Risk of Childhood Asthma Prevalence Attributable to Residential Proximity to Major Roads in Montreal, Canada

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ABSTRACT

Objectives: Exposure to traffic-related air pollutants plays a role in several health outcomes. A large body of evidence tends to link asthma in children with traffic exposure. Increasing asthma prevalence and incidence in children in Canadian cities has been of concern for public health authorities. The following study focuses on estimating the risk of asthma prevalence attributable to residing in proximity to major roads on the Island of Montreal, Canada.

Methods: Risk functions pertaining to asthma in children and residential proximity to major roads were selected from the literature and applied to Montreal. Asthma prevalence was taken from population-based studies. Population data were retrieved from Canadian census. Exposure was estimated using the proximity to major road and highway category of the Desktop Mapping Technologies Inc. database (DMTI Spatial Inc.).

Results: Based on different studies, the percentage of prevalent asthma cases attributable to residing within 50 metres of a major road or highway for children aged 2, 4 and 6 years varied between 2.4% (0-4.3), 5.6% (0.1-8.6) and 5.9% (0.1-9.0). For the 5-7 year age group residing within 75 m of a major road or highway, the percent of cases was 6.4% (2.6-9.3). For children aged 8 to 10 residing within 75 m of a highway only, the percent of cases was 0.7% (0.2-0.9).

Conclusion: These numbers represent the best crude estimates and are an indication of a possible range of cases linked to residential proximity to major roads. As there are uncertainties linked to the application of exposure-response functions, these estimates will be reassessed as new evidence is gathered through further research.

Key words: Asthma; attributable risks; children; traffic; air pollutants

La traduction du résumé se trouve à la fin de l'article.

Can J Public Health 2012;103(2):113-18.

Vehicle traffic emissions result in a complex mixture of carbon monoxide (CO), nitrogen oxides (NOx), particulate matter (mainly ultra-fine particles) and air toxics (1,3-butadiene, benzene, formaldehyde, polycyclic aromatic hydrocarbons-PAHs). For the province of Quebec, approximately 75% of NOx and 14% of PM_{2.5} (particulate matter with median diameter of less than 2.5 µm) emissions are related to mobile sources.¹

Epidemiological studies that evaluate the relation between long-term exposure to traffic emissions and health outcomes have been reviewed in a number of studies.²⁻⁶ Exposure to traffic-related air pollutants has been linked to premature mortality.⁷⁻¹⁰ Epidemiological studies have also linked traffic pollutant exposure to cardiovascular outcomes like myocardial infarction.¹¹⁻¹³ Birth cohort, case-control and cross-sectional studies have also been performed to assess childhood exposure to traffic emissions and incidence and prevalence of asthma and asthma-like symptoms.^{3,14-16}

According to the Health Effects Institute (HEI) review of the literature, of the many outcomes of traffic-related exposures, asthma in children has been judged to have between sufficient and suggestive evidence to support a causal relationship with traffic exposures.³ Furthermore, exacerbation of respiratory symptoms in children with asthma was judged sufficient to infer a causal association with traffic exposure. The increasing prevalence and incidence of asthma in Canadian cities,¹⁷ especially in children, is an issue that requires further attention. Computation of asthma risks attributable to exposure to traffic-related pollutants can thus help

orient policies and interventions related to transportation and public health.

The focus of this study was an attempt to assess the range of prevalent asthma cases in children attributable to residing near a major road or highway on the Island of Montreal.

METHODS

Initial scoping of health risk functions

The study selection on asthma prevalence and proximity to major roads or highways was based on the previous literature review per-

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Acknowledgements: Elena Boldo was supported by a grant from the Ministry of Science and Innovation and the Carlos III Institute of Health, Spain (Bolsa de Ampliación de Estudios de la Acción Estratégica de Salud. Plan Nacional I+D+i 2008-2011. BOE 58, 08-03-2010).

Conflict of Interest: None to declare.

formed by a panel of experts from the HEI report.³ We selected this review because i) it is a comprehensive update of the latest studies published in relation to traffic pollution and health effects, and ii) a comprehensive approach to assess causality was applied.^{18,19}

We selected studies from the HEI report if they related to asthma prevalence in children and if the exposure of interest was a dichotomous variable for proximity to a major road or highway (e.g., less than 50 or 75 m from a major road or a highway), since information on these parameters was available for further application to Montreal. Here, we did not assess incident cases attributable to this exposure as too few studies were available on asthma incidence and proximity to major roads or highways (less than 75 m).³ We also did not assess exacerbation of respiratory symptoms in children with asthma since studies that related this outcome and proximity to major roads or highways were not available. Attributable fractions were computed using studies performed in locations other than Montreal, given the lack of published studies of traffic proximity and asthma prevalence in Montreal.

