the Indian
subcontinent (611 from India, 68 from Bangladesh, 77 from Pakistan).

White children were more likely to be exposed to environmental factors such as
maternal tobacco smoke, short duration of breastfeeding and pets (**Table 1**). A family
history of atopic disease was also more common in whites. Low birthweight was more
common in south Asians. More south Asian families lived in overcrowded households
in deprived inner city areas, but there were more white children in single parent
households.

Overall, more white (25.9%) than south Asian (21.6%) children were reported to have
wheezed in the previous 12 months (p=0.003, **Table 2**). The prevalence of current
wheeze in south Asian children did not vary by language, religion, or maternal country
of birth. The pattern of wheeze, however, varied with age: both viral wheeze and
multiple wheeze were less frequent in 1 year-old south Asian than white children, but
there was no difference in the reported crude prevalence of either phenotype in 2 to 4
year-olds (**Figure 1(a)** and **Table 2**). There were no consistent ethnic differences in

8

reported severity of wheeze: parents of white children reported more attacks in the past year and those of south Asian children more activity restriction (both p<0.001). Frequency of sleep disturbance and shortness of breath with wheeze did not differ between the groups.

In univariable analyses of 1 year-olds the following variables were strongly associated with both asthma phenotypes: living in a single parent household, having a mother who smoked, being breastfed for under 6 months and a family history of asthma or wheeze (**Table 3a**). Multiple wheeze but not viral wheeze was strongly associated with increasing material deprivation. After controlling for all factors, these associations persisted, but the effects of maternal smoking and having a single parent were attenuated. The lower risk of wheeze in south Asian compared to white 1 year-olds remained after controlling for all other factors (adjusted OR for viral wheeze 0.81, 95% CI 0.64-1.03, and for multiple wheeze 0.66, 95% CI 0.47-0.92).

In 2 to 4 year-olds (**Table 3b**), after controlling for environmental and family risk factors there was strong evidence of a higher risk of multiple wheeze in south Asian compared with white children (OR 2.21, 95% CI 1.19-4.09). Associations between material deprivation and wheeze in this age group differed by ethnicity (p for interaction test =0.003): in south Asian children, neither viral nor multiple wheeze was clearly associated with increasing deprivation whilst the prevalence of multiple wheeze but not viral wheeze was much higher in white children living in the most deprived areas. Maternal smoking, older siblings and duration of breastfeeding were not strongly associated with either phenotype at this age.

The association between south Asian ethnicity and multiple wheeze in 2 to 4 year-olds was unchanged when the analysis was restricted to children with severe wheeze (more than 3 attacks per year accompanied at least sometimes by shortness of breath (OR

9

2.24 (95% CI 0.99-3.08), n=207), to children of Gujarati-speaking families (OR 2.69 (1.37-5.28), n=447), and to children whose parents reported no problem understanding the questionnaire (OR 2.00 (1.05-3.81), n=471). The factors that had most influence in unmasking the higher odds of multiple wheeze in south Asian children were: Townsend score, single parenthood, parental atopy and maternal smoking (**Table 4**). The person answering the questionnaire (mother vs. father) did not confound the association between ethnicity and wheeze.

South Asian children in both preschool age groups were more likely than white children to have seen a general practitioner for wheeze or cough, even after adjustment for severity of wheeze (OR 2.29 in 1-year olds and 2.99 in 2-4 year olds; **Table 5**). Parents of 2 to 4 year-old south Asian children also reported more hospitalisations for asthma or wheeze compared to parents of white children (OR 1.58). In contrast, inhaled corticosteroid use was lower in south Asian children (OR 0.46 in 1 year-olds, and 0.63 in 2 to 4 year-olds) after controlling for severity.

Discussion

This large population-based study showed that the risk of multiple wheeze (a condition that has many features of chronic atopic asthma) was higher in south Asian than white 2 to 4 year-olds after taking into account differences in exposures to environmental, social and genetic risk factors (the latter approximated by family history). In 1 year-olds, wheezing in general (and both wheezing phenotypes) were less common in south Asian children. Conversely, south Asian children were more likely to be taken to their general practitioner, but less likely to use inhaled corticosteroids. South Asian 2 to 4 year-olds were also admitted to hospital for wheeze or asthma more often.

