

**POPPING THE BUBBLE WRAP: EXAMINING CHILDREN'S INDEPENDENT
MOBILITY IN CANADA**

by

Negin Alivia Riazi

B.A., University of California, Davis, 2012

M.A., California State University, Chico, 2015

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The following individuals certify that they have read, and recommend to the Faculty of Graduate and Postdoctoral Studies for acceptance, the dissertation entitled:

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submitted by Negin Alivia Riazi in partial fulfillment of the requirements for

the degree of Doctor of Philosophy

in Kinesiology

Examining Committee:

Dr. Guy Faulkner, Faculty of Education, School of Kinesiology, UBC

Supervisor

Dr. Mariana Brussoni, Faculty of Medicine, Department of Pediatrics, UBC

Supervisory Committee Member

Dr. Patricia Vertinsky, Faculty of Education, School of Kinesiology, UBC

Supervisory Committee Member

Dr. Nicola Hodges, Faculty of Education, School of Kinesiology, UBC

University Examiner

Dr. Alex Bigazzi, Faculty of Applied Science, School of Community and Regional Planning, UBC

University Examiner

Abstract

Children's independent mobility is defined as a child's freedom to travel and play in their neighbourhood without adult supervision. While independent mobility is associated with a range of benefits there is also evidence that a number of children today have less independent mobility than previous generations. The purpose of this dissertation was to explore children's independent mobility and 1) identify and examine the social-ecological correlates of children's independent mobility and 2) explore the nuances of children's independent mobility from children's and parents' perspectives as a family unit. This multi-method dissertation adopted a social-ecological approach to examine children's independent mobility. Study 1 was a systematic review (n=43 articles included) examining the correlates of children's independent mobility in primarily Western, industrialized countries. This review identified significant correlates at every social-ecological level and highlighted that Canadian studies were geographically limited. Study 2 was a multi-site school-based study examining correlates of children's independent mobility across different sites in Canada (n=1699 participants). Independent mobility varied across study sites, but parental perceptions of safety and the environment were consistently associated with independent mobility. Study 3 was a qualitative study exploring children's and parents' perspectives of children's independent mobility within the family unit through face-to-face interviews (n=66 participants; n=22 families) across three neighbourhoods in the Greater Vancouver Area. This study highlighted key preconditions associated with helping children and their parents negotiate independent mobility including 1) parents' positive interpretation of their childhood experiences of independent mobility, 2) a positive appraisal of children's individual characteristics by both children and parents, 3) communication within the family unit, and 4) positive perceptions of the neighbourhood social environment. This dissertation builds on

existing literature, highlights the complexities of independent mobility, and provides supporting evidence for multi-level and multi-sectoral initiatives that are aimed at promoting children's independent mobility.

Lay Summary

Children's independent mobility refers to a child's freedom to travel and play in their neighbourhood without parental supervision. However, the decline in children's independent mobility is concerning, especially as independent mobility is known to be related to children's physical activity, active transportation, and outdoor play and helps foster children's physical, social, and cognitive benefits. The overall purpose of this dissertation was to explore children's independent mobility. Specifically, the aims were to 1) identify and examine the social-ecological factors of children's independent mobility and 2) explore children's independent mobility from children's and parents' perspectives as a family unit. This multi-method dissertation was guided by a social-ecological approach and shed light on the complex correlates of children's independent mobility. It highlighted the social environment as a key area of focus for future research and interventions, as well as emphasizing the need for multi-level and multi-sectoral initiatives in supporting children's independent mobility.

Preface

This dissertation is comprised of three original studies with details outlined below. One of the three studies is published.

Study 1 (Chapter 2): This study helped inform a book chapter and documentary.

- Riazi, N.A., & Faulkner, G. (2018). Children's independent mobility. In Larouche, R. (Ed.), *Children's active transportation* (pp. 77-91). Elsevier Inc.
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- No ethics approval necessary
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- Negin Riazi's contributions:
 - Co-designed study with supervisor Guy Faulkner
 - Lead database searches, data collection, analysis, and interpretation
 - Primary writer of manuscript
- Collaborator contributions:
 - Guy Faulkner co-designed study, helped with interpretation of data and findings, revised and approved the final version of manuscript
 - Mariana Brussoni and Patricia Vertinsky read and provided feedback on the final version of manuscript
 - Kelly Wunderlich and Lira Yun acted as independent secondary reviewers for screening of studies included in the review

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- Negin Riazi’s contributions:
 - Author of the ethics application
 - Research coordinator of the Vancouver site in this multi-site study
 - Formal analysis of data by Negin Riazi and Guy Faulkner
 - Primary author of manuscript (including original draft preparation, revisions, and editing)
- Co-author contributions:
 - Conceptualization of the initial study by Richard Larouche, Guy Faulkner, François Trudeau, Mark Tremblay
 - Sébastien Blanchette and Geneviève Leduc acted as research coordinators at other study sites
 - Supervisor Guy Faulkner revised and approved ethics application, helped with interpretation of data and analysis, contributed to revising and approving final version of manuscript
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- Negin Riazi’s contributions:
 - Led a portion of interviews in the State of Play study
 - Lead the analysis and interpretation of the qualitative interviews
 - Primary author of manuscript (including original draft preparation, revisions, and editing)

- Collaborator contributions:
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 - Guy Faulkner, Mariana Brussoni, and Patricia Vertinsky approved study design, provided feedback on iterations of manuscript, and approved final version of manuscript
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List of Abbreviations

GIS = geographical information system

IM = independent mobility

MVPA = moderate-to-vigorous physical activity

PA = physical activity

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For my family

May we continue to overcome life's challenges together

Chapter 1: Introduction

Children's independent mobility (IM) refers to a child's freedom to travel (and play) in their neighbourhood or city without adult supervision (Tranter & Whitelegg, 1994). It is the foundation that supports children's participation in physical activity (PA) through active travel to school and other destinations and outdoor play. However, evidence suggests that the amount of IM afforded to children has declined significantly over the last several generations (Hillman et al., 1990; Shaw et al., 2015). This is particularly concerning in light of global concern over children's physical inactivity (World Health Organization, 2020d) and obesity (World Health Organization, 2020a) and consequences for physical and mental health. The objective of this dissertation is to address this challenge by further informing this research area and identifying ways in which such declines can be reversed.

1.1 Physical (In)activity

PA is defined as 'any bodily movement produced by skeletal muscles that requires energy expenditure' (World Health Organization, 2020b, para. 1). The World Health Organization recommends that children and youth (5-17 years old) should accumulate at least 60 minutes of moderate-to-vigorous physical activity (MVPA) daily with muscle and bone strengthening activities incorporated at least three times a week (World Health Organization, 2020c). In Canada, the 24-Hour Movement Guidelines for Children and Youth (5-17 years old) recommend that children achieve at least 60 minutes of MVPA daily, with an additional several hours of light PA, uninterrupted sleep with consistent bed and wakeup times, and no more than two hours per day of recreational screen time (Tremblay et al., 2016). These guidelines highlight

the holistic and integrative nature of these movement behaviours (i.e. PA, sedentary behaviour, and sleep).

The World Health Organization has raised concern over global physical inactivity levels in children and youth (World Health Organization, 2020d). Sufficient levels of PA are critical for children and youth and the associated health benefits have been well documented (Janssen & LeBlanc, 2010). Recent evidence highlights that greater levels of PA are associated with improved cardiovascular health (e.g., arterial stiffness, maximal oxygen uptake), bone health (e.g., bone mineral density), improved adiposity (e.g., fat mass, body mass index), as well as positive associations with brain health and cognitive development (Carson et al., 2016; Colley et al., 2019; Janssen & LeBlanc, 2010; Poitras et al., 2016; Saunders et al., 2016; Tremblay et al., 2010). Sufficient levels of PA may also provide mental health benefits, including lowering rates of depression and anxiety, improved self-esteem, and increased academic performance (Biddle & Asare, 2011; Poitras et al., 2016). Lee and colleagues (2012) quantified the effect of physical inactivity on major noncommunicable diseases worldwide, finding that PA caused 6-10% of major noncommunicable diseases including type-2 diabetes, coronary heart disease, and breast and colon cancers with physical inactivity causes 9% of premature mortality globally (Lee et al., 2012). There are clear benefits to children and youth being physically active, emphasizing the importance of meeting the guidelines.

Globally, a large proportion of children are not engaging in adequate levels of MVPA (Janssen et al., 2005). Although, limited intervention studies have focused on low- and middle-income countries which may face greater challenges in relation to insufficient health policies and socioeconomic inequalities (Barbosa Filho et al., 2016). The Global Matrix 3.0, a comprehensive assessment of children and youth PA worldwide, presents variation in PA grades with children in

non-Western countries (such as Zimbabwe, Ghana, Nigeria, and Bangladesh) scoring a grade higher for overall PA than children in Western countries (Aubert et al., 2018). Furthermore, the global status report by the World Health Organization examining progress and prevention and control of noncommunicable diseases globally, has found this trend of physical inactivity also present in adults, where worldwide a quarter of adults are not meeting PA recommendations (World Health Organization, 2014, 2019b).

Colley and colleagues examined PA levels in Canada over a 9-year period (2007-2015) using accelerometry and found the majority of children (6-17 years old) were not meeting PA recommendations (Colley et al., 2017). Only 7% of children and youth accrued 60 minutes of MVPA on 6 out of 7 days per week, and 33% accumulated a weekly average of at least 60 minutes daily. Moreover, this study highlighted the low levels of PA and the lack of major change in children and youth's PA levels over nearly a decade. Colley and colleagues' study found that boys were more physically active than girls, and that younger children (6-11 years old) accumulated more moderate-to-vigorous PA than older children (12-17 years old) (Colley et al., 2017). Similar trends are seen in numerous countries, with insufficient PA levels seen in children and adolescents, with boys typically accumulating more PA compared to girls (Active Healthy Kids Global Alliance, 2018b; Guthold et al., 2020).

Additionally, there is concern over sedentary behaviours ('any waking behaviour characterized by an energy expenditure ≤ 1.5 METs while in a sitting or reclining posture') (Tremblay et al., 2017, p. 2), which may also be a contributor to declining children's PA levels. Canadian 24-Hour Movement Behaviour Guidelines for Children and Youth (5-17 years old) recommend that children and youth engage in no more than 2 hours of recreational screen time daily (Tremblay et al., 2016). With the increased use of technology during leisure time activities,

such as screen-based activities (e.g., video games, smart phones, tablets), sedentary behavior has increased (Mullan, 2019). A study using data from Canada's 1994 National Longitudinal Survey of Children and Youth found that sedentary behaviours like video game use and television viewership were risk factors for children being overweight or obese (Tremblay & Willms, 2003). In the *2020 ParticipACTION Report Card on Physical Activity for Children and Youth*, children in Canada received a 'D+' for the 'Sedentary Behaviour' category which indicated that only 38% of 5 to 17-year-olds were meeting this age-specific benchmark for screen time recommendations (ParticipACTION, 2020). Of concern is the increasing time spent on screens as children get older (1.9 hours per day for 5-11-year-olds; 3.8 hours per day for 12-17-year-olds) (ParticipACTION, 2020). As suggested by the Canadian 24-Hour Movement Guidelines, movement behaviours exist on a continuum from little to no movement (e.g., sleep) to lots of activity (e.g., PA), and there is an interplay between these movement behaviours (Tremblay et al., 2016). For example, more time spent on indoor screen-based activities can leave less time for outdoor activities. A review found that PA significantly tracks over all life phases (childhood to adolescence to adulthood), which supports the idea that PA habits developed early on in childhood and adolescence may be extremely important from a public health standpoint (Telama, 2009). High obesity rates, low PA levels, and a shift toward more sedentary behaviours, highlights a need to explore different avenues to help children achieve the recommended levels of PA.

1.2 Children's Independent Mobility in Current Literature

PA has a number of important physical and mental health benefits for children and youth. However, low numbers of children in Canada and in many countries across the world are accumulating sufficient PA levels. There is a need for research and policy to support a 'healthier

world' broadly, and more specifically, a need to help children and youth maintain healthy levels of PA. Children's IM may be a useful domain to support children in accumulating recommended levels of PA, as well as augmenting their cognitive, social, and emotional development (Riazi & Faulkner, 2018; Shaw et al., 2015).

Children's IM can refer to active modes of travel (e.g., cycling, walking, scootering, etc.) or other forms of transportation (e.g., public transit, bus). It can occur when the child travels alone or with a peer (e.g., friend(s), sibling(s)) to a variety of destinations (e.g., school, parks, shops, playground) at various ranges (e.g., within their immediate neighbourhood, in their city). It has been defined in a variety of ways, including being commonly operationalized as, IM 'licenses.' These licenses, 'issued' by parents to their children, reflect parental views concerning their children's maturity and competence that they deem necessary for children to navigate their neighbourhoods safely (Hillman et al., 1990). In one operationalization, six licenses have been used to assess children's IM and include a child's allowance to independently 1) cross main roads, 2) go to places other than school, 3) come home from school, 4) go out after dark, 5) travel on local bus, and 6) cycle on main roads (Hillman et al., 1990; Shaw et al., 2015). Alternatively, IM has been assessed via 'range' – actual territorial range or distance a child can travel from home without adult supervision (Cordovil et al., 2015; Loo & Lam, 2015). It has also been assessed by 'destinations' – whether children could independently travel to various local destinations and how often (Page et al., 2009; Villanueva et al., 2012). Finally, 'time' has been used to indicate the amount of time a child can spend outside their home without adult supervision (Marzi & Reimers, 2018). Children's IM can encompass travel (e.g., to and from a destination like a park) and play participation (e.g., outdoor, independent play).

Children's IM represents a key area of study that may lead to positive health outcomes of children. Research on IM has the potential to help influence public policies that can support independent mobility, active transportation, and outdoor play. While the literature on children's IM has grown, few studies have been conducted in Canada and those studies have limited geographic variability (Buliung et al., 2017; Larsen et al., 2015; Mitra et al., 2014; Vlaar et al., 2019).

1.2.1 Benefits of Children's Independent Mobility

IM may provide children with a number of benefits. Firstly, it may be a key facilitator of PA. Research has found that children with high levels of IM tend to be more physically active (Mackett et al., 2007; Page et al., 2009; Schoeppe et al., 2013). IM provides children with greater opportunities to be active in the local environment. For example, traveling to local parks with friends allows children the opportunity to be physically active on the journey to-and-from the park as well as engage in PA at the park.

Besides the positive influence on PA levels, IM may provide further benefits for children's cognitive, social, and emotional development. Rissotto and Tonucci's study examined children's autonomy and its influence in the acquisition of environmental knowledge through mapping activities and found that children with greater freedom of movement have better environmental knowledge and spatial mapping skills (Rissotto & Tonucci, 2002). IM may also provide important opportunities for children to interact with their environment and the people in that environment. One study highlighted that children with higher levels of IM had more chances to socialize with their peers both indoors and outdoors (Prezza et al., 2001) and could help in building friendships, lessening fear of crime, and enhancing a sense of community (Prezza &

Pacilli, 2007). Children independently traversing their neighbourhoods have opportunities to hone their decision-making and problem-solving skills without defaulting to an adult figure, practice traffic and cycling safety, as well as learn about their neighbourhoods and community (Kegerreis, 1993; Tranter & Whitelegg, 1994). Children's freedom to travel in their neighbourhood independently may also be important for developing a sense of belonging to that neighbourhood (Engwicht, 1992 as cited in Tranter & Whitelegg, 1994). Additionally, it may play a vital role in children's active transportation (Larouche, 2018b) and outdoor play (Veitch et al., 2008).

1.2.2 Generational Decline in Children's Independent Mobility

Although children's IM is associated with many benefits, there has been a dramatic decline in IM levels worldwide since the beginning of the twentieth century. A study examining children's use of public space over the span of three generations (1915-1976) found that the age at which children were allowed outdoors without adult supervision increased, as did the number of professionally supervised activities (Gaster, 1991). Hillman and colleagues' (1990) notable study examined children's IM levels in 1971 and again in 1990 in England. A questionnaire administered at two time points showed that the percentage of 7 to 8-year-old children traveling to school by themselves or with their friends dropped from 80% in 1971 to 9% in 1990 (Hillman et al., 1990). Hillman and colleagues' (1990) study also highlighted differences between children in England and Germany. Since 1971, there has been an increase in number of escorted children (typically by car) in both countries. However, children in Britain had considerably less IM compared to children in Germany in 1990. These stark differences in IM levels over time and

between these countries may be partly attributed to social, cultural, and economic changes and differences (Hillman et al., 1990).

These declines in children's IM are seen in many developed countries such as the United States, New Zealand (Freeman & Tranter, 2011), Italy (Rissotto & Tonucci, 2002), and Germany (Shaw et al., 2013). One Australian study compared children's travel mode to and from school between 1971 and 2003 and found that over time children's travel mode shifted from active (walking) to inactive (car) mode (van der Ploeg et al., 2008). Specifically, the percentage of children (5-9 years of age) that walked to school dropped from 57.7% (1971) to 25.5% (2003) while the percentage of children driven to school increased from 22.8% (1971) to 66.6% (2003) over the course of four decades (van der Ploeg et al., 2008). Even Scandinavian countries (e.g., Finland, Denmark, Norway) that exhibit higher levels of IM compared to other countries, have seen a decline in levels of IM (Shaw et al., 2015).

An updated report by Shaw and colleagues (2013) since Hillman's *One False Move*, examined children's IM levels in England since 1971 until 2010, finding that overall IM had declined in school children and accompaniment of children increased on the route to school (64% in 1971 to 77% in 2010) and on journeys to other destinations (41% in 1971 to 62% in 2010) (Shaw et al., 2015). Similar trends were seen in Germany, with children being accompanied by an adult more (9% in 1990 to 33% in 2010) and fewer primary school children walking home from school (83% to 61% from 1990 to 2010) and more being driven (12% in 1990 to 30% in 2010) (Shaw et al., 2013). In short, many countries have witnessed a decline in levels of children's IM as well as a shift away from active modes of travel (e.g., walking, cycling) toward more passive modes of transportation (e.g. child being driven).

1.2.3 Active Transportation

Children's IM may help provide more opportunities and flexibility for them to engage in active transportation. Active transportation encompasses walking, cycling, and other types of 'rolling' (e.g., scootering) to and from various destinations (Voss, 2018). Active transportation also incorporates PA – children who engage in walking and cycling accumulate more moderate-to-vigorous PA (Larouche et al., 2014). Studies have highlighted that when given a choice, many children prefer walking or cycling to school, compared to being driven (Larouche et al., 2016). This may arise from children's generally positive perceptions of walking and cycling including viewing them as environmentally beneficial or as convenient modes of transport, especially in younger children compared to older children and parents (Lorenc et al., 2008), and a desire to travel independently within public space (Mitchell et al., 2018). Another study found that adolescents who engaged in more than 15 minutes per day of active commuting reported higher levels of happiness, psychological well-being, and decreased psychological stress (Ruiz-Ariza et al., 2015).

Active transportation affords children the opportunity to explore their neighbourhoods. In a study by Fusco and colleagues (2012), researchers examined how children experienced the transport and built environment relationship through use of photovoice interviews. Children who actively traveled to school demonstrated a 'micro-focus' on the environment and attention to detail in their photographs along with more pictures of natural (e.g., gardens, trees) and built environment features (sidewalks, roads), which were absent in children who did not travel actively in the environment (Fusco et al., 2012). Children actively traveling in their neighbourhoods can gain more familiarity with their environments. There is increased exposure to the natural, built, and social environment that children are not exposed to when traveling in a

car. Chauffeured children develop a limited awareness of the environment – limited to the destination they are driven to and from (Mitchell et al., 2007). Children who actively travel to school have greater opportunities for social interaction, as well as environmental exploration (Mitchell et al., 2007). Additionally, Fusco and colleagues' findings emphasize that children's understandings and perceptions of their environment are 'sophisticated' and 'unique' (Fusco et al., 2012, p. 68) and children who are chauffeured may be 'seeing more' but are 'learning less' as passive passengers (Mitchell et al., 2007, p. 616).

Over the last several decades children's active transportation has declined. Several factors may be responsible for these observed declines including increasing distances between the home and the child's school, perceived convenience of driving children to school, perceptions of traffic and crime, and declining levels of children's IM (Larouche, 2018b). This decline in children's active transportation is evident in many countries. For example, the US National Household Travel Survey reported that 47.7% of children (grades K-8) walked or cycled to school in 1969 versus 12.7% of children in 2009 (McDonald et al., 2011). Since the 1940s in Britain, there have been observed decreases in the proportion of children walking alone and increases in children being driven to school by adults (Pooley et al., 2005). The percentage of children (5-10 years old) walking to school dropped from 73.5% in 1975 to 54.0% in 2001 (Pooley et al., 2005). In Denmark, the percentage of walking trips dropped by 40% between 1978 and 2000 (Fotel & Thomsen, 2004). In Canada, a report examining active transportation levels in the Greater Toronto and Hamilton Area found that the percentage of children (11-13 years old) walking to school dropped from 55.5% in 1986 to 39.0% in 2011 (Metrolinx, 2018).

A number of factors influence children's active transportation to school. A study in New Zealand highlighted that proximity to school, younger age, fewer vehicles in the household,

social interaction (i.e. chatting with friends), and student-reported parental perceptions of active school transportation safety were all positively associated with adolescents' active transportation to school (Mandic et al., 2015). Additionally, other individual (e.g., child age, gender, ethnicity), interpersonal (e.g., parents influence), community (e.g., social norms), and built and physical environment (e.g., sidewalks, cycle paths, weather), and policy factors (e.g., regional, national policies) were found to influence children's active transportation (Larouche & Ghekiere, 2018). Importantly, children with higher levels of IM are more likely to engage in active transportation (Schoeppe et al., 2013).

