Equity Analysis of Children's Mobility and Safety in Montreal

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This research brief is one of a series of briefs that shares findings from research conducted as part of Mobilizing Justice's Theme 1, which aims to understand the experiences of people historically underserved by the transportation system.

SPOTLIGHT

Population(s) of focus	Children aged 8 to 12 years old
Mode(s) of focus	Active transportation mode, specifically pedestrian traffic
Geographic area of focus	Montreal, Canada
Community collaborator	City of Montreal, Green Communities of Canada

POLICY AND PRACTICE IMPLICATIONS OF THE RESEARCH

- **Safety Enhancements:** We developed a traffic hazard tool that can identify problem spots systematically. Integrating this traffic hazard tool with child population data and specific deprivation variables can help identify high-risk areas from both a traffic safety and equity perspective

- **Targeted Accessibility Improvements:** A key recommendation is to identify specific locations for interventions to address low accessibility, characterized by limited access to daily destinations within a defined walking distance threshold. This issue often arises due to traffic safety concerns, such as hazardous streets restricting mobility, or a lack of diverse and reachable destinations. Interventions would likely include traffic safety improvements and should assess opportunities available through the built environment such as access to a variety of destinations in their daily lives. The interventions should be designed to effectively target and mitigate the specific mobility barriers children face and include children's input on potential solutions.

- **Policy Revisions**: Urban planning policies should systematically incorporate children's mobility needs beyond simply trips to school by addressing the traffic hazard they are exposed to. This could be through introducing various traffic calming measures to reduce vehicle speeds and enhancing active transport infrastructure that includes children's independent travel in their design scope. Focus should go beyond simply trips to school as a child's life is not limited to school but should allow for diverse activities.

- **Community Engagement**: Children should be directly involved in the process. Their views and perspectives are not the same as adults, including their parents. As with other marginalized groups, we (adults) should assume that we can speak for them as we do not experience their reality. The result of this engagement could improve the effectiveness of mobility policies by ensuring that interventions, such as reduced speed limits, expanded pedestrian zones, and traffic calming measures, directly address children's needs and concerns. Additionally, it could lead to better accessibility-centered land use planning, ensuring that children's daily destinations are equitably distributed within safe and walkable distances, ultimately fostering a more inclusive and sustainable urban environment.

INTRODUCTION AND CONTEXT

The complexity of children's travel experiences presents significant challenges. Most transport surveys exclude children, requiring participants to be at least 15 years old, and often fail to address the specific travel needs of younger age groups. Additionally, children's travel, lacking a quantifiable "value-of-time," is traditionally undervalued in transport infrastructure cost-benefit analyses. Consequently, children, particularly those from low-income families, are marginalized in transport planning, which is predominantly tailored to adult needs. These practices exclude the most vulnerable users like children who depend on active transportation, raising significant equity concerns.

Children's independent mobility is frequently restricted by traffic dangers—both perceived and real—limiting their ability to travel without adult supervision. Despite the recognized risks, there is a lack of specialized tools to accurately assess traffic dangers faced by children. Moreover, the accessibility of children to necessary and desirable destinations is not only a matter of safety but also of proximity. Traditional accessibility measures often assume that all pedestrians can use any road or intersection, which does not hold true for children. Children travel to various destinations, driven by distinct needs for social interaction and physical activity. These destinations can be formal spaces like parks, playgrounds, and stores, but also informal areas such as sidewalks, the street in front of their house, and hidden nooks within urban environments that are generally overlooked in adult-centric planning.

This research seeks to address these gaps by developing targeted tools that better reflect the realities of children's mobility and by evaluating how well cities meet the needs of young residents across different neighborhoods. It explores the extent to which Montreal neighborhoods provide safe and equitable access to destinations for children between ages 8 to 12. To achieve this, we developed two tools: 1) a tool to estimate traffic danger and 2) a tool to estimate accessibility to child-relevant destinations.

RESEARCH OBJECTIVES

- Tool Development: Create validated tools for assessing traffic danger and measuring accessibility to child-relevant destinations.