Methodological issues

The strengths of this study include its population-based sampling strategy, large sample size and good response rate, so our results should be generalisable within the UK, particularly for the largest ethnic minority sub-group, Gujarati-speakers of Indian origin. Studies of ethnic comparisons that try to answer aetiological questions have been criticised for using crude measures of ethnicity.[14] In our study, we obtained two reports of self-defined ethnic group and included only children whose ethnic group was the same as their mother's. We also collected additional information about language, religion and mother's country of birth and confirmed our results in a homogenous subgroup. It is possible that south Asian families under-reported symptoms due to misunderstanding of the term "wheeze".[15] The questionnaires were deliberately not translated, as we could not be sure that the term "wheeze" would retain the same meaning in six languages. We do not think that this explains our results because the findings were similar in children with severe wheeze, which is more reliably reported by parents and when we included only families from both ethnic groups who reported to have had not problems understanding the questionnaire.[12] There was little

11

heterogeneity in findings according to household language, maternal country of birth or religion. Also, misunderstanding or cultural attitudes are unlikely to explain the differences that we found by age and asthma phenotype. Although we could not validate reported treatment and health care utilisation with medical records, responses to these questions were highly repeatable in both ethnic groups when the questionnaire was reapplied three months later to 413 children (Cohen's kappa between 0.57 and 0.80). This gives us some confidence in the reliability of our findings. One limitation of the study is the lack of objective measures of asthma-associated traits, such as atopy and bronchial responsiveness.

An interesting issue which emerged from the stepwise adjustment for different confounders was that socioeconomic factors, which had a different effect in south Asian and white children, especially the Townsend score, were largely responsible for the differences between the adjusted and unadjusted models. These deprivation measures represent a large number of correlated exposures related to lifestyle, health and psychosocial issues. The fact that they seem to have a different effect in the two ethnic groups is intriguing and needs further investigation. Other exposures, which in the unadjusted analysis had partly hidden the higher propensity of south Asian children for multiple trigger wheeze, were the lower exposure to maternal smoking and the lower prevalence of atopic diseases in the family.

Comparison with other studies
Our results are consistent with a meta-analysis of studies in the UK that reported a lower crude prevalence of wheeze in south Asian than white children.[2] However, meta-analyses of observational studies cannot adequately incorporate the effects of confounding factors.[16] We found that age, wheezing phenotype, and differential exposure to risk factors need to be taken into consideration when interpreting crude

prevalence figures. Family history of atopy, maternal smoking, keeping pets, short duration of breastfeeding and family history of wheeze were all more common in whites, while socio-economic conditions also had an additional important confounding effect. After controlling for all these influences, the odds of multiple wheeze in 2 to 4 year-old south Asian children was more than twice as high as in white children.

Interpretation of ethnic differences in asthma

The higher prevalence of multiple wheeze in south Asian compared with white toddlers, which became apparent after large differences in exposure to risk factors were taken into account, clearly shows the importance of environment in determining prevalence and phenotype of wheeze. One explanation is that young children of south Asian ancestry are at higher intrinsic risk from the environmental determinants of atopic disorders such as asthma.[7] Le Souëf and co-authors proposed that proinflammatory genotypes based on IgE and eosinophil-mediated mechanisms are more common in populations in tropical countries because these genotypes provide an evolutionary advantage against prevalent helminth and parasitic infections. In those who live in temperate climates but have recent tropical ancestry asthma might be a manifestation of these strong immune responses. The observation that south Asian children in the UK have a higher prevalence of positive skin prick tests [17] and a higher prevalence of food-related wheeze [18] than white children lends further support this hypothesis. We are currently doing skin prick tests on the cohort children (ongoing study, unpublished observations), and found that 61% of the139 south Asians and 36% of the 326 white children who have already visited the lab are skin prick test positive (p<0.001), the difference being significant both for never wheezers (45% vs. 26%, p=0.006) and for current wheezers (81% vs. 64%, p=0.047).

