

The Prevalence of Asthma in Canadian Children of South Asian Descent

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Summary. Background: Asthma is the most common disease in childhood. The prevalence of asthma is known to vary greatly between and within countries and among different ethnic groups. In this study, we aimed to determine the prevalence of asthma and wheezing symptoms in South Asian children living in Canada. Methods: In a cross sectional study, data from the Phase III International Study on Asthma and Allergies in Childhood (ISAAC) were analyzed. A surname algorithm to determine South Asian ethnic descent was used. Prevalence was calculated and compared to non-South Asian children from the same survey and to the reported prevalence from the Indian subcontinent ISAAC III survey for children ages 6–9 and 13–16. Results: The prevalence of asthma and wheezing did not differ between children of South Asian descent and non-South Asians living in Canada. When compared to the children living in India, the prevalence of asthma, wheeze, and exercise induced wheeze was significantly higher in the South Asian children living in Canada. Higher body mass index of the child, parental smoking, and pet ownership were strongly associated with asthma and wheeze. Conclusions: In contrast to other studies these data suggest that South Asian children living in Canada have a similar asthma prevalence to non-South Asian children; both of whom had higher asthma prevalence compared with children residing in South Asia. This suggests that environmental and social factors play a role in asthma prevalence. Risk factors for asthma in children of South Asian descent living in Canada are similar to those of the overall population. **Pediatr Pulmonol.** © 2013 Wiley Periodicals, Inc.

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INTRODUCTION

Asthma is the result of complex interactions between genetic, environmental, social and psychological factors.¹ As a result the prevalence of asthma varies greatly both between and within countries.² Canada ranks as one of the highest asthma prevalent countries in the world;^{2,3} in 2010 an estimated 10.5% of individuals older than 12 years of age reported a doctor diagnosis of asthma.⁴ Within such a geographically and ethnically diverse country, it is not surprising that considerable between and within-region variations in asthma prevalence have also been observed.^{4,5} In addition to geographical differences in environmental risk factors,

different patterns of immigration and settlement could also explain the observed regional differences in asthma prevalence.⁵

Ethnic differences in asthma within the same geographical region have been previously reported in the United States and United Kingdom. For instance, asthma prevalence was reported to be greater in black African and black Caribbean children and adults compared with white Caucasians.^{6,7} The prevalence within ethnic groups also varied according to age at migration. For example, black African and black Caribbean children born in the UK were more likely to have asthma compared with those who had lived in the UK for <5 years.⁸ South Asian woman born in the UK, or who migrated before the age of

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5 years had similar asthma prevalence to white women; whereas those who migrated after the age of 5 had lower asthma prevalence compared to white women.^{9,10} In a UK study, lower asthma prevalence was observed in Bangladeshi children compared to white children; the differences were largely explained by cultural traditions.⁷ In Canada, Wang et al.,¹¹ found Chinese children born in Canada had greater asthma burden than Chinese children born in China but that now live in Canada and greater still than those still resident in China.

As of yet, no research has estimated the burden of asthma in the South Asian population in Canada, the second largest immigrant group with over 1.3 million people making up 4.1% of the Canadian population.^{12,13} In this study, we aim to estimate the prevalence of asthma in South Asian children and adolescents and compare this to a similar group of children and adolescents from the general population, and those living in the Indian subcontinent. We hypothesized that the prevalence of asthma will be lower in the South Asian group compared to the general population.

METHODS

In this cross-sectional study, we analyzed the Canadian data from the third phase of the International Study on Asthma and Allergies in Childhood (ISAAC) survey. The purpose of the ISAAC study was to enable research into asthma, allergic rhinitis, and eczema and to allow comparisons of the prevalence of these disorders among populations in different countries.¹⁴ The much larger third phase of the ISAAC survey, implemented 5–10 years after the first phase, aimed to extend the scope of the survey and examine time trends in asthma.¹⁵ A major strength of the third ISAAC phase was its large size and methodological rigor. The exact same survey was conducted in 237 centers worldwide, including five centers in Canada (Hamilton, Winnipeg, Saskatoon, Vancouver, and Halifax) which recruited a total of 15,692 children, split in two age groups: ages 6–9 and ages 13–16. The ISAAC survey in South Asia consisted of 19 centers in India and one center in Sri Lanka. In total there were 39,644 children included. The only methodological difference between participating countries and centers was that each used available sampling frames to select the schools and/or subjects.

