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Prevalence and determinants of asthma among aboriginal adolescents in Canada

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ABSTRACT

Objective: The objective of the study was to determine the prevalence and associated risk factors of asthma in Aboriginal adolescents in Canada based on the Canadian Aboriginal Peoples Survey (APS) 2012. Few studies have investigated the prevalence and risk factors of asthma in Aboriginal adolescents in Canada. **Methods:** Data from the cross-sectional APS 2012 were analyzed to accomplish the objective. Logistic regression analysis was utilized to determine significant risk factors of lifetime diagnosis of asthma among Aboriginal adolescents. The outcome of interest for adolescents was based on the question: "Do you have asthma that have been diagnosed by a health professional?" Individual, environmental, and contextual factors were tested for an association with lifetime diagnosis of asthma among adolescents. **Results:** The overall prevalence of lifetime diagnosis of asthma was 16.0%. The prevalence of lifetime diagnosis of asthma was 16.8% for adolescent boys and 15.3% for adolescent girls. Based on multivariable logistic regression analysis, the risk factors of lifetime diagnosis of asthma were: age, income, being overweight, smoking inside the home, having one to two children under 18 years in the household, history of bronchitis, living in an urban residence, education, and geographical location. Female sex was reported to have a protective effect on or reduce risk of the prevalence of lifetime diagnosis of asthma compared to the male sex. **Conclusions:** Lifetime diagnosis of asthma prevalence appears to be lower in Aboriginal adolescent girls than in adolescent boys. Lifetime diagnosis of asthma prevalence in these adolescents is associated with age, income, education, being overweight, smoking inside the home, history of bronchitis, and location of residence, both geographical region and urban residence. The prevalence of lifetime diagnosis of asthma among Aboriginal adolescent is higher compared to the general adolescent population in Canada.

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Asthma; aboriginal; adolescents; risk factors; aboriginal peoples survey

Introduction

Asthma is a common chronic condition in adolescents including Aboriginal adolescents in Canada [1]. Studies have shown an increased prevalence of asthma and hospitalization rates in preschool children and older adults among Aboriginal populations [2,3]. According to the Aboriginal Peoples Survey (APS) 2006, the prevalence of asthma was 14.3% in Canadian Aboriginal children 6–14 years of age and 14.0% in adults 15 to 64 years of age [4]. Factors associated with ever having asthma in off-reserve Aboriginal children included male sex, allergies, low birth weight, obesity, poor dwelling conditions, and urban residence [4]. A study of children aged 0–11 years living in the Northern Territories of

Canada has showed that childhood allergies and mother's daily smoking habit were significant risk factors for asthma-like symptoms in Aboriginal children [5].

To our knowledge, research on the prevalence of asthma and the determinants associated with asthma in Aboriginal adolescents in Canada is limited and has not been well established. According to the World Health Organization (WHO), an adolescent is any person between age 10 and 19 [6]. For this study, an adolescent is defined as any person between age 12 and 19. The overall goal of this report is to evaluate the association between demographic variables, medical history, environmental variables, socioeconomic status, educational attainment of parents/guardian,

and household income and the outcome of lifetime diagnosis of asthma among Aboriginal adolescents (12–19 years old), including First Nations living off reserve, Métis, and Inuit.

Material and methods

Study population and data sources

The APS 2012 was used to achieve the above objective. The APS 2012 was a national cross-sectional post-censal survey conducted from February 2012 to July 2012 of the social and economic conditions of First Nations people living off reserve, Métis, and Inuit, aged 6 years and over [7], living in private dwellings, excluding people living on Indian reserves and settlements and in certain First Nations communities in Yukon and the Northwest Territories. Statistics Canada conducted the first cycle of APS in 1991 and the fourth cycle of APS in 2012 (APS 2012). The final response rate was 76%. In the APS 2012 survey, an Aboriginal person is defined as anyone who reported being a First Nations person (North American Indian), Métis or Inuit, a Status Indian (a Registered or Treaty Indian as defined by the Indian Act of Canada), or a member of a First Nations or Indian band. A person may have reported more than one Aboriginal identity group aggregated into “Multiple Aboriginal identities.” Of all respondents ($N = 24,803$) of the APS 2012 survey, 11,189 (51.3%) were single-identity First Nations, 10,063 (42.7%) were single-identity Métis, 3358 (5.4%) were single-identity Inuit, and 193 (0.7%) held multiple Aboriginal identities. Due the small percentages, multiple Aboriginal identities were removed from the analysis. Therefore in this analysis, single-identity First Nations living off reserve, single identity Métis, and single-identity Inuit adolescents aged 12–19 years were considered.