Based on the HEI report performed for studies from 1980 through October 2008, a total of six studies evaluated the association between proximity to major roads and prevalence of asthma in children (within 75 m of a roadway).^{3,15,20-24} Only four studies from the United States and Europe were retained for this analysis (see Figure 1).^{15,20-22} One study was not selected based on reservations put forward in the HEI report concerning study design issues and lack of control for confounders, making the study hard to interpret.²⁴ Another study was not retained for our assessment since it reported inconclusive results.²³ It should be mentioned that we also decided not to retain a positive but non-significant association between roadway proximity (<50 m from major roads or highways) and asthma prevalence in children aged 4 to 12 years from Montreal (unpublished results: OR: 1.09; 95% CI: 0.91-1.31, n=5,650).

Selected risk functions

The chosen four studies from which risk functions were obtained are listed in Table 1, accompanied by the study characteristics (epidemiological design, health outcome studied, reported risks, exposure categories and demographic characteristics of the study group). All retained studies had been adjusted for confounding and modifying factors and their ORs were used to calculate the number of cases attributable to residing in proximity to major roads. Point estimates between studies are similar and confidence intervals overlap, hence in these studies, the impact appears to be similar across study design and different age groups. Although a meta-analysis would provide more accurate results, too few studies are available for the same age groups and the same proximity to roadway variables to perform a meta-analysis.

Exposure: Proximity to major roads or highways

Exposure of Montreal children to traffic-related pollutants was estimated by using proximity of residences to major roads or highways. We estimated the location of residential addresses using the six-digit postal codes. In Montreal, a six-digit postal code usually corresponds to a city block side. Following the selection of studies, different traffic exposure scenarios (e.g., <50 m or <75 m from a major road or highway) were considered (see Table 1). The road traffic categories nearest to residential addresses were obtained through the DMTI database (DMTI Spatial Inc.). In this study, we

Figure 1. Schematic overview of retained and excluded studies for our assessment

used two categories: major roads and highways (which includes the DMTI classes of secondary and principal highway, expressway and major roads) as well as highways only (which includes the DMTI classes of secondary and principal highway and expressway). The major roads and highways category in Montreal had a traffic density that was superior to approximately 20,000 vehicles/day and was used when calculating attributable asthma cases based on the studies from McConnell et al., 2006,¹⁵ Morgenstern et al., 2007²⁰ and 2008.²¹ The highways only category corresponds, in Montreal, to a traffic density that is superior to approximately 150,000 vehicles/day; it was used to calculate attributable prevalent asthma cases based on the study by Kim et al., 2008.²²

Population at risk and health data

In order to apply the risk functions presented in Table 1 to Montreal, the following information was also estimated:

- population of children residing near major roads and highways in Montreal for different age groups;
- population of asthmatic children in different age groups of the chosen risk functions.

The population of children residing near major roads and highways was estimated using the population numbers assigned to the centroid location of six-digit postal codes of 1996. Population numbers for six-digit postal codes were not available for more recent years. In 1996, there were 1,797,912 people residing on the Island of Montreal.²⁵ In 2006, this population rose to 1,873,589 people. Given the limited increase in population numbers, we did not adjust the 1996 value.

In order to determine the proportion of children from each age group of the chosen risk functions (2, 4, 6, 5 to 7 and 8 to 10), we determined the percentage of children in 2006 in each age group

Table 1. Description of Information Concerning the Retained Studies for Application to the Montreal Context