We applied a surname algorithm published by Shah et al.¹⁶ using the 200 most common validated South Asian surnames to the Canadian ISAAC dataset to identify subjects of South Asian ethnic descent. South Asian ancestry was defined as people who originate from India, Pakistan, Bangladesh, or Sri Lanka. The South Asian list includes mostly Hindu, Sikh, and Sri Lankan names while surnames from other religious or cultural groups are excluded (i.e., names used by South

Asians that are shared with people from those faiths in other parts of the world).¹⁶ The sensitivity of the surname list is low (50.4%), but the specificity (99.7%) and positive predictive value are high (89.3%), making it suitable to identify an ethnic minority cohort for epidemiological studies. Use of similar lists has shown this to be a validated technique to identify ethnic origin.^{17,18}

Statistical Analysis

We calculated the prevalence (number of affected cases divided by total number of subjects) in the South Asian subjects and the non-South Asian subjects for three main outcomes (asthma ever, wheeze ever and exercise induced wheeze in the past 12 months). We also compared the prevalence in the two Canadian groups to prevalence from the Indian sub-continent published by Pearce et al.,¹⁵ which reports prevalence of asthma, wheeze and exercise wheeze derived from the same Phase III ISAAC survey for several geographic regions, including South Asia.

Prevalence was compared using a one-sided z tests for proportions. Odds ratios were calculated to compare the risk for all three outcomes across the different populations using the Mantel–Haenszel method. We also compared risk factors for all three outcomes between the Canadian South Asian and non-South Asian populations using logistic regression. The models were adjusted for age and sex. Results are presented as odds ratios with 95% confidence intervals. Multi-variable analysis adjusted for potential confounding factors such as country of birth, smoking exposure, and pet exposure. Birth weight was unknown for subjects aged 13–16 and was only used for the 6- to 9-age group. For all analysis, only variables with more than 25 observations were included in the analysis.

RESULTS

The ISAAC survey consisted of two age groups, children ages 6–9 years and children ages 13–16 years: a total of 7,515 6- to 9-year-old children and 8,541 13- to 16-year-old children were surveyed in five cities across Canada. Of these, 41 subjects [0.55% (95% confidence Interval (CI) 0.43–0.81%)] in the 6- to 9-year group and 116 subjects (1.36% 95%CI (1.15–1.67%)) in the 13- to 16-year-age group were assigned South Asian descent based on the validated algorithm. Overall 157 of 16,056 children were of South Asian descent [0.9% 95%CI (0.8–1.1%)].

The process is described in the flow diagram in Figure 1. In four of these five cities, the reported prevalence of South Asians is lower than the Canadian average of 4.1%,¹³ whereas in one city (Vancouver) the reported prevalence was higher (10.2%).¹⁹

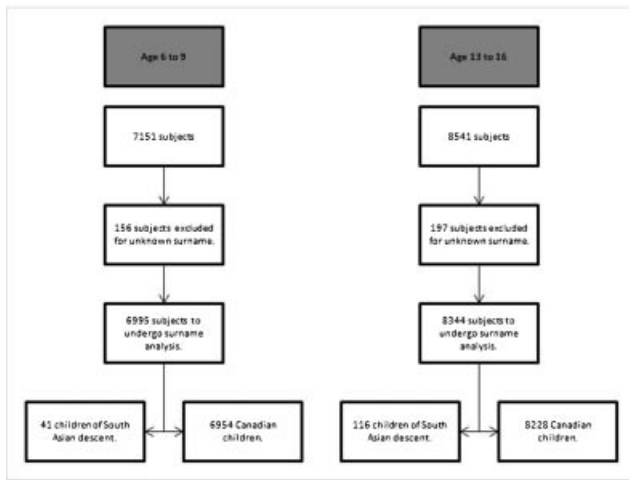


Fig. 1. Flow diagram describing the study population. Subjects with an unknown surname were excluded.

Population Demographics

South Asian and non-South Asian subjects were similar in age, sex, body mass index (BMI), birth weight, and the number of older siblings (Table 1). The majority of South Asian children were born in Canada; 87.5% in the 6- to 9-year group and 86.1% in the 13- to 16-year-old group.

Asthma Prevalence

The prevalence of asthma ever, wheeze ever and exercise induced wheeze in the past 12 months are presented in Table 2. Overall there are no significant differences between the South Asian and non-South Asian children, except for the prevalence of wheeze, which was lower for South Asian children (Table 2). The prevalence for all outcomes was significantly lower for the children on the Indian subcontinent than for children of South Asian and non-South Asian children in Canada (Table 2).