The survey included information on: Aboriginal identity, education, employment language, income, health, communication technology, mobility, housing, and family background [7]. The survey provides information on Aboriginal children and adolescents. Individuals between the ages of 12 and 17 were interviewed directly with prior approval of parents or guardians; if approval was not given, the data were collected from the parent/guardian [7]. For individuals between the ages of 18 and 19, interviews were conducted directly with the youth.

Statistics Canada granted access to the data, and all analyses were conducted within the secure environment of the University of Saskatchewan, Statistics Canada Research Data Centre, located at Saskatoon.

Statistical analysis

Univariable association of prevalence of asthma with each of the various risk factors was estimated for Aboriginal adolescents aged 12–19 years. Binary logistic regression [8] was used to model the probability of asthma in adolescents aged 12–19 years. An appropriate weight variable computed by methodologists of Statistics Canada was used at the analysis stage to account for the unequal probability of selection. Stratification and clustering (inherent in the study design) effects of the cross-sectional complex survey design were accounted for by computing robust standard errors of regression coefficients using the balance repeated replication (BRR) method [9].

All potential scientifically important two-way interactions were examined. The strengths of associations are presented as odds ratios (ORs) with associated 95% confidence intervals (95% CIs). SAS version 9.2 (SAS Institute) and STATA version 13 (Stata Corp.) were used to conduct all analyses [10].

Measures

The outcome variable in the present study was the presence or absence of a diagnosis of asthma using the question “CC2_Q01—Do you have asthma (a long-term condition which is expected to last or have already lasted 6 months or more and that have been diagnosed by a health professional)?”

The prevalence of asthma was related to several factors, such as demographic, socioeconomic, environmental, and health-related variables. Age of adolescents was divided into two groups (12–14 years and 15–19 years) to see the differences in prevalence of asthma among younger and older adolescents. Sex was divided into two categories: boys and girls. Location of residence had two categories: rural or urban. Geographical area was a nominal variable with six categories: (1) Yukon, Northwest Territories (NWT) and Nunavut, (2) Atlantic (Halifax, Newfoundland and Labrador, New Brunswick, and Prince Edward Island) and Québec, (3) Ontario, (4) Manitoba and Saskatchewan, (5) Alberta, and (6) British Columbia.

Environmental variables included both household members and regular visitors, smoking inside the home every day or almost every day (yes/no), and number of persons under 18 years (0, 1–2, and 3 or more).

Health-related variables consisted of history of bronchitis (yes/no) and body mass index (BMI). We used different definitions of BMI for ages 12–17 years

Table 1. Weighted proportions of lifetime diagnosis of asthma and factors associated with lifetime diagnosis of asthma among first nations and metis adolescents (12–19 years).^a