Increasing distances to destinations (e.g., schools) are likely to play a part in declining active transportation and IM. For example, McDonald et al. (2011) highlighted that children living within ¼ mile from schools were 14 times more likely to walk to school compared to children living further away (1-2 miles) (McDonald et al., 2011) and found that while 48% of children living within 1.6 km of school engaged in active transportation, only 3% of children walked to school if living further than 1.6 km (McDonald, 2008). Factors that could influence these greater distances on the home-school journey may include family school choice (e.g., specialized school, school outside catchment zone), school choice policies (e.g., more supportive policies for children traveling further to attend school; school zoning), school siting guidelines (e.g., policies regarding where new schools are built), and closure of small schools (Larouche, 2018b). Increasing distances to various desired destinations have been found to be negatively associated with not only active transportation, (Larouche, 2018b), but also children's IM (Shaw et al., 2015). Consistent with this, Pooley and colleagues have found that in England, both children's IM and active transportation have declined in parallel (Pooley et al., 2005).

1.2.4 Outdoor Play

Children's IM may also help facilitate children's outdoor play by providing opportunities to be outside without parental supervision and travel to various destinations for play (e.g., local playground, basketball court, green space). Outdoor play describes 'child-organized and initiated spontaneous and voluntary activities that take place outdoors' (Lee et al., 2015), and more specifically, active outdoor play describes 'any form of unstructured PA participation' (Houser et al., 2016). IM grants children the opportunity to engage in outdoor play independently or with peers.

Access to the outdoors allows children the opportunity to gain a series of benefits. Active outdoor play allows children to accumulate PA, develop motor and social skills, and decreases the risk of severe childhood obesity (Hinkley et al., 2018; ParticipACTION, 2020; Porter et al., 2018). In an examination of children's (7-14 years old) outdoor time and measures of PA, Larouche and colleagues found that each additional hour Canadian children spent outdoors was associated with 7 more minutes of moderate-to-vigorous PA, 762 more steps and 13 fewer minutes engaged in sedentary behaviour (Larouche et al., 2016). Supporting these findings, a systematic review by Gray and colleagues found that outdoor time had overall positive effects on PA, sedentary behaviour, as well as cardiorespiratory fitness (Gray et al., 2015).

Play can have other benefits for children including the opportunity for children to learn about societal roles, norms, and values, as well as hone their creativity and efficacy (Brussoni et al., 2012; Milteer et al., 2012). Specifically, outdoor play increases children's opportunities to interact with nature and the natural environment, which provide positive benefits for children. Children's exposure to nature may be protective for children's mental health (Piccininni et al., 2018). Piccininni and colleagues used data from the 2013/2014 cycle of the Canadian health

Behaviour in School-aged Children study to examine associations between outdoor play and perceived importance of nature connectedness related to psychosomatic symptoms (an indicator of mental health) and found that greater than 0.5 hours weekly of outdoor play was associated with a 24% reduction in prevalence of psychosomatic symptoms among females (e.g., depression, irritability, nervousness, and difficulty sleeping) and valuing connection to nature as ‘somewhat important’ or ‘important’ was also associated with lower prevalence of psychosomatic symptoms for males and females (Piccininni et al., 2018). Further evidence suggests that besides benefits of PA, outdoor play can provide important opportunities for children’s improved attention, motor skills, communication, and social development in children (Kemple et al., 2016; O’Brien & Murray, 2007; White, 2011).

Similar to children’s IM and active transportation, frequency of engagement in outdoor play has seen a decline over the last several generations (Mullan, 2019). A recent UNICEF Canada report found that only 20.8% of children (5-11 years old) engaged in 1.5 hours per day of active play (UNICEF Canada, 2019). Recently, the 2020 ParticipACTION Report Card reported that Canadian children received an ‘F’ in the ‘Active Play’ category, which dropped from a ‘D’ in 2018. Also highlighted was a steady decrease in time spent outdoors as children entered adolescence (from 2.1 hours per day for 5 to 6 years-olds to 1.7 hours per day for 12 to 14-year-olds) (ParticipACTION, 2020). Reflecting a generational decline, Valentine and McKenrick found that parents’ own accounts of their childhoods highlight higher levels of outdoor play in the parents’ childhood compared to their children the same age (Valentine & McKendrick, 1997) reinforcing the downward trend in outdoor play from parents’ to their children’s generation. Parental and societal social norms may play a crucial role in influencing parental decisions around granting more outdoor play. This may be particularly important with increased parental

concerns about children's safety with regard to traffic and stranger danger. These concerns likely have an influence on providing opportunities for outdoor play (Carver et al., 2008; Malone, 2007; Valentine, 1997a).

Additionally, parents may be key gatekeepers to limiting or promoting their child's outdoor play. Veitch and colleagues examined children's access to locations where children could engage in active free play and concluded that low levels of children's IM may limit children's opportunity to engage in active free play (Veitch et al., 2008). Another Australian study found that while most children preferred to engage in outdoor activities at a variety of locations (e.g., bush, parks, beach), a major limiting factor was parents' restrictions on roaming range (Tandy, 1999). For example, although more than 90% of the children in the sample reported having a bicycle, the percentage who could actually ride their bikes without adult supervision was much less (50.7% for females; 67.2% for males) (Tandy, 1999).

1.2.5 Children's Independent Mobility, Active Transportation, Outdoor Play, Physical Activity Connections

Children's IM appears to be a foundation for children's active transportation and outdoor play granting children more opportunities to be outside in their neighbourhood. Consequently, children have a chance to engage in active transportation when traveling from their home to a friend's house, to the local community centre, or to nearby shops. They can engage in outdoor play, whether that be at the local park or biking with friends in the neighbourhood. With the opportunity to travel and play outdoors independently, children consequently are more active and accumulate greater amounts of PA. IM may be an important avenue for integrating PA, active transportation, and outdoor play into children's lives.

1.3 Conceptualization of Children’s Independent Mobility

In April 2017, a Vancouver father was faulted for letting four of his children (ages 11, 9, 8, and 7 years at the time) take public transit to school. Over the course of two years, the father, Adrian Crook, taught his children how to safely take public transit from their condo in downtown Vancouver to their school. From riding with them on the bus for the entire trip, to the children riding independently for a portion of it, to finally riding public transit by themselves. The children took a 45-minute bus ride from the stop in front of their condominium to a stop directly in front of their school, equipped with GPS-tracked cell phones (Crook, 2017). However, a call made to the Ministry of Children and Family Development put an end to these independent public transit trips for the children as the Ministry opened an investigation into the matter (Kassam, 2017). The Ministry made the decision that ‘until the children are 10 years old, they cannot be unsupervised in the community, at home, or on transit’ (Crook, 2018). The father explained that, ‘The number one thing is to make my kids into independent, confident humans who can navigate their own way in the city’ (Kassam, 2017). He filed a petition in the British Columbia Supreme Court. The decision from the court came back, barring Crook from letting his children take the bus to school unsupervised. The Vancouver father appealed the decision (Little, 2020).

The aforementioned case study highlights the complexities of children’s IM. Not only were individual characteristics of the children (i.e. age, child’s skills and abilities) brought into question, but this case also highlights a series of other levels of influence including parent-level factors (e.g., father’s parenting), social environment-level factors (e.g., children traveling alone viewed as dangerous), and policy-level factors (e.g., at what age a child can be unsupervised). Due to these various levels and the interactions between them, it is vital to examine children’s IM through a social-ecological lens, which acknowledges the interplay of different levels of influence.

1.3.1 Social-Ecological Framework of Health Behaviour

Although health promotion initiatives first began focusing solely on individual determinants of health behavior (e.g., individual lifestyles), during the 1980s, more social and

policy views were incorporated (Rootman et al., 2017). Since then, health promotion initiatives have evolved to take a more comprehensive approach involving and encompassing multiple levels (Rootman & O'Neill, 2012). Broadly, ecological models highlight people's interactions with their surroundings, which encompass physical and sociocultural environments (Stokols, 1992). Professor Urie Bronfenbrenner first proposed an ecological approach to human development in the 1970s, highlighting the concept of the 'developing person,' 'the environment,' and 'the evolving interaction between the two' (Bronfenbrenner, 1979, p. 3). A key tenet of this ecological orientation is that there is continued development and evolution between the person and their environment, and this relationship is influenced by the larger physical and social environments (Bronfenbrenner, 1979). In this model, the environmental influences are divided into various levels of influence including *micro-* (e.g., interactions among individuals in specific settings like families or work groups), *meso-* (e.g., the interrelations of the settings where an individual interacts like school), *exo-* (e.g., the larger social system in which the individual is located), and *macro-*system (e.g., cultural beliefs and values which can consequently influence the *micro-* and *meso-*system) (Bronfenbrenner, 1979; McLeroy et al., 2016; Sallis et al., 2015). One limitation of early ecological models is that the physical and social environment are collapsed as a single level of influence which consequently makes it difficult to identify which components within this level, be it physical and/or social, would be appropriate targets for health interventions. McLeroy (1988) developed a version of an ecological model that identified five sources of influence on health behaviours including intrapersonal (e.g., individual characteristics, such as attitudes and skills), interpersonal (e.g., formal and informal social network such as family and friends), institutional (social institutions with organizational characteristics with rules and regulations for operation such as the workplace), community (e.g.,

relationships between informal networks, organizations and institutions such as neighbourhoods, local schools, and cities), and public policy factors (e.g., local, state, national laws and policies)(McLeroy et al., 2016; Sallis et al., 2015), which further separated out the multiple levels of influence.

Previously, health promotion programs focused on individual behaviour change (e.g., changing diet, exercise), but failed to consider resources or modifying environmental components (e.g., design of stairways) to facilitate those changes (Stokols, 1992). Ecological models highlight that multiple factors influence a health behaviour and acknowledge the complexity of interactions. Stokols (1992) further built on an ecological approach by developing an ecological analysis health promotion focus on health promotive environments and encompassing the social ecological perspective (e.g., social, cultural context). Several assumptions underlay this social-ecological perspective including (Stokols, 1992):

- 1) the wellbeing of people is influenced by multiple facets of the physical and social environments as well as individual-level factors;
- 2) the multidimensional aspects and complexity of people's environments (both actual and perceived qualities) must be acknowledged when examining or analyzing health and health promotion;
- 3) individuals within these complex environments can be studied at different levels starting at the individual and moving outward to encompass small groups, organization, to populations;
- 4) the interrelations between individuals and their environments are 'cycles of mutual influence' where the physical and social environment can influence individuals' health and individuals' can modify the 'healthfulness' of their surroundings

Broadly, a social-ecological approach focuses on the interplay of different levels of influence and individuals' interactions with their physical and sociocultural environments (Stokols, 1992) and allows for a comprehensive approach to health behaviour change considering individual, social, environmental, and policy factors in the equation (Sallis et al., 2015). Some social-ecological models are specifically designed to target specific categories of behaviours (e.g., Flay & Petraitis, 1994), while others have been developed to apply to a number of health behaviours (McLeroy et al., 2016; Sallis et al., 2015; Stokols, 1992).

Several underlying principles for understanding social-ecological perspectives have been proposed (Sallis et al., 2015). These include that 1) health behaviour is influenced by multiple levels, 2) these influences can interact across levels, 3) behaviour change interventions should be more effective when they encompass multiple levels of influence, and 4) ecological models are most useful when tailored for a specific behaviour. For example, if one hopes to increase active transportation (e.g., walking and cycling) in the city, it may be necessary to increase individual's knowledge of active transportation benefits (e.g., PA, better for the environment), create protected cycling lanes or more sidewalks, which in turn may influence individuals' sense of safety to engage in walking and cycling, and additionally, and develop city policies that lower the speed of cars or update regulations on safe crosswalks (e.g., crosswalks with blinking lights).

1.3.2 Social-Ecological Framework in this Dissertation

Identifying the factors that influence a health behaviour is a key step toward being able to change that behaviour. It is an important step in addressing children's generational loss of freedom to explore their local neighbourhoods and more broadly, their physical and social environments (Hillman et al., 1990). The social-ecological framework for this dissertation

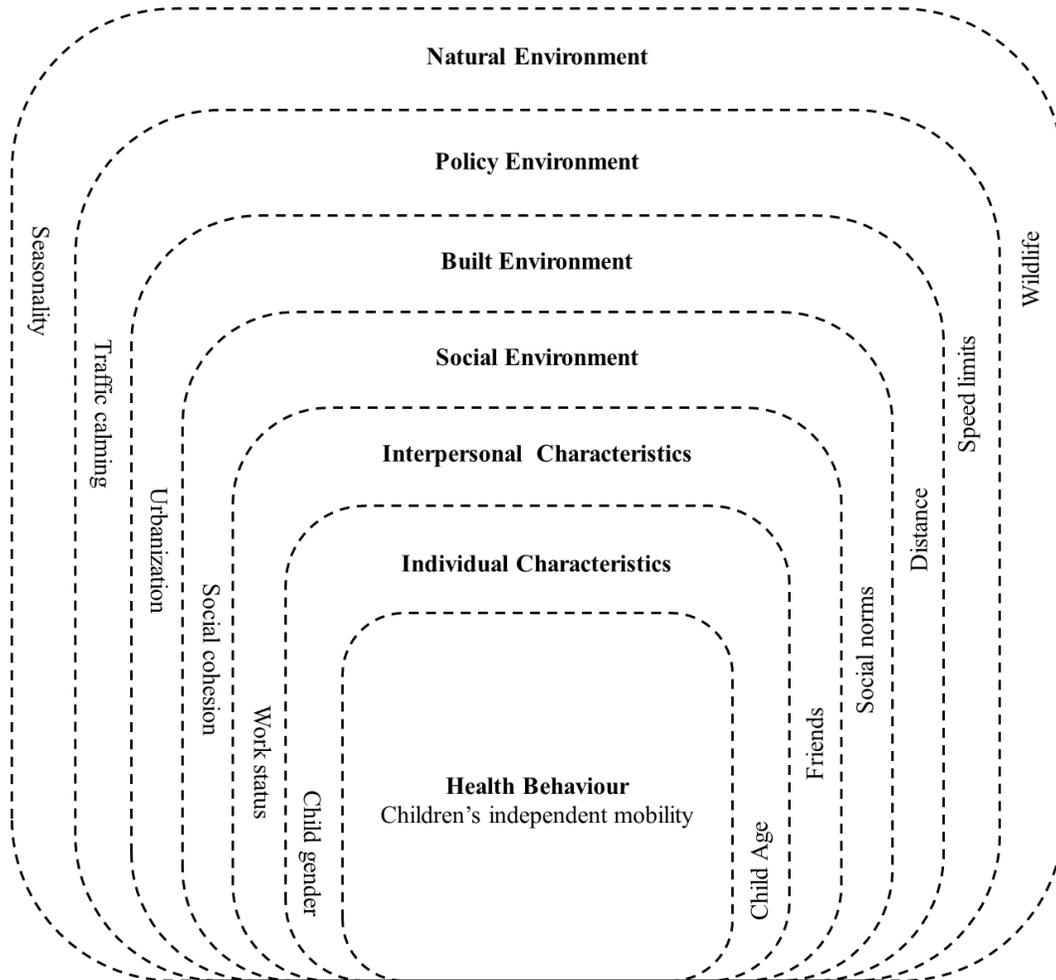
encompasses the models outlined by Stokols (Stokols, 1992, 1996) and McLeroy (McLeroy et al., 2016) applied to children's IM. Figure 1.1 presents my adaptation of a social-ecological framework for children's IM. This framework was adapted from Larouche and Ghekiere (2018) and Özdemir (2013). It acknowledges that there are multiple levels of influence on an individual's behaviour (i.e. children's IM). It includes the individual level (e.g., child age, child gender, ethnicity) and interpersonal level (e.g., family/household level factors like household income, parent age). The community level and social environment level are combined under the heading of social environment (e.g., encompassing parental perceptions of safety, social cohesion, social norms). The social environment can be defined as 'the immediate physical or social setting in which people live or in which something happens or develops. It includes the culture that the individual was educated or lives in, and the people and institutions with whom they interact' (Barnett & Casper, 2001, p. 465). Next, the built environment level encompassed features like cycling paths, green spaces, and distances to destinations. The built environment can broadly be defined as including 'land use patterns, the transportation system, and design features that together provide opportunities for travel and PA. Land use patterns refer to the spatial distribution of human activities. The transportation system refers to the physical infrastructure and services that provide the spatial links or connectivity among activities. Design refers to the aesthetic, physical, and functional qualities of the built environment, such as the design of buildings and streetscapes, and relates to both land use patterns and the transportation system' (Transportation Research Board & Institute of Medicine, 2005, p. xiii). The policy level (e.g., policies supporting independent mobility at the local, provincial, and national levels) (Larouche & Ghekiere, 2018) and natural environment (Özdemir, 2013) (e.g., harsh weather conditions, hours of daylight, topography) were also included. The natural environment is

broadly defined as the ‘environment, place, or setting where vegetation and other natural elements (such as water)’ are present (Steg et al., 2018, p. 58) and ‘...not a product of human activity or intervention...It deals with landscape rather than with the built environment’ (Altman & Wohlwill, 2012, p. 7) (e.g., topography, climate, wildlife). The policy and the natural environment levels were included in the figure as they can positively or negatively impact other aforementioned levels. For example, harsh weather may impact the built environment (e.g., icy roads, smoke from fires impact air quality), supportive policies may have a positive impact on social norms, and presence of wildlife (e.g., bears) may impact parents and children’s perceptions of safety.

Additionally, it is acknowledged that the environment encompasses multiple dimensions and these include not only objective (e.g., actual) characteristics, but subjective (e.g., perceived), social, and physical characteristics as well. For example, while a neighbourhood may have traffic calming measures that can be objectively identified, perceptions that traffic is too fast may undermine the intended purpose of traffic calming to increase safety in the neighbourhood. Additionally, it is acknowledged that people interact with their environment at and across these various levels and these interactions could be reciprocal and cyclical. For instance, if parents have concerns about allowing their children to independently travel in the neighbourhood due to traffic concerns, and the city works to implement a number of crosswalks with blinking lights and lower the speed limit around the neighbourhood, these changes to the environment may then act to influence parents’ perceptions of safety, and thus their allowances for children’s independent travel. This social-ecological framework was applied throughout this dissertation to identify and categorize correlates of children’s IM as well as broadly structure and develop

conceptual understandings of the results. A thorough discussion of the correlates will be provided in the systematic review reported in Chapter 2. Broader influences worth considering will now be discussed.

Figure 1.1 Social-ecological framework for correlates of children's independent mobility



1.4 Trends and Shifting Social Norms in Children's Independent Mobility

The following subsections describes several broad shifts in social norms (e.g., rising car culture, culture of fear) that may have impacted levels of children's IM.

1.4.1 A ‘Car Culture’

Instead of traveling to school on their own or with their peers, children are more often accompanied to school by their parent(s), who tend to choose the most convenient mode of transportation. Often, parents and older children view car travel as the ‘easiest and most convenient way’ to travel (Faulkner et al., 2010; Lorenc et al., 2008) and save time (McDonald & Aalborg, 2009). As one systematic review found, there is a rising ‘culture of car use’ where cars are seen as the most convenient mode of transportation, perceptions that cars are ‘cool’, and an essential part of a ‘normal adult lifestyle’ (Lorenc et al., 2008). Car ownership and use have increased and this increase has been negatively associated with children’s IM (He & Giuliano, 2017; Mammen et al., 2012; Shaw et al., 2015).

This trend in rising car usage is seen in various countries across the globe. In the United States, the US National Household Travel Survey found that the percentage of children being driven to school has jumped from 12.2% in 1969 to 45.3% in 2009 (McDonald et al., 2011). Similarly, from 1993 to 2000, car journeys for Danish children (6-10 years old) have doubled and car journeys for children 11-15 years have tripled (Fotel & Thomsen, 2004). In Britain, the percentage of children (5-10 years old) traveling by car more than doubled from 15.0% and 39.0% between 1975 to 1999/2001 (Pooley et al., 2005). Data from the Transportation Tomorrow Survey in Canada found that in the Greater Toronto and Hamilton Area between 1986 and 2011, the percentage of 11-13 years-olds being driven to school nearly tripled (11.6% to 30.8%) (Metrolinx, 2018).

With the prevalence of car ownership and use, there have also been increases in distances between home, school, and work locations, whereas in the pre-car era distances tended to be shorter (Tranter & Whitelegg, 1994). Additionally, distances to destinations may ultimately

impact children's IM and travel mode. For example, the removal of school zoning policies (which allow children to attend schools that may be further away) can impact distance to school and consequently, mode of travel (e.g., active travel vs being driven). Schools that are further away ('magnet schools') tend to have lower rates of walking and cycling compared to nearby schools ('neighbourhood schools') (Wilson et al., 2010). Mandic and colleagues found that adolescents who attended the school closest to them had three times higher rates of walking and five times higher rates of completing that journey via active transportation compared to youth who were not enrolled in the closest school (Mandic et al., 2017). However, a combination of car ownership, use, and increasing distances to destinations like school has led to a shift toward parental 'chauffeuring' or accompanying of children. As Hillman and colleagues wrote, the increasing traffic and 'its accompanying noise, pollution, danger and unpleasantness have contributed to a feeling of insecurity owing to the continuing decline of street life...' (Hillman et al., 1990, p. 107) and additionally have contributed to increased escort-time for parents, traffic congestion, and injury rates (Tranter & Whitelegg, 1994). Besides the shift toward car use, there have been broad shifts in societal and parental social norms that have influenced levels of children's IM.

1.4.2 Societal and Parental Social Norms

In 2016, an Ontario minister wrote an open letter asking the City of Toronto to reconsider the ban on portable basketball and hockey nets for play in the streets. The city's transportation department had deemed them a 'safety hazard' for players and motorists as well as potentially interfering with road maintenance (Dehaas, 2016). In 2017, a school in Northern Ontario decided to ban cartwheels (i.e. feet-to-hands-to feet flip) on their playgrounds due to risk of 'concussions,

and neck and wrist injuries’ according to the principal of the school, despite not having any reported injuries (London Free Press, 2017). In 2018, a Vancouver Island, British Columbia community announced a ban on sidewalk chalk, ball hockey, and riding bicycles on residential streets citing the dangers of cars not seeing children in the road or on the sidewalks (Dehaas, 2018). These types of incidences are not isolated to Canada (BBC News, 2019; Turner, 2019) and draw attention to changing perceptions in the acceptability of children playing and traveling in their neighbourhoods and environment. Moreover, it raises the question about whether we are ‘bubble-wrapping’ children in order to prevent *any and all* exposure to risk.