In the 6- to 9-age group prevalence for each outcome was similar between the South Asian and non-South Asian children and not significantly different. Compared to children of the same age surveyed in the Indian subcontinent, the prevalence of asthma and exercise induced wheezing was significantly lower in the Canadian children of South Asian descent (Table 2).

In the 13- to 16-age group the prevalence of wheezing was significantly lower in the South Asian group than in the non-South Asian group; the other prevalence for the other outcomes was similar and did not differ significantly (Table 2). All three outcomes were significantly lower in adolescents surveyed in the Indian subcontinent when compared to the Canadian South Asian population (Table 2).

Univariable Logistic Regression

Univariable regression analysis on both age groups separately shows that the odds of each of the three outcomes were significantly greater for males and older children. The odds of asthma and wheeze also increased as BMI increased. There were inconsistent effects of ethnicity on the outcomes; in South Asian children aged 6–9 the odds of asthma and exercise induced wheeze were greater, but not for wheeze ever. South Asian children aged 13–16 years were less likely to have wheezing or exercised induced wheezing, compared to non-South Asians.

Multivariable Logistic Regression

Multivariable regression analysis adjusted for ethnicity, age and sex (Fig. 2), as well as those variables that were found to be significant on univariable analysis, was performed on the data of both age groups separately. In the analysis of children 6–9 years, female sex and greater birth weight decreased the odds of asthma. For both age groups a greater BMI was associated with greater odds of all three outcomes.

TABLE 1—Demographic Characteristics of the Two ISAAC Age Groups Stratified by Ethnicity

Demographic	Age 6–9			Age 13–16		
	South Asian	Non SA	P-value	South Asian	Non SA	P-value
Number, absolute (%)	41 (0.6)	6,954 (99.4)	<0.01	116 (1.4)	8,228 (98.6)	<0.01
Mean age (SD)	6.32 (0.52)	6.37 (1.24)	0.54	13.42 (0.51)	13.41 (1.09)	0.84
Male, abs (%)	20 (48.8)	3,411 (49.1)	0.65	49 (42.2)	4,018 (48.8)	0.05
Mean BMI (SD)	16.92 (3.89)	16.82 (3.81)	0.87	19.88 (4.26)	20.37 (3.75)	0.22
Mean birthweight (SD)	3.14 (0.53)	3.41 (0.60)	<0.01	—	—	—
Older siblings, abs (%)	25 (61.0)	3,815 (54.9)	0.43	66 (56.9)	4,654 (56.6)	>0.99
Younger siblings, abs (%)	13 (31.7)	3,367 (48.4)	0.03	68 (58.6)	4,497 (54.7)	0.38
Country of birth, Canada	36 (87.5)	6,634 (95.4)	0.02	100 (86.1)	7,006 (85.1)	0.75

Non SA, non South Asian.

Comparison is made using one-sided z- test.

TABLE 2—Prevalence of Three Outcomes for the Two Age Groups, Stratified by Ethnicity

Population	Prevalence									<i>P</i> -value		
	Non SA			South Asian			Indian			SA vs. Non SA	SA vs. Indian	Non Sa vs. Indian
	N	%	95% CI	N	%	95% CI	N	%	95% CI			
Overall												
Asthma	3,153	20.80	20.1–21.4	29	18.50	12.9–25.6	2,249	5.70	5.5–5.9	0.233	<0.001	<0.001
Wheeze	5,576	36.70	35.9–37.5	33	21.00	15.1–28.4	1,329	5.10	4.8–5.4	<0.001	<0.001	<0.001
Exercise wheeze	3,357	22.10	21.4–22.8	37	23.60	17.3–31.1	2,188	6.50	6.2–6.8	0.335	<0.001	<0.001
Age 6–9												
Asthma	1,293	18.60	17.7–19.5	9	22.00	11.1–38.0	982	5.20	4.9–5.5	0.307	<0.001	<0.001
Wheeze	2,309	33.20	32.1–34.3	13	31.70	18.6–48.2	1,284	4.00	3.7–4.3	0.418	0.001	<0.001
Exercise Wheeze	716	10.30	9.6–11.0	6	14.60	6.1–30.0	755	6.80	6.5–7.1	0.224	<0.001	<0.001
Age 13–16												
Asthma	1,860	22.60	21.7–23.5	20	17.20	11.1–25.6	1,267	6.10	5.8–6.4	0.067	<0.001	<0.001
Wheeze	3,267	39.70	38.7–40.8	20	17.20	11.1–25.6	1,329	6.90	6.6–7.3	<0.001	<0.001	<0.001
Exercise wheeze	2,641	32.10	31.1–33.1	31	26.70	19.1–36.0	1,433	6.40	6.1–6.7	0.096	<0.001	<0.001

Prevalence for Indian children based on Pearce et al.¹⁵ were used as a reference group. Comparisons were made using one-sided z tests. South Asian refers to the South Asian population, Non SA to the non South Asian and Indian to the population from the Indian subcontinent.