- Equity Evaluation: Analyze how variations in traffic danger and accessibility correlate with socio-economic disparities and identify the most affected populations.

- Policy Impact: Provide actionable data to influence local and national policies towards creating safer, more inclusive urban environments for children.

METHODS

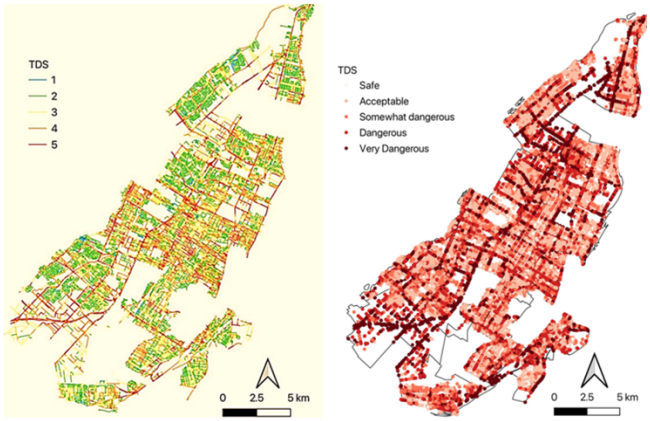
We utilized open-source data, including Canadian census data, data from the City of Montreal, and OpenStreetMap, combined with geospatial analysis to assess traffic danger and accessibility. Additionally, surveys and focus groups were conducted with children, parents, and experts to inform the development of our tools assessing traffic danger and accessibility.

Traffic Danger: We adopted the Multi-Criteria Decision Aiding method to measure the level of traffic hazard on street segments and at intersections in the study area. Focus groups with children, parents, and traffic safety experts provided insights into factors influencing traffic danger, which shaped the criteria for our traffic hazard score [1]. Levels for each criterion were established and evaluated for their impact on perceived danger. Traffic experts then assigned relative weights to these criteria. An aggregate score was calculated to estimate traffic hazard on road segments and intersections, complemented by visual representations using the City of Montreal's GIS dataset. We also analyzed the exposure of children to traffic hazard, considering socio-economic variables such as income levels and number of households with children to assess equity impacts.

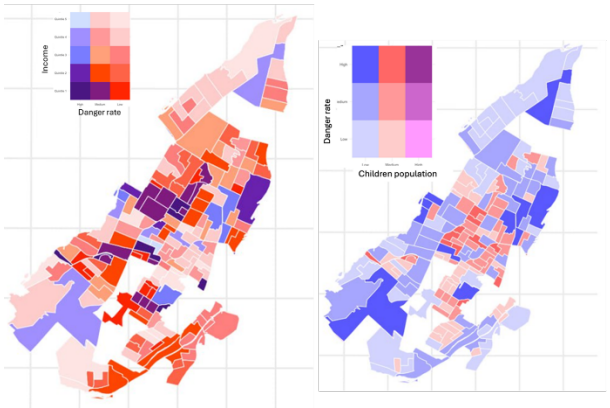
Accessibility: A systematic review identified child-relevant destinations [2], which was enhanced by feedback from focus groups [3]. Surveys were conducted with parents and children nationwide to further inform this list. Service areas were delineated based on a 1 km walking radius from key points, with two types of areas defined: one including all segments, and another after applying traffic danger scores. Children's walking accessibility scores were calculated based on the availability of seven categories of child-relevant destinations (including education, sports activities, leisure activities, green spaces, social and cultural places, commercial establishments, and public transport) within the service areas, using infrastructure deemed safe. Additionally, to examine the relationship between walking accessibility and income levels, we estimated the accessibility levels corresponding to each income group for each category of accessibility. This analysis also shows how integrating socio-demographic data improves the equity assessment of children's walking accessibility.

