

Associations between Neighborhood Walkability and Incident and Ongoing Asthma in Children

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Abstract

Rationale: Childhood asthma has shown variable associations with children's physical activity. Neighborhood walkability captures community features that promote walking and is protective against some chronic conditions, such as obesity and diabetes.

Objectives: We evaluated associations between home neighborhood walkability and incident and ongoing childhood asthma.

Methods: In this population-based cohort study, we used prospectively collected administrative healthcare data for the Province of Ontario housed at the Institute for Clinical Evaluative Sciences. We followed an administrative data cohort of 326,383 Toronto children born between 1997 and 2003, inclusive, until ages 8–15 years. Home neighborhood walkability quintile was measured using a validated walkability index with four dimensions: population density, dwelling density, access to retail and services, and street connectivity. Incident asthma was defined by time of entry into the validated Ontario Asthma Surveillance Information System database, which requires two outpatient visits for asthma within two consecutive years or any hospitalization for

asthma and follows children with asthma longitudinally starting at any age. Associations between walkability and incident asthma were examined using Cox proportional hazards models. Associations between ongoing asthma and walkability in each year of life were examined using generalized linear mixed models.

Results: Twenty-one percent of children ($n = 69,628$) developed incident asthma and were followed longitudinally in the Ontario Asthma Surveillance Information System database. Low birth home neighborhood walkability was associated with an increased incidence of asthma (hazard ratio, 1.11; 95% confidence interval, 1.08–1.14). Among children with asthma, low walkability in a given year of a child's life was associated with greater odds of ongoing asthma in the same year (odds ratio, 1.12; 95% confidence interval, 1.09–1.14).

Conclusions: Children living in neighborhoods with low walkability were at increased risk of incident and ongoing asthma. Neighborhood walkability improvement, such as by adding pedestrian paths to improve street connectivity, offers potential strategies to contribute to primary asthma prevention.

Keywords: incident; longitudinal; obesity; income; atopy

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Asthma development in early life has been associated with childhood obesity (1–6) and has been less consistently associated with childhood levels of physical activity (6–10), which have included reports of both episodic physical activity and an active lifestyle with less sedentary time. To further understand the relationship between a physical activity–promoting environment and asthma, we sought to determine long-term associations between home neighborhood walkability and incident and ongoing childhood asthma.

Neighborhood walkability is a distinct concept referring to the physical features of a neighborhood that promote walking and is used as a community-based measure of active lifestyle (11). It may include components such as street connectivity, residential and commercial area land use mix, and availability of public transportation. Variable associations have been demonstrated among walkability, obesity, and physical activity levels (12–15), all of which are discrete measures. Among adults, neighborhood walkability has been shown to be protective against some chronic diseases, such as obesity (16, 17) and diabetes (16–18), after controlling for socioeconomic status.

To our knowledge, associations between childhood asthma and walkability have not previously been published. In the present large longitudinal study of prospectively collected administrative data of Toronto children born between 1997 and 2003, inclusive, we evaluated the associations between home neighborhood walkability and incident and ongoing childhood asthma. We hypothesized that lower neighborhood walkability would be associated with incident and ongoing asthma. With this exploratory research question, we could not directly examine causative mechanisms of asthma development.

Methods

Data Sources

We used prospectively collected health administrative data for the province of Ontario housed at the Institute for Clinical Evaluative Sciences, including data from Ontario Health Insurance Plan (OHIP) records of clinic visits, National Ambulatory Care Reporting System (NACRS) records of emergency department visits, and Canadian

Institute for Health Information Discharge Abstract Database (CIHI-DAD) records of hospitalizations. Children who were born between 1997 and 2003, inclusive, and who had lived in the Greater Toronto Area (GTA) at any time during their lives were identified through the Registered Persons Database and followed from birth to March 31, 2012 ($N = 326,383$). Up to 15 years of data were available for children born in 1997, and up to 8 years of data were available for children born in 2003. This study was approved with a waiver of informed consent by research ethics boards at the Hospital for Sick Children and the University of Toronto.