As highlighted earlier, activities (e.g., cartwheels, climbing trees, playing tag) that previous generations enjoyed, are more recently viewed as risky (Gill, 2007) and therefore a knee-jerk reaction is to ban such activities. The term risk can refer to the probability, likelihood or chance of an outcome – a definition with a neutral connotation (Ball et al., 2008). However, today risk may be seen more negatively; the first definition of risk according to the Merriam-Webster dictionary refers to ‘possibility of loss or injury’ with synonyms including ‘danger,’ ‘hazard,’ and ‘threat’ (Merriam-Webster, 2020) with a negative connotation attached to the definition (Lupton & Tulloch, 2002). This is particularly concerning as children’s IM inherently involves some risk (e.g., injury while cycling, tripping while playing tag with peers). However, some risk may be necessary to engage and challenge children as well as contributing to learning and development (Ball et al., 2008). In his book, Ungar explains, ‘Too much risk and we endanger a child. Too little risk and we fail to provide a child with healthy opportunities for growth and psychological development’ (Ungar, 2009, p. 3). The decrease in children’s IM may in part be associated with societal propensity toward risk avoidance or averseness as well as parental fears of judgement.

Although the ban on street hockey in Toronto was lifted (Mehta, 2016), it highlighted the steps taken to keep children ‘safe’. While there is growing acknowledgement that a ‘zero-risk’ childhood is not logical or desirable (Gill, 2011) and researchers across the globe are raising awareness and working toward making children’s IM, active transportation, and outdoor play more accessible (Brussoni et al., 2012; Larouche, 2018a; Shaw et al., 2013), there is still a need for research and initiatives that increase children’s freedom and opportunities to explore their environment, and more importantly learn from their environment.

Parental fear of judgement from others relating to norms of ‘good’ and ‘bad’ parenting may be another obstacle for children’s IM (Crawford et al., 2017; Dowling, 2000). There are reinforced and socially constructed ideas, propagated through our society often via the media, about the meaning of ‘good parenting’ or the ‘right’ way to raise children (Miller, 2018). Western society presents children as vulnerable and in need of protection (Valentine, 1997b) and consequently ‘good parenting’ has been normalized as protecting children from all risk obstacles or activities (Murray, 2009). In *No Fear: Growing Up in a Risk Averse Society*, Hugh Cunningham, Emeritus Professor of Social History at the University of Kent, is quoted, ‘Children in the past have been assumed to have capabilities that we now rarely think they have...So fixated are we on giving our children a long and happy childhood that we downplay their abilities and their resilience’ (Gill, 2007). As Crawford and colleagues found, parents acknowledged the benefits of IM for children, but were confused and unsure about the fine line between ‘desirable’ and dangerous levels of children’s IM (Crawford et al., 2017). In a study by Dowling (1999) examining suburban car use, including mothers who drove their children to school reinforced the idea of ‘good mothering’. Furthermore, ‘good’ parenting encompasses the social norms of ‘risk avoidance’ and can consequently be linked to how children travel and play

(Murray, 2009). Sheltering children from *all* risks may act to undermine children's opportunities to develop the necessary skills to be able to safely navigate the environment (Gill, 2007).

Therefore, parents who encourage and grant IM, may fear judgement from others for their parenting practices (Pynn et al., 2019). This fear of judgement may consequently impact parents' decisions to grant their children freedom to travel independently.

Additionally, other limiting factors like technology may contribute to declining IM. Technology, especially screen-based activities, has permeated society and consequently, IM and outdoor time competes with indoor, 'home-based leisure technology' like computer and video games, cell phones, and generally more screen time. One Canadian study found that children aged 6-11 years were engaging in an average of 2.5 hours per day of screen time (Colley et al., 2012). Another study examining screen-based sedentary behaviour of 51,922 Canadian youth in grades 6-12 found that half spent longer than 2 hours per day on screens and the average daily screen time was 7.8 ± 2.3 hours (Leatherdale & Ahmed, 2011). The draw of screen time and the increasing time spent potentially indoors, may inextricably decrease time for IM, as well as active transportation and outdoor play, in the outside world. As IM has declined, we have seen a parallel increase in screen time – a compelling leisure time activity that can be done indoors.

1.5 Research Gaps

Current evidence indicates that levels of children's IM have dramatically declined over the last several generations. This is especially alarming in light of global concerns over children's physical inactivity and evidence that PA decreases as children get older (Biddle et al., 2004; Biddle et al., 2011). The freedom to travel and play independently not only helps children engage in more PA, but helps them gain environmental competency and confidence in their own

abilities, socialize with peers and neighbours, improve their risk assessment and problem-solving skills, develop fine and gross motor skills, and develop an appreciation for the environment and neighbourhood where they live (Christensen & O'Brien, 2003; Rissotto & Tonucci, 2002; Schoeppe et al., 2013). Children's IM represents a possible and vital target for intervention with potential for positive impact on children's health and wellbeing. The focus of this dissertation is to contribute to a greater understating of how to intervene.

1.6 Structure of the Dissertation

The overall aim of this dissertation is to explore children's IM in the Canadian context. More specifically, the purpose of the dissertation is to 1) identify and examine the social-ecological correlates of children's IM and 2) explore the nuances of children's IM from children's and parents' perspectives as a family unit. Three studies were completed to achieve these overarching aims with a view to ultimately informing recommendations for addressing declines in childhood IM. Table 1.1 outlines the studies in this dissertation.

Table 1.1 Overview of main body chapters of dissertation (Chapters 2, 3, and 4)

Chapter	Objective	Design	Sample
2	Systematically review the current literature to identify the social-ecological correlates of children's IM	Systematic review	43 papers included in review
3	Identify and describe the social-ecological correlates of children's IM in the Canadian context	Cross-sectional using linear mixed-effects models	1699 children (8-12 years old) and parents
4	Explore the perspectives of children and parents on children's IM in Metro Vancouver families	Qualitative	22 families (22 children 10-13 years old; 44 parents)

First, a systematic review was conducted to identify and synthesize the correlates of children's IM within the extant literature in children 5-17 years old. As outlined by the social-ecological framework, children's IM is influenced by a multitude of factors. It is therefore important to identify these factors, identify gaps for future research, and recognize which factors could be targeted for intervention. At the time I began this dissertation, no synthesis of these studies on correlates of IM existed. While there are various reviews (Marzi & Reimers, 2018; Qiu & Zhu, 2017; Sharmin & Kamruzzaman, 2017) which focused on specific domains of IM correlates (e.g., housing and community, built environment), this review aimed to examine all social-ecological correlates of children's IM. This could help better identify gaps that required further investigation and could also help inform policies and interventions (Mulrow, 1994).

While there were several studies on correlates of children's IM in Canada, most were geographically limited and restricted to the Greater Toronto and Hamilton area (Buliung et al., 2017; Mammen et al., 2012; Mitra et al., 2014). Chapter 3 describes a cross-sectional multi-site

study conducted in primary schools examining the correlates of children's IM in Canadian children in grades 4, 5, 6 (Riazi et al., 2019). Given the limited spatial variability in Canadian studies, it is important to examine a wider geographic area to examine differences in locations, while also considering varying urbanization and neighbourhood socioeconomic status as these have been found to have varying influences on children's IM. Data were drawn from the Active Transportation Independent Mobility (ATIM) study, which focused on examining active transportation, IM, and PA. Schools (n=37) were selected from three regions across Canada (Ottawa, Ontario, Vancouver, British Columbia, and Trois-Rivières, Québec). Schools were selected in varying urban (urban, suburban, and rural) and socioeconomic levels (low vs high). This was the first Canadian study to take a multi-site approach to quantitatively measure correlates of children's IM. Sampling across geographical, urban and socioeconomic levels filled research gaps in the literature. Additionally, findings emphasized the importance of considering 'modifiable factors' or social environment-level factors (e.g., parental and children's perceptions of neighbourhood safety) in addressing declines in children's IM.

Lastly, a qualitative study was conducted exploring children's and parents' perspectives of IM for children aged 10-13 years old in the Metro Vancouver area. Cross-sectional studies examining children's IM make up the majority of the literature on the topic and provide only a 'snapshot' of various variables that help make inferences about possible associations with children's IM (Cherry, 2019; Lavrakas, 2008). Qualitative research may be better suited to exploring *how* these variables interact to affect behaviour, in this case children's IM (Austin & Sutton, 2014).

As the social-ecological framework highlights there are interactions between individual (i.e. child) and interpersonal level (i.e. parent and family). It is therefore important to

acknowledge the interdependent and reciprocal nature of family relationships and capture both perspectives if possible. A methodological review highlighted the variety of methods (e.g., questionnaires, surveys, activity diaries, mapping activities) used to measure children's IM and the differences in respondents (e.g., only parents, only children, a combination of children and parents) (Bates & Stone, 2015). However, in the current literature, typically one parent's perspective is represented (e.g., one parent fills out the survey sent home) and it is usually the mothers' perspective (Aggio et al., 2017; Alparone & Pacilli, 2012; Bhosale et al., 2017; Prezza et al., 2001). It identifies a need for better representation of both parents' perspectives on children's IM. Additionally, it is important to include the child's perspective in research examining IM, as it is a topic that centers on them. The final qualitative study therefore focused on a sample of twenty-two family units, including both parents in the household and their child, living in three distinct neighbourhoods in Metro Vancouver. This study aimed to address research gaps including representation of both the child and parent perspectives and the perspectives of both parents.

A final chapter provides a summary of findings from each study. Additionally, this chapter identifies key contributions and practical implications of the research and considers its strengths and limitations. This chapter concludes with a description of future research directions and briefly addresses children's IM during the COVID-19 pandemic.

Collectively, these three studies contribute to a more comprehensive understanding of children's IM in the Canadian context. The findings in this dissertation shed light on key areas of the social-ecological framework that could be targeted through future research and intervention. Improving the levels of children's IM may have resounding impacts on children's PA, and their physical, social, cognitive, and emotional development. The findings of this dissertation may be

useful to a variety of sectors and key stakeholders including urban developers, city planners, transportation departments, city councils, school boards, families and communities, and other researchers interested in promoting children's IM, PA, active transportation, and outdoor play. The findings may also help illuminate what factors should be considered when creating local, provincial, and national policies that are supportive of children's IM, and consequently active transportation and outdoor play.

Chapter 2: Social-ecological correlates of children’s independent mobility: A systematic review

2.1 Background

Physical activity (PA) is associated with a number of benefits including improved cognitive functioning, physical, psychological, and social health (Donnelly et al., 2016; Poitras et al., 2016). However, globally most children and youth are not achieving PA recommendations requiring children and youth (5-17 years of age) to accumulate 60 minutes of moderate-to-vigorous PA daily (World Health Organization, 2020c, 2020d). Of the countries participating in The Global Matrix 3.0 the majority scored in the ‘D’ range for ‘overall PA’ on an ‘A’ to ‘F’ scale (Active Healthy Kids Global Alliance, 2018b). With growing concerns over the prevalence of physical inactivity in children and adolescents and the implications of childhood PA tracking into adulthood and positively influencing adult health outcomes (Loprinzi et al., 2012; Telama, 2009), it is important to examine facilitators of PA during childhood.

While facilitators of PA may include access to sports participation or involvement in physical education (Biddle et al., 2011), there is a growing interest in the role of children’s independent mobility (IM). Children’s IM refers to a child’s “freedom to travel around their own neighbourhood or city without adult supervision” (Tranter & Whitelegg, 1994, p. 265) and it may play a vital role in helping children and youth achieve recommended levels of PA. Children’s IM has been operationalized in a number of ways within the literature, such as through six IM licenses (e.g., crossing major roads, walking to school) reflecting the amount of freedom children are granted (Hillman et al., 1990; Larouche et al., 2017). Children’s IM has

also been measured via territorial range (e.g., how far from home can a child travel)(Rissotto & Tonucci, 2002), play participation (e.g., autonomous outdoor play), time of day (e.g., independent activity during the afterschool period) (Shaw et al., 2015), and weekday versus weekend IM (Kytta et al., 2015).

A systematic review of fifty-two studies by Schoeppe and colleagues found that children with the freedom to travel actively or play outdoors independently tend to accumulate more PA than their less independently mobile counterparts (Schoeppe et al., 2013). A study by Page and colleagues found that IM was related to increased likelihood of boys' participation in play, structured sports and exercise, and active commuting and girls' active commuting (Page et al., 2010). The benefits of children's IM move beyond the accumulation of PA and may also provide children with social, cognitive, and personal development benefits (Page et al., 2009; Shaw et al., 2015). Children engaging in more freedom of movement within their environment tend to have a more comprehensive environmental knowledge of the context in which their route home-to-school is situated (Rissotto & Tonucci, 2002).

Over recent decades, there has been a general decline in levels of children's IM. One landmark study by Hillman and colleagues found that CIM levels in England fell dramatically over the span of two decades, from 80% of 7-8-year-old traveling independently to school in 1971, to only 9% in 1990 (Hillman et al., 1990). Similar trends have been seen in Germany (Shaw et al., 2013) and Scandinavian countries like Denmark, Finland and Norway (Fyhri et al., 2011). These declines are attributed to a number of factors including increased car ownership and use, perceived dangers from traffic and 'stranger danger' (Hillman et al., 1990; Shaw et al., 2013; Valentine & McKendrick, 1997), and what some argue is a risk-averse society (Gill, 2007). These declining levels are concerning, especially as children's IM may be an important

facilitator of PA as well as providing children with cognitive and psychosocial development through peer interactions, development of wayfinding skills, risk assessment and enhancement of their decision-making skills (Tranter & Whitelegg, 1994). It is therefore important to identify the factors which influence IM.

At the time of registering this review on PROSPERO (2016), no reviews of correlates of children's IM existed. A few reviews have now been conducted with a focus on homes and communities (Qiu & Zhu, 2017), social and physical environments (Marzi et al., 2018), or the built environment (Sharmin & Kamruzzaman, 2017). These reviews have highlighted the importance of the social environment for IM (Marzi et al., 2018) with one review proposing the social environment may be an important mediator between environmental correlates and parent's decision-making for IM (Qiu & Zhu, 2017). A meta analytic review examining built environmental factors and IM found land use patterns and street design patterns to be significantly associated with IM; additionally, the review underscored the large amount of diversity amongst primary studies arising from differences in study locations, design, and characteristics of the included samples (Sharmin & Kamruzzaman, 2017).

These reviews have highlighted the diversity of correlates influencing children's IM. With the acceleration of studies examining IM, it is vital to provide an up-to-date synthesis of the broad range of factors influencing IM that can be used by multiple key stakeholders (e.g., city planners, parents, school boards). The purpose of this review is to synthesize and summarize the literature on the correlates of IM through a social-ecological lens. A social-ecological framework acknowledges that a health behaviour is impacted by multiple levels of influence and these influences on behaviour interact across different levels (Sallis et al., 2015; Stokols, 1996). These different layers of influence may include factors at the individual level (e.g., children's

characteristics and behaviour), interpersonal level (e.g., household and parent characteristics), social-environment level (e.g., child and parent perceptions on traffic, stranger danger), built-environment level (e.g., density, design), policy level (e.g., school policies to promote active transportation), and natural-environment level (e.g., weather). Identifying the correlates of children's IM may help inform future interventions, policies, and the development of effective strategies to increase children's IM.

2.2 Methods

2.2.1 Search strategy

The PRISMA guidelines (Moher et al., 2009) were utilized and the protocol was developed a priori and registered on PROSPERO (registration number: CRD42016042174). An internet search was conducted utilizing the following databases: PubMed (1946-present), Web of Science Core Collection (1900-present), PsycINFO (1880-present), EMBASE (1974-present), Sport Discus (1837-present), CINAHL (1982-present), Urban Studies Abstracts (1973-present). A department-specific certified librarian was consulted regarding the search strategy including databases and keywords. Keywords used to search for children's IM articles included: "independent mobility" OR unsupervised OR "outdoor autonomy" OR self-reliance OR journey OR "outdoor play" OR excursion OR "active travel" OR "active transport*" OR active commut* OR "active play" AND child* OR youth* OR adolescen*.

2.2.2 Inclusion and exclusion criteria

The criteria for inclusion of studies in this review were as follows: 1) IM was the primary outcome variable; 2) studies examined correlates of IM; 3) studies focused on children and youth

as the target sample of IM (i.e. school-aged children, 5-17 years); 4) studies had an observational design (longitudinal or cross-sectional); 5) studies were peer-reviewed, published studies; 6) studies were written in an English language. The search was not limited by publication date. The main exclusion criteria were: 1) studies of qualitative design as no outcome variables or statistical results were reported; 2) studies where IM was not the focus or IM was considered an independent variable; 3) the study was a protocol paper, review, meta-study, book chapter, conference proceeding or abstract.

2.2.3 Selection process and coding associations

A web-based software program, EPPI-Reviewer 4 (Thomas et al., 2010), was used to manage and sort the studies extracted for this review. EPPI-Reviewer 4 was used for each stage of the review process including: reference management, screening, coding, and synthesis. Initial searches were run and articles gathered from July to August 2017 by lead author (NR). A second search was run from the end of the first search until January 2019 (August 2017 to January 2019) as a significant amount of time had passed since initial searches were conducted. A final search update is planned for October 2020. Duplicates were removed and title and abstract screening of the articles was performed by two independent reviewers (NR and research assistant Kelly Wunderlich (KW) (1st search), Lira Yun (LY) (2nd search)) to identify studies that met the inclusion criteria. Any disagreements were discussed between the reviewers and if needed, resolved via consultation with a third reviewer (Dr. Guy Faulkner (GF)). Full text studies were screened, cross-checked, and data were extracted independently by two independent reviewers (NR, KW, LY). Disagreements that arose were discussed amongst the two reviewers and were resolved through consensus with a third reviewer (GF). Additionally, the references of included

studies were scanned for additional studies. Data from included studies were extracted including origin of study data, sample population, results, and correlates of IM.

2.2.4 Quality assessment

The methodological quality of the studies was assessed using a 17-point criteria adapted from Schoeppe and colleagues for reporting on observational studies (Schoeppe et al., 2013). The modified checklist captured the quality of reporting as well as characteristics of the study quality. The quality of the studies was appraised independently by two reviewers (NAR and KW) and disagreements were resolved through consultation with another reviewer (LY). Each criterion was rated on a scale of 0 to 1 (0=no/unclear; 0.5=partial; 1=yes) for fulfillment of the criterion. The highest score attainable for a study was 17; the score for each study was divided by the highest score possible and multiplied by 100 to provide an overall percentage of study quality. The studies were then grouped to represent high (>66.7%), fair (50-66.6%), or low (<50%) study quality (Schoeppe et al., 2013).

2.2.5 Coding associations and classifying variables

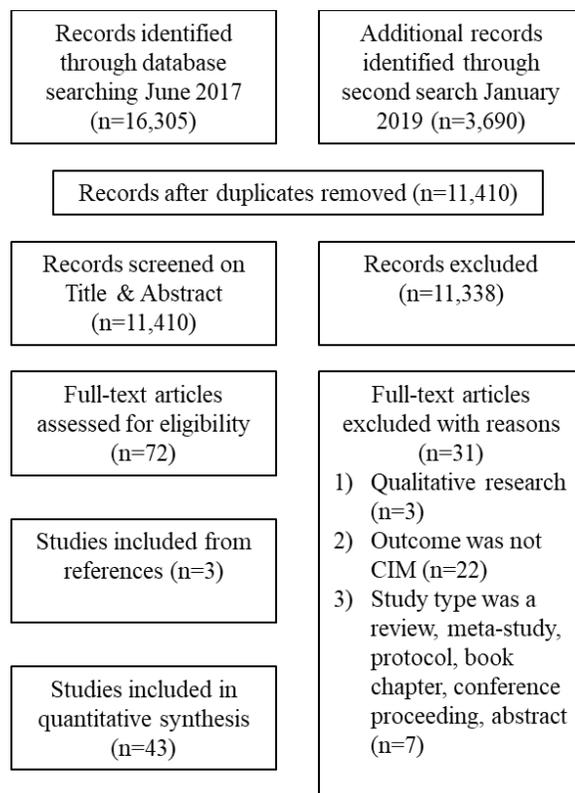
Studies included a wide range of statistical techniques to evaluate associations including correlations, t-tests, ANOVAs, and multivariate analyses (e.g., linear regression, logistic regression, structural equation modeling). The column 'Related to children's independent mobility' indicates which studies reported significant associations (+ or -) between the variable and children's IM, while the column 'Unrelated to children's independent mobility' indicates studies with nonsignificant associations between the variable and children's IM. There was variability in reporting between univariate and multivariate tests; if multivariate tests were

conducted, the results from those tests were reported. Variables are not shown in summary tables unless three or more comparisons were found (Sallis et al., 2000). Some variables were combined if conceptually similar and there were not enough studies to examine the variables individually. For example, a 'perceived competence' category was created to encompass children's perceptions of their safety experience, maturity, and confidence related to IM. The summary column represents the percentage found by taking the number of associations supporting the expected association divided by the total number of associations for the variable (Sallis et al., 2000). Based on the percentage of studies supporting the association, the associations were labeled: 0-33% → no association (0); 34-59% → indeterminate or inconsistent (?); 60-100% → positive or negative association (+ or -). If more than 4 studies supported the association in the same direction, it was labeled 00, ??, ++, or --. The ?? code indicated that a variable has been frequently studied with considerable lack of consistency in findings (Sallis et al., 2000).