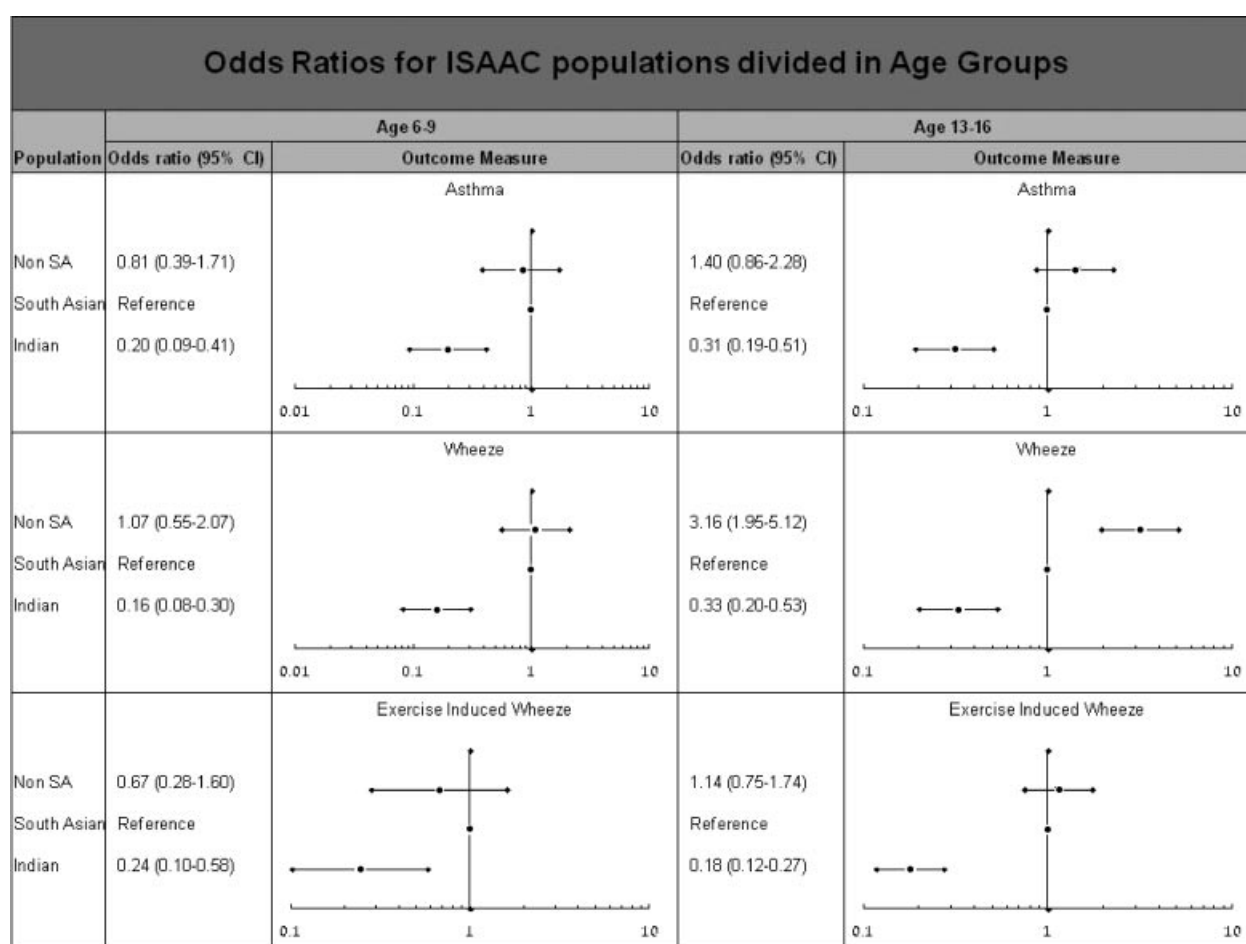


Fig. 2. Odds ratios with 95% confidence intervals for outcomes obtained by logistic regression. Blank spaces indicate no significant association ($P > 0.05$).

DISCUSSION

This study demonstrated that the prevalence of asthma in South Asian children living in Canada is similar to non-South Asian children. Consistent with the literature for other ethnic groups, a higher asthma prevalence was observed for South Asian children living in Canada compared to those residing in the Indian sub-continent. Risk factors for asthma in South Asian Canadian children were similar to those previously reported for the overall population of children in Canada.