Measurement of Asthma Outcomes

Asthma outcomes were ascertained using the Ontario Asthma Surveillance Information System (OASIS), which includes all Ontario residents who have required two outpatient clinic or emergency department visits for asthma within two consecutive years or any hospitalization for asthma (19). Entry into the OASIS database has been validated with good sensitivity and specificity (91.4 and 82.9%, respectively) against a clinical diagnosis of childhood asthma made by a physician (20) and by parental reporting of physician-diagnosed asthma in children (21). Asthma healthcare visits were defined by the OHIP code or the primary diagnostic International Classification of Diseases, Ninth or Tenth Revision, code in NACRS and CIHI-DAD (see Table E1 in the online supplement). For children in the OASIS database, asthma visits recorded in the OHIP, NACRS, and CIHI databases were available for each year of life during which the child lived in Ontario.

We defined the timing of incident asthma development as the date of the child's second outpatient clinic or emergency department visit for asthma within two consecutive years or as the first hospitalization for asthma, either of which satisfied the criteria for entry into the OASIS database. Each child entered into the OASIS database was followed longitudinally. Among children followed for asthma in the OASIS database, ongoing asthma was defined as at least one healthcare visit for asthma in a given year of the child's life, distinguishing children who continued to have healthcare visits for asthma from children who remained in Ontario but stopped having visits for asthma.

Measurement of Walkability

Neighborhood walkability was evaluated using an existing validated index developed for the GTA by Glazier and colleagues (Figure E1) (11, 17, 18). Their walkability index encompasses 524 GTA census tracts (population range, 20–22,724; median, 4,638), was created for the years 2001–2003 and 2006–2009, and was stable for given neighborhoods over these two time periods (16). The index was developed by factor analysis, beginning with neighborhood characteristics conducive to walking, such as proximity to public transportation and recreational facilities. Characteristics with sufficient factor loading remained in the index, which included four dimensions: population density, dwelling density, access to retail and services, and street connectivity (intersection density) (11, 17). The walkability index quintiles (1 = low walkability to 5 = high walkability) were validated among adults by comparison with actual levels of walking in transportation surveys (17).

Study participants were assigned a birth neighborhood walkability quintile corresponding to the walkability index for the postal code of their residence at birth. Walkability in each year of life was defined as the walkability quintile for their home residence at the beginning of each year of life. For the primary analysis, walkability was dichotomized into the two lowest versus the two highest quintiles to align with the original publication of neighborhood walkability (18). Walkability was also evaluated by quintile and using other dichotomization cut points, including the lower three quintiles versus the higher two quintiles and the lower four quintiles versus the highest quintile.

Measurement of Covariates

The covariates available in the Registered Persons Database included sex and census tract–level neighborhood income quintile. Health services administrative data available from the OHIP, NACRS, and CIHI-DAD databases (Table E1) included presence of a diagnostic code for history of preterm birth (before 37 wk of gestation), obesity (weight at or above the 95th percentile), or other atopic conditions (at least one of allergic rhinitis, eczema, and food allergy). Sex, preterm birth, obesity, and other atopic conditions were dichotomous variables based on the presence or absence of diagnostic codes. Income quintile assignment

to a neighborhood was based on the 2001 census incomes. Income was dichotomized into the two lowest quintiles versus the two highest quintiles and was also evaluated as a categorical measure and using other dichotomization cut points, including the lower three quintiles versus the higher two quintiles and the lower four quintiles versus the highest quintile.

Ontario health services data reported in the OHIP, NACRS, and CIHI-DAD databases included history of asthma, preterm delivery, obesity, and other atopic conditions. These data were complete while the child lived in Ontario, but they were not available for years during which the child lived outside Ontario. Walkability quintile data were defined while the child lived within the GTA, but they were not available for years during which the child lived outside this region; 90.2% of children lived in the GTA at birth, 61.8% of children lived in the GTA throughout the study, and 64.6 to 89.3% of children lived in the GTA in any given year, mirroring changes in the Greater Toronto population over that time (22, 23). Neighborhood income was defined for a slightly larger area than neighborhood walkability, but it was not available in the database until 1999. Income data were defined at birth for over 95% of children born between 1999 and 2003, inclusive, and in any given year for at least 90% of children. Children were included in the analyses during years for which they had available asthma and walkability data.