2.3 Results

From the 72 full-text articles assessed for eligibility, 43 studies of children's IM were reviewed. The process of inclusion and exclusion of studies in this review is described in Figure 2.1 using the preferred reporting items of systematic reviews and meta-analyses PRISMA (Moher et al., 2009). A summary of characteristics of included studies can be found in Appendix A.3.

Figure 2.1 Flow chart for the selection of reviewed studies



Studies examined children in the age range of 6 to 18 years of age. Most data for the included studies originated from Australia (n=14), followed by Canada (n=4) and Finland (n=4). Three studies originated from Italy, Portugal, United States, and New Zealand, respectively. These were followed by Belgium and Hong Kong with 2 studies respectively, and Norway, Austria, United Kingdom, and Spain each contributing one study. Most studies (38 studies; 88%) were published in 2011 or later. Three studies (7%) were published between 2006-2010 and 2 studies (5%) were published between 2000-2005. Most studies were cross-sectional in design (41 studies; 95%) and two studies had a longitudinal/prospective design (5%). Table 2.1 details characteristics of included studies and Appendix A.3 further summarizes included studies. Appendix A.1 presents the criteria for quality assessment and the number (%) of studies scoring

points for each criterion. The overall quality was classified as ‘high’ in 37 studies (86%) and fair in 6 studies (14%). Measures of IM varied amongst the included studies (Appendix A.1). The majority of studies used self-report questionnaires and/or surveys; nearly half included data from both parents and child, followed by only parent report, and only several that reported only child data. As Bates & Stone reported in their methodological review, various measures of IM exist with no single standardized method (Bates & Stone, 2015). The correlates of children’s IM are presented through a social-ecological framework including levels for individual, interpersonal, social-environment, and built environment level correlates of children’s IM (see table in Appendix A.2).

Table 2.1 Characteristics of studies in systematic review (n=43)

Characteristics	N of studies (%)	Studies
Data drawn from		
Australia	14(33)	(Carver et al., 2012, 2013, 2014; Christian et al., 2014, 2015, 2016; Curtis et al., 2015; Foster et al., 2014; Schoeppe, Duncan, et al., 2016; Schoeppe, Tranter, et al., 2016; Veitch et al., 2008, 2017; Villanueva et al., 2012, 2014)
Canada	4(9)	(Buliung et al., 2017; Larsen et al., 2015; Mammen et al., 2012; Mitra et al., 2014)
Finland	4(9)	(Broberg, Kyttä, et al., 2013; Broberg, Salminen, et al., 2013; Kyttä, 2004; Kyttä et al., 2015)
United States	3(7)	(He & Giuliano, 2017; Janssen et al., 2016; Wolfe & McDonald, 2016)
Italy	3(7)	(Alparone & Pacilli, 2012; Pacilli et al., 2013; Prezza et al., 2001)
Portugal	3(7)	(Cordovil et al., 2015; Lopes et al., 2014; Santos et al., 2013)
New Zealand	3(7)	(Bhosale et al., 2017; Chaudhury, 2017; Lin et al., 2017)
Belgium	2(5)	(Ghekiere et al., 2017; Huertas-Delgado et al., 2018)
Hong Kong	2(5)	(Lam & Loo, 2014; Loo & Lam, 2015)
Norway	1(2)	(Fyhri & Hjorthol, 2009)
Sweden	1(2)	(Johansson, 2006)

Characteristics	N of studies (%)	Studies
Austria	1(2)	(Stark et al., 2018)
UK	1(2)	(Aggio et al., 2017)
Spain	1(2)	(Herrador-Colmenero et al., 2017)
Year published		
2016-2020	16(37)	(Aggio et al., 2017; Bhosale et al., 2017; Buliung et al., 2017; Chaudhury, 2017; Christian et al., 2016; Ghekiere et al., 2017; He & Giuliano, 2017; Herrador-Colmenero et al., 2017; Huertas-Delgado et al., 2018; Janssen et al., 2016; Lin et al., 2017; Schoeppe, Tranter, et al. 2016, Schoeppe, Duncan, et al. 2016; Stark et al., 2018; Veitch et al., 2017; Wolfe & McDonald, 2016)
2011-2015	22(51)	(Alparone & Pacilli, 2012; Broberg, Kyttä, et al., 2013; Broberg, Salminen, et al., 2013; Carver et al., 2012, 2013, 2014; Christian et al., 2014, 2015; Cordovil et al., 2015; Curtis et al., 2015; Foster et al., 2014; Kyttä et al., 2015; Lam & Loo, 2014; Larsen et al., 2015; Loo & Lam, 2015; Lopes et al., 2014; Mammen et al., 2012; Mitra et al., 2014; Pacilli et al., 2013; Santos et al., 2013; Villanueva et al., 2012, 2014)
2006-2010	3(7)	(Fyhri & Hjorthol, 2009; Johansson, 2006; Veitch et al., 2008)
2000-2005	2(5)	(Kyttä, 2004; Prezsa et al., 2001)
Design		
Cross-sectional	41(95)	
Longitudinal	2(5)	(Carver et al., 2014; Veitch et al., 2017)

2.3.1 Individual-level correlates

The table in Appendix A.2 summarizes the associations between potential correlates of children's IM that were examined in at least three studies. The review identified five individual-level variables that were examined in three or more studies. The most often examined variable was child age with a common focus range of 10 to 12 years of age. In 86% of the comparisons, older children had greater IM compared to younger children. Child gender was the next most frequently studied variable but findings were inconsistent. Varying ethnicity and race variables

(e.g., ethnicity, language spoken at home) were positively associated with IM; this association was typically positive for non-minority groups (e.g., White compared to minority ethnicities). Child's perceived competence, including the child's safety experience, maturity, and confidence in their IM skills, was positively associated with IM. Access and ownership of a car was negatively associated with IM, with car use frequency and number of vehicles being associated with less IM.

2.3.2 Interpersonal-level correlates

Thirteen correlates were examined in three or more studies. Several variables including parent age, gender, and educational level had no association with IM. Low socioeconomic status (SES) was positively associated with IM. Parents' perception of child's confidence and perception of active school travel benefits were inconsistently related to IM. Parents attitude toward IM however was positively associated with IM. Additionally, no association was found for parents' physical activity and encouragement (for walking/cycling, or modeling) and IM. Parents' supportive policies (e.g., parents allow child to walk/cycle to a friend's house, parents allow child to play anywhere within neighbourhood) with regard to independent play and travel had a positive association. No association was found for household structure (dual vs single parent household, and whether one parent was unemployed), although having siblings was consistently positively associated with IM. Additionally, parental work status which included employment status and work hours (e.g., parents, mother, father) was not associated with IM.

2.3.3 Social environment-level correlates

Twelve social environment-level variables appeared in three or more studies. For child correlates, children's positive perceptions of safety (e.g., park is safe, live in a safe area to walk alone) had an inconsistent association while no association was present for children's negative perceptions of safety (e.g., cars speeding, crime). Perceptions of social norms (e.g., lots of other children walking or cycling to school, lots of children their own age to hang out with) had an inconsistent association. Only children's interest (e.g., perception of fun things to do at local park, and children enjoyed walking and cycling) was positively associated. Parent perceptions of traffic were inconsistently associated with IM. No consistent associations were found for perceptions of stranger danger and crime. Parents' positive perceptions of safety in the neighbourhood were consistently positively associated with IM, while parent's negative perceptions of safety were inconsistently associated. No association was found with informal social control and inconsistent association was found with social norms. However, social cohesion was consistently positively associated with IM.

2.3.4 Built environment-level correlates

Twenty-one built environment-level variables were reported three or more times. Several broad categories of correlates, including destination density, road density and population density were not associated with IM. Housing/residential density was the only density variable that was consistently positively associated with IM. Destinations like walking and cycling infrastructure and green space were not associated with IM while 'other local destinations' (encompassing destinations like shopping, recreation, and community centres) had indeterminate associations with IM. Design components such as type of housing (e.g., single-family, multi-family,

condominium), and whether an area was urban/highly urbanized were inconsistently associated with IM. Urbanization, including urban, suburban, and rural settings, was consistently and positively associated with IM; each type of urbanization was positively associated with IM in various studies. Walkability was positively associated for girls' IM. Length of residency in one's home and access to outdoor space, walking, and cycling were positively associated with IM. The diversity component of land use mix had no association with IM. Low socioeconomic neighbourhoods were positively associated with IM. Distance was one of the most frequently studied built environment-level variable. Shorter distances were consistently positively associated with IM. Mother's distance deviation (distance deviation of the child's school location from mother's commute) to work was positively associated and in contrast no association was found with distance/deviation to father's work. Finally, proximity to green space was positively associated with IM.

2.4 Discussion

Children's IM has seen a dramatic generational decline which is concerning as IM provides a variety of physical, social, and personal development benefits. It is important to examine correlates of IM as findings may help inform intervention and policy development. As seen over the last decade, there has been an acceleration in the number of studies examining correlates of IM. This review aimed to comprehensively examine correlates of IM using a social-ecological framework to map these correlates across individual, interpersonal, social, and built environment levels. Similar to previous reviews (Marzi et al., 2018; Qiu & Zhu, 2017; Sharmin & Kamruzzaman, 2017), significantly associated correlates were found for each level of the social-ecological framework highlighting the complexity of IM. A wide array of methods was

used to measure IM; the most common being parent and child questionnaire or surveys. In line with Bates & Stone's (Bates & Stone, 2015) methodological review, this review found variability in measurement of IM including use of Hillman's mobility licenses (i.e. children can travel alone 1) home from school, 2) to destinations other than school, 3) cross main roads, 4) cycle on main roads, 5) travel on the bus, 6) go out after dark) (Hillman et al., 1990), modified mobility licenses (either more or less than six mobility licenses), questions assessing accompaniment to/from school, or to a variety and number of destinations, and from whom the data were collected including child-report and/or parent-report. Additionally, this review highlighted multiple terms used to encompass IM, including children's 'autonomy' or children being 'unescorted' or 'unaccompanied'. Based on the heterogeneity of measures, methods, and terms used to examine children's IM, it may be worth using standardized measure of IM, for example, mobility licenses, in order to facilitate comparisons across global studies as well as considering consistent terminology that could aid in searching for other IM studies.

Among consistently associated individual level correlates, unsurprisingly, as children get older, they may gain more maturity, safety skills, and gain competence in their own abilities which may help increase their IM (Hillman et al., 1990). Children's perceived competence was consistently and positively associated with IM highlighting a need to build children's competence and confidence in IM and skills associated with it like traffic, road, and cycling safety skills. Schools may also influence children's IM through policies promoting active school travel (e.g., school travel plans), offering cycling and road safety workshops, and promoting further drop-off zones for parents dropping off children (Buliung et al., 2011).

Ethnicity and/or race correlates were consistently positively associated with IM, which may point to cultural factors having a significant influence on IM. These cultural factors may

impact household structures, perceptions of safety and danger, and social norms, which may in turn impact whether families are receptive toward IM. Ethnicity and race have been found to be influential for active school travel (Davison et al., 2008) and physical activity (Barr-Anderson et al., 2017; Sallis et al., 2000, 2002). Car ownership and access were also consistently negatively associated with IM, which may allude to parents' tendency to drive or chauffeur children to/from school, maybe on the way to another destination (e.g., work) (Kytta et al., 2015). Additionally, there is evidence that parents who frequently drive their children to school, have higher concerns about traffic and active school travel (Cloutier et al., 2011) even though it is statistically safer for children to walk rather than travel in cars (Cardinal et al., 2012). Initiatives that help raise awareness about active school travel benefits including children's physical health, IM, and reduction in traffic around schools (Buliung et al., 2011) may be helpful in easing parents' concerns.

Additionally, low socioeconomic status was positively associated with IM. This may arise from other related factors such as limited car access and ownership and whether children need to be independently mobile out of necessity. Some studies have shown that families with higher socioeconomic status are more likely to chauffeur children (Lam & Loo, 2014; Loo & Lam, 2015). Although work status had no association with IM, mother's work hours (e.g., mothers working outside the home, working longer hours) were positively associated with IM. This is consistent with fact that mothers in dual-earner families undertake two-thirds of the escorting (Motte-Baumvol et al., 2017). Greater participation of women in the workforce (Government of Canada, 2015), including mothers, increased working hours outside the home, and distance and deviation from commute to child's school (He & Giuliano, 2017), may consequently lead to more opportunities for children to be independently mobile. Unsurprisingly,

children whose parents had supportive policies and attitude toward IM were more independently mobile. Parents' role as 'gatekeepers' to children's IM should not be ignored; it may be important to support parents through city, provincial, and national policies that encourage or facilitate IM. For example, Utah was the first state to amend the definition of 'neglect' in order to support children's independent travel and play (Child Neglect Amendments, 2018).

Positive associations with presence of sibling(s) also highlights the importance of children traveling in groups which may help lessen children's and parents' concerns (Christian et al., 2016). The lack of research on the impacts of friends/peers on children's IM (e.g., studies asked if child traveled alone or with peer, but not specifically examined) was notable and may be a useful area of future study as traveling with peers can facilitate IM (O'Brien et al., 2000). Additionally, the social environment level correlates of children's interest in their environment, parents' positive perceptions of safety, and perception of social cohesion were all positively associated with IM. These correlates may also be beneficial targets of IM initiatives that help build community, social cohesion, and accessible, interesting places for children to travel to and play at. Social cohesion may encompass the connectedness between people within the neighbourhood and more specifically, the sense of belonging to a community and relationships amongst its members (Manca, 2014). These feelings of connectedness may influence parents' willingness to let their children roam the environment independently. Perceptions of safety and social cohesion and social interactions have been important for children's PA and active travel as well (Duke et al., 2012; Panter et al., 2008).

Several built environment correlates were also consistently associated with IM. Housing and residential density, access to outdoor space, walkability of the neighbourhood environment (for girls' IM specifically), and length of time in one's residence were all positively associated

with IM. Higher housing/residential density may allude to the availability of children to play with, more ‘eyes on the street’ to provide informal surveillance, while length of time in one’s home may contribute to perceptions of safety, knowledge of the environment, social cohesion, and point to financial stability (Keene et al., 2013). Low income neighbourhood was positively associated with IM perhaps indicating IM is more a necessity than a luxury, pointing to diminished car access, or less likely to be supervised by adults (Mitra et al., 2014). Interestingly, urbanization (rural, suburban, urban) was also consistently associated with IM; each type of urbanization may help facilitate IM in different ways. For example, rural environments may offer less traffic, while suburban environments may offer more opportunities to hang out with peers or greater neighbourhood cohesion, and urban environments may provide a greater variety of destinations to travel to and play at. A positive implication of this finding is that IM appears possible in most macro-settings. Future studies should consider varying sampling procedures to account for neighbourhood socioeconomic status and urbanization, which have been shown to influence IM.

Several correlates were inconsistently associated with IM. Child gender, while measured in many studies, was inconsistently associated with IM which may point to other factors like age, child’s perceived competence, or parents’ perceptions of neighbourhood safety playing a more dominant role in determining IM. Additionally, parental concern about traffic was inconsistently associated with IM, potentially arising from the multitude different aspects of perceptions of traffic that were measured in various studies. For example, these factors encompass everything from perceptions of traffic calming, whether home is on a busy road, speed of traffic, presence of exhaust fumes, heavy traffic around school, and drunk driving. Perceptions of social norms were consistently indeterminate but will require further investigation as they may influence safety

perceptions of parents and children. When parents and children perceive that there are lots of children walking and cycling to school, or children their own age to hang out with, or the presence of people out and about in the neighbourhood, children tend to have more IM (Veitch et al., 2017; Villanueva et al., 2014). Future research should also consider examining social norms related to parental concern about judgement, acceptability of IM, and how these vary in different cultural contexts (e.g., Scandinavian countries typically have higher levels of IM compared to North American countries) (Shaw et al., 2015). Children's perceptions of safety were inconsistently associated with IM perhaps suggesting that parents' perceptions are more influential than children's perceptions of safety and reinforcing parents' role as 'gatekeepers'. This is similar to a review by Carver et al. that highlighted parents influence on children's walking and cycling in the neighbourhood (Carver et al., 2008) and another review by Lee et al. that found parents' perceived safety concerns were a barrier to children's independent active free play (Lee et al., 2015). Lastly, correlates related to type of housing and other local destinations (e.g., community centre, recreation centre) were inconsistently associated with IM and may require further examination to determine which types of homes and destinations are more influential for IM. As demonstrated, distance is highly influential for IM and therefore destinations and housing type may be important simply because of proximity to a child's home (e.g., park across the street from child's home, recreation centre close by) (Giles-Corti et al., 2009).

Finally, a variety of social-ecological correlates were not associated with IM. Parental characteristics like gender and age, were not associated with IM, and educational level, PA level, household structure, and work status were consistently not associated with IM. This may mean that while future interventions promoting IM may need to consider cultural factors, they may not

need to be tailored based on parents' individual characteristics or household structure (single vs dual earner household). Surprisingly, parental perceptions of stranger danger and crime were not associated with IM, while traffic concerns were inconsistently associated with IM. While informal social control was not associated with IM, it may be tied with social cohesion in the neighbourhood and as connections are made, perceptions of 'eyes on the street' may increase as well. It may be worth further exploring how informal social control and social cohesion may facilitate IM. Interestingly, population and destination density and land use mix were not associated with IM; this may indicate that increased numbers of people resulting from diverse land use may not be related to IM or that increased density may have a negative impact on social cohesion. As Sharmin et al. (2017) determined, while residential areas were important for enhancing IM, land use mix may limit IM range due to increased numbers of people on the street which may in turn affect perceptions of safety (e.g., stranger danger; traffic). Additionally, walking and cycling infrastructure (e.g., walking path, bike tracks) and proportion of green space were not associated with IM. Although caution is required given how the built environment is measured these findings suggest that costly retrofitting of neighbourhood environments may not be necessary to support children's IM.

This review identified a number of social-ecological correlates and given the diversity of these correlates there is likely a need for multi-level and multi-sectoral interventions. Some individual-level correlates like child's perception of their competence may be a focus for future IM promotion initiatives; helping children build the skills and capacity to navigate the environment safely is important. However, the social environment-level correlates may be a key focus area for future research. Modification of individual-level characteristics (e.g., age) may not be possible and modification of the built environment may be a slow, costly process (e.g.,

approval of projects, funding, and/or construction time) and ultimately, if parental safety perceptions are negative, the positive aspects of the built environment may not matter for IM. Therefore, it may be important to reframe the risks of IM, outdoor play, and active travel. Addressing child and parental concerns and perceptions of the social environment may be a necessary step in helping reverse the decline in IM. Efforts may need to focus on building neighbourhood connections, social cohesion, and creating child-friendly environments where the norm is children traveling and playing outdoors, either independently or with their peers. More importantly, this review has highlighted a lack of studies examining correlates of IM at the policy level. Future research and interventions may wish to focus on the influence of policies at the national, provincial, city, and/or community level.

2.4.1 Strengths and Limitations

Strengths of this review included a thorough search of multiple, popular databases, no limitation of publication date, and references of included studies were checked for additional studies. Furthermore, the use of the social-ecological framework to guide the review and categorize the correlates of IM. Taking a social-ecological approach acknowledges the interrelatedness of these identified correlates and points to the importance of considering them in concert to positively impact IM. A limitation of this review is that only correlates examined in three plus studies were included in the final correlates table as per the protocol outlined by Sallis et al., 2000. As such, several variables that were examined in less than three studies were not included, but worth mentioning. For example, bicycle ownership was positively associated with girls' IM (Villanueva et al., 2012, 2014). Bicycles may provide an alternative, often faster ways, for children to travel to destinations especially those that are further away. Additionally, dog

walking and ownership (Christian et al., 2014, 2016) and cell phone ownership (Carver et al., 2012) were positively associated with IM and may be important tools that facilitate IM. Dog ownership (Oliveira, 2014; Salmon et al., 2010), and cell phone ownership (Government of Canada, 2018), may help address child and parental concerns about children traveling alone in the neighbourhood. Finally, seasonality (i.e. winter) was negatively associated with IM in one study. Seasonality may be a natural environment variable that should be considered as it may either facilitate (e.g., sunny, warm weather) or impede (e.g., icy conditions, harsh conditions) IM especially if parents or children perceive unsafe conditions. Additionally, this review was limited in geographical span and included English written studies. While the studies came from diverse locations around the globe (e.g., North America, Europe, Australia, etc.), these countries are all considered high income countries (The World Bank, 2020). Therefore, the view and understanding of the correlates of children's IM are highly limited by the context in which they are examined. Future research should examine correlates of IM in low- and middle-income countries to better understand context-specific barriers and facilitators of IM. Additionally, future studies may be important to examine correlates of IM more robustly with the inclusion of mediators and moderators and how IM itself may play a role as a mediator/moderator of other health behaviours. This review highlighted that the vast majority of studies examining correlates of IM are cross-sectional in design. It may be important for future research to prospectively examine IM as the influence of these correlates may change as a child gets older (e.g., child's skills and competence may improve, changes in perceptions of safety). Despite these limitations, this review identifies a range of correlates that may help future researchers tailor interventions.

2.5 Conclusions

Children's IM may be an important facilitator for PA, while also positively influencing children's physical, social, and personal development. This is the first comprehensive review of all individual, interpersonal, social, built environment correlates associated with IM. A variety of correlates were consistently associated with IM and represented all levels of the social-ecological framework and may represent focus areas for future IM promotion initiatives. Variables that were classified as having an indeterminant or inconsistent association with IM require further study. Some of these correlates have been well-studied such as gender, children's positive perceptions of safety, and children's and parents' perceptions of social norms, but may require further qualitative inquiry to better understand inconsistencies reported in the literature. Some variables had been studied too few times to make definitive conclusions and therefore require further examination. Given the range of inter-related correlates identified interventions to promote children's IM likely will need to adopt a multi-level and multi-sectoral approach. However, given the evidence, a focus on the social environment (e.g., social cohesion, parents' perceptions of traffic safety) should be central to intervention work. Finally, social and cultural norms, race and ethnicity, and socioeconomic status are important contextual factors that must be taken into account in future research and practice. Efforts to increase IM should consider how all children (e.g., children with a disability, children of different cultural identities, children living in developing countries) can access safe opportunities for IM, and consider how we, as a society, can equitably support children's freedom to independently travel and play.