	Lifetime diagnosis of asthma, n (%)	OR ^{Design} (95% CI _{BRR}) unadjusted	OR ^{Design} (95% CI _{BRR}) adjusted
Demographic characteristics			
Sex			
Boy	13,380 (16.75)	1.00	1.00
Girl	11,790 (15.31)	0.90 (0.85–0.96)	0.88 (0.82–0.94)
Age (yr)			
Less than 15 yr	7570 (13.67)	1.00	1.00
15 yr and more	17,600 (17.34)	1.32 (1.25–1.40)	1.30 (1.21–1.39)
Location of residence			
Rural	5210 (13.28)	1.00	1.00
Urban	19,970 (16.97)	1.33 (1.24–1.44)	1.18 (1.09–1.29)
Geographical area			
Yukon, NWT, & Nunavut	400 (5.60)	1.00	1.00
Atlantic/Québec	3260 (15.26)	3.04 (2.77–3.34)	2.62 (2.34–2.93)
Ontario	5900 (16.38)	3.30 (2.98–3.67)	2.46 (2.19–2.77)
Manitoba/Saskatchewan	5210 (13.80)	2.70 (2.47–2.95)	2.17 (1.95–2.41)
Alberta	5510 (20.78)	4.42 (3.99–4.90)	3.17 (2.82–3.57)
British Columbia	4890 (17.39)	3.55 (3.21–3.92)	2.82 (2.50–3.17)
Socioeconomic status			
Educational attainment of guardian			
Completed university certificate or diploma or degree	3120 (13.11)	1.00	1.00
Completed college or nonuniversity cert. or diploma	4230 (18.78)	1.53 (1.40–1.68)	1.62 (1.48–1.77)
Some postsecondary or diploma	3640 (16.18)	1.28 (1.15–1.43)	1.23 (1.09–1.38)
Completed High school	8080 (14.40)	1.12 (1.02–1.22)	0.98 (0.89–1.08)
≤Some high school	4990 (16.61)	1.32 (1.19–1.47)	1.22 (1.08–1.38)
Yearly income (\$)			
≥\$85,000	8220 (13.57)	1.00	1.00
65,000–84,999	3110 (14.14)	1.05 (0.95–1.16)	0.96 (0.87–1.07)
45,000–64,999	3260 (14.27)	1.06 (0.97–1.17)	0.93 (0.83–1.03)
25,000–44,999	5940 (19.75)	1.57 (1.43–1.72)	1.45 (1.31–1.62)
<25,000	4640 (21.66)	1.76 (1.61–1.93)	1.54 (1.39–1.70)
Health-related characteristics			
Smoking in the home			
No	18,560 (15.29)	1.00	1.00
Yes	6410 (18.59)	1.27 (1.17–1.37)	1.21 (1.11–1.32)
No. persons under 18 in the household			
0	2820 (15.41)	1.00	1.00
1–2	16360 (17.13)	1.14 (1.02–1.27)	1.27 (1.12–1.44)
3 or more	5410 (14.02)	0.90 (0.80, 1.01)	1.13 (0.99, 1.30)
History of Bronchitis			
No	23,390 (15.17)	1.00	1.00
Yes	1680 (69.42)	12.78 (11.05–14.78)	11.89 (10.23–13.82)
Body mass index			
Neither obese nor overweight	17,830 (15.67)	1.00	1.00
Overweight	4590 (19.85)	1.35 (1.22–1.46)	1.27 (1.16–1.38)
Obese	1480 (14.15)	0.89 (0.80–0.98)	0.81 (0.74–0.89)

^aOdds ratios and 95% confidence intervals were obtained from logistic regression accounting for the design effects using balanced repeated replication (BRR) method.

Odds ratios that are significantly different from zero ($p < 0.05$) are shown in bold.

and for ages 18–19 years due to differences in age ranges of the definitions. For adolescents aged 12–17 years, we used three BMI categories: obese, overweight, and neither obese nor overweight, according to age and sex-specific BMI cutoffs as defined by Cole et al. [11,12]. For adolescents aged 18–19 years, we used three BMI categories: obese (BMI ≥ 30), overweight (BMI 25–29.99), and neither obese nor overweight (BMI < 25), according to Health Canada and the WHO [13]. For the calculation of BMI, weight and height measurements were not actually measured; instead, the respondents' reported values were used. Socioeconomic status variables consisted of the education and income of the parent or guardian completing

the form. Education had five categories: (a) completed university certificate or diploma or degree; (b) completed college or nonuniversity certificate or diploma; (c) some postsecondary or diploma; (d) completed high school; and (e) completed some high school. Annual household income consisted of five categories: $< \$25,000$, $\$25,000$ to $\$44,999$, $\$45,000$ to $\$64,999$, $\$65,000$ to $\$84,999$, and $\geq \$85,000$.