Statistical Analyses

The association between age of incident childhood asthma and low versus high home neighborhood walkability at birth was examined in unadjusted and multivariable Cox proportional hazards models. The associations between ongoing asthma and low walkability in a given year of the child's life were examined using generalized linear mixed models, which accounted for the nonindependent "clustered" measures of any healthcare visit for asthma repeated in multiple years of the child's life. This multilevel model allowed for different numbers of years of data for different children and possible correlation of the data among different years of life for a given child. Some children who did not move homes would have had the same home walkability in each year of life. Others may have moved frequently and had their

walkability change with each new neighborhood or not change at all.

Covariates shown to have previously established associations with childhood asthma and available in the healthcare administrative databases included sex, preterm birth, neighborhood income, obesity, and other atopic conditions (1, 2, 24, 25). All variables were included in the adjusted models and removed individually by backward elimination if their maximum likelihood was nonsignificant ($P \geq 0.05$); no variables were eliminated by this criterion. Effect modification with neighborhood walkability was evaluated for all covariates with possible interaction based on the literature, including interactions of walkability with income quintile and obesity and interactions of income quintile with obesity, prematurity, and atopic conditions other than asthma. The least squares means were plotted for each of the four walkability covariate categories in the generalized linear mixed models (26). The associations with incident asthma were confirmed by discrete-time hazard analyses (27). The evaluation of ongoing asthma by year of life was repeated using generalized estimating equations (28).

Sensitivity analyses were performed to determine if the results changed after excluding children who moved into and/or out of the GTA over the course of the study. We repeated the analyses including children born between 1999 and 2003, inclusive, the

years for which birth income quintile data were available. We then repeated the analyses for children born in an Ontario hospital, who would have had complete preterm birth data. Finally, we repeated the analyses for children who had lived in the GTA throughout the study to evaluate for possible differences with children who had moved into and/or out of the GTA during the study. All analyses were performed using SAS 9.3 software (SAS Institute).

Results

Among the 326,383 children born in Toronto between 1997 and 2003, inclusive, 69,628 (21.3%) met the criteria for incident asthma and entry into the OASIS database; 14,050 children (4.3%) who entered the OASIS database had a healthcare visit for ongoing asthma in the final 12 months of the study. The median ages at asthma diagnosis were 2.5 years (interquartile range, 4.0) for all children with asthma and 3.5 years (interquartile range, 5.3) among children with ongoing asthma until the end of the study.

The incidence of asthma was similarly distributed among the walkability quintiles in each year of birth (Figure 1), with the highest incidence clustered in the three lower walkability quintiles (Q1 to Q3) and the lowest incidence in the highest or most

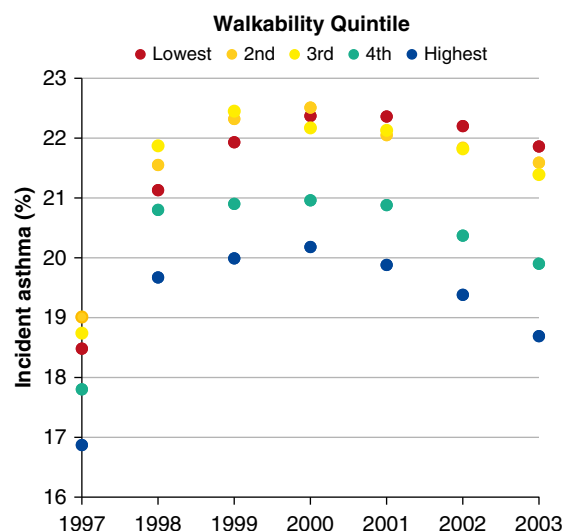


Figure 1. Scatterplot of incident asthma and walkability quintile by year of birth. The distribution of incident asthma by walkability quintile ($N = 326,383$) remains similar among participants born in each year of the study. The overall increase in incident asthma from 1997 to 2000 was consistent with overall trends in Ontario during this time period (29). Reprinted from Reference 47.

walkable quintile (Q5). Associations between asthma and walkability quintile using the highest or most walkable quintile as a reference demonstrated higher hazards of incident asthma among the lower three quintiles of neighborhood walkability for all birth years (Figure 2). The fourth or second highest walkability quintile showed a more variable hazard ratio (HR) of incident asthma by year of birth and a wider 95% confidence interval (CI) (Figure 2).