The differences between ethnic groups in the findings for viral and multiple wheeze in 2-4 year olds in this study confirm that it is important to distinguish these two phenotypes.[3, 4] This difference was not seen in 1 year-olds, perhaps because most wheezing in under-2s is probably of non-atopic origin. The lower prevalence of all forms of wheeze in under-2s in south Asian than in white children might be explained by a lower prevalence of innate bronchial hyperresponsiveness. The sparse data available suggest that bronchial responsiveness in infants, measured shortly after birth and prior to the onset of any respiratory illness is associated with subsequent wheezing during the first 1 to 2 years of life.[19, 20] There are no data available for south Asian infants. However, in our cohort, south Asian preschool children with current wheeze were less likely than white children to report wheeze in response to the common non-allergic triggers of bronchoconstriction; laughter (23% v 34%, p=0.001) and running or playing (17% v 24%, p=0.047). Although we controlled for some environmental exposures which have been associated with non-allergic bronchial hyperresponsiveness, such as parental smoking, the lower risk of wheeze in south Asian under-2s persisted: genetic and environmental factors might therefore protect south Asians against non-atopic bronchial hyperresponsiveness and thus against early (viral) wheeze.

Use of health services

South Asian children have higher hospital admission rates [21-24] and higher general practitioner consultation rates [25, 26] than white children. We confirmed that south Asian preschool children were more likely to visit their general practitioner even after adjusting for severity of wheeze. Hospital admissions in our cohort were also more common in south Asian than white 2 to 4 year-olds. These parent-reported data are confirmed by hospital-episode statistics for the Leicester Royal Infirmary, the only secondary care children's centre in the county. During 2004, 243 white and 64 south

14

Asian children aged 1-12 years were hospitalised for asthma or wheeze, giving hospitalisation rates of 1408/100,000 (95%CI 1334-1479) in south Asian and 307/100,000 (95%CI 272-339) in white children, a rate ratio of 4.6 (95%CI 3.5-6.0, p<0.001, data obtained from East Midlands Public Health Observatory). Cross-sectional data such as those presented in our paper cannot be conclusive about the reasons for this discrepancy, because it is impossible to disentangle asthma severity, asthma control and medication. However, the lower reported use of inhaled corticosteroids by south Asian children, as found in this and other populations [11, 27] suggests that there might be ethnic differences in the availability and access to care for asthma. This deserves further sensitive investigation. Cultural differences in attitudes to asthma were shown in a recent hospital-based study from London,[28] south Asian parents were more reluctant to give drugs to their children and to tell others about their children's asthma. This would not explain the greater use of GP services but the lower use of inhaled corticosteroids in our group.

Conclusions

Crude prevalence data for ethnic groups [2] may be useful for healthcare planning, but mask important differences in environmental exposures and genetic risk.[29] These limitations cannot be overcome by meta-analysis, but underline the need for carefully conducted cohort studies with good measures of ethnicity, socioeconomic conditions and environmental exposures. If ongoing studies confirm the largely atopic nature of multiple wheeze and the transient, non-atopic nature of viral wheeze, these results will support the hypothesis that the genetic risk of atopic asthma might be higher in recent migrants from a tropical environment [7] and should prompt research into genetic and environmental risk factors for both phenotypes of early childhood asthma.

15

Competing interests:

There are no competing interests.

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Legend

Figure1: (a) Crude and (b) adjusted* prevalence of current wheeze in 1-4 year-old children, by ethnic group, age and wheezing phenotype[†].

—■— south Asian - multiple wheeze —□— white - multiple wheeze
—▲— south Asian - viral wheeze —△— white - viral wheeze

* adjusted for Townsend score, single parenthood, paternal education, maternal smoking, older siblings, breastfeeding, parental wheeze/asthma, parental hayfever, parental eczema.