Chapter 3: Correlates of children’s independent mobility in Canada: A multi-site study

The World Health Organization has deemed physical inactivity a “global public health problem” (World Health Organization, 2020d) as evidence suggests that most children in many countries are insufficiently active (Aubert et al., 2018). Achieving adequate levels of physical activity (PA) not only benefits cardiovascular and bone health (Janssen & LeBlanc, 2010) but also improves brain function and mental health (e.g., anxiety, depression) (Ahn & Fedewa, 2011; Biddle & Asare, 2011; Hillman et al., 2014; Sallis et al., 2000). The level of moderate- to vigorous-intensity physical activity (MVPA) among Canadian children has not changed significantly over the course of nearly a decade (2007 to 2015) (Colley et al., 2017). According to the Canadian Health Measures Survey only 7% of Canadian children and youth are accumulating 60 min of MVPA on at least 6 out of 7 days, with 33% achieving a weekly average of at least 60 min MVPA daily (Colley et al., 2017). If PA levels have failed to increase over the past decade despite initiatives aimed at trying to encourage higher levels of PA (e.g., interventions have been largely school-based, and in general, interventions may not have been implemented at a sufficient scale) (Sluijs et al., 2007), it is important to consider alternative approaches in helping children achieve the recommended levels of PA. There remains a limited understanding regarding the determinants of change in children’s PA (Craggs et al., 2011); children’s independent mobility (IM) could be one such determinant. Additionally, IM may provide other developmental benefits for school-aged children.

Children's IM is defined as a child's freedom to travel and play around their neighborhood or city without parental supervision (Hillman et al., 1990; Tranter & Whitelegg, 1994). Previous research has shown that children with higher levels of IM tend to be more active (Mackett et al., 2007; Page et al., 2009, 2010; Schoeppe et al., 2013). Beside the benefit of increased PA, IM can also provide a number of personal, psychosocial, and developmental benefits. Children's IM can help improve risk assessment, spatial awareness, and wayfinding skills and help in "processing and structuring environmental knowledge" (Rissotto & Tonucci, 2002, p. 65). Additionally, greater IM provides an opportunity to interact with peers, improve self-confidence, develop better decision-making skills, and gain the competence to navigate their neighborhood safely (Mackett et al., 2007; Oliver et al., 2011; Prezza et al., 2001; Tranter & Whitelegg, 1994).

Of concern is the dramatic decline in IM levels worldwide over the last few decades (Fyhri et al., 2011; Shaw et al., 2013, 2015). A report by Shaw and colleagues (2015) reported that IM levels varied worldwide and significant restrictions (e.g., what children are allowed to do, how far children can roam) were placed on IM in nearly all 16 countries surveyed. While some countries like Finland, Germany, and Norway had higher aggregate rank scores of IM compared to other countries (e.g., France, Sri Lanka, Brazil, Ireland, and Australia), overall the report found low levels of children's IM internationally. Although various studies have examined correlates of IM internationally, few studies have examined IM in Canada. In general, Canadian studies examining IM have had a narrow geographic scope (Buliung et al., 2017; Mammen et al., 2012; Mitra et al., 2014). Children's IM and the correlates of IM likely vary across locations (e.g., cities), urbanization (e.g., urban, suburban, rural), and socioeconomic status (SES; e.g., low vs. high). Therefore, sampling should reflect that potential variation to ensure that the role of

perceived and objectively measured built environment influences in particular is not underestimated.

Research on correlates of any type of PA, including IM, can be mapped through a social-ecological framework (Sallis et al., 2015; Stokols, 1996). The framework emphasizes the dynamic interplay between multiple spheres of influence on a health behavior. These include individual correlates (e.g., child's age, child's gender, SES), social environment correlates (e.g., social norms, perceptions of neighborhood), built and physical environment correlates (e.g., urbanization), and policy correlates. Guided by the social ecological framework, the aim of this study was to examine the individual, social, and physical or built environmental correlates of IM in grade 4, 5, and 6 children (8–12 years old) in Canada.

3.1 Materials and Methods

3.1.1 ATIM Study

This cross-sectional study is based on data drawn from the ATIM project (Active Transportation and Independent Mobility). The ATIM project was a large, national, school-based study conducted across three regions in Canada (Ottawa, Ontario; Vancouver, British Columbia; and Trois-Rivières, Québec) with a primary aim of examining active transportation, IM, and PA in elementary-aged school children. Canadian census data show wide variability in population size, climate, language, and ethnic make-up across these three regions (Government of Canada, 2017b). The secondary aims were to examine the correlates of active transportation, IM, and PA. Ethics approval for conducting the ATIM project was obtained from the Research Ethics Boards at Children's Hospital of Eastern Ontario (15/103X), University of British Columbia (H15-

02710), and Université du Québec à Trois-Rivières (CER-15-218-07.05), as well as from participating school boards.

3.1.2 Participants

A purposive sampling strategy was used to recruit schools in each site. A priori power calculations identified that a sample of at least 1080 children (8–12 years old) was needed to examine correlates of IM. Overall, 1892 child–parent dyads (Ottawa: 510; Vancouver: 828; Trois-Rivières: 554) in grades 4, 5, and 6 were recruited from elementary schools in Ottawa ($n = 12$), Vancouver ($n = 13$), and Trois-Rivières ($n = 12$). The schools were stratified according to urbanization level (urban, suburban, rural) and socioeconomic level (low, high). Once school board approval was obtained, grade 4, 5, and 6 classes were recruited. As some classes were mixed grade, a few grade 7 students also participated in the study. For participation in the study, written consent was obtained from school officials and parents and assent from the children. Parents and children were asked to complete a survey on IM and active transportation, which was available in both English and French languages, and return to the school one week later. Additionally, the Vancouver site translated the parent and child surveys to Punjabi and Mandarin in an effort to be more inclusive of the diversity in the Greater Vancouver Area. Back translations were conducted to ensure the accuracy of the translations. Data collection took place between March 2016 and June 2017. Overall, the study had a 54% consent rate and 97% participation rate across the three sites. The final sample used for the analysis included data from 1699 participants who returned either the child or the parent survey.

3.1.3 Measures

3.1.3.1 Individual Factors

Children self-reported their gender (girl vs. boy), age (years), and grade in school (4th, 5th, 6th). Parents who completed the survey provided their gender (woman vs. man), age (under 30, 30–44, 45+ years), and working status (working vs. not working). Parents reported car ownership (“Does your household have regular use of a car (including car share)?”), home ownership (“Does your family own your home?”), and highest education level (high school or less vs. college/university). Parents also indicated the number of children (≤ 10 years) and teens (11–15 years) within the household (sibling vs. no sibling), language spoken at home (“Do you speak a language other than English or French at home?”, yes vs. no), method of travel to work (“How do you usually travel to and from work?”, bike/public transit/car/walk, and more than one option could be selected), whether their child had “a long-standing illness, disability, or infirmity” (illness vs. no illness), and whether their child had a mobile phone (yes vs. no).

3.1.3.2 Social Environment Factors

Social environment questions were drawn from Shaw and colleagues’ 16-country IM study (Shaw et al., 2015). Parents were asked about their perceptions of informal social control, stranger danger, and traffic danger. Parents were asked to what extent they agreed or disagreed with the statements “Most adults who live in the neighborhood look out for other people’s children in the area” and “Some young people and adults in the area make you afraid to let your children play outdoors” on a 5-point Likert scale (1 = strongly disagree and 5 = strongly agree). Parents were also asked, “How worried are you about the risk of your child being injured in a

traffic accident when crossing a road?” and responded on a scale from 1 to 4 (1 = not at all, 4 = very).

Parental perceptions of barriers to children walking and cycling were assessed using seven items that applied to the school route and more broadly to the neighborhood. Parents indicated their level of agreement with the statements “There are no sidewalks or bike lanes”, “The route does not have good lighting”, “There is too much traffic around our home”, “There is one or more dangerous crossing”, “It is unsafe because of crime (strangers, gangs, drugs)”, and “My child gets bullied, teased, harassed” on a scale of 1 to 4 (1 = strongly disagree, 4 = strongly agree).

Children were asked about their perceptions of neighborhood safety, “How safe do you feel on your own in your local neighborhood?”, on a 4-point scale (1 = not at all safe, 4 = very safe). Additionally, children were asked about their concerns (“When you are outside on your own or with friends are you worried by any of the following?”) in relation to each of the following items: “Traffic”, “Getting lost”, “Bullying”, “Strangers”, “Do not feel that I am old enough to go about on my own”, and “Not knowing what to do if someone speaks to me” (yes vs. no).

3.1.3.3 Physical or Built Environment Factors

The built environment was assessed by site (Ottawa, Vancouver, Trois-Rivières) and objective measures of urbanization (urban, suburban, rural) as categorical variables following the methods outlined in Rainham et al. (2012), school-level SES (high vs. low) estimated from 2006 Canada census data on median household income within the census tract of the school, and the neighborhood walkability of the environment within network buffers of 400 m and 1600 m. The

neighborhood walkability was assessed for the child's home address with a modified version of the index (Frank et al., 2010) using ArcGIS 10.3 (ESRI Canada, Ottawa, ON, Canada). Canadian geographic information systems do not readily contain retail floor area ratio information compared to other countries (Kerr et al., 2013). The formula used for walkability was walkability = $[(2 \times z\text{-intersection density}) + (z\text{-net residential density}) + (z\text{-land use mix})]$.

3.1.3.4 Independent Mobility Measures

Children's IM was assessed through parent self-report. Children's IM was operationalized as Hillman's six mobility licences which included children's licence to (1) travel home from school alone, (2) cross main roads alone, (3) cycle on main roads alone, (4) travel on buses alone (other than school bus), (5) travel alone to places other than school, and (6) go out alone after dark (Mayer Hillman et al., 1990). The six IM licences were dichotomized (1 = yes; 0 = no), and an IM index was constructed ranging from 0 to 6 as the sum of scores for each mobility licence (0 = no IM and 6 = high IM). A separate ATIM pilot study by Larouche and colleagues (Larouche et al., 2017) found the IM index to be reliable and valid for both English and French surveys.

3.1.4 Statistical Analysis

The "mice" package in R Studio software (RStudio Team, 2015) was used to impute the incomplete multivariate data (Buuren & Groothuis-Oudshoorn, 2010). A total of 20 imputed datasets was produced with 25 iterations per imputation. Predictive mean matching was used for continuous data, logistic regression was used for binary data, proportional odds were used for ordered categorical data, and polytomous logistic regression was used for unordered categorical

data (Buuren & Groothuis-Oudshoorn, 2010). Statistical analyses were performed using IBM SPSS Statistics version 25 (IBM Corp., 2017). The study sample was described using descriptive statistics. Linear mixed-effects models were used to examine the association of individual, social, and physical or built environmental correlates and parent-reported IM. Maximum likelihood null models were created including site, urbanization, SES, and schools to determine the within-school intra-class correlation coefficient (ICC), resulting in school being a significant random effect. Site, urbanization, and SES were therefore assigned as fixed effects in all models. The models corresponded to the levels of a social–ecological model: Model 1 examined the individual correlates and IM, Model 2 examined the social environment correlates and IM, and Model 3 examined the geographical and area-level correlates of IM. Child age and child grade violated the assumption of multicollinearity; therefore, child grade ($\beta = 0.513$) was included as a proxy for child age. Subsequent analyses were stratified by gender due to well-documented gender differences in IM (Foster et al., 2014; Mackett et al., 2007; O’Brien et al., 2000). Both non-stratified and stratified results are provided in Section 3. A significance level of $p < 0.05$ was used for all statistical inferences. Finally, the multiply imputed models were compared with a complete case analysis to examine the consistency of the findings.

3.2 Results

Table 3.1 presents the descriptive characteristics of 1699 participants. Over half (55.1%; $n = 936$) of child participants were girls, and children’s ages ranged between 8 and 13 years (mean age = 10.21 ± 0.98 years). More than three-quarters (80.9%; $n = 1375$) of parent respondents were women, in the age range of 30–44 years (68.9%), working either full-time or part-time (84.5%), and held a college or university degree (87.8%). Using the parent-reported IM

index (0–6 scale), the mean IM index was 2.06 ± 1.55 . Boys' IM (mean = 2.16 ± 1.56) was significantly higher than girls' IM (mean = 1.98 ± 1.54 , $t = 2.341$, $p = 0.019$). On the IM index, 21.0% of children ranked 0, 20.4% ranked 1, 18.1% ranked 2, 18.4% ranked 3, 17.0% ranked 4, 4.8% ranked 5, and only 0.4% ranked 6.

Table 3.1 Descriptive characteristics of study sample (n=1699)

Parent Characteristic	N	Percentage (%)	Child Characteristic	N	Percentage (%)
Gender			Gender		
Woman	1375	80.9	Girl	936	55.1
Man	324	19.1	Boy	763	44.9
Age (years)			Age (years)		
Under 30	19	1.1	8	15	0.9
30-44	1170	68.9	9	440	25.9
45+	510	30.0	10	584	34.4
			11	493	29.0
			12	161	9.5
			13	6	0.4
Education Level			Grade Level		
High school or less	166	9.8	4	582	34.3
College/University	1491	87.8	5	600	35.3
Language Spoken at home			6	498	29.3
Yes, speak a language other than English or French at home	517	30.4	7	19	1.1
Parent Work Status			Child Illness		
No	263	15.5	Yes, child has a long-standing illness, disability, or infirmity	80	4.7
Yes, full-time or part-time	1436	84.5	Child mobile phone ownership		
Car Ownership			Yes	227	13.4
No car	62	3.6			
Yes, own either 1 or more cars	1637	96.4			
Home Ownership					
No, don't own home	447	26.3			
Yes, own home	1252	73.7			

Parent Characteristic	N	Percentage (%)	Child Characteristic	N	Percentage (%)
Siblings					
No	285	16.8			
Yes	1412	83.1			
Parent Travel Mode to Work					
Walk	221	13.0			
Bike	108	6.4			
Public Transit	208	12.2			
Car	1200	70.6			

Table 3.2 shows the individual-level correlates of IM. Prior to stratification by gender, children's grade in school ($\beta = 0.612, p < 0.001$), their gender (ref. boy, $\beta = -0.257, p < 0.001$), and phone ownership ($\beta = 0.593, p < 0.001$) were all significantly associated with IM. Additionally, language spoken at home other than English or French ($\beta = -0.503, p < 0.001$), parent gender (ref: man, $\beta = -0.269, p = 0.001$), and car ownership (ref: no car, $\beta = -0.374, p < 0.05$) were negatively associated with IM. For both girls and boys, grade in school ($\beta = 0.560, p < 0.001$ for boys; $\beta = 0.658, p < 0.001$ for girls), language spoken at home ($\beta = -0.599, p < 0.001$ for boys; $\beta = -0.487, p < 0.001$ for girls), and ownership of a mobile phone ($\beta = 0.433, p < 0.01$ for boys; $\beta = 0.700, p < 0.001$ for girls) remained significant after stratifying by child gender. Boys had significantly higher IM if the parent respondent traveled to work by car ($\beta = 0.271, p < 0.05$). However, the gender of the parent respondent (i.e., mother respondent) was negatively associated with boys' IM ($\beta = -0.387, p < 0.05$).

Table 3.2 Individual-level correlates of children’s independent mobility

Correlate	Girls (n=936)		Boys (n=763)			
	β	95% CI	β	95% CI		
Child Characteristics						
Child grade level	0.658***	0.550	0.766	0.560***	0.433	0.688
Child illness	-0.278	-0.716	0.159	-0.255	-0.686	0.176
Mobile phone ownership	0.700***	0.452	0.948	0.433**	0.117	0.750
Household Characteristics						
Parent age	-0.169	-0.360	0.022	0.015	-0.200	0.229
Parent gender	-0.160	-0.375	0.055	-0.387**	-0.634	-0.140
Parent work status (not working vs working)	0.177	-0.083	0.438	-0.102	-0.397	0.193
Parent education	0.011	-0.268	0.289	-0.160	-0.510	0.190
Language spoken (English/French vs other language)	-0.487***	-0.712	-0.262	-0.599***	-0.845	-0.354
Car ownership	-0.445	-0.910	0.019	-0.179	-0.750	0.393
Home ownership	-0.038	-0.252	0.176	0.204	-0.054	0.463
Siblings (no sibling vs sibling(s))	0.043	-0.193	0.279	0.075	-0.182	0.333
Parent Travel Mode to Work						
Walk	-0.123	-0.394	0.148	0.309	-0.017	0.636
Bike	0.351	-0.004	0.706	0.045	-0.375	0.465
Public transit	-0.228	-0.504	0.047	0.060	-0.255	0.376
Car	-0.059	-0.266	0.148	0.271*	0.022	0.519

Significant correlates are bolded: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; CI: confidence interval; β : unstandardized regression coefficients.

Table 3.3 shows social-environment-level correlates of IM. Prior to stratification by gender, a child’s worry about getting lost ($\beta = -0.275, p < 0.05$) was negatively associated with IM. Parents’ worry regarding the risk of their child being injured in a traffic accident was negatively associated with IM ($\beta = -0.321, p < 0.001$). Additionally, parents’ concerns that their neighborhood was unsafe due to crime (strangers, gangs, drugs) ($\beta = -0.235, p < 0.001$), that there were one or more dangerous crossings present ($\beta = -0.209, p < 0.001$), or that there were no sidewalks or bike lanes ($\beta = -0.114, p < 0.05$) were negatively associated with IM. Parental

perceptions that their child might face bullying, teasing, or harassment were positively associated with IM ($\beta = 0.190, p < 0.05$). Stratifying by gender showed that parents' concern over traffic ($\beta = -0.287, p < 0.001$ for boys; $\beta = -0.339, p < 0.001$ for girls) and the presence of one or more dangerous crossings ($\beta = -0.176, p < 0.01$ for boys; $\beta = -0.292, p < 0.001$ for girls) was negatively associated with IM in boys and girls. For boys, parents' perception of crime (strangers, gangs, drugs) in the neighborhood was negatively associated with IM ($\beta = -0.313, p < 0.001$). For girls, parents' concern over stranger danger ($\beta = -0.146, p < 0.05$) and a child's worry about getting lost ($\beta = -0.364, p < 0.05$) were negatively associated with IM. Parental concern regarding the absence of sidewalks or bike lanes and bullying was no longer significant after stratification.

Table 3.3 Social environment-level correlates of children's independent mobility

Correlate	Girls (n=936)			Boys (n=763)		
	β	95% CI		β	95% CI	
Child Perceptions						
Neighbourhood safety	-0.194	-0.405	0.017	0.025	-0.186	0.235
Child worried about...						
Traffic	-0.102	-0.419	0.215	-0.175	-0.497	0.147
Getting lost	-0.364*	-0.670	-0.059	-0.279	-0.602	0.044
Bullying	0.248	-0.115	0.612	0.175	-0.176	0.527
Strangers	-0.194	-0.471	0.083	0.001	-0.272	0.273
Feeling they are not old enough to go about on their own	-0.244	-0.646	0.159	-0.231	-0.642	0.181
Not knowing what to do if someone speaks to them	0.060	-0.235	0.356	-0.264	-0.572	0.044
Parent Perceptions						
Most adults in the neighbourhood look out for other people's children in the area	0.070	-0.051	0.192	0.059	-0.065	0.183
People in the area make me afraid to let child play outdoors	-0.146*	-0.268	-0.023	-0.034	-0.156	0.088
Worried about risk of child being injured in a traffic accident	-0.339***	-0.494	-0.183	-0.287***	-0.441	-0.134
Barriers to child walking or cycling						
No sidewalks or bike lanes	-0.093	-0.242	0.056	-0.117	-0.261	0.026

Correlate	Girls (n=936)			Boys (n=763)		
	β	95% CI		β	95% CI	
Route does not have good lighting	0.139	-0.029	0.307	0.069	-0.089	0.228
Too much traffic around the home	-0.007	-0.152	0.139	0.027	-0.120	0.174
One or more dangerous crossing	-0.292 ^{***}	-0.423	-0.162	-0.176 ^{**}	-0.307	-0.046
Unsafe due to crime (strangers, gangs, drugs)	-0.144	-0.302	0.014	-0.313 ^{***}	-0.473	-0.152
Child gets bullied, teased, harassed	0.263	-0.001	0.527	0.158	-0.079	0.396

Significant correlates are bolded: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; CI: confidence interval; β : unstandardized regression coefficients.

Table 3.4 shows geographical and area-level correlates of IM. Site and urbanization were significantly associated with IM. Compared to children from Trois-Rivières, children in Ottawa ($\beta = -1.188, p < 0.001$) and Vancouver ($\beta = -1.216, p < 0.001$) had lower IM. In comparison to rural environments, suburban environments were negatively associated with IM ($\beta = -0.382, p < 0.05$). No significant associations with IM were found for children living in urban versus those in rural areas. These results remained consistent for site after looking at boys and girls separately (Ottawa: $\beta = -0.979, p < 0.001$ for boys; $\beta = -1.273, p < 0.001$ for girls; Vancouver: $\beta = -1.058, p < 0.001$ for boys; $\beta = -1.295, p < 0.001$ for girls). After stratifying by gender, suburban environments, in reference to rural areas, were negatively associated with IM for boys ($\beta = -0.536, p < 0.05$) but not for girls ($\beta = -0.217, p = 0.275$). For girls, neighborhood walkability (400 m buffer) was positively associated with IM ($\beta = 0.064, p < 0.01$) but negatively associated with IM with a 1600 m buffer ($\beta = -0.059, p < 0.05$). Additionally, area-level SES was not significantly associated with IM ($\beta = -0.129, p = 0.385$).