For each decrease in walkability quintile compared with the most walkable quintile, the risk of incident asthma increased by 3% (Table 1) in fully adjusted models. Children with birth home neighborhood walkability in the two lowest quintiles had an increased risk of incident asthma compared with children in the two highest quintiles (HR, 1.11; 95% CI, 1.08–1.14) (Table 1).

In a fixed-intercept generalized linear mixed (subject-specific) model adjusted for neighborhood income, sex, preterm birth, obesity, and other atopic conditions, children had increased odds of a healthcare visit for ongoing asthma in a given year of life if they lived in a neighborhood with low walkability in that year of life

(odds ratio [OR], 1.12; 95% CI, 1.09–1.14). There was no evidence of interaction between neighborhood walkability and the covariates.

In all models, the covariates low birth neighborhood income, male sex, preterm birth, obesity, and atopic conditions other than asthma remained independently associated with incident and ongoing asthma, but adjustment for the covariates did not significantly change the association between home neighborhood walkability and childhood asthma. The associations between asthma and walkability did not change with the use of different cut points to dichotomize walkability and income (Table 1) or after restricting the analyses to children who were born between 1999 and 2003, children who were born in an Ontario hospital, and children who had lived in the GTA continuously since birth (Table 1).

Model diagnostics demonstrated good fit. The associations between birth neighborhood walkability and incident childhood asthma agreed well between the Cox proportional and discrete-time hazard models (OR, 1.12; 95% CI, 1.09–1.15). The results for ongoing

asthma generated in subject-specific models (generalized linear mixed models) and population average models (generalized estimating equations) (OR, 1.11; 95% CI, 1.09–1.13) also showed good agreement.

Discussion

Lower home neighborhood walkability was associated with a greater incidence of asthma in Toronto children after adjustment for sex, preterm birth, neighborhood income, obesity, and concomitant atopic conditions other than asthma. Adjustment for these covariates did not significantly change the association between walkability and asthma development; however, the covariates were retained in the final model to demonstrate that they did not account for the walkability–asthma association. Ongoing asthma in a given year of life was also associated with neighborhood walkability in that year in fully adjusted models, suggesting a contribution to asthma beyond early wheezing. Similarly, adjustment for the covariates did not significantly change the association between walkability and ongoing asthma.