† See text for definitions of phenotypes

Table 1: Socio-demographic characteristics, environmental exposures and family history of respondents, by self-reported ethnic origin

	South Asian children (n=1714)			White children (n=4366)			
	n	%	(95% CI)	n	%	(95% CI)	p
Demographic variables							
Male sex	883	51.5	(49.1-54.8)	2291	52.5	(51.0-54.0)	0.502
Age ≥2 years	927	54.1	(51.7-56.4)	1419	32.5	(31.1-33.9)	<0.001
Questionnaire completed by mother	1120	65.3	(63.1-67.6)	4077	91.8	(91.0-92.6)	<0.001
Birthweight <2.5kg	195	11.4	(9.9-12.9)	244	5.6	(4.9-6.3)	<0.001
Socio-economic conditions							
Inner city address	1561	91.1	(89.7-92.4)	1535	35.2	(33.7-36.6)	<0.001
Townsend score (tertiles)							
Least deprived	292	17.2	(15.4-19.0)	1983	46.4	(44.9-47.9)	<0.001
Moderalely deprived	521	30.7	(28.5-32.9)	1533	35.9	(34.4-37.3)	
Most deprived	883	52.1	(49.7-54.4)	759	17.6	(16.6-18.9)	
Overcrowding (>1person/room)	742	48.0	(45.5-50.5)	696	16.4	(15.3-17.5)	<0.001
Single parenthood	55	3.2	(2.4-4.0)	412	9.4	(8.6-10.3)	<0.001
Environmental exposures							
Maternal smoking	21	1.2	(0.7-1.8)	1099	25.2	(23.9-26.5)	<0.001
Heating with fossil fuel stoves *	636	37.1	(34.8-39.4)	809	18.5	(17.4-19.7)	<0.001
Keeping furry pets	72	4.2	(3.3-5.2)	2235	51.2	(49.7-52.7)	<0.001
Older siblings (≥1 vs. none)	1315	76.7	(74.7-78.7)	2963	67.9	(66.5-69.3)	<0.001
Breastfeeding > 6 months	359	21.0	(19.0-22.9)	768	17.6	(16.5-18.7)	0.002
Family history of atopic disease †							
Parental wheeze or asthma	343	20.0	(18.1-21.9)	1586	36.3	(34.9-37.8)	<0.001
Parental hayfever	554	32.3	(30.1-34.5)	2085	47.8	(46.3-49.2)	<0.001
Parental eczema	305	17.8	(16.0-19.6)	1586	36.3	(34.9-37.8)	<0.001

* Gas heaters or coal/wood fires in rooms, whether or not they also had central heating;

† positive history in either parent.

Table 2: Reported prevalence of current wheeze in 1-4 year-old children, by ethnic group, age and wheezing phenotype*

	South Asian children (n=1714)			White children (n=4366)			
	n	%	(95% CI)	n	%	(95% CI)	p
All children †							
Wheeze last 12 months	395	21.6	(19.4-24.0)	1359	25.9	(24.3-27.5)	0.003
Viral wheeze	250	12.6	(10.8-14.5)	855	15.1	(13.9-16.5)	0.014
Multiple wheeze	145	9.1	(7.6-10.8)	504	10.8	(9.6-12.0)	0.062
1 year-olds							
Wheeze last 12 months	201	25.5	(22.5-28.6)	1049	35.6	(33.9-37.3)	<0.001
Viral wheeze	142	18.0	(15.4-20.7)	689	23.4	(21.9-24.9)	<0.001
Multiple wheeze	59	7.5	(5.7-9.3)	360	12.2	(11.0-13.4)	<0.001
2 to 4 year-olds							
Wheeze last 12 months	194	20.9	(18.3-23.6)	310	21.9	(19.7-24.0)	0.613
Viral wheeze	108	11.7	(9.6-13.7)	166	11.7	(10.0-13.4)	0.900
Multiple wheeze	86	9.3	(7.4-11.2)	144	10.2	(8.6-11.7)	0.510

* See text for definitions of phenotypes; † weighted by age

Table 3a: Factors associated with reported prevalence of viral and multiple wheeze phenotypes* during the past 12 months, in children aged 1 year (N=3734)