Table 3.4 Geographical and area-level correlates of children’s independent mobility

Correlate	Girls (n=936)			Boys (n=763)		
	β	95% CI		β	95% CI	
Socioeconomic status	-0.182	-0.486	0.122	-0.106	-0.472	0.260
Site						
Ottawa, Ontario	-1.273***	-1.657	-0.890	-0.979***	-1.443	-0.514
Vancouver, British Columbia	-1.295***	-1.660	-0.929	-1.058***	-1.495	-0.622
Trois Rivières, Québec	0	.	.	0	.	.
Urbanization						
Urban	-0.154	-0.589	0.282	-0.318	-0.816	0.180
Suburban	-0.217	-0.612	0.178	-0.536*	-1.004	-0.068
Rural	0	.	.	0	.	.
Walkability						
400 m	0.064*	0.015	0.114	-0.003	-0.062	0.055
1600 m	-0.059*	-0.114	-0.003	0.024	-0.035	0.083

Significant correlates are bolded: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; CI: confidence interval; β : unstandardized regression coefficients; m: meters.

The examination of multiply imputed models compared to complete case analysis found comparable results, with a few notable differences primarily concerning individual correlates of IM. A child having a long-standing illness, disability, or infirmity was negatively associated with IM ($\beta = 0.388, p < 0.05$). Parental travel mode to work was significant for boys’ and girls’ IM. For boys, parents traveling to work via public transport was negatively associated with IM ($\beta = -0.518, p < 0.05$). For girls, parents traveling to work via cycling was positively associated with IM ($\beta = 0.478, p < 0.05$). Additionally, parental work status (either part- or full-time) was positively associated ($\beta = 0.530, p < 0.01$) and parent age was negatively associated with girls’ IM ($\beta = -0.328, p < 0.01$). Additionally, a child’s perception of neighborhood safety was positively associated with IM ($\beta = 0.209, p < 0.001$). The multiply imputed data results are displayed in Tables 3.2 through 3.4, and complete case analyses results are in Appendices B.1, B.2, and B.3.

3.3 Discussion

The aim of this study was to examine factors influencing IM amongst three distinctly different sites across Canada each with varying urbanization (urban, suburban, rural) and SES (high vs. low) environments. Unsurprisingly, children's individual characteristics, specifically grade level in school and gender, were significantly associated with IM, in line with previous literature indicating that older children were more likely to have higher levels of IM (Alparone & Pacilli, 2012; Christian et al., 2015; Veitch et al., 2008). As a child gains maturity, knowledge, and pertinent skills, parents feel more comfortable letting the child roam independently. Also, children's gender predicted IM such that boys were more likely to have higher levels of IM, consistent with previous literature (Carver et al., 2014; Christian et al., 2015, 2016; Fyhri & Hjorthol, 2009; Mitra et al., 2014). Future research may wish to examine more closely how gender within the family unit (e.g., mothers, fathers, sons, daughters) may influence perceptions of the social environment and, consequently, IM. Car ownership was negatively associated with IM, indicating that increased car ownership or access to a vehicle negatively impacts children's levels of IM and active travel (Fyhri & Hjorthol, 2009; Kytta et al., 2015; Mammen et al., 2012).

Language spoken at home (when different from the co-official Canadian languages English and French) was significantly negatively associated with IM. Language spoken at home may reflect social and cultural norms, which may affect IM by influencing parental decision-making (McMillan, 2005). Studies in New Zealand (Chaudhury, 2017) and the United States (Wolfe & McDonald, 2016) found differences in IM based on race and/or ethnicity. These differences may influence household make-up (e.g., single-parent household), community make-up (e.g., extended family living in close proximity) (Chaudhury, 2017), parental concerns about the neighborhood environment (Lin et al., 2017), and commuting mode (He & Giuliano, 2017),

which may in turn impact IM. As Wolfe and colleagues (Wolfe & McDonald, 2016) argue, interventions should consider the “social and cultural norms of different races and ethnicities” to better predict how active travel plans will be received by a diverse array of families (p. 977). However, other studies have found no significant association between ethnicity and/or race and IM (He & Giuliano, 2017; Janssen et al., 2016). Regardless of mixed findings, it may be important to further examine the influence of race and/or ethnicity and, by extension, social and cultural norms that may impact IM. Interestingly, mobile phone ownership was a significant factor associated with both girls’ and boys’ IM. A child’s ownership of a mobile phone may give parents a sense of security and social control (Mikkelsen & Christensen, 2009), a way to communicate amongst family members (Hjorthol, 2008), and a tool for long-range surveillance of children.

Several social environmental factors were significantly associated with both girls’ and boys’ IM. Parents’ perceptions and concerns regarding traffic danger, crime, and dangerous crossings were, unsurprisingly, negatively associated with IM. These findings echo previous literature showing lower levels of IM when parents are concerned about the neighborhood environment and perceived danger from traffic, crime, and the built environment (e.g., dangerous crossings) (Carver et al., 2014; Christian et al., 2015; Janssen et al., 2016; Villanueva et al., 2012). These results suggest that regardless of gender, real and perceived dangers from traffic, crime, and the built environment negatively influence IM. Additionally, a child’s own worry about getting lost was a factor negatively associated with IM. For girls, a child’s worry about getting lost was still significant after stratifying by gender.

For boys, IM levels were higher when the parent respondent traveled to work by car but lower when parents perceived crime within the neighborhood and when the parent respondent

was a mother. Past research has found a positive association between parents', especially mothers', increased working hours and longer distances to work and their child's IM (He & Giuliano, 2017). Car usage, longer distances to work, or work destination in the opposite direction to a child's school may prompt children to travel independently (e.g., public transit) or actively (e.g., walking, cycling) to school or other destinations. Also, prior to stratification by gender, parents' perceptions that a child might face bullying, teasing, or harassment were positively associated with boys' IM, which may not intuitively make sense. This may reflect parental perceptions that such a possibility is heightened, rather than real, given their child's increased exposure to other children while unsupervised by an adult.

A notable contribution of this study given the sampling frame is that several physical or built environmental correlates were not significantly associated with IM. Area-level SES was not related to IM in this study. Findings regarding the association between IM and SES have been mixed in past research. While some studies have found no association with SES (Larsen et al., 2015; Mammen et al., 2012; Wolfe & McDonald, 2016), others have found low- and middle-SES environments to be more conducive for IM (He & Giuliano, 2017; Veitch et al., 2008). Additionally, the level of urbanization was not significant, except for boys living in suburban environments showing a lower level of IM compared to boys living in rural environments. Previous literature on urbanization and IM have found mixed results regarding the suburban environment having a positive association with IM (Kytta et al., 2015; Loo & Lam, 2015) with IM compared to urban and rural environments. In Kytta's model explaining the covariation of IM and actualization of affordances in four different environments (i.e., Bullerby, Wasteland, Cell, and Glasshouse), some suburban environments can be "sleepy" or "too dull" and may be categorized as "Wasteland" environments (Kytta, 2004). Affordances are defined as

opportunities (e.g., physical, emotional, social, and cultural) which an individual perceives within a specific environment, while actualized affordances are ones that “the individual perceives, utilizes or shapes” (Kytta, 2004, p. 181). Suburban environments may provide a lack of diversity of affordances and may be empty of things for children to discover, thereby limiting actualized affordances (Kytta, 2004).

Neighborhood walkability was only associated with girls’ IM. These findings are similar to two studies which found walkability to be positively associated with IM, but only in girls (Villanueva et al., 2012, 2014). However, walkability has yielded mixed results, including no significant association between parental perceptions of walkability and IM (Carver et al., 2014). Walkable neighborhoods for adults may not be supportive of PA among children (Janssen & King, 2015). Higher intersection density, for example, will result in a greater number of street crossings. Children’s IM may be restricted as a result of parental safety concerns about the subsequent increase in potential exposure of their child to traffic. However, in the current study, walkability within the 400 m buffer was positively associated with girls’ IM, but not when using a larger buffer (1600 m). It is well documented in the literature that increasing distances, especially above 1 km, result in lower levels of IM (Buliung et al., 2017; He & Giuliano, 2017; Lin et al., 2017). Accordingly, the walkability of the area most proximal to the home appeared important for girls.

Overall, the strongest correlate of IM, even after stratification by child gender, was location (i.e., site). Children’s IM was lower in Ottawa and Vancouver compared to Trois-Rivières. While populations in these locations (Ottawa = 934,243; Vancouver = 631,486; Trois-Rivières = 134,413 according to 2016 Census Profile) (Government of Canada, 2017a) may influence IM (e.g., population density), other factors like the social and cultural differences

should be considered. Secondary analyses (not reported here) found no significant associations between site and parents' perceptions of informal social control, traffic concerns, and stranger danger. The differences in IM by site may stem from social and cultural differences.

Additionally, as a multi-cultural country, Canada is home to a diverse array of people, especially in hubs like Ottawa and Vancouver, and therefore encompasses a range of cultural and social norms. This is reflected by the diversity of languages spoken at the two larger sites, Vancouver and Ottawa, compared to Trois-Rivières. Secondary analyses determined that higher proportions of languages (other than English and French) were spoken at home in Ottawa and Vancouver compared to Trois-Rivières. In Trois-Rivières, only 4.1% reported speaking a language other than English or French, while this percentage was 32.5% and 47.0% for Ottawa and Vancouver, respectively. In Ottawa, higher percentages of Arabic, Creole, and Spanish were spoken at home, while in Vancouver, higher percentages of Asian languages were spoken (i.e., Mandarin, Chinese, Cantonese, Korean, and Japanese). Participants in Ottawa and Vancouver self-reported speaking over 45 different languages at home compared to 7 self-reported languages in Trois-Rivières.

Language differences may reflect cultural differences. Potential differences in cultural norms may influence family structure and social norms regarding IM, which may in turn affect whether families adopt or reject certain travel modes (e.g., independent travel). In a study by Lam and Loo in Hong Kong (Lam & Loo, 2014), higher numbers of grandparents or domestic helpers within the family structure reduced children's independent travel opportunities, and children from extended households showed lower levels of IM compared to children from nuclear families or single-parent families. These cultural differences can be seen in various countries across the world for IM as well as active transportation (Davison et al., 2008).

Although IM has declined worldwide, Scandinavian countries like Finland, Norway, Sweden, and Denmark, as well as other countries like Germany and Japan, rank the highest for children's IM (Shaw et al., 2015). The most recent Global Matrix 3.0, the most comprehensive assessment of global variation in children and youth PA, found that while Canada and the United States scored a D- for active transportation, other countries such as Japan, Nepal, Denmark, and Finland scored in the A- to B+ range (Active Healthy Kids Global Alliance, 2018b). It is therefore necessary to consider how social and cultural differences may influence IM and consequently develop research, strategies, and policies that are tailored and take these differences into account.

While the physical or built environment and individual-level variables are strong correlates of IM, many of these factors can also be classified as *non-modifiable* factors, such as location and child age. In terms of location, levels of IM looked remarkably similar regardless of where a child lived. In the hopes of positively influencing IM levels, it may be important to shift focus to *modifiable* factors. These modifiable factors encompass the social correlates of IM, more specifically, parents' and children's perceptions of safety. After stratification by gender, the majority of the significant correlates were parental perceptions of the social environment. In line with previous literature, this study found that parental perceptions of neighborhood safety, crime, bullying, stranger danger, and traffic were significantly associated with IM (Carver et al., 2014; Foster et al., 2014; Janssen et al., 2016; Mitra et al., 2014).

These findings may have implications for policies and interventions that aim to encourage IM, active transportation, and outdoor play. While city planners and urban developers can work toward creating child-friendly environments, it is important to acknowledge parents' role as "gatekeepers" for their children's access to the outside world. Parental influence over

their IM licenses may be considered a social environmental influence and may play a role in either enhancing or restricting children's actual mobility. Interventions that aim to increase IM will need to target parents' fears and concerns (e.g., perceptions of traffic danger, neighborhood safety) as these are modifiable factors that can be addressed. There are current initiatives that aim to help parents reframe those risks. For example, an online tool, OUTSIDEPLAY.ca, aims to address parental fears by helping them reframe the risk and gain confidence in allowing their children to engage in outdoor risky play (Brussoni et al., 2018). The social–ecological framework emphasizes the interplay of several layers of influence on a health behavior (e.g., IM); while we suggest focusing research on modifiable factors, it is still important to consider how to improve neighborhood safety.

Finally, in line with previous literature, significant differences in IM are seen between boys and girls. Additionally, this study found a negative association between parent gender (i.e., mother respondents) and boys' IM. Previous research has noted differences between fathers and mothers regarding risk allowance and negotiation for recreational activities. Fathers are often deemed “risk experts” while mothers tend to be more protective and tend to counter the father's risk allowance (Brussoni et al., 2013, p. 1390). The findings identify a need for future research to more closely explore the gendered nature of IM.

3.3.1 Strengths and Limitations

The strengths of this study include the relatively large sample size ($n = 1699$), as well as sample stratification by region (Ontario, British Columbia, and Québec), urbanization (urban, suburban, and rural), and socioeconomic status (high vs. low median income), although more than half the parent respondents were women (80.9%) and most were highly educated (87.8%). Additionally, while attempts were made to vary the regions and urbanization where the sample

was recruited, it is important to acknowledge that not all environments were considered. For example, people living in northern regions of Canada may face unique barriers to IM and PA, such as wildlife, inclement weather, and hours of daylight available. The questions examining social environment factors were drawn from a 16-country study; however, it is important to acknowledge that there are no published data on the reliability and validity of these measures. This study used the most common and validated measure of IM (Bates & Stone, 2015), yet the responses may be vulnerable to recall and social desirability biases.

3.4 Conclusions

Children's IM is influenced by a diverse set of correlates including individual, social, and physical or built environmental level factors. While there are non-modifiable factors including individual and physical or built environmental factors that influence IM, it will be vital for interventions to target modifiable factors, including children's and parents' perceptions of their social environment. Perceptions of neighborhood safety (e.g., traffic, crime, and stranger danger) can be influenced and may offer a target area for IM interventions. Moreover, the influence of gender and cultural background needs to be further examined in order to help address parents' perceptions of safety, concerns, and worries, which in turn can affect IM.

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Chapter 4: ‘Well you feel more responsible when you’re unsupervised’:

Exploring family perspectives on children’s independent mobility

4.1 Introduction

Children’s independent mobility (IM) refers to a child’s freedom to travel in their neighbourhood without the supervision of an adult (Tranter & Whitelegg, 1994) and may involve independent travel (e.g., walking, cycling) and play. Children’s IM is associated with a number of benefits including greater physical activity (PA) (Schoeppe et al., 2013), improved risk assessment, way-finding skills, self-confidence and self-esteem (Riazi & Faulkner 2018). However, there have been several challenges to IM including unsupportive social norms (e.g., children moving around the neighbourhood independently not seen positively), parental fear of what others may think, and the potential involvement of social services (Christian et al., 2015; Shaw et al., 2015). For example, in 2017, the story of one Vancouver father gained international media attention after being faulted by the Ministry of Children and Family Development for allowing his four children (ages 11, 9, 8, and 7 years at the time) to take public transit to school by themselves (Kassam, 2017). The Vancouver father had spent two years training his children to take the bus to their school. However, the Ministry ruled that children under 10 years of age could not be unsupervised on the bus (Crook, 2018). This case exemplifies one of the challenges for IM. In the past decade, research on IM has grown exponentially (Chapter 2) along with a growing understanding of the myriad of benefits and barriers. Of concern, however, is evidence pointing to general declines in independent mobility (IM) levels over several generations (Hillman et al., 1990; Shaw et al., 2015). This may consequently affect children’s PA levels, as

well as other social, cognitive, and developmental benefits gained from being able to roam their neighbourhood independently.

In Canada, the 24-Hour Movement Guidelines for Children and Youth recommend 60 minutes per day of moderate-to-vigorous physical activity (MVPA) (Tremblay et al., 2016). However, 61% of Canadian children (5-17 years old) are not meeting the recommended PA guidelines (ParticipACTION, 2020) and over a 9-year period, no marked improvements were seen in Canadian children (Colley et al., 2017). Additionally, the decline in IM may consequently affect decreases in active school transportation. It is therefore important to further explore IM as it may influence other behaviours (e.g., PA, active transportation) to understand how we may be able to halt and reverse this downward trend in Canada and in other Western countries.

A variety of social-ecological correlates have been identified that influence IM (Riazi & Faulkner, 2018; Chapter 2; Chapter 3). These include individual-level factors like children's age and gender with most studies finding higher levels of IM for older children and boys compared to younger children and girls (Marzi et al., 2018). Social environment-level factors are negatively associated with IM when concerns about stranger danger, traffic and crime are heightened and may consequently hinder IM (Janssen et al., 2016; Mitra et al., 2014; Villanueva et al., 2014). Built environment-level factors like distance and destination availability and type (e.g., green space, recreation centre) are also associated with IM, with increasing distance often being associated with less IM (Fyhri & Hjorthol, 2009; Lin et al., 2017). However, the social environment in particular, may be an important focus for IM as factors such as parental perceptions of the neighbourhood environment appear to be influential but remain potentially modifiable. While previous quantitative studies have identified a number of correlates associated

with IM, they have also highlighted a need for more in-depth examination of these factors and exploration of their nuances. For example, while many cross-sectional studies have identified that boys and older children tend to have higher levels of IM than girls and younger children (Janssen et al., 2016; Wolfe & McDonald, 2016), other studies have shown the opposite (Valentine, 1997b; Veitch et al., 2008). Qualitative methodologies may be more suited to exploring these inconsistencies and considering how other factors like personality and maturity may play a role as these individual characteristics are hard to quantify especially in quantitative studies.

Limited qualitative research has endeavored to explore children's and parents' perspectives on IM. Brown and colleagues (2008) examined children's (11-12 years old) gender differences in acquiring IM in two locations in southeast England (both suburban but contrasting in density, car ownership, and deprivation). While boys tended to have higher levels of IM, girls gained similar levels by adjusting how they traveled (i.e. in groups) (Brown et al., 2008). Additionally, Crawford and colleagues (2017) conducted focus groups with 132 children (8-15 years old) and a small group of parents (n=12) examining experiences and perceptions of IM in metropolitan and regional areas in Victoria, Australia representing varying physical and community environments (e.g., suburban areas; beach-side inner suburbs; farming communities). The study highlighted that children reported a wider variety of safety concerns in comparison to parents, but also that children liked having IM. Another study by Veitch and colleagues (2006) examined parents' perceptions of social-ecological influences on their children's (average age 8.3 years old) active play in Australia. Findings suggest that safety and social factors (e.g., social network of friends and neighbours) influence IM and active play (Veitch et al., 2006).

Additionally, it is vital to consider whose perspectives are being captured in the IM research. Mothers' perspectives are predominantly represented within the IM literature (Aggio et al., 2017; Alparone & Pacilli, 2012; Bhosale et al., 2017; Prezza et al., 2001). For example, a multi-site primary school-based study examining correlates of IM found that mothers (approximately 80.9%) were more likely to fill out the parent survey (Riazi et al., 2019). Studies by Alparone et al. (2012) and Prezza et al. (2001) have specifically focused on the perspectives of mothers, and a large portion of IM studies within the literature have samples largely skewed toward mothers. Similarly, other literature highlights low representation of fathers in observational studies (Davison et al., 2016). As a result, research may not fully capture the diverse family perspectives on IM. Most IM studies are also cross-sectional in design and primarily focused on identifying correlates of IM. Such designs tend to be overly descriptive and yield little insight into how correlates may interact, how different households experience IM, or how interactions between caregivers (in most cases mothers and fathers) may shape children's IM.

More recently, Brussoni et al. (2020) examined factors that facilitated or hindered children's unsupervised outdoor play through children's interviews and found two overarching themes relating to children's sense of safety and perceptions of things to do in the neighbourhood. This study highlighted the child perspective. However, it underlines a need to examine IM from the child and parents' perspectives on IM and its negotiation. While children's and/or parents' perspectives have been considered, the family unit as a whole has not been examined. Children exist within the family unit and are co-creators of that family environment; considering a single perspective, whether it be the child or parent, overlooks other important perspectives within the family unit. It is therefore important to consider the perspectives of the

family unit to provide a comprehensive understanding of how IM is negotiated within the family context. Comparing and contrasting perspectives may shed new insight on children's IM. Additionally, extant literature has emphasized parents' role as 'gatekeepers' (Boxberger & Reimers, 2019). As gatekeepers, parents can either enable or limit a child's IM; parents' perspectives are therefore vital for understanding IM. However, it is equally important to strive to include children's perspectives and participation in the 'issues that affect them' (UNICEF Innocenti Research Centre, 2004). As highlighted through family systems theory, interactions within family units are complex, connected, and often interdependent (Bregman & White, 2010). As such, research within families may lead to contradictory accounts, recruitment of all members of the family may be challenging and may also lead to large amounts of collected data. That is, little research on IM has focused on the context and precursors of negotiation of IM within the family unit.

The purpose of this qualitative study was to examine children's and parents' perspectives and negotiations of IM within the family unit. Several questions guided our investigation including: What are different family members' (parents and child) perspectives of IM in relation to attitudes and approaches to IM? How do parents and children negotiate children's IM? This examination is important in advancing our understanding of the influence of individual- and social- level factors on children's IM, how families negotiate IM, and may provide important insight for the development of policy and practice interventions to increase IM.

4.2 Methods

4.2.1 State of Play Study

This qualitative study was embedded in a larger cross-sectional study (The State of Play) conducted in the Metro Vancouver area, Canada. The State of Play study explored the socio-ecological perspectives on children's outdoor play and IM. Families (children 10-13 years old and their parents) were recruited from three distinct neighbourhoods in the Metro Vancouver area including Vancouver's Grandview-Woodland, North Vancouver's Lonsdale, and Richmond's Steveston. These three neighbourhoods were selected for their variation in urbanization, population density, ethnic make-ups, and number of children (Han et al., 2018). Families were recruited through a variety of avenues including word-of-mouth, social media (e.g., targeted Facebook ads.), community centres and libraries, and local parent listservs. Criterion-based sampling was used to select participants. Inclusion criteria included living within one of the target communities in Metro Vancouver, reading, speaking, and understanding English. Additionally, children had to be able to participate in physical activities at the time of study and were able to roam either independently (or with friends) at least within their yard and/or driveway. A total of 35 families were interviewed in each of the three neighbourhoods (n=105 child interviews; n=127 parent interviews). Further details about the State of Play study including characteristics of the neighbourhoods can be found elsewhere (Han et al., 2018). Written informed parental consent and child assent was obtained. Ethics approval was obtained from the institutional Research Ethics Boards at The University of British Columbia and British Columbia Children's and Women's Hospital (H15-02190).