Study	Health Outcome	Type	Surrogate for Exposure: Proximity		Age (yrs)
			Measure	OR (95% CI)	
[15]	Asthma prevalence (cross-sectional analysis from birth cohort)	<ul style="list-style-type: none"> Prospective birth cohort (Munich, Germany) logistic regressions adjusted for sex, parental atopy, maternal education, siblings, environmental tobacco smoke (ETS), gas cooking, moulds, dampness, pets 	<50 m main road (motorway, federal or state roads)	1.23 (1.00, 1.51)	2
[20]	Asthma prevalence (cross-sectional analysis from birth cohort)	<ul style="list-style-type: none"> Prospective birth cohort (continuing results from [15]) logistic regressions adjusted for sex, age, parental atopy, maternal education, siblings, ETS, gas cooking, dampness, moulds, pets 	<50 m main road (motorway, federal or state roads)	1.66 (1.01, 2.59)	4 and 6
[21]	Asthma prevalence (cross-sectional analysis from cohort)	<ul style="list-style-type: none"> Cohort study (Southern California) logistic regressions adjusted for age, sex, race, community, language, housing characteristics 	<75 m major road (freeway, highway, arterial roads; approximately 50,000-270,000 v/day ²⁴)	1.50 (1.16, 1.95)	5 to 7
[22]	Current asthma	<ul style="list-style-type: none"> Cross-sectional study (San Francisco Bay) logistic regressions adjusted for crowding, pests, moulds, chest illness before age of 2, maternal asthma, demographic variables, housing characteristics 	<75 m from freeway/highway; approximately 92,070-184,521 v/day)	3.80* (1.20, 11.71)	8 to 10 (3 rd to 5 th grade)

* The OR for this study is between 2 and 3 times higher than for the other studies.
v=vehicles.

Table 2. Number of Cases of Asthma in Children Attributable to Proximity to Major Roads Corresponding to Different Exposure Scenarios

Ref.	Pop. at Risk (yrs)	Pop. Child Residents in Proximity to Major Roads or Highways in Montreal	Pop. of Children (Pop _i)	Proportion of Exposed Cases (P _{ei})	Prevalence of Asthma in Montreal Children (P _o)	Number of Asthma Cases on the Island of Montreal at Specified Age		Prevalent Cases Attributable to Proximity		
						Based on Prevalence From Ontario ¹⁷	Based on Prevalence From Montreal ²⁶	Based on Prevalence From Ontario ¹⁷ (95% CI)	Based on Prevalence From Montreal ²⁶ (95% CI)	
									Attributable Number of Cases (AN)	Attributable Fraction (AF,%)
[15]	2	2973	18,850	0.16	0.10	2903	1855	69 (0-125)	44 (0-80)	2.4 (0-4.3)
[20]	4	2830	17,945	0.16	0.13	2764	2388	154 (4-238)	133 (3-206)	5.6 (0.1-8.6)
[20]	6	2887	18,310	0.16	0.19	4120	3506	241 (6-372)	205 (5-317)	5.9 (0.1-9.0)
[21]	5 to 7	11,809	54,450	0.22	0.18	12,251	10,013	778 (322-1138)	636 (263-930)	6.4 (2.6-9.3)
[22]	8 to 10	650*	57,470	0.01	0.19	14,655	10,735	108 (24-134)	79 (18-98)	0.7 (0.2-0.9)

* In proximity to highways only.

Note: Values of P_{ei} were obtained as follows:

$$P_{ei} = \frac{\text{Pop. child residents in proximity to major roads or highways in Montreal}}{\text{Pop}_i}$$

(relative to the entire 2006 population) living on the Island of Montreal and applied the percentages to the population in each road traffic category.²⁵

For the purpose of comparison, the prevalence of asthma was taken from two studies using different approaches: one performed on the Island of Montreal in 2006²⁶ (questionnaire-based approach) and another performed in the province of Ontario, Canada from 1996 to 2005²⁷ (based on diagnoses in health care service databases). For the asthma prevalence reported by questionnaire, results were cross-checked with the Medicare database (reported doctor diagnosis). Both sources of data reported similar prevalence rates for two or more asthma diagnoses in children's health files. For the Montreal prevalence study, the definition of asthma was the one used in the 1995-1996 Health Canada Student Lung Health Survey.

Estimation of health impacts

Using the information concerning population numbers for different age groups and proximity categories to major roads and highways for Montreal, corresponding odds ratios for the different categories were applied to Montreal. The attributable fraction (AF)

estimation of asthma prevalence related to proximity to major roads or highways was calculated as follows:²⁸

$$AF_i = p_{ei} \frac{(RR_i - 1)}{RR_i} \quad \text{Equation 1}$$

p_{ei} = proportion of exposed cases at age "i" (living within 50 or 75 m of major roads or highways). The prevalence of asthma in the exposed population was not available to calculate this value. We assumed the prevalence of asthma in the exposed population to be equal to the prevalence of asthma in the whole population.