Risk factors	Viral Wheeze (n=831)						Multiple Wheeze (n=419)					
	Unadjusted			Adjusted †			Unadjusted			Adjusted †		
	OR	(95% CI)	p	OR	(95% CI)	p	OR	(95% CI)	p	OR	(95% CI)	p
South Asian ethnicity	0.68	(0.54-0.82)	<0.001	0.81	(0.64-1.03)	0.080	0.53	(0.40-0.71)	<0.001	0.66	(0.47-0.92)	0.015
Socio-economic conditions												
Townsend score (tertiles)												
Least deprived	1		0.324	1		0.332	1		<0.001	1		<0.001
Moderately deprived	1.08	(0.90-1.30)		1.06	(0.88-1.28)		1.20	(0.93-1.55)		1.17	(0.90-1.52)	
Most deprived	1.17	(0.95-1.42)		1.19	(0.95-1.50)		1.85	(1.43-2.39)		1.86	(1.39-2.50)	
Single parenthood	1.95	(1.46-2.61)	<0.001	1.58	(1.15-2.15)	0.004	3.47	(2.52-4.77)	<0.001	2.37	(1.67-3.36)	<0.001
Paternal education > 16 yrs	0.74	(0.63-0.87)	<0.001	0.89	(0.74-1.06)	0.197	0.55	(0.44-0.69)	<0.001	0.75	(0.59-0.97)	0.026
Environmental exposures												
Maternal smoking	1.56	(1.29-1.89)	<0.001	1.24	(1.01-1.53)	0.041	2.07	(1.64-2.61)	<0.001	1.30	(0.99-1.69)	0.056
Older siblings (≥1 vs. none)	1.12	(0.95-1.32)	0.163	1.19	(1.01-1.41)	0.043	1.32	(1.06-1.65)	0.013	1.37	(1.09-1.72)	0.086
Breastfeeding > 6months	0.59	(0.47-0.73)	<0.001	0.62	(0.49-0.77)	<0.001	0.51	(0.38-0.70)	<0.001	0.60	(0.44-0.82)	0.002

Family history of atopic disease ‡

Parental wheeze or asthma	2.08	(1.77-2.45)	<0.001	1.96	(1.64-2.34)	<0.001	2.38	(1.93-2.94)	<0.001	2.05	(1.62-2.60)	<0.001
Parental hayfever	1.40	(1.19-1.64)	<0.001	1.14	(0.96-1.36)	0.128	1.69	(1.37-2.08)	<0.001	1.39	(1.10-1.75)	0.005
Parental eczema	1.19	(1.01-1.40)	0.043	0.98	(0.82-1.18)	0.860	1.40	(1.13-1.74)	0.002	1.10	(0.87-1.39)	0.417

* See text for definitions of phenotypes; † adjusted for all other variables in this table; ‡ positive history in either parent; OR odds ratio.

Comparison group for both phenotypes is children without current wheeze.

Table 3b: Factors associated with reported prevalence of viral and multiple wheeze phenotypes* during the past 12 months, in children aged 2 to 4 years (N=2436)

| Risk factors | Viral Wheeze (n=274) | | | | | | Multiple Wheeze (n=230) | | | | | |
| | Unadjusted | | | Adjusted † | | | Unadjusted | | | Adjusted † | | |
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	(95% CI)	p
South Asian ethnicity	0.98	0.76-1.28	0.900	1.43	0.77-2.65	0.257	0.91	0.68-1.21	0.510	2.21	1.19-4.09	0.012
Socio-economic conditions												
Townsend score (whites)												
Least deprived	1		0.031	1		0.395	1		<0.001	1		0.012
Moderately deprived	1.15	0.78-1.68		1.11	0.75-1.64		1.46	0.97-2.21		1.45	0.95-2.21	
Most deprived	1.78	1.15-2.74		1.38	0.87-2.21		2.53	1.62-3.97		2.07	1.27-3.37	
Townsend score (south Asians)												
Least deprived	1		0.057	1		0.048	1		0.620	1		0.696
Moderately deprived	1.56	0.84-2.92		1.61	0.85-3.03		0.72	0.37-1.40		0.75	0.38-1.47	
Most deprived	0.93	0.50-1.73		0.93	0.49-1.75		0.80	0.44-1.46		0.87	0.47-1.61	
Single parenthood	1.91	1.29-2.85	0.001	1.70	1.10-2.63	0.017	1.88	1.23-2.89	0.004	1.56	0.97-2.49	0.064
Paternal education > 16 yrs	0.68	0.52-0.89	0.005	0.67	0.50-0.90	0.009	0.74	0.55-0.99	0.040	0.79	0.57-1.09	0.151