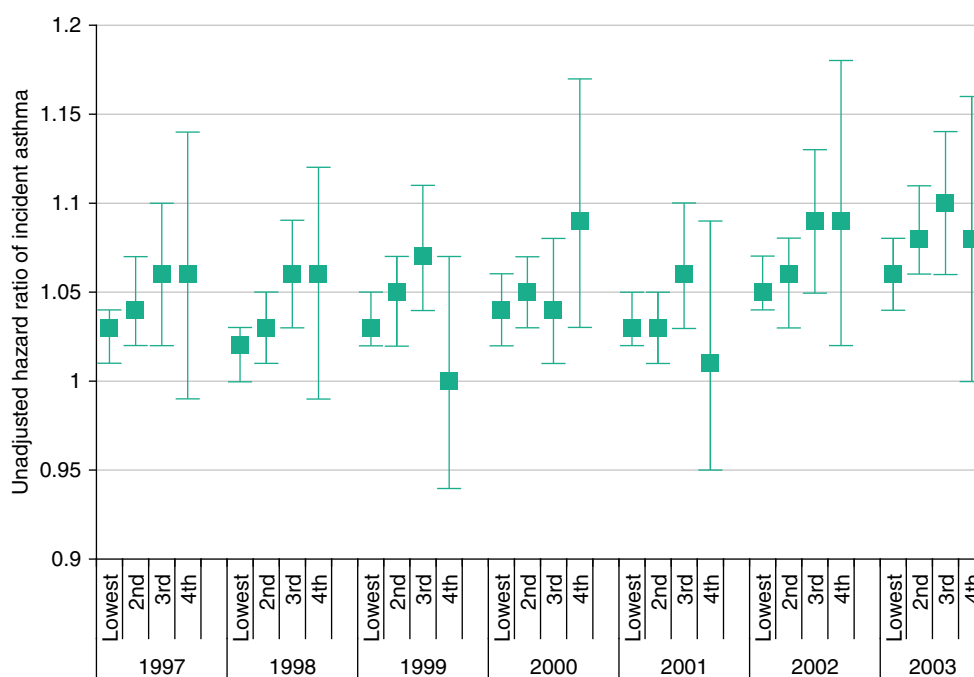


Figure 2. Comparison of four lower quintiles of walkability with the highest or most walkable quintile by year of birth (unadjusted hazard ratio, 95% confidence interval). The associations between birth neighborhood walkability and incident childhood asthma were compared by using Cox proportional hazards models ($N = 326,383$). Compared with the highest or most walkable quintile, the lower three quintiles of neighborhood walkability demonstrated higher hazards of incident asthma for all birth years. The fourth or second highest walkability quintile showed a more variable hazard ratio of incident asthma by year of birth and a wider 95% confidence interval. Reprinted from Reference 47.

Table 1. Associations between low birth neighborhood walkability and incident asthma

	Data	P Value
Total cohort, <i>n</i>	326,383	
Incident asthma, <i>n</i> (%)	69,628 (21.3)	
One-category decrease in walkability score		
Adjusted* hazard ratio (95% confidence interval) [†]	1.03 (1.03–1.04)	<0.0001
Four lowest quintiles vs. highest quintile		
Unadjusted hazard ratio (95% confidence interval) [†]	1.12 (1.10–1.15)	<0.0001
Adjusted* hazard ratio (95% confidence interval) [†]	1.10 (1.07–1.12)	<0.0001
Three lowest quintiles vs. two highest quintiles		
Unadjusted hazard ratio (95% confidence interval) [†]	1.09 (1.07–1.11)	<0.0001
Adjusted* hazard ratio (95% confidence interval) [†]	1.10 (1.08–1.13)	<0.0001
Two lowest quintiles vs. two highest quintiles		
Unadjusted hazard ratio (95% confidence interval) [†]	1.12 (1.10–1.14)	<0.0001
Adjusted* hazard ratio (95% confidence interval) [†]	1.11 (1.08–1.14)	<0.0001
Sensitivity analysis (two lowest vs. two highest)		
Adjusted* hazard ratio (95% confidence interval) [†]		
Born between 1999 and 2003	1.11 (1.08–1.14)	<0.0001
Born in Ontario	1.12 (1.09–1.16)	<0.0001
Lived whole life in Greater Toronto Area	1.11 (1.08–1.14)	<0.0001

*Adjusted for income quintile, sex, preterm birth, obesity, and atopic conditions other than asthma.

[†]Results of Cox proportional hazards models.

This study included up to 8–15 years of data for each child, which allowed evaluation of the temporal relationship between asthma and walkability in a large number of children. Entry into OASIS is a sensitive, validated measure of asthma and is ideal for following children who are at high risk for ongoing asthma. The asthma incidence (21.3%) determined for GTA children in this study was similar to the incidence for all of Ontario (29).

The walkability index we used has been validated against individual physical activity levels in adults (17). No corresponding measure of GTA walkability has yet been validated in children and adolescents. Parental physical activity levels have been correlated with children's physical activity levels in previous studies (30, 31). Although the associations between parental and adolescent physical activity levels have been less clear (32), the neighborhood built environment has been associated with moderate to vigorous physical activity among teenagers (33, 34). The causative mechanisms by which neighborhood walkability may affect childhood asthma could not be directly investigated in the present study. However, the relationships among maternal obesity, child body mass index, and child wheezing demonstrated in a previous study (35) support the possibility

of parental physical activity influencing child health in association with child physical activity and could account for the association between birth neighborhood walkability and incident childhood asthma. Levels of physical activity or nonsedentary activity in children and adolescents could be a possible mechanism contributing to ongoing asthma in a given year of life.