RR_i = Relative risk (Prevalence ratio) for age group "i"

The attributable number (AN) of prevalent asthma cases due to residing near major roadways was determined as follows for each age group:²⁹

$$AN_i = \text{Pop}_i * P_o * AF_i$$

Pop_i = population of children of age group "i"

P_o = prevalence of asthma in age group "i"

Values of RR (or Prevalence ratios, PR) were not reported in the selected studies; only values of ORs were reported. In the case of diseases with very low incidence among the non-exposed, OR and RR (PR) are likely to be very similar. However, for outcomes that are not so rare, such as asthma, the ORs and RRs can differ.³⁰ In order to account for these differences, we estimated the RR (PR) as follows, using equation 2:³⁰

$$RR = \frac{OR}{(1 - P_o) + (P_o \times OR)} \quad \text{Equation 2}$$

P_o = prevalence of asthma in the initial studies

Equations 1 and 2 were then applied to the different exposure scenarios presented in Table 2, so as to obtain a range of attributable cases, based on the different risk functions that were selected. The confidence interval for the number of cases was calculated based on the 95% CI of the ORs, as reported in the selected studies (Table 2), assuming normal distribution of the error on the OR.

RESULTS

Based on the chosen risk functions, there were 5 age groups for which information was calculated (2, 4, 6, 5 to 7 and 8 to 10). Populations of children residing at different distances for each age category were estimated to range in Montreal from 650 at <75 m for the highway only category, and from 2,830 at <50 m to 11,809 at <75 m for the major road and highway category.

The numbers of prevalent cases that may be attributable to proximity of residences to major roads or highways were calculated using prevalence from the questionnaire-based Montreal study²⁶ and prevalence from the Ontario study.²⁷ Attributable cases using Montreal prevalence ranged from 44 for the 2-year age group at <50 m to 636 in the 5 to 7 year age group residing within 75 m of a major road or highway (Table 2). Attributable cases using the Ontario asthma prevalence ranged from 69 for the 2-year age group at <50 m to 778 in the 5 to 7 year age group residing within 75 m of a major road or highway (Table 2). Depending on the exposure scenario and prevalence rates used, we estimated that exposure to proximity to major roads and highways could have an impact of 0.7% to 6.4% of prevalent asthma cases in Montreal.

DISCUSSION

This study is an attempt to quantify the risk of asthma prevalence in children that is attributable to living near major roads or highways on the Island of Montreal, Canada. The results presented here should be seen as a potential range of attributable cases, as other factors not considered may also be responsible for the disease. Attributable fractions may be lower or higher than those calculated, as there are uncertainties in calculations and competing risk factors that we have not considered when applying risk functions to our specific population (such as environmental tobacco smoke). Overall health risks attributable to proximity to roads are, however, more important than the ones presented in this study where only asthma-prevalent cases are presented. Other studies have shown that exposure to traffic emissions is linked to several health effects not reported in this study, such as premature mortality and cardiovascular outcomes.³

Applying risk functions in populations other than the initial study population has also been performed by other authors to cal-

culate prevalent asthma cases attributable to proximity to major roads.^{31,32} In these studies, which were applied to Southern California, the percentage of prevalent asthma cases attributable to residing in proximity to major roads ranges between 6% and 9.3%. These fractions were estimated using the study by McConnell et al., 2006,²¹ which was one of the studies retained for our assessment. Here, based on the ORs of the four studies that we retained, we report attributable fractions lower than the ones estimated for Southern California (range 0.7 to 6.4%), probably due to various factors like differences in ORs, prevalence rates and children's population within 50 or 75 m of major roads or highways.^{15,20,22}

It should be stressed that attributable risk is only valid if causality between the exposure and disease exists.²⁸ We retained a health outcome (prevalence of asthma) for which a causal association due to exposure to traffic pollutants has been judged to be between sufficient and suggestive, but uncertainties regarding causality still remain since not all studies performed in different locations and population subgroups have shown consistent results (e.g., greater risks have been found in girls in some studies, but not in others^{21,22}). The size of the differences in risk coefficients between studies in different locations can also be considerable. Thus, the study by Kim et al., 2008, has larger OR and confidence intervals since the study was performed with a very limited number of children residing within 75 m of a highway.²²