Environmental exposures

Maternal smoking	1.43	(1.03-1.98)	0.035	1.12	(0.76-1.64)	0.576	1.69	(1.20-2.37)	0.002	1.21	(0.81-1.81)	0.344
Older siblings (≥1 vs. none)	0.86	(0.62-1.17)	0.331	0.92	(0.66-1.28)	0.634	0.98	(0.69-1.39)	0.898	1.10	(0.76-1.60)	0.597
Breastfeeding > 6months	0.83	(0.59-1.17)	0.298	0.98	(0.69-1.41)	0.930	0.57	(0.37-0.86)	0.007	0.66	(0.43-1.02)	0.063

Family history of atopic disease ‡

Parental wheeze or asthma	2.44	1.88-3.17	<0.001	2.25	1.69-3.01	<0.001	2.86	2.16-3.78	<0.001	2.36	1.73-3.21	<0.001
Parental hayfever	1.28	0.99-1.65	0.059	1.01	0.76-1.34	0.959	2.00	1.51-2.64	<0.001	1.66	1.22-2.24	0.001
Parental eczema	1.82	1.40-2.37	<0.001	1.59	1.19-2.12	0.002	1.86	1.40-2.47	<0.001	1.43	1.04-1.95	0.027

* See text for definitions of phenotypes; † adjusted for all other variables in this table; ‡ positive history in either parent; OR odds ratio.

Comparison group for both phenotypes are children without current wheeze.

Table 4: Association between south Asian ethnicity and reported prevalence of the multiple wheeze phenotype* during the past 12 months, in 2-4 year-old children

	OR	(95 CI)	p
Unadjusted	0.90	(0.68-1.20)	0.482
+ gender	0.91	(0.68-1.21)	0.510
Above + family history †	1.22	(0.90-1.64)	0.199
Above + mother smoking & breastfeeding	1.39	(1.00-1.90)	0.048
Above + older siblings	1.38	(1.00-1.89)	0.049
Above + single parenthood & father education	1.50	(1.08-2.09)	0.015
Above + Townsend score	2.21	(1.19-4.09)	0.012

OR odds ratio for current wheeze, comparing south Asian with white children.

Comparison groups are always children without current wheeze.

* See text for definitions of phenotypes; † Family history corresponds to parental wheeze/asthma, parental hayfever and parental eczema.

Table 5: Comparison between south Asian and white children's experience of: general practitioner visits, hospitalisations and treatment for wheeze (N=6080)

Health care*	Age 1 to 1.99 years					Age 2 to 4.99 years				
	South Asian (n=787)	White (n=2947)		Adjusted odds ratio†		South Asian (n=927)	White (n=1419)		Adjusted odds ratio†	
	n (%)	n (%)	OR	(95% CI)	p	n (%)	n (%)	OR	(95% CI)	p
GP visits for wheeze or cough‡										
Never or once	343 (43.6)	1787 (60.6)				435 (46.9)	1012 (71.4)			
2 to 3 times	278 (35.3)	785 (26.6)				315 (34.0)	273 (19.2)			
≥ 4 times	166 (21.1)	375 (12.7)	2.29	(1.95-2.68)	<0.001	177 (19.1)	134 (9.4)	2.99	(2.50-3.57)	<0.001
Hospitalisation for wheeze or asthma §	42 (5.3)	166 (5.6)	1.03	(0.70-1.51)	0.889	71 (7.7)	79 (5.6)	1.58	(1.09-2.29)	0.015
Treatment with inhaled corticosteroids	20 (2.5)	156 (5.3)	0.46	(0.28-0.77)	0.003	68 (7.3)	139 (9.8)	0.63	(0.44-0.91)	0.012

* Each outcome reported as odds ratio comparing south Asian with white children; † adjusted for severity of wheeze (activity restriction, shortness of breath when wheezing); ‡ ordered logistic regression; § during the past 12 months in 1-year olds, ever in 2-4 year olds.

Wheeze and asthma prevalence and related health-service use in white and south Asian preschool children in the UK

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Running head title

Asthma in south Asian preschool children in the UK

Figure 1:

a)

b)