Our findings document a statistically robust longitudinal association between childhood asthma and low neighborhood walkability, extending the results of previously published studies that have demonstrated variable associations between childhood asthma and exercise or sedentary lifestyle (6–10). Our results also support community-level interventions to modify the home neighborhood environment in ways that are associated with positive changes in individual physical activity levels.

Overall level of fitness is a possible mechanism of association between lower neighborhood walkability and asthma. Randomized controlled trials have shown decreased asthma symptoms, airway inflammation, and bronchial hyperreactivity with exercise among children (36) and adults (37) with asthma. One cohort study (10) has shown an association between lower fitness test performance and asthma

development in childhood and early adulthood, although the researchers in that study did not examine other covariates that may be associated with both sedentary lifestyle and asthma. However, cohort studies have not consistently shown protective associations between incident childhood asthma and physical activity measured by accelerometer (9) or reported physical activity frequency (8). Screen time, a surrogate for sedentary activity, has shown associations with both obesity (7) and asthma (6, 8). Daily screen time of 1 hour or more at ages 8–9 years was associated with physician-diagnosed asthma at ages 12–14 years (OR, 2.11; 95% CI, 1.14–3.89), especially for obese adolescents (OR, 3.95; 95% CI, 1.70–9.12) (8). These results reflect stronger associations between childhood asthma and an active lifestyle with less sedentary time than episodic moderate to vigorous physical activity. Similar results for cardiometabolic risk factors have also been published (38).

Obesity remained significantly associated with childhood asthma in all models, but it did not eliminate or substantially attenuate the association between asthma and walkability, suggesting that obesity was not an intervening variable between walkability and asthma. Although causative mechanisms could not be directly examined, low neighborhood walkability contributing to obesity does not appear to be a possible mechanism by which low walkability could have contributed to childhood asthma in this study. In a study of adults in the GTA, the prevalence of overweight and obesity was higher in the least walkable quintile relative to the most walkable quintile and increased over time in less walkable quintiles (16). However, in our present study, we did not find an association between childhood obesity and neighborhood walkability. Studies have generally shown associations between being obese or overweight and childhood asthma development (1–5). The mechanisms of action have not been fully elucidated (6), and the association may also depend on the asthma phenotype, age of onset (39), and possible common genetic mechanisms for asthma and obesity (40).

Longitudinal studies have suggested associations between obesity onset and childhood asthma. In one birth cohort (2), 8-year-old children showed increased odds of dyspnea and bronchial hyperreactivity if their body mass index was above the 85th

percentile at ages 6–7 years, regardless of their body mass index at age 2 years. However, in a pooled analysis of eight birth cohorts (1), researchers found that rapid body mass index increase until age 2 years was associated with increased risk of asthma development (HR, 1.27; 95% CI, 1.06–1.51), even if the body mass index trajectory normalized by ages 6–7 years. In a large birth cohort, the relationship between maternal obesity and childhood wheezing was shown to be mediated by the child's body mass index (35).

Income, a surrogate for socioeconomic status, has also been associated with asthma development in some other populations (41, 42). In a prospective Australian birth cohort (41), physician-diagnosed asthma at age 14 years was associated with chronic (OR, 2.21; 95% CI, 1.17–4.17) but not transient low income. Children attending California elementary schools with more than 40% of children living in poverty also had an increased risk of asthma development (HR, 1.68; 95% CI, 1.10–2.56) (42).

Atopic conditions were included in the multivariable analyses as a surrogate for atopy, which is unlikely to be a mechanism by which low walkability could contribute to childhood asthma but may be associated with the phenotype and persistence of childhood asthma (43) and with the relationship between asthma and obesity (44). In the present study, atopic conditions were strongly associated with asthma but did not appear to confound or act as an effect modifier of the association between asthma and walkability.