Results

The overall prevalence of lifetime diagnosis of asthma was 16.0%. The prevalence of lifetime diagnosis of asthma was modestly greater among adolescent boys

(16.8%) than among adolescent girls (15.3%). As shown in Table 1, the proportion of adolescents with lifetime diagnosis of asthma was significantly greater among those with reported history of bronchitis ($p < 0.0001$). Adolescents who lived in an urban location were significantly more likely to have a report of lifetime diagnosis of asthma than those who were in a rural location ($p < 0.0001$). Adolescents 15 years and older were significantly more likely to report of lifetime diagnosis of asthma ($p < 0.0001$). Adolescents from low-income families were significantly more likely to report a lifetime diagnosis of asthma ($p < 0.0001$). In the current study, 14% of adolescents had a less than or equal to \$25,000 annual household income level. Of those, 22% adolescents reported a lifetime diagnosis of asthma. Adolescents from households with one to two persons under 18 years were significantly more likely to report a lifetime diagnosis of asthma ($p < 0.05$). Adolescents from families who smoked inside the home were significantly more likely to report a lifetime diagnosis of asthma ($p < 0.0001$). Overweight adolescents were significantly more likely to report a lifetime diagnosis of asthma ($p < 0.05$), whereas obese adolescents were significantly less likely to report of a lifetime diagnosis of asthma ($p < 0.05$). Lifetime diagnosis of asthma prevalence was higher in other geographic regions compared to Yukon, NWT, and Nunavut. Also, adolescents with a parent or guardian who had completed university or received a diploma or degree were less likely to report a lifetime diagnosis of asthma.

Based on multivariable logistic regression analysis, the significant risk factors of lifetime diagnosis of asthma were: age (OR = 1.30; 95% CI = 1.21–1.39 for 15 years and older compared to 12–15 years old), income (OR = 1.45; 95% CI = 1.31–1.62 for \$25,000–\$44,999 income category and OR = 1.54; 95% CI = 1.39–1.70 for <\$25,000 income category), being overweight (OR = 1.27; 95% CI = 1.16–1.38 for overweight group compared to neither obese nor overweight group), smoking inside the home (OR = 1.21; 95% CI = 1.11–1.32 for smoking inside the home compared to no smoking inside the home), one to two children under 18 in the household (OR = 1.27; 95% CI = 1.12–1.44 for one to two children younger than 18 years compared to no children younger than 18 years), history of bronchitis (OR = 11.89; 95% CI = 10.23–13.82 for self-reported history of bronchitis compared to no history of bronchitis), location of residence (OR = 1.18; 95% CI = 1.09–1.29 for urban residence compared to rural residence), and education and geographical location. Female sex was reported to have a protective effect on or reduce risk of the

prevalence of lifetime diagnosis of asthma compared to male sex (OR = 0.88; 95% CI = 0.82–0.94). Potential interactions were examined, and they were not significant.

Discussion

In this cross-sectional APS 2012 study, the overall prevalence of lifetime diagnosis of asthma among Aboriginal adolescents aged 12–19 years was 16.0%. Boys showed a greater prevalence (16.8%) of lifetime diagnosis of asthma than girls (15.3%). The Canadian Community Health Survey 2012 reported that prevalence of lifetime diagnosis of asthma among the general population of adolescents aged 12–19 years was 10.6% for boys and 9.8% for girls [14]. An earlier study of the 2004 British Columbian Youth Survey (aged 12–19 years) on smoking and health reported that a much lower prevalence of asthma 7.5% [15] than the current study. This concludes that lifetime diagnosis of asthma rates were higher for Aboriginal adolescents than for adolescents of the same age group in the general Canadian population.

This study confirmed that urban residence was a risk factor for lifetime diagnosis of asthma among Aboriginal adolescents. Asthma prevalence among children has been reported to be low in rural areas [16]. The reason for the lower prevalence of asthma may be that rural areas and farming environment involve higher exposure to microbial agents, which might provide a protective effect and lower the incidence of asthma [17,18].