FINDINGS

a) **Children's Traffic Danger Index:** The equity analysis revealed specific areas with a high concentration of children exposed to significant traffic danger. It also highlighted socio-economic disparities, showing that children in poorer neighborhoods face greater risks. In addition, the traffic hazard tool assigns each street segment and intersection an index based on traffic risk, classifying them into five danger levels ranging from safe to very dangerous. The streets categorized as dangerous and very dangerous have been integrated into the accessibility tool as barriers, highlighting the obstacles children face in reaching their destinations safely.

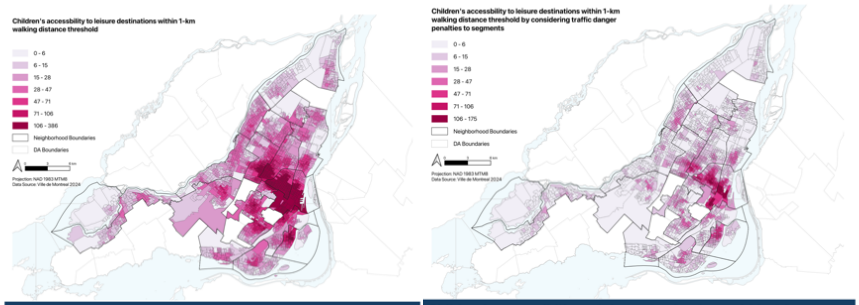


Traffic Hazard Index, a) street segment , b) Intersection



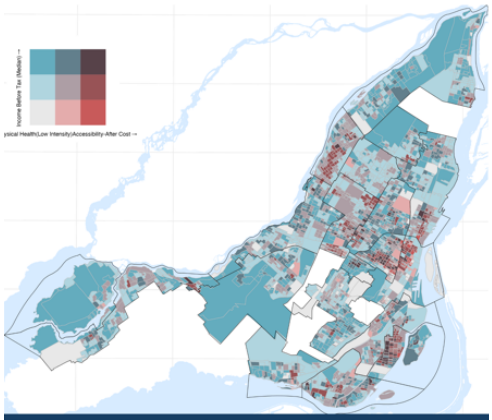
Equity analysis of Traffic hazard

b) **Children's Accessibility Measure**: The analysis calculated the distribution of child-relevant destinations accessible to children with and without applying traffic danger to each road segment. The results show traffic danger is estimated to reduce children's accessibility significantly. Also, children's accessibility is extremely limited in non-central areas. In terms of the relation of income and accessibility, in the case of Montreal, we found that children in lower-income households generally have higher accessibility on foot compared to children in higher-income quintiles. This may be due to the presence of older neighborhoods, built before current zoning laws and car-oriented development, which feature more apartments, and, potentially, lower property values (as the buildings are often much older).



Children's accessibility to leisure destinations within 1-km walking distance threshold before applying traffic danger penalties to the segments

Children's accessibility to leisure destinations within 1-km walking distance threshold after applying traffic danger penalties to the segments



Bivariate map of income and accessibility to the destinations after applying traffic danger

c) **Identifying Priority Locations for Interventions**: We employed a spatial framework integrating traffic danger, socio-demographic, and deprivation data to identify high-risk areas for children. This analysis helped pinpoint locations needing urgent safety enhancements. By examining the interplay between the number of children, household incomes, and local deprivation, we could understand variations in children's walking accessibility. The findings direct future efforts to improve both safety and access to essential daily destinations for children across the city.

WANT MORE INFORMATION?

- More information on the focus groups with children, parents and experts to identify factors contributing to traffic danger for children is available in is available in this article: *Understanding the Factors Affecting Traffic Danger for Children: Insights From Focus Group Discussions* [1]

- The impact of dangerous intersections on children's independent mobility is explored in Identifying the Influence of Dangerous Intersections in Measuring Accessibility for Children's Independent Mobility, A Case Study in Montreal, Canada [4]

- To understand how traffic danger influences children's accessibility, see Traffic Danger's Potential Impact on Children's Accessibility [5]

- Insights from focus groups with children, parents and experts into where children travel daily and how they navigate their environments can be found in "Where Do Children Go?": Exploring Children's Daily Destinations With Children, Parents, and Experts [3]

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