In our assessment, the chosen studies had both strengths and weaknesses for the purpose of transfer of risk functions to the Montreal context. On one hand, risk functions used were adjusted for many confounding or modifying factors. On the other hand, the exposure response functions used for proximity to roadways were not developed specifically for Montreal children, and their applicability in other regions than the one under study (the Island of Montreal) is uncertain. Different locations may present differences in pollutant levels and population characteristics. Pollutant levels may differ greatly on major roadways between countries since characteristics of vehicle fleet are likely different (automobile, truck, and number of diesel engines) as well as the composition of the emission mixture (based on motor emission standards). Background levels of pollutants may also be different in other countries compared to those in Montreal.

We also recognize the limitations of our assessment concerning the evaluation of real exposure, and this could lead to an over- or underestimation of our findings. Our analysis was performed using proximity to major roads or highways as a surrogate of exposure to traffic-related pollutants, since measures of air pollutants were not available for the present study. Proximity to roads has commonly been used as a proxy for exposure to road traffic emissions in epidemiological studies as traffic pollutant levels (e.g., NOx) are higher than background levels in proximity to roadways (i.e., at a distance less than 200 m).³³ It should be stressed, however, that compared to Land Use Regression models that estimate exposure to pollutant levels, proximity to roadways is particularly prone to errors in estimating exposure and to classification bias. Nonetheless, proximity to roadways is a way to assess the risks associated with a mixture of air pollutants. In our assessment, we chose to be conservative and only report on risks attributable to distances of less than 75 m from roadways.³

Other uncertainties also arise from the estimation of attributable risk. In another study, attributable cases of asthma due to traffic-

related pollutants and proximity to roadways were calculated using the standard equation ($AF = p_p(RR-1)/(p_p(RR-1)+1)$, where p_p = proportion of exposed children).³² However, the application of this equation requires the assumption that exposure to other factors not considered does not increase the disease risk, which we cannot ascertain in this study. Thus, we chose to apply an alternative formulation³⁴ (Equation 1 in this study, which is a function of the prevalence of exposure in diseased individuals). To adequately calculate this value, it is essential to have the prevalence of asthma in the exposed population. We did not have this information and we assumed this value to be equal to the prevalence of asthma in the whole population. This is a conservative approach since the prevalence of disease in the exposed population should be higher than in the whole population if exposure is associated with asthma prevalence.

Uncertainties are also associated with estimations of the number of exposed children. First, the population residing near major roads or highways was based on the location of postal codes of 1996, since more recent population numbers for postal codes were not available. This is an underestimation since population numbers between 1996 and 2006 increased by approximately 4%. Using the centroids of postal codes on a given street block is only an approximation of the location of the residences. Furthermore, the proportion of children of different age groups residing near these major roads or highways was deemed to be the same as that found across the Island of Montreal; this assumption requires validation. Better estimations would be provided with real population numbers.

Finally, we should recognize that retaining studies for which an association with the exposure to proximity to major roads was significant is an approach that would tend to lead to systematic bias. Meta-analysis including further studies and assessing publication bias are needed to provide more accurate results to estimate attributable risks.

From our assessment in Montreal, we identified a number of scientific gaps, including the development of risk functions specific to Montreal and possibly with estimates of exposure to air pollutants alongside major roadways. This input would be useful for either calculating the attributable fraction of prevalent asthma for the specific population, or to be included in a meta-analysis of relevant studies.

Even though uncertainties are present as cited in the preceding paragraphs, a range of childhood asthma cases that can be linked to residing near major roadways, as suggested by epidemiological risk functions, can be estimated, until more substantial information is made available. Our study is thus a first attempt to calculate crude risks of asthma prevalence attributable to proximity of residence to major roads or highways on the Island of Montreal. It points out the main limitations that we encountered and the directions that future studies must take to properly address the issue.