A review of epidemiology of asthma reported that children of parents with a low socioeconomic status have severe asthma and high rate of hospitalization due to asthma [19,20]. The reason could be that children of low socioeconomic status children are vulnerable to the airway infections that drive asthma. Also, children of low socioeconomic status were less likely to access healthcare system and receive diagnosis [21]. Similar to the findings of non-Aboriginal children and Aboriginal children living off-reserves, children from households with lower income in this study were more likely to report lifetime diagnosis of asthma than those from households with high income [4,22]. A descriptive analysis of APS 2001 indicated that those in the lowest income groups of Aboriginal children 0–14 years of age and adults 15 years and older with lifetime diagnosis of asthma reported significantly high lifetime diagnosis of asthma prevalence [19]. In this study, adolescents with a parent or guardian who had less than high school education had a higher risk of lifetime diagnosis of asthma compared

to those whose parents has received a university certificate or diploma or degree. A similar trend has been reported [23]. There was a higher prevalence of lifetime diagnosis of asthma for Aboriginal children 0–14 years old whose parents had less than high school education compared those whose parents had completed high school or higher education [23].

There is a strong relationship between smoking and asthma [15,24]. Incidence of asthma and asthma-related emergency rooms visits could be reduced by eliminating environmental tobacco exposure [25,26]. Other studies showed that environmental tobacco smoke exposure was associated with increased risk of asthma [21,27]. The National Survey of Children's Health reported an increased risk of asthma among adolescents exposed to household smoking [28]. This study also reported similar results that children living in homes in which occupants smoked inside the home were more likely to report lifetime diagnosis of asthma than children living in smoke-free homes. Smoking rates among Aboriginal youth in Canada are at least three times higher than for their non-Aboriginal peers [29].

There was an increase in the prevalence of asthma with smaller family size (total number of siblings) [21, 30]. The current study was not consistent with these studies and reported adolescents from homes with one to two children aged less than 18 years were significantly more likely to have received a lifetime diagnosis of asthma diagnosis ($p < 0.001$). Also, adolescents from homes with three or more children aged less than 18 years were more likely to have received asthma diagnosis, with a borderline significance ($p = 0.067$). A review reported by Karmaus and Botezan [31] found that inconsistencies for reporting sibling effect regarding the presence of siblings at home increasing the chance of developing infections in early life and these infections in early life protecting against the development of allergic diseases including asthma.

Studies have reported that respiratory infections were related to higher prevalence of asthma [32–35] due to the fact that respiratory infections could increase symptoms of asthma. In a recent study it was shown that a lifetime history of bronchitis among children and adolescents was significantly associated with asthma [35]. Similarly, this study reported that history of bronchitis was significantly related to lifetime diagnosis of asthma.

Many studies have indicated that overweight and obese children/adolescents were at higher risk of developing asthma [35–37]. This could be due to

being overweight and obesity increasing the severity of asthma and being related to changes in airway hyperresponsiveness [35]. In this study we found that overweight adolescents were associated with increased risk of lifetime diagnosis of asthma; however, obese adolescents were associated with decreased risk of lifetime diagnosis of asthma. We do not have an explanation for this finding. No modification effect of sex and body mass index was observed. It has been shown that American Indian children (6–19 years) who have higher body mass index (both overweight and obese) have higher odds of lifetime diagnosis of asthma [38]. The National Health and Nutrition Examination Study reported that the lifetime diagnosis of asthma prevalence increased with increasing quartiles of BMI [39]. It is unclear why obesity had a protective effect in the current study.

Strengths and limitations of the study

This study was a large Aboriginal study in Canada including all provinces but does not include on reserve individuals. The study has identified several factors associated with lifetime diagnosis of asthma in Aboriginal adolescents 12–19 years. These results help to compare lifetime diagnosis of asthma prevalence for similar factors among non-Aboriginal adolescents in Canada. However, there were several limitations in this study. This survey was not designed to collect information on respiratory health specifically. Therefore, some of factors related to lifetime diagnosis of asthma prevalence were not assessed (e.g. allergy, family history of asthma). Due to the cross-sectional design of the APS 2012, temporal variations of exposures and outcome were not clear.

Conclusions

The prevalence of lifetime diagnosis of asthma among Aboriginal adolescent is higher compared to the general adolescent population in Canada. The lifetime diagnosis of asthma prevalence is associated with age, income, education, being overweight, smoking inside the home, history of bronchitis, and location of residence, both geographical region and urban residence. Low socioeconomic status of the household is associated with higher prevalence of asthma among Aboriginal adolescents. Future studies could aim at designing intervention programs for preventing asthma in these aboriginal populations.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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