4.2.2 Participants

Twenty-two families were purposefully sampled from the larger study in order to select information-rich cases to shed light on the questions being investigated (Patton, 2014). Families were included if both parents completed a semi-structured interview and the child completed a walk-along interview. No exclusion criteria were placed for children and parents based on age, gender, or neighbourhood in which they lived. Sixty-six total interviews met the inclusion criteria (22 child interviews; 44 parent interviews) and were included in the analysis. The included family units were spread across the three neighbourhood sites (Vancouver, n=10; North Vancouver, n=6, Richmond, n=6). Participants self-identified as White (n=49; 74.2%), Asian (n=13; 19.7%), Prefer not to answer (n=2; 3.0%), Mixed (n=3; 4.5%), women (n=24), men (n=20), and heterosexual couples (n=20 families), and homosexual couples (n=2 families). Child participants self-identified as girls (n=9), boys (n=12), and non-binary (n=1) (see Table 4.1 and 4-2 for participant demographics). Close to half (45.5%) of parent participants fell in the 41-45 age range followed by the 46-50 age range (29.5%) and child mean age was 11.5 years old. Most children (82%) had higher levels of IM (≥ 4.6 ; range 1-6) parent-reported scores (Table 4.2 reports the average IM score for the child from both parents' reported scores). Each parent and child received \$50 and \$100 respectively for participating in the study.

4.2.3 Data Collection

Face-to-face interviews were conducted with parents and walk-along interviews were conducted with children. Interviews were chosen as they provide a way for participants to share their experiences in 'rich and detailed ways' and acknowledges that participants' perspectives and interpretations on those experiences are shaped by social factors (Smith & Sparkes, 2016).

During the walk-along interview the researcher accompanies the participant on ‘outings in their familiar environments’, in this case the child’s neighbourhood (Carpiano, 2009). The walk-along interview method is flexible regarding interview structure (i.e. semi-structured interview), helps build rapport, and reduces power dynamics between the researcher and participant (Carpiano, 2009). Semi-structured interview guides [please see Appendix C.1 and C.2] were used for both parents and children. Parents were asked how they and their partner differed in their approach and IM of their child and children were asked about whether they perceived differences between their parents’ approach to IM. Parents were asked about their own childhood, their general philosophy around independent play, what unsupervised meant to them, and questions specific to their IM related to barriers, fears, and/or concerns regarding IM. Furthermore, parents were asked about facilitators of IM, including neighbourhood connectedness and whether they felt safe in their neighbourhood. Each parent also reported their child’s IM by scoring on a scale from 1 (my child is not allowed out alone) to 6 (my child is allowed out more than a 15-minute walk from home). Children were asked about their time spent playing outside, whether the time is unsupervised/independent, the range the child could travel, how their time independently mobile is spent, and facilitators of IM. Additionally, social-ecological factors were explored including perceptions of the social environment and individual and built environmental factors.

Interviews were conducted by the PI, research coordinator and a team of research assistants (RAs), and graduate research assistants (GRAs) (n=6) including the first author. All members of the interview team were trained in qualitative interviewing by the research coordinator prior to leading interviews. A semi-structured interview guide was used for both parents and children for its flexibility and consistency and comparability since participants were interviewed by several research assistants (Bryman, 2012). Interviews with parents lasted

approximately 60 minutes, walk-along interviews with children lasted 45 to 60 minutes, and all interviews were conducted between April 2016 and February 2018. Most of the data collection occurred during the months that children were in school during autumn and spring (September to October; March to June).

4.2.4 Data Analysis and Quality

All interviews were audio-recorded, transcribed verbatim by a local professional transcriber, RA, or GRA from the State of Play research team, and checked for accuracy by a RA. This study adopted a social constructivist approach, which acknowledges that individuals develop ‘subjective meanings’ from their experiences and these meanings are ‘varied and multiple’ (Creswell & Poth, 2017) and the researcher attempts to interpret the meanings others have about the world (Creswell & Poth, 2017). Data from the parents’ and children’s interviews were analyzed through reflexive thematic analysis (Braun et al., 2016, 2019). The first author began by immersing herself in the data by reading and re-reading all the interview transcripts analytically while taking reflexive notes, familiarizing herself with the data. The data were read and key pieces of data relevant to the research were tagged. QSR International’s NVivo 12 Software was used to organize and code the data. Each interview in a family unit (both parents and child) was coded, before moving on to the next family unit. Family units within the same neighbourhood were coded before moving on to the next neighbourhood. Codes were identified for each family unit, across each neighbourhood, then across the full dataset. The first author coded the data abductively, creating, deleting, and updating codes, informed by literature on IM, until the point where she felt the codes captured the varying perspectives in the data. She then organized the generated codes into ‘candidate themes’ and then re-examined, named, and refined these into four overarching themes (Braun et al., 2016). These themes answered the research

question, were also consistent and coexistent, and reflected the patterns generated across the dataset. Throughout the analysis and writing process, the first author moved back and forth between the data and writing, reflecting on the generated themes and conclusions, and updating and refining these in the process. Participant codes were replaced with pseudonyms.

A variety of steps were taken during data collection and analysis to address the multiple perspectives (i.e. both parents and child) in the data. Interviews were conducted separately with each participant in an attempt to address power relations, the potential silencing of the voice of the child, and/or parents influencing children's answers, or each other's answers (Harden et al., 2010). Children, however, could have their sibling or parent come on the walk-along interview if that helped them feel more comfortable. The first author worked to provide equal consideration on children's and parents' accounts through reflexivity and analytical notes during analysis (Harden et al., 2010). To ensure quality, the use of 'critical friends' was adopted (Smith & McGannon, 2018). Critical friends included the co-authors of this paper (Faulkner, Brussoni, Vertinsky) who had expertise in IM, PA, outdoor play, and qualitative methods. The co-authors acted as sounding-boards, to stimulate discussion, provide feedback on conclusions and data interpretations, and encourage the researcher's reflexive acknowledgement of results and perspectives in the research process (Smith & McGannon, 2018).

4.3 Results

The results of this study are presented below. First, a descriptive summary of the sample is provided followed by a description of common barriers to IM reported by children and parents. The results are then split into four overarching themes that resonated with the 22 families in the

sample. Pseudonyms will be followed by participant age, neighbourhood (Vancouver=V; Richmond=R; North Vancouver=Nv), and family (e.g., F1, F2, etc.).

In this sample, most families had a household income equal or over \$110,000 and most parents had a university or post-graduate degree (Table 4.1). This sample of families was also marked by higher levels of IM across the three different neighbourhoods (Table 4.1 and 4.2). Participants, both children and parents, discussed destinations children could independently travel to including to/from school, followed by the local neighbourhood, and various other destinations (e.g., parks, friend’s home, major streets, locations with shops and food venues). While families discussed engaging in family activities, most children demonstrated the ability to also travel and play in their neighbourhoods most often with their friends, followed by their siblings, and alone.

Table 4.1 Parental demographic characteristics

Demographics	Parent	
	<i>n</i>	<i>%</i>
<i>Age range</i>		
36-40	4	9.1
41-45	20	45.5
46-50	13	29.5
51-55	6	13.6
56+	1	2.3
<i>Race/ethnicity</i>		
Asian	9	20.5
White	33	75.0
Prefer not to answer	2	4.5
<i>Marital status</i>		
Common law	27	61.4
Divorced	16	36.4
Married	1	2.3
<i>Employment status</i>		
Employed for wages	30	68.2
Homemaker	2	4.5
Self-employed	9	20.5
Both self-employed and part-time employed	1	2.3

Demographics	Parent	
Student	1	2.3
Working part-time	1	2.3
<i>Education</i>		
Post grad	15	34.1
University	19	43.2
Some university	2	4.5
College	7	15.9
Some college	1	2.3
<i>Household income</i>		
Unable to work	1	2.3
<\$29,999	1	2.3
\$50,000-\$69,999	1	2.3
\$70,000-\$89,999	5	11.4
\$90,000-\$109,999	6	13.6
\$110,000 to \$129,999	9	20.5
≥\$130,000	21	47.7

Table 4.2 Child demographic characteristics

Demographics	Child	
<i>Age range</i>	<i>n</i>	<i>%</i>
10	4	18.2
11	8	36.4
12	5	22.7
13	5	22.7
<i>Grade in school</i>		
4 th	3	13.6
5 th	2	9.1
6 th	8	36.4
7 th	4	18.2
8 th	5	22.7
<i>Ethnicity</i>		
White	16	72.7
Asian	3	13.6
Mixed	3	13.6
<i>Independent mobility level</i>		
	<i>(range 1-6)</i>	
1-2.5	2	9.1
2.6-3.5	1	4.5
3.6-4.5	1	4.5
4.6-5.5	9	40.9
5.6-6	9	40.9

Most children reported feeling ‘comfortable’ and ‘good’ about being independently mobile in their respective neighbourhoods. As Ryan (13, V, F2) described, ‘often times on Sundays I go for bike rides with my friend, and we don’t actually quite have a plan on where we’re going, we just sort of end up somewhere. Which I think is really cool...And that’s where I found out about most of my favourite spots.’ Other children admitted feeling ‘more responsible when you’re unsupervised’ (Alice, 12, V, F8) and believed that their ‘parents trust’ them (Caleb, 13, R, F19). Angela (12, R, F21) spoke about her mother’s expectations, ‘Like my mom she’s like, “I’m not here to supervise you so you can go and do whatever you want as long as you’re not getting in trouble.” So I’ll just go out, as long as we’re not like being like irresponsible or like getting into doing bad things, she’s fine with it.’

While a few children preferred being in the company of a friend, being home instead of outside, or were sometimes more comfortable with an adult around, overall, most children valued and enjoyed their IM. While both girls and boys in the sample enjoyed similar levels of IM, boys more often said they traveled to a greater variety of destinations and it appeared several of them could travel greater distances. Freddy (11, R, F17) explained, ‘...as long as I get my parents’ permission I can go wherever I want, really.’ Both boys and girls acknowledged that they could travel further if they were with friends or a sibling.

A variety of concerns about IM were touched upon by families. Concerns mostly focused on the social environment with some concerns about the child’s individual characteristics. Concerns raised by members of the family were often consistent within the family unit. The most commonly cited concern by participants was traffic (e.g., cars, dangerous street crossings, reckless drivers) as highlighted by one family. Claire (41, NV, F13) commented that she is ‘concerned for both of them [sons] just mostly because of the traffic and the cars. That’s

probably the number one.’ Similarly, her partner Anthony (48, NV, F13), wished there was ‘Less traffic...people don’t really care for the signs...they’re pretty reckless....so we always tell them [sons] like take different routes to make sure there’s lights, or a crossing guard’. Their son, George (12, NV, F13) reaffirmed this sentiment explaining that his concern was ‘like cars mostly’.

Amongst families in Vancouver and North Vancouver the second most discussed concern was related to drug use: people smoking, doing or dealing drugs, and appearance of needles or syringes on the ground. Additionally, parents and children discussed concerns about homeless people in these neighbourhoods and individuals who were in an altered mental state due to poor mental health or intoxication. Across all neighbourhoods, parents raised concerns about children’s individual characteristics (e.g., lack of awareness, does not evaluate situations well, etc.). Additionally, other concerns were raised by parents and children including stranger danger and ‘sketchy people,’ and worries about kidnapping or abduction. Broadly, there was consistency in the perspectives of children and parents regarding these concerns and potential barriers to IM.

In spite of families’ concerns, most children exhibited moderate to high levels of IM. In exploring the perspectives and negotiations of IM within the family unit, four major themes were identified that give insight into key preconditions associated with helping with negotiation of IM between parents and children in this sample. These included the influence of parents’ childhood on their views of IM, the role of children’s characteristics on their IM, communication as a key coping strategy for families, and the influence of perceptions of the social environment on IM.

4.3.1 ‘It’s a great sense of freedom’: The role of parents’ own childhood experiences on children’s independent mobility

In this section, I will detail how parents’ childhood experiences may inform their parenting practice in relation to their IM and describe differences between parents’ and children’s childhood experiences. The majority of parents painted a stark picture of the difference between their childhoods and those of children today. Participants highlighted the freedoms they experienced whilst growing up. One set of parents spoke about having ‘free reign’ and the ability to go ‘anywhere and everywhere’ (Nelson, 47, V, F6) and being ‘...allowed a lot more freedom than I think kids are today’ (Lauren, 45, V, F6). Parents consistently highlighted freedoms that came with their own IM including traveling to various destinations, playing outside until ‘sunset’ (Allen, 42, NV, F15), and playing with their friends and peers. For example, Meghan (42, R, F17) remarked that as a child, she ‘walked to kindergarten by [herself] and came home’, while another parent said at the age of 8 years old, she would walk a half-hour to school on weekdays (Karen, 45, V). Echoing parental sentiments, most children also enjoyed their IM. As Alice (12, V, F8) explained, ‘Well, you feel more responsible when you’re unsupervised.’ Additionally, IM helped children feel confident in their skills, and provided them a greater range and freedom to explore.

Parents’ own childhood experiences and the value they placed on being independently mobile and the consequent parent-reported benefits (e.g., outdoor time, learning experiences, time with peers) may have influenced their children’s IM levels. Parents wanted their children to experience the same freedoms they themselves had as children. Lily (53, R, F21), explained that the independent exploration allowed ‘...you [to] learn to be more independent because you get to make mistakes and learn something...’ Parents valued the benefits that came from being

independent including unstructured time, outdoor play, and lessons learned from and through those independent experiences.

While parents often spoke favourably about the freedoms afforded to them as children, they also discussed the shift in societal norms since then. Barbara (52, V, F7) spoke about how she had a ‘happy childhood’ with lots of ‘unstructured play’ and believed that it was ‘great for kids to be playing outside. But I think that the world that [son] is growing up in, and the environment he is growing up in is very different from the one that I grew up in.’ One of these differences was the absence of technology. Nora (52, V, F10) explained that even though,

...nobody had cellphone or pagers or anything...’ she could still, ‘...go out and have an adventure and catch tadpoles in jars and do all that sort of exploring and make up our own games...and we did it for years, and we loved it and we’d go exploring all over the neighbourhood.

Although current technology (e.g., cell phones, GPS trackers) was not available, children in the past were not restricted from exploring their environment. Some parents also commented that their children could do with less technology, screen time, and indoor play (e.g., video games). A father admitted that he would rather his son, ‘[go] outside playing, doing stuff outdoors...I guess the modern child probably thinks differently than we did and wants to do a lot more...video games than playing outside’ (Bill, 49, NV, F16). Additionally, a few parents touched upon the shift from more unstructured, free play in their childhood to present day structured activities. Monica (57, V, F9) explained that she tried to do ‘unstructured and ad-hoc kinds of activities’ with her son, but ‘nobody was around because people were in structured activities, and so it was kind of like “ugh”. You know, we got a little bit lonesome and I remember taking [son] and we would knock on people's doors and there would be nobody

home.’ During parents’ childhoods, IM took the form of travel and unstructured free play allowing opportunities to explore, engage their imaginations, and be immersed in the outdoors.

Several families also discussed changing societal norms over acceptable parenting practices and fear of others’ opinions and judgement regarding their parenting. One father explained that while he and his partner try to encourage their children to ‘be independent and to be active and to play...but at the same time, ...what we would let them do and not do...it’s now modulated by what is accepted in our society today and it’s probably less than what we had when I was a child myself’ (Adam, 48, NV, F11). Parents may feel more reluctant in allowing their children to engage in certain freedoms (e.g., independent travel and play) based on how society views those activities (e.g., parents may feel that they are judged negatively for allowing child to roam freely). This sentiment was echoed by other parents who admitted wanting their children to experience a childhood like their own,

I do feel some societal pressure at times to hover a little bit, certainly when he was younger but now that he’s older I feel a little bit more relaxed...there is a certain level of I think expectation in the media that you’re gonna do everything you can to make sure that your child is healthy and successful and, god forbid you let your child play in the dirt because they’ll get salmonella or something like that (Scott, 42, V, F3).

This societal shift from ‘come back when the streetlights come on’ (Nora, 52, V, F10) to an expectation of constant supervision was a topic parents discussed throughout the interviews, reiterating the dissonance between their childhood experiences and those of their children.

Additionally, parents also discussed a generational rise in fears about what potential harm could befall children. One father, Richard (44, V, F5), said, ‘my mom and dad like to remind me that they weren’t scared when I went off or...we lived about two or three kilometers from the

school I went to, and they weren't scared of me getting abducted or anything like that.'

Similarly, a mother explained that while she was out and about as a child, '...nobody seemed to worry, nobody seemed alarmed' (Monica, 57, V, F9). A few parents spoke about having freedoms they enjoyed as children but would not necessarily allow those same freedoms for their child because of worry about 'kids playing outside like that' (Edward, 40, R, F22) or being uncomfortable with their child engaging in the same freedoms like riding the bus downtown (Lauren, 45, V, F6). Additionally, a couple of families raised concern over judgement from others and societal expectations. Lauren admitted, '...there's a lot of judgement about what your kids are allowed to do' and she explained an incident where another parent from school raised concern over her children walking home from school by themselves. Lauren admitted that 'But from then on I felt much more cautious about letting my kids do ... roam on their own than I think I would've had that hadn't happened because she [other parent] was like horrified that I let my you know six- and eight-year-old walk home.'

Although parents pointed to stark generational differences, there was consistent agreement across most interviews that both mothers and fathers valued the freedoms and experiences from their childhoods and often wanted to recreate that for their own children. Margaret (48, V, F4) remembered, 'It was a pretty good childhood and we want basically the same kind of thing for our kids to be able to just go and do stuff on their own and not need to be totally structured'. Her partner Daniel (50, V, F4) explained,

I mean that's the lifestyle that we like and we also want our kids to have...we don't want to be helicopter parents and be supervising all the time...it's important for them [children] to you know, develop the responsibility on their own and self-reliance on their own.

Parents often referred to their own childhoods when making decisions about their children's IM.

As Dave (42, V, F2) mentioned,

I use that to really inform myself on a daily basis when they ask for more freedom on things, especially around movement and neighbourhoods... but we're really hoping and starting to see that he could very well be emulating that kind of freedom that we both cherished, you know, mostly when we were young.

Most parents agreed with their partners regarding their philosophies on IM, comfort levels, and benefits IM could provide for children. However, some parents pointed to differences between themselves and their partners in their approaches or perspectives on IM, specifically regarding level of concern between parents. In one family, Lily (53, R, F21) explained that her partner, Oliver (53, R, F21), was '...probably a lot less concerned. We say if [Oliver] is in charge just know that they're not being, well, supervised...' while Oliver acknowledged that, 'Yeah, we differ in our parenting styles...I basically let [daughter] do more than her mother lets her get away with.' Interestingly, their daughter Angela (12, R, F21) felt that her parents were 'both totally fine with me being outside, being unsupervised.' It may be that the child perceives the combined, final product decisions of her parents' decision-making and negotiations. Some parents negotiated these differences by implementing their own rules when the child was with them. Ella (45, NV, F11) described that, 'When he [husband] is in charge, it's his rules. But if I'm in charge, it's my rule.' Her partner, Adam (48, Family 11), explained that they differed, but 'not in a huge fashion and I tend to be a little more permissive than she is.' While parents may have admitted to some differences in their parenting styles, these differences may not have been sufficient to meaningfully affect IM.

While some parents negotiated these differences by implementing their own set rules with their child, other parents addressed these differences through communication within the family unit. Communication occurred in several ways including parents' communicating their expectations to their child, children confirming their awareness of these expectations, and parents being aware of differences in comfort level regarding IM. Kathleen (49, NV, Family 16) explained, 'I'm way more relaxed... whereas Bill, I think is like, "where are you going?" Like, literally "how long are you going to be in," and two seconds after that time if he hasn't heard from [James], he's almost in the car and going. Where[as] I'm more, "Just give him another 5 minutes.'" Her partner, Bill (49, NV, Family 16) explained that he expected more specific details about his child's location. He confirmed, 'I think I am probably more fussy... I just think that I'm more particular about needing to know where he is, who he's with, and what time he's coming home.' Their son, James (11, NV, Family 16) demonstrated awareness of his parents' expectations and commented on the differences in his parents' approaches to his IM, 'I think it's kind of my mom that's kind of like, "Eh". My dad's like "where is he, what's he doing?"' He also explained that he had his 'phone on me all the time' for communication purposes highlighting his understanding that having the capacity for direct communication was an important part of his IM. This was confirmed by Bill, who explained, '...we just generally have drummed into him over the years that you know, if he's going somewhere, now particularly, he's got a cellphone that he needs to take that with him. So we've got a way of communicating with him and he has with us.'

4.3.2 ‘A very trustworthy kid’: Children’s individual characteristics and their independent mobility

Children’s individual characteristics (e.g., child age, confidence) and both children’s and parents’ perceptions of these characteristics shaped IM. Although a child’s age was discussed as factor for greater IM, it did not come up in conversation as often as other characteristics of the child. Parents who felt that their child had their ‘act together’ (Karen, 45, V, F5) (e.g., aware of surroundings, ability to deal with unexpected situations, able to navigate neighbourhood, trustworthy) were less worried about perceived dangers (e.g., traffic, stranger danger, abduction) by knowing that their child had the ability to deal with those dangers.