REFERENCES

- Environment Canada. National Pollutant Release Inventory Online Data, 2008. Available at: http://www.ec.gc.ca/pdb/websol/emissions/ap/ap_query_f.cfm (Accessed December 2, 2010).
- World Health Organization. Health effects of transport-related air pollution. Krzyzanowski M, Kuna-Dibbert B, Schneider J (Eds.). Copenhagen, Denmark: WHO, 2005;190.
- Health Effects Institute. Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects. HEI Panel on the Health Effects of Traffic-Related Air Pollution. HEI Special Report 17. Boston, MA: HEI, 2010.
- Patel MM, Miller RL. Air pollution and childhood asthma: Recent advances and future directions. *Curr Opin Pediatr* 2009;21(2):235-42.
- Bråbäck L, Forsberg B. Does traffic exhaust contribute to the development of asthma and allergic sensitization in children: Findings from recent cohort studies. *Environ Health Perspect* 2009;8:17.
- Delfino RJ. Epidemiologic evidence for asthma and exposure to air toxics: Linkages between occupational, indoor, and community air pollution research. *Environ Health Perspect* 2002;110(Suppl. 4):573-89.
- Beelen R, Hoek G, van den Brandt PA, Goldbohm RA, Fischer P, Schouten LJ, et al. Long-term effects of traffic-related air pollution on mortality in a Dutch cohort (NLCS-AIR study). *Environ Health Perspect* 2008;116:196-202.
- Finkelstein MM, Jerrett M, Sears MR. Environmental inequality and circulatory disease mortality gradients. *J Epidemiol Community Health* 2005;59:481-87.
- Gehring U, Heinrich J, Kramer U, Grote V, Hochadel M, Sugiri D, et al. Long-term exposure to ambient air pollution and cardiopulmonary mortality in women. *Epidemiol* 2006;17:545-51.
- Jerrett M, Finkelstein MM, Brook JR, Arain MA, Kanaroglou P, Stieb DM, et al. A cohort study of traffic-related air pollution and mortality in Toronto, Ontario, Canada. *Environ Health Perspect* 2009;117:772-77.
- Hoffman B. Residential exposure to traffic is associated with coronary atherosclerosis. *Circulation* 2007;116:489-96.
- Rosenlund M, Berglund N, Pershagen G, Hallqvist J, Jonson T, Bellander T. Long-term exposure to urban air pollution and myocardial infarction. *Epidemiol* 2006;17:383-90.
- Tonne C, Melly S, Mittleman M, Coull B, Goldberg R, Schwartz J. A case-control analysis of exposure to traffic and acute myocardial infarction. *Environ Health Perspect* 2007;115:53-57.
- Brauer M, Hoek G, Van Vliet P, Meliefste K, Fischer PH, Wijga A, et al. Air pollution from traffic and the development of respiratory infections and asthmatic and allergic symptoms in children. *Am J Respir Crit Care Med* 2002;166:1092-98.
- Morgenstern V. Respiratory health and individual estimated exposure to traffic-related air pollutants in a cohort of young children. *Occup Environ Med* 2007;64:8-16.
- Oftedal B, Nystad W, Brunekreef B, Nafstad P. Long-term traffic-related exposures and asthma onset in schoolchildren in Oslo, Norway. *Environ Health Perspect* 2009;117:839-44.
- Garner R, Kohen D. Changes in the prevalence of asthma among Canadian children. *Health Rep* 2008;19:45-50.
- Hill AB. The environment and disease: Association or causation? *Proc R Soc Med* 1965;58:295-300.
- Bates DV. Health indices of the adverse effects of air pollution: The question of coherence. *Environ Res* 1992;59(2):336-49.
- Morgenstern V, Zutavern A, Cyrys J, Brockow I, Koletzko S, Kramer U, et al. Atopic diseases, allergic sensitization, and exposure to traffic-related air pollution in children. *Am J Respir Crit Care Med* 2008;177:1331-37.
- McConnell R, Berhane K, Yao L, Jerrett M, Lurmann F, Gilliland F, et al. Traffic, susceptibility, and childhood asthma. *Environ Health Perspect* 2006;114:766-72.
- Kim JJ, Huen K, Adams S, Smorodinsky S, Hoats A, Malig B, et al. Residential traffic and children's respiratory health. *Environ Health Perspect* 2008;116:1274-79.
- Lewis SA, Antoniak M, Venn AJ, Davies L, Goodwin A, Salfield N, et al. Secondhand smoke, dietary fruit intake, road traffic exposures, and the prevalence of asthma: A cross-sectional study in young children. *Am J Epidemiol* 2005;161:406-11.
- Shima M, Nitta Y, Adachi M. Traffic-related air pollution and respiratory symptoms in children living along trunk roads in Chiba prefecture, Japan. *J Epidemiol* 2003;13:108-19.
- Statistique Canada. Montréal, Québec (Code2466023) (tableau). Profils des communautés de 2006, Recensement de 2006, produit n° 92-591-XWF au catalogue de Statistique Canada. Ottawa, 2007. Available at: <http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=F> (Accessed January 5, 2011).
- Deger L, Plante C, Goudreau S, Smargiassi A, Perron S, Thivierge RL, et al. Home environmental factors associated with poor asthma control in Montreal children: A population-based study. *J Asthma* 2010;47:513-20.
- Gershon AS, Guan J, Wang C, To T. Trends in asthma prevalence and incidence in Ontario, Canada, 1996-2005: A population study. *Am J Epidemiol* 2010;172:728-36.
- Rockhill B, Newman B, Weinberg C. Use and misuse of population attributable fractions. *Am J Public Health* 1998;88(1):15-19.
- World Health Organization. Comparative Quantification of Health Risks. Global and Regional Burden of Disease Attributable to Selected Major Risk Factors. Volume 2. Ezzati M, Lopez AD, Rodgers A, Murray CJL (Eds.). Geneva, Switzerland: WHO, 2004.
- Zhang J, Yu KF. A method of correcting the odds ratio in cohort studies of common outcomes. *JAMA* 1998;280:1690-91.
- Perez L, Künzli N, Avol E, Hricko AM, Lurmann F, Nicholas E, et al. Global goods movement and the local burden of childhood asthma in Southern California. *Am J Public Health* 2009;99:S622-S628.