The prevalence for asthma and wheeze was higher in South Asians living in Canada than children living in the Indian subcontinent. The use of identical survey methods allowed for comparison between countries, although the selection of schools may have been different in each country and thus they are not directly comparable with respect to risk factors. In a similar study using the ISAAC survey, Wang et al.,¹¹ found Chinese born Canadians, and migrants had higher asthma prevalence compared to the children living in China. These findings are also consistent with previous studies in the UK that demonstrated UK born South Asians had greater asthma prevalence compared with South Asians that migrated after the age of 5 years.⁹ Migration to a country with a high prevalence of asthma from a country with a low prevalence certainly changes exposure to environmental, social and physiological risk factors. Environmental risk factors will vary greatly between countries, and even within countries, and may explain some of the differences in asthma prevalence observed. Earlier age of migration and longer time since migration have been associated with greater asthma prevalence in children and adults.^{7,9} Since the majority of South Asian children in the Canadian ISAAC survey were born in Canada social influences, including poverty, stress and acculturation, which are strongly associated with exposures (diet and housing conditions), may also explain the observed results. Data from the Millennium Cohort Study showed that differences in asthma prevalence at 3 years of age between Bangladeshi and white Caucasian children were entirely accounted by Western behaviors.⁷ How genetic predisposition is modified by the environment and lifestyle factors is the focus of many gene-environment interaction studies. Zhang et al.²⁰ recently reported the genotype/phenotype relationship of innate immune genes differs between Western/Eastern environments, which could serve as one explanation for the effects of migration on asthma risk and prevalence observed in these studies.

In the UK health care utilization and rates of hospitalization are much greater in the South Asian population despite a lower prevalence of asthma. Higher hospitalization rates may be a result of greater disease severity or poor management of disease. The described differences between asthma prevalence and health care

utilization warrant further investigation into why the South Asian population seems to have greater disease burden.

Limitations

The cities involved in the ISAAC survey were broadly representative of the Canadian population, but four of the five cities in the survey had a lower South Asian population compared to the Canadian population as a whole. South Asians in Canada are generally concentrated in two metropolitan regions (Toronto, Vancouver),¹³ which is why the prevalence of South Asian children in the ISAAC survey was highest in the Vancouver center. More than half of all South Asians in Canada live in Toronto, a city that was not included in the Canadian sample. Thus the sample included in these analyses is likely under representative of South Asian children in Canada. In addition the algorithm has low sensitivity, and may have underestimated the true number of South Asian children in the ISAAC sample.

The limited sample size means that the precision of our prevalence estimates was poor and we may have been underpowered to detect a difference. The limited sample size further limited our analyses, as we could not stratify the sample based on country of birth to evaluate acculturation, or interpret age subgroups and multi-variable models with great confidence. Post hoc power calculations confirm the potential for a Type II error, nonetheless the prevalence estimates are similar and would even suggest a higher prevalence in the South Asian group for some of the outcomes.

In addition, unlike previous studies that compared South Asian populations to Caucasian, we compared South Asian children to a group of non-South Asian children which may have included other ethnic groups, which does not make our study directly comparable to others. In addition, children are generally assigned the paternal surname, which thus excludes any children whose mothers are of South Asian descent, and fathers are not. In Canada however, people of South Asian origins are the least likely to report being married to someone outside their ethnic group,¹³ therefore the impact of this misclassification is likely minimal. In the future, as the demographics of the population change these assumptions may no longer be valid.

CONCLUSION

In the Canadian ISAAC survey, the prevalence of asthma and wheeze did not differ significantly between the South Asian and non-South Asian samples. The prevalence of asthma and wheeze among South Asian children in Canada were significantly higher than those estimated for the Indian sub-continent using the same survey tools. These data suggest that social, cultural and environmental factors influence the prevalence of asthma

and wheeze symptoms. To better understand our findings further studies with much larger samples of South Asian children are required to evaluate factors such as acculturation and country of birth.

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Joost Moerman designed the research study, analyzed, and interpreted the data and wrote the manuscript. Padmaja Subbarao developed the research concept and revised the manuscript. Felix Ratjen revised the manuscript. Malcolm Sears led the ISAAC studies in Canada, acquired the data and revised the manuscript. Sonia S. Anand developed the research concept and revised the manuscript. Sanja Stanojevic developed the research concept, designed the research study, analyzed and interpreted the data, and revised the manuscript.

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