The major strength of this study is the reporting of a novel and modifiable risk factor, neighborhood walkability, in a large, urban, population-based sample. With carefully conducted sensitivity analyses, we reduced the possibility of selection bias that might occur as a result of including children who were missing important covariate data, such as income and preterm birth data, and the possibility of misclassification bias with asthma and other allergic disease diagnoses

that might occur owing to mobility of the population.

Potential limitations of this study include the absence of individual risk factors for childhood asthma, such as home secondhand smoke exposure. One large study evaluating walkability and metabolic risk factors among adults in the Toronto area found similar rates of smoking (12.0 to 13.3%) in different walkability quintiles, reducing the concern for unmeasured bias in our study (45). Asthma control is another important aspect of ongoing asthma that could be examined with the availability of individual-level asthma outcome measures. Other neighborhood-level exposures associated with asthma, such as traffic-related air pollution with nitric oxide, have been shown to be higher in higher-walkability neighborhoods, which have denser populations and more major roads and where pedestrians may be closer to the traffic (46). Adjusting for traffic-related air pollution might have increased our effect size, and researchers in future studies of walkability and asthma should examine the presence of reverse confounding or confounding by air pollution.

Results derived from a study in the GTA may not be generalizable to all urban centers or to suburban or rural communities; however, Toronto is a multiethnic city with a population of over 6 million inhabitants, making it representative of many large urban centers in industrialized countries. The healthcare administrative data for preterm delivery, obesity, and other atopic conditions have not been validated against clinical diagnoses, although they show reasonable face validity.

Attributes that promote or detract from walking appear to be complex. The GTA walkability index is an amalgamation of physical characteristics that permit and promote walking in GTA neighborhoods. The relationship demonstrated between this walkability index and actual measures of walking (17) suggests that if the neighborhood structure is walkable, people are more likely to walk. However, the

presence or absence of social, economic, cultural, or behavioral incentives to walk may also play a role and may carry a risk for residual confounding even after adjustment. As described above, some studies have demonstrated interaction between walkability and social or cultural characteristics in their associations with chronic disease (18) or measures of physical activity (33). Other studies, including the present one, have shown walkability and potential confounders such as income to be independently associated with chronic disease. Continued examination of these varied characteristics and their associations with chronic conditions such as asthma is needed.

In conclusion, children living in neighborhoods with low walkability were at increased risk of incident asthma and ongoing asthma after adjustment for neighborhood and individual characteristics previously associated with asthma. The results of this study demonstrate a link between childhood asthma and a community measure of sedentary lifestyle, and they may support community-level interventions to modify home neighborhood physical environment in ways that are associated with positive changes in individual physical activity levels. Improvement of neighborhood walkability—for example, by greater placement of services such as grocery stores within residential neighborhoods and adding pedestrian paths between roads to improve street connectivity—may offer strategies to contribute to primary asthma prevention. Walkability should also be promoted in neighborhoods that are under development. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

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Online Data Supplement

Associations between Neighborhood Walkability and Incident and Ongoing Asthma in Children