32. Künzli N, Perez L, Lurmann F, Hricko A, Penfold B, McConnell R. An attributable risk model for exposures assumed to cause both chronic disease and its exacerbations. *Epidemiol* 2008;19(2):179-85.
33. Gilbert NL, Woodhouse S, Stieb DM, Brook JR. Ambient nitrogen dioxide and distance from a major highway. *Sci Total Environ* 2003;312:43-46.
34. Benichou J. Biostatistics and epidemiology: Measuring the risk attributable to an environmental or genetic factor. *CR Biologies* 2007;330:281-98.

Received: May 3, 2011

Accepted: November 5, 2011

RÉSUMÉ

Objectif : L'exposition aux polluants atmosphériques liés au trafic routier contribue à plusieurs résultats sanitaires. De nombreuses preuves tendent à lier l'asthme chez les enfants à l'exposition au trafic routier. La prévalence et l'incidence croissantes de l'asthme chez les enfants dans les villes du Canada préoccupent les autorités de santé publique. Nous avons estimé le risque de prévalence de l'asthme imputable au fait de résider à proximité de grandes artères sur l'île de Montréal, au Canada.

Méthode : Nous avons sélectionné dans la littérature scientifique et appliqué à Montréal les fonctions de risque afférentes à l'asthme chez les enfants et au fait d'habiter à proximité de grandes artères. La prévalence de l'asthme vient d'une étude populationnelle. Les données démographiques sont extraites du Recensement du Canada. Nous avons estimé l'exposition à l'aide d'une catégorie de la base de données de Desktop Mapping Technologies Inc. (DMTI Spatial Inc.) : « proximité de grandes routes et artères ».

Résultats : D'après différentes études, le pourcentage de prévalence des cas d'asthme imputable au fait de vivre à moins de 50 mètres d'une grande route ou artère, pour les enfants de 2, 4 et 6 ans, variait entre 2,4 % (0-4,3), 5,6 % (0,1-8,6) et 5,9 % (0,1-9,0). Dans le groupe des 5 à 7 ans vivant à moins de 75 m d'une grande route ou artère, le pourcentage de cas était de 6,4 % (2,6-9,3). Chez les enfants de 8 à 10 ans vivant à moins de 75 m d'une route seulement, le pourcentage de cas était de 0,7 % (0,2-0,9).

Conclusion : Ces chiffres représentent les meilleures estimations brutes et pourraient indiquer un éventail de cas liés au fait de résider à proximité d'une grande route. Il y a cependant des incertitudes liées à l'application des fonctions exposition-réaction; ces estimations seront donc réévaluées à mesure que les chercheurs réuniront de nouvelles preuves.

Mots clés : asthme; risques attribuables; enfant; trafic routier; polluants atmosphériques

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Présenté par l'Association canadienne
de santé publique (ACSP).

Cette production a été financée grâce à une
subvention éducative des fabricants de Lysol.®