



## Research Paper

## Walking accessibility to urban parks by children: A case study of Montreal

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## HIGHLIGHTS

- Parks are key elements of the urban landscape and are believed to promote active lifestyles.
- Accessibility to parks by children in Montreal is investigated.
- A model of travel behavior uncovers variations in the mobility of children in Montreal Island.
- As a consequence, differentials in accessibility to parks are detected, by locality, gender, income, and family structure.
- Customized accessibility profiles provide a valuable tool for analysis of inequalities in accessibility.

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## ABSTRACT

Parks are elemental components of urban landscapes that provide environmental and social function value. In particular, urban parks provide spaces for open-air physical activity. In order to enjoy the opportunities for activities in parks, users must have reasonable access to these resources. A starting point for inquiries about utilization and potential benefits of urban green spaces is an assessment of their geographical accessibility. Of particular interest, in terms of potential users of parks, are children, whose geographical range is limited by their ability to traverse space using nonmotorized modes of transportation, or by their dependence on adults for common forms of motorized mobility. The objective of this paper is to measure accessibility to urban parks from the perspective of children traveling by walking in Montreal, Canada. Implementation of accessibility measures is supported by statistical analysis of trip length using Montreal's 2008 Household Travel Surveys database. Estimates of trip length based on attributes such as age, gender, income class, family structure, as well as geographical location are used to calculate accessibility to urban parks. We evaluate the relationship between the distribution of children population and conditions of accessibility to urban parks to understand the potential for use and possible spatial disparities in the distribution of urban parks. This research contributes to the assessment of the distribution of access to urban parks by children, and can assist planners and policy makers to improve the supply of parks, while accounting for the mobility patterns of children.

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## 1. Introduction and scope

Urban parks are key elements of urban landscapes. Parks in urban settings are valuable for their environmental and ecological services, as well as their contributions to the social, physical, and psychological well-being of citizens (Chiesura, 2004). Much research has been devoted to the intrinsic environmental value of urban parks (Morancho, 2003; Tyrvaïnen, 1997) and their

contributions to urban sustainability (Restrepo, 2009). Parks add appeal value to cities (Jacobs, 1979) and more locally, monetary or fiscal value to surrounding property (Crompton, 2005; Kovacs, 2012). The social aspects of parks have also elicited interest, as for instance in terms of the meanings and values that people attach to them (Burgess, Harrison, & Limb, 1988) or the effect of social integration and inclusion in their usability (Seaman, Jones, & Ellaway, 2010). More recently, there has been a surge of research into the role that parks may play in encouraging more active lifestyles (e.g. Ries et al., 2009; Witten, Hiscock, Pearce, & Blakely, 2008), and therefore as elements of the landscape that could potentially promote positive health outcomes or reduce the impact of negative ones (e.g. Coen & Ross, 2006; de Vries, Verheij, Groenewegen, & Spreuwenberg, 2003). Of salient interest has been the topic of

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obesity that currently threatens to become a public health crisis. Relevant researches include [Cutts, Darby, Boone, and Brewis \(2009\)](#) and [Potestio et al. \(2009\)](#), who investigate the links between park access and being overweight or obese.

In order to enjoy the opportunities and potential benefits of activities conducted in parks, users must have reasonable access to these resources. A starting point for inquiries about utilization and potential benefits of urban green spaces is an assessment of their geographical accessibility. Accordingly, the issue of accessibility to urban green spaces or parks has attracted considerable attention. Some works have been methodological, and have assessed the capabilities of different approaches and techniques (e.g. [Hewko, Smoyer-Tomic, & Hodgson, 2002](#); [Higgs, Fry, & Langford, 2012](#); [Lotfi & Koohsari, 2009](#); [Nicholls, 2001](#); [Talen & Anselin, 1998](#); [Tsou, Hung, & Chang, 2005](#); [Van Herzele & Wiedemann, 2003](#); [Zhang, Lu, & Holt, 2011](#)). Given the potential benefits of access to urban parks and green spaces, other studies have paid attention to issues of equity or environmental justice, as these may well be related to limiting factors in terms of usage, and thus may be a source of disparity in health outcomes. [Talen \(1997\)](#), for instance, argues in favor of developing a link between accessibility and equity in the provision of urban services. This theme has received broader attention, with calls to adopt accessibility measures as more general indicators of social equity ([Lucas, 2012](#); [Lucas & Jones, 2012](#)). With regards to playgrounds, [Talen and Anselin \(1998\)](#) investigate whether accessibility is geographically random or non-random, the implication being that non-random variations constitute evidence of inequalities in the provision of this amenity. [Lindsey, Maraj, and Kuan \(2001\)](#) use GIS and spatial analysis to explore equity in access to greenways in Indianapolis, Indiana. [Tsou et al. \(2005\)](#) consider spatial equity in access to public services, including municipal, community, and neighborhood parks, in Ren-De, Taiwan, and state that achieving equity is a basic task of planners. Likewise, [Barbosa et al. \(2007\)](#) are concerned with the distribution of benefits in access to green space across members of the population in Sheffield, UK. With respect to environmental justice, [Cutts et al. \(2009\)](#) investigate the social and physical barriers that affect access to parks in Phoenix, Arizona.