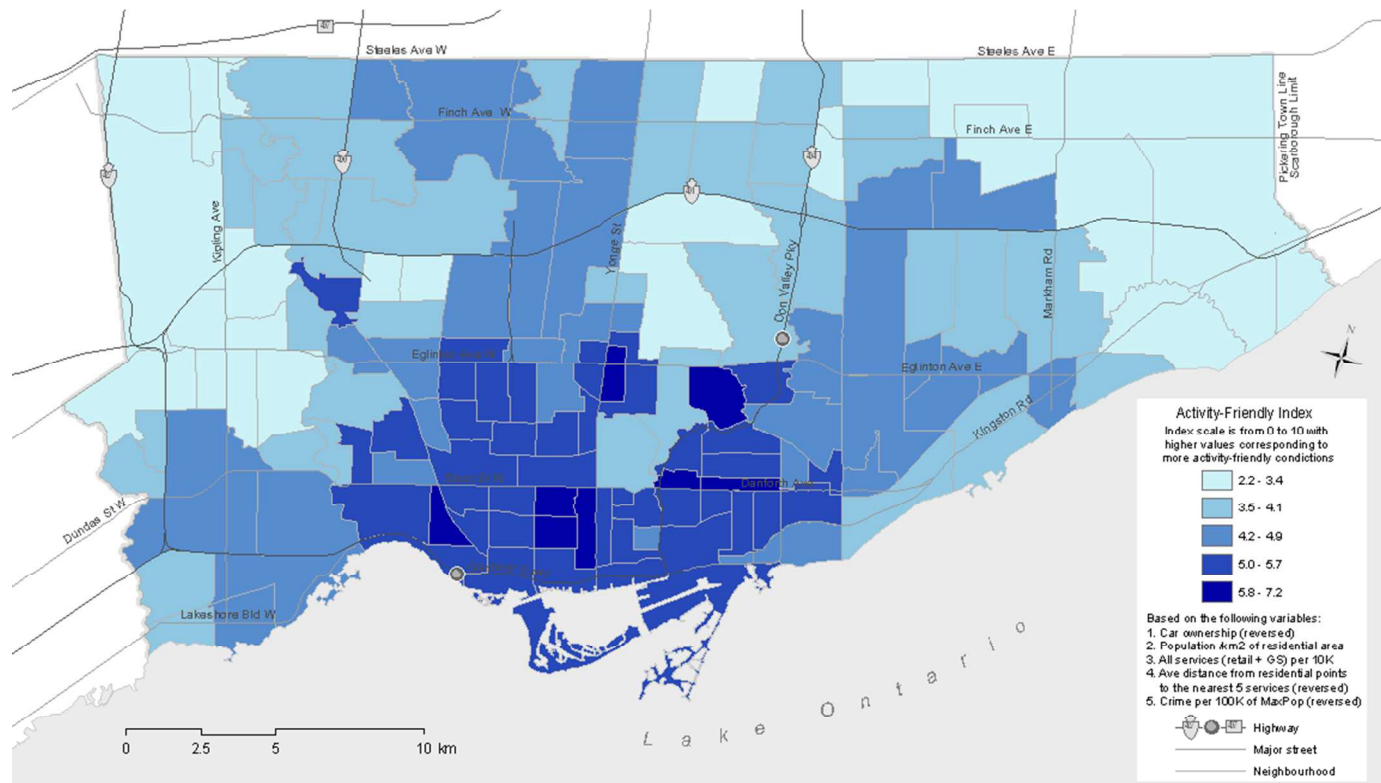
Elinor Simons, MD PhD, Sharon D. Dell, MD, Rahim Moinuddin, PhD, Teresa To, PhD

Table E1. OHIP, ICD-9 and ICD-10 diagnostic codes

Condition	OHIP	ICD-9	ICD-10
Asthma	493	493 Asthma	J45 Asthma
Preterm delivery	765	765.00-765.19 extremely immature or other preterm at various birth weights <2500 g	P070 extremely low birth weight P071 other low birth weight newborn P072 extreme immaturity of newborn P073 preterm newborn
Obesity	278	278.00 obesity, unspecified	E660 obesity due to excess calories E668 other obesity E669 obesity, unspecified
Other atopic conditions			
Allergic rhinitis	477	477.00 allergic rhinitis due to pollen 477.08 allergic rhinitis due to other allergen 477.09 allergic rhinitis, unspecified	J301 allergic rhinitis due to pollen J302 other seasonal allergic rhinitis J308 other allergic rhinitis J309 allergic rhinitis, unspecified
Atopic dermatitis	691	691.8 other atopic dermatitis	L208 other atopic dermatitis L209 atopic dermatitis, unspecified
Food allergy	995	995.0 anaphylaxis, unspecified 995.6 anaphylaxis due to food	Anaphylactic reaction due to T7800 unspecified food T7801 peanut T7802 shellfish T7803 fish T7804 fruits and vegetables

T7805 tree nuts and seeds
T7806 food additives
T7807 milk and dairy products
T7808 eggs
T7809 other food

Figure E1. Walkability reported as neighborhood quintiles



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http://www.torontohealthprofiles.ca/a_documents/aboutTheData/12_1_Reports AndPapers_Walkability_WKB_2012.pdf