Of particular interest, in terms of potential users of parks, are children, a demographic group that has been found to significantly benefit from access to green spaces ([Maas et al., 2009](#)). Children are also potentially more vulnerable to equity and environmental justice issues, due to their more limited independent geographical range, constrained as it is by their ability to traverse space using non-motorized modes of transportation. Thus, if inequalities due to accessibility differentials are at issue, the effect is likely more pronounced in the case of children.

In this paper, we investigate the accessibility situation of children with respect to urban parks. More specifically, we concentrate on minors between the ages of seven and sixteen. This range of ages is below the youngest age of majority in Canada (18 years), consistent with the age adopted by the United Nations Convention on the Rights of the Child, and at the limit for obtaining a driver license in many jurisdictions, including most provinces in Canada. Since accessibility is mediated by mobility, the research also focuses on walking as the mode of travel. Child/youth mobility is an emerging topic in transport geography ([Buliung, Sultana, & Faulkner, 2012](#)) spurred mainly by concerns over shifting rates of active travel among children and the rising rates of obesity in various parts of the world ([Buliung et al., 2012](#); [Cutts et al., 2009](#); [Potestio et al., 2009](#)). In this sense, walking as a form of transportation and accessibility to parks may be complementary ways to promote physical activity among children.

The case study is Montreal Island, in Quebec, Canada. For this research, the concept of accessibility is implemented as the cumulative opportunities available within a certain distance or travel time

from the perspective of users. A common characteristic of many of accessibility studies has been the use of place-based accessibility measures ([Kwan, 1998](#)). Popular implementations of accessibility in previous researches adopt a fixed distance from assumed origins and count the number of destinations that can be reached. [Talen and Anselin \(1998\)](#) calculated the average distance from all origins (zonal centroids) to destinations (parks). [Smoyer-Tomic, Hewko, and Hodgson \(2004\)](#) used a distance of 0.8 km, to conform to specifications by the local government regarding service provision. [Nicholls \(2001\)](#) also used a distance of 0.8 km as a reasonable threshold for walking trips (the threshold is not specific to a population group). [Tsou et al. \(2005\)](#) and [Van Herzele & Wiedemann \(2003\)](#), on the other hand, defined varying distances that depended on the type of facility (e.g. 1 km for playground, longer distances for municipal parks). However, within each class of facility the distance was fixed. An alternative approach is to calculate accessibility as the distance to the nearest facility (e.g. [Hewko et al., 2002](#); [Higgs et al., 2012](#); [Lotfi & Koohsari, 2009](#); [Talen & Anselin, 1998](#); [Zhang et al., 2011](#)). As discussed by [Paez, Scott, and Morency \(2012\)](#) these implementations of accessibility consider the spatial and/or physical characteristics of locations but are more limited in terms of accounting for observed variations in mobility between different users. A fixed distance or nearest distance to a facility may or may not correspond to the willingness to travel by different members of the public.

For the above reason, we opt for a positive implementation of accessibility, one that relies on revealed mobility preferences of children ([Paez et al., 2012](#)). Using data from Montreal's 2008 Household Travel Survey, we develop a statistical model of trip length that takes into account attributes such as age, gender, income class, family structure, as well as the geographical location of the place of residence. The model can be used to obtain estimates of walking trip length, which in turn are used to calculate accessibility to parks. We illustrate two different analytical approaches. First, we calculate accessibility using in-sample observations corresponding to children. These estimates of accessibility averaged at the level of zones provide information about levels of accessibility among the current population of children. And secondly, we examine two scenarios, where hypothetical individual profiles are explored to identify potential variations in accessibility due to socio-economic and demographic factors. This research contributes to the assessment of the distribution of access to urban parks by children, and can assist planners and policy makers to evaluate the supply of parks, in a way that is responsive to the mobility patterns of children.

## 2. Research context and data

### 2.1. Context

The World Health Organization (cited in [OECD, 2013](#)) recommends that cities provide a minimum of 9 m<sup>2</sup> of green area per inhabitant, assuming that green areas are designed so that residents live within a 15 min walk of an open space. This guideline aligns well with the use of distance to nearest facility in accessibility studies. However, it also highlights a limitation of the approach. Walking speeds between 0.9 and 1.5 m/s are considered normal for children aged 5–11 ([Chen, Kuo, & Andriacchi, 1997](#)), which implies a distance for a 15 min walk of between 810 and 1350 m. The average walking speed of adults lies at the upper range of the normal range for children, and thus implies even longer distances, and, other things being equal, greater accessibility for most travelers. With respect to the provision of green space, Montreal had 12 m<sup>2</sup> of green area per inhabitant in 2010, slightly above the guideline suggested by the World Health Organization. However, the

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