One family in Vancouver spoke about their son Jake’s (11, V, F5) characteristics and negotiating their concerns for his safety. The father explained, ‘...he’s a very trustworthy kid. He’s smart. I’m not worried about him. Like, he’s got good street smarts...He’s got his act together...you know, I think he’s responsible’ (Richard, 44, V, F5). The mother, Karen (45, V, F5), echoed these sentiments,

I think he’s a really responsible kid. I think he makes really good decisions. I think he evaluates situations really well...I guess I could start getting concerned about all the things that could go wrong, but I just...that would just take up all your time...I don’t think he’s going to get into a bad situation. I think he’s smart and capable and can think on his feet, and I think he’s fine.

Jake’s (11, V, F5) perspective also aligned with his parents’ assessments when he explained, ‘And I just know it’s [smoking and drugs] bad to do and I just stay away from those people, and I know where is a good place for me to be and where’s not.’

As another parent pointed out, ‘Yeah. I mean—you’re always on edge, you’re a parent’ (Bill, 49, NV, F16). This concern or worry about children stemmed from a number of sources outlined previously (e.g., traffic, drugs). Parents affirmed that they worried about their children being independently mobile, but they also understood there was a need for trust and confidence in their children to safely navigate the neighbourhood. Bill explained,

I mean you kind of got to trust that, you got that confidence in them that they’re going to be okay... if you go around living your life, worrying that they’re never going to come home because he’s going to get hit by a car... You’ll never let them out.

Alternatively, other parents described worries stemming from their children’s individual characteristics such as personality or maturity. Claire (41, NV, F13) explained that her son, George (12, NV, F13) was ‘very trusting’ so she tended to worry about him. ‘George assures me no [that he isn’t too trusting], but that’s one concern because he is a very loving kid and he may not always understand what people’s motives, and intentions...a big worry...’ The perception of children not having adequate ‘problem-solving skills’, the ability to deal with situations on their own, being naïve or too trusting were other characteristics discussed amongst various families. For example, Cayden’s (10, V, F7) assessment of himself aligned with his parents’ Barbara (52, V, F7) and Angie’s (45, V, F7) assessments in which the whole family unit acknowledged the child’s anxiety as playing a role in limiting his IM.

Cayden: ...if I don't know when I'm going to meet them [parents], then I start panicking because...I have high anxiety.

Researcher: Do you think having high anxiety has any effect on the way you play outside?

Cayden: Well, I mean, I’m less adventurous.

Barbara: He gets anxious about some things...he gets, he's kind of in his head.

Angie: And he's also an anxious personality as well...but also personality wise he's quite introverted and also very much in his own world and ...I don't know if he would necessarily pick up on sort of social cues that would help him read a situation that might be dangerous.

However, Julie (10, V, F1), questioned why her parents Katherine (46, V, F1) and John (48, V, F1) worried about her. Julie explained that, 'for some reason I'm not allowed to walk to the bus stop, but I can still take the bus by myself... they [parents] still don't like it when I go there and they don't let me go there without some like communicating with them which is annoying because I still don't really have a phone.' Her parents, however, raised concerns about their daughter's ability to solve unexpected problems and assess situations and people. Katherine explained she had 'fear of [Julie's] decision-making, problem solving ability and just how she evaluates situations, safety situations...And so I'm like, you know, you just need to be able to show me that you identify who...where the issues are more before I let you go.' Her partner, John, agreed that he was waiting to see '[Julie's] problem solving skills' develop so that he could 'be more comfortable with her going further out or walking to places by herself.'

Differences were observed amongst parents when asked whether they would worry more if the child was the opposite gender. Interestingly, most parents with daughters said they would not feel differently if they had a son. Adam (48, NV, F11) explained, 'I'm not sure I would, nope. To me that that [gender] doesn't really make a difference. To me that's a maturity of the child.' Parents attributed this decision to the trust they had in their daughter and confidence in her abilities. A few parents with daughters admitted they worried more about their daughters, in

the future, anticipating concerns about sexual predators or abductions would become more salient as their children grew older. Ella (45, NV, F11) explained,

Would I feel differently? I think society push[es] us to think differently. I don't think we should, but I think I would—I don't know...it's more like the sexual predator would be more my concern if she's a girl than a boy, of course, but the rest would be the same.

While more than half of parents with sons felt they would not worry more, a portion of parents admitted they would worry more if they had a daughter due to several reasons. Reasons discussed included the perception that girls receive more unwanted attention and were more at risk of sexual abuse. Leslie (46, R, F19) explained, 'I mean, I don't think any gender is immune to being kidnapped or, but certainly if you're a girl, there's a worry that someone's going to take your child and molest them or whatever.' There was a sentiment that several parents raised that they knew their fears were irrational, however they could not readily dismiss them. As Henry (47, R, F17) acknowledged, 'I don't know, I think I would feel more apprehensive about that even though it's probably irrational to think that way...' While this hypothetical question posed to parents elicited these perceived concerns, both girls and boys in this sample displayed similar levels of IM. Overall, parents' perceptions that children were confident, cautious, had good problem-solving, or decision-making skills, positively influenced parents' confidence in their child's capacity to navigate their neighbourhood environment safely.

4.3.3 'A little more peace of mind': Communication as a coping strategy

The majority of participants, both parents and children, discussed how communication was an important facilitator of IM. Communication encompassed four subthemes: the logistics of communication (e.g., with whom, for how long, etc.), communication within the family unit,

communication related to safety, and technology as a tool for communication. Communication, either in-person or by cell phone, between children and parents consistently played a role in facilitating IM. Broadly, there was a general expectation from parents that children needed to communicate certain facts when going out into the neighbourhood independently. These key bits of information included asking for permission, identifying how long, or until what time they would be gone, and where they were headed. Tracy (13, V, F10) described her IM experience:

My parents aren't really that strict because they know I'm safe and they know the neighbourhood pretty well...There isn't really a limit. I always tell my parents where I'm going, and how long I'll be gone for, and when I'll be back. They're always just like, "Have your phone with you, and always answer calls or texts right away. Don't ignore them."

As long as Tracy communicated with her parent(s), she had an extensive roaming range. Her mother, Nora (52, V, F10), echoed her sentiment explaining that '...as long as I know where she's going, and if she's with someone if it's an area I don't know...Well she's outside, she's out with friends in night time and they'll often play a glow in the dark game capture the flag, or something with glow sticks and things. So if she's with a group of people, sure that's fine'.

Albert (49, V, F10) said that when Tracy first started taking the bus 'she was a little nervous about it at first, but we were pretty encouraging and cool about it. And it didn't take much. Like first day, my wife took the bus with her, and like the next day Nora was like "do you want me to that with you again?" and Tracy was like "no, I got it". And that was fine with us.'

Communication also played an important role in the negotiation of IM within the family unit. Parents often discussed boundaries of IM between themselves before discussing with their

child. Dave (42, V, F2) described discussions he and his partner had about Ryan's (13, V, F2) expanding IM:

Not as a daily conversation, but as Ryan's world expands, we definitely you know, 'so is it okay for him to hang out in the mall and stuff' 'yeah okay sure'. So yeah I mean we're talking about it more and more definitely, but I think when we talk about how we feel about him doing things outside of the home, I think we both are starting and ending in a place of let's find a way to be eye to eye on this so we're a unified unit when we talk to him about it, so we're not giving him mixed messages on it.

While differences may have existed in parents' comfort levels, often it was negotiated through discussion and a decision was reached that both parents could agree to. A few parents however, acknowledged that they allowed either more or less IM if they were the ones making the decision rather than their partner.

Communication between the child and parent could give parents confidence that their child knew how to navigate their environment safely and therefore, could be granted IM. Ryan (13, V, F2) explained that in regard to how far he could travel, 'As long as I let my parents know, pretty much as far as I want' and Lisa (41, V, F2), the mother, seemed quite at ease about Ryan's roam range, 'Pretty far, I mean he's in high school now, so like he goes to Metrotown on his own, he goes to Downtown on his own, he visits friends'. Interestingly, some parents commented that they were ready to give their child more IM, however, the child had not raised the topic yet.

As Dave (42, V, F2) explained:

...[Ryan] hasn't asked me to go anywhere yet where I've gone "oh that's too far". I guess you know, as long as, if I know he can get there, if I just ask him how he can get there then I'm confident he can get back...

Sometimes, children were unsure the extent of their roaming range as they had yet to discuss this explicitly with their parents. When Casey (12, NV, F15) was asked how far she could travel, she responded, ‘I’m not really sure. I guess I just have to like ask them [parents].’ Discussions between parent and child about IM was a precursor to facilitating the expansion of that mobility.

Communication between parents and children was also key for addressing safety concerns. One way to address these concerns and mitigate risks was through safety discussions in the family unit. These safety discussions had different foci for different families dependent on what concerns were most salient – they could range from talks about awareness, drug safety, cycling safety, traffic safety, homelessness, and people in altered mental states. For example, Kathleen (49, NV, F16) explained that her son, James (11, NV, F16), had ‘been told over the years what we expect of him and how to look after himself and be safe.’ These safety discussions helped parents convey important, need-to-know, information about the neighbourhood and helped prepare children on how to safely roam the neighbourhood.

Cell phones and technology as an important resource was also discussed. A little more than half of children in the study had a cell phone, although the phone’s calling and texting capabilities and data plan varied. Instead of a cell phone, some children had an iPad or iPod with messaging and calling capabilities via WiFi. Parents whose children had a communication device (e.g., cell phone, iPod) felt it was a tool to open a line of communication. Daniel (50, V, F4) explained that his son’s cell phone was ‘more of a safety valve or resource;’ ‘Well I just know like...if he gets lost or in a situation that he’s gonna have a hard time handling, he can always call us’. A few parents of children without cell phones did discuss being ‘more comfortable’ (Marc, 43, R, F20) if their child had a way to communicate with them. Often their child checked in with them using a friend’s phone, an adult’s phone, used a WiFi hotspot to text via another

device, or had a more limited roaming range. Most of the children with a cell phone felt that having a phone provided a sense of safety and many parents also agreed. Kathleen (49, NV, F16) explained that

...having the phone to communicate with [James] (11, NV, F16) allowed me to relax. But now it's, it's even better because now he can communicate back the way "Oh if you're running late, can I go to someone, so and so's house now and I'll meet you back at home?"

Additionally, having a cell phone either provided a greater sense of IM for the child or parents confirmed that IM would increase once the child had a phone. As Trevor (12, V, F 9) explained, 'I think having a phone has had an impact on how far I feel like I can go. Because then I can always find my way with Google Maps.' For Trevor, while his parents afforded him a wide range of IM, having a phone allowed him to feel more comfortable traveling alone. While a sense of comfort and safety came from having a cell phone, a number of parents preferred their children to be older (preferably high school) before they received a cell phone and several raised concerns over dangers of cell phones, primarily the increased screen time and exposure to social media. Lily (53, R, F21), whose daughter did not have a cell phone, talked about the dangers of all 'those social media things' because '...I don't think that they [children] know how to govern themselves with it or what they do with that information that they get out of it'. Instead, Lily's daughter Angela (12, R, F21) typically traveled 'in pairs' with a peer and communicated 'where [she's] going' and the 'timeframe' with a parent. Communication played an important role in negotiating IM between parents and children. Family discussions of safety and readiness for IM were prominent while access to communication devices helped ease some parental worries (e.g., traffic, unexpected events) associated with the outside world through check-ins.

4.3.4 ‘You look out for people’: The social environment and children’s independent mobility

Families’ perceptions of the social environment were prominent in shaping IM. Most parents and children reported feeling safe in their respective neighbourhoods. Feelings of safety were attributed to a number of factors including having a ‘kid culture’ (i.e. other children in the neighbourhood), familiarity with the neighbours and neighbourhood, and a sense of informal social control.

As one mother, Lisa (41, V, F2), explained, ‘there is a very live kid culture in this area; it’s why people flock here when they have families because they can feel it right?’ Another family highlighted the benefit of having other children in the neighbourhood including allowing children to interact with their peers. Allen (42, NV, F15) explained, ‘We have great neighbours around so then the kids play out like 3 or 4 girls and they have some girls from across the street as well.’ Additionally, Laura (40, NV, F15), explained why it was important for the family to live in neighbourhood that had children, ‘I always felt like if you live in the community where other kids are...they [children] have a chance to interact and be out and here [in the neighbourhood]...’ Their daughter Casey (12, NV, F15) also highlighted the availability of peers in her neighbourhood, ‘I usually hang out with my friends a lot. And I have a lot of friends nearby.’

Parents and children emphasized that children in the neighbourhood helped create connections between neighbours. As Lauren (45, V, F6) explained, ‘the people I know the best are people who my kids have played with’ and Nelson (47, V, F6) affirmed ‘The neighbour on that side, our eldest daughter babysits their kids. Lydia babysits the cat across the street...Ronald

[son] has a got a friend at the corner. We had a block party which was really good, we've had that for a number of years.' On her walk-along interview, Lydia (11, V, F6) also indicated friends' and neighbours' homes in the neighbourhood, '...that blue house over there. [Pebbles], is a cat that...[I] cat sit. That's my house. That is my friend's house, just over there.' As Trevor (12, V, F9) said, 'The favourite thing about my neighbourhood is that there are just so many people nearby that I can go to if I need someone to hang out with.' This 'kid culture' in the neighbourhood helped create opportunities for children to be independently mobile, play, and travel with their peers. Trevor's mother, Monica (57, V, F9), echoed the importance of having a neighbourhood community, 'And we live in a nice neighbourhood with people who are also at that school and who are very community-minded...we're not really interested in like a big house or a lot of stuff. For us, it's more important to have a good community, good neighbourhood...'

Furthermore, the overall feeling of familiarity with the neighbours and neighbourhood helped both parents and children feel a sense of safety and often lead to greater IM. For example, one North Vancouver family explained their familiarity with their neighbours:

Brigette (11, NV, F11): I know pretty much like all the people on my block and they're all really friendly.

Ella (45, NV, F11): I talked to other people and they said that no other neighbourhood had people coming to knock at their door to play...I guess we were really lucky we had amazing neighbours.

Adam (48, NV, F11): We knew the neighbours, we knew that there were other children, we knew that there were people always in parks you know, walking their dogs and so people we know would help a child...

The presence of people out and about in the neighbourhood ('eyes on the street') lent itself to a sense of safety, but also promoted a sense of friendliness and community. This echoed the sentiment expressed by most families in the sample. Parents in Richmond, Charlotte (45, R, F18) and Hugh (43, R, F18), agreed when it came to their neighbourhood. Charlotte explained she had had safety discussions with their son Devon, 'We'll say "look if something happens when we're not here, just a reminder these are the people that you know that you can go to." He knows everyone so, he's got plenty of people he can just approach.' As Devon (10, R, F18) confirmed, he knew 'usually certain ones' of his neighbours that he could go to for help. And Hugh reaffirmed how connected they feel to their neighbours, 'you can't buy the neighbourhood. So you can't move because it's just too good.' A large portion of families commented on the importance of neighbourhood for parents' raising their children, children having other children to 'hang out' with and living in a safe overall environment.

Several parents also discussed their efforts to encourage mingling and connection in their neighbourhoods. Olivia (40, R, F20) explained:

And like I said before, I just like knowing more people in the neighbourhood. I have done a few neighbourhood small grants and stuff, trying to connect people in the neighbourhood. I think...it would make people feel more connected and feel safer, you know?

While most families spoke well of their neighbours and feeling connected to them, a few participants did mention a few neighbours who were not as social or 'crusty neighbours' (Meghan, 42, R, F17) who disliked the noise of children playing. The responses in these cases varied to children avoiding those neighbours, to parents attempting to build bridges through community-building activities (e.g., bloc parties). Broadly, most families alluded to familiarity

with their neighbours helping create a sense of connection and safety; and consequently, parents felt more comfortable allowing their children IM and children knew they had a safety network in the neighbourhood should they need it.

Moreover, many families referred to a sense of informal social control, where other members of the neighbourhood took collective responsibility for children (Foster et al., 2014). As Freddy (11, R, F17) explained, he liked having people out and about in his neighbourhood, ‘...like my brother fell the other day and then like minutes later all the adults were around to help him so it’s like the perfect amount of supervision because nobody is there yet everyone is there, you know’. His mother, Meghan (42, R, F17), spoke about the community in her neighbourhood, where,

It’s sort of a group mentality of parenting that everybody sort of knows where the other kids are... I don’t even know where my kids are right now, they’re out there somewhere, I don’t know where they are. Somebody will call me if they need me or they’ll come...I think that that’s really invaluable.

Meghan’s partner, Henry (47, R, F17), expressed similar thoughts to the rest of his family, ‘So I think if I had to describe an area where we would feel comfortable it would be an area like this one where you had kind of a quiet street... you’ve got lots of young kids in the same age group and you generally have parents that are around’. Many participants commented on how they felt comfortable letting their child go out independently and/or children felt at ease outside because families knew others in the neighbourhood would help if a child should need it.

Much of the discussion centered around families’ immediate neighbourhoods. As some parents explained, they did not have concerns (e.g., traffic, stranger danger) for their children in the vicinity of their home, which ranged anywhere from immediate neighbourhood block(s)

surrounding the home to extending to further boundaries like major roads or destinations. As Lisa (41, V, F2) clarified, her worries increased when her child went outside the neighbourhood, ‘But once they get out of this neighbourhood, and I worry sometimes, like we have conversations like “you have to be careful when you’re walking in the suburbs like you have to watch because people aren’t paying attention in their cars.”’ Overall, families acknowledged that their neighbourhoods felt safe, neighbours looked out for each other, and people would lend a helping hand if it were needed.

4.4 Discussion

The purpose of this study was to examine and explore parents’ and children’s (10-13 years old) perspectives and negotiations of IM within the family unit in Vancouver, North Vancouver, and Richmond neighbourhoods. Through one-on-one interviews with participants several themes were highlighted including the roles of parents’ childhood experiences, children’s individual characteristics, communication, and perceptions of the social environment. These were key components associated with explaining the IM of the children in this sample. This paper contributes to the growing literature examining IM by identifying several pre-conditions that may be important for facilitating negotiations of IM within family units. To better understand individual behaviour (e.g., child, parent), it is important to understand the relationship context in which the individual exists (e.g., family unit); moreover, an individual’s behaviour is influenced by the interdependencies and exchanges between members within that family unit (Bregman & White, 2010). While some studies have examined IM qualitatively, this paper addresses a limitation by examining perspectives and negotiations of IM within 22 family units composed of children and their parents.

Most parents in our sample described positive interpretations of their childhoods relating to IM they enjoyed growing up. Although recalling past memories may not cover the ‘exact factual details’ of the past (i.e., rose-coloured glasses), the emotional ties, whether positive or negative, can often be accepted (Sutherland, 2002) as meaningful. As parents in this study demonstrated, positive views of their childhood experiences of IM may have translated to motivations and attitudes that influence their own children’s upbringing (e.g., aiming to provide at least a semblance of the freedoms they enjoyed for their children). While parents provided encouragement for IM, they also played an important role in defining the limits of children’s freedoms through: parent-parent discussion around children’s range of travel, destinations they could travel to, safety discussions pertinent to the neighbourhood, and parent(s)-child discussions discussing these topics. These findings highlight not only the linked nature of family members (Bregman & White, 2010), but also that parents’ perspectives filter through to children and may consequently impact limits to children’s freedoms including timing and range of IM (Brussoni et al., 2020). Another study found that parents’ fear of crime was negatively impacted their IM, while perceptions of neighbourhood safety were positively associated with IM (Janssen et al., 2016). While positive childhood recollections were common amongst parents in this study, it may be helpful for future initiatives to encourage parents to reflect on their childhoods, identify the benefits and skills they may have gained through their own experiences of IM, and reframe the risks they may perceive for their children today. For example, one recent online tool helps parents reframe the risk of children’s outdoor play through self-reflection and experiential learning tasks (Brussoni et al., 2018).

Additionally, discussion and concern around potential societal judgement and differences between parents’ and children’s childhoods highlighted shifting social norms including idealized

parenting practices which are culturally constructed, fear of judgement for parenting practices, declining freedoms like IM, and shifts toward more organized activities for children (Bhosale et al., 2015, 2017; Hjorthol & Fyhri, 2009; Valentine, 1997b). The case of the Vancouver father described earlier highlights social norms as well as potential judgement of parenting practices. Generational shifts in norms have further impacted constructions of ‘good’ parenting and children’s geographies. Pynn and colleagues examined generational parenting ideals and active free play finding that changing expectations of parental involvement, influence of news media on perceptions of safety, and worries of judgment on social media were all related to shifting parenting ideals (Pynn et al., 2019). Over time, children’s space and geographies have also changed, in that children ‘do not play outside that often; they have less freedom of movement; and they have a smaller territory’ (Karsten, 2005, p. 289). Additionally, a study examining children’s time use in the United Kingdom over 40 years found a significant decrease in children’s outdoor play (Mullan, 2019). Future research and initiatives targeting children’s IM should acknowledge the important influence of societal norms on parenting and consequently, the trickle-down effect on IM.

The extant literature has spotlighted associations of various individual characteristics with IM including child age, gender, and skills (Fyhri & Hjorthol, 2009; Johansson, 2006; Villanueva et al., 2012). Our results shed light on the complexity of children’s individual characteristics and consequently, highlight the importance of both children’s and parents’ perceptions of the children’s maturity, skills and abilities in negotiating IM. If the child was confident, could ‘think on their feet’ (Karen, 45, V, F5), had ‘street smarts’ (Richard, 44, V, F5), and displayed good decision-making skills, then this helped alleviate parents’ concerns, regardless of their child’s age or gender. Additionally, children who were confident in their own

abilities to navigate the environment often commented on feeling comfortable traveling and playing in their neighbourhoods. However, parental uncertainty in their child's maturity and abilities hindered IM, more so than consideration of child's gender and age. This may explain the inconsistent associations in the literature between these characteristics and IM (see Chapter 2). Parental attitude toward independent travel is related to children's characteristics and also to parental factors like the need to protect the child (Johansson, 2006). One prevalent view in Western society is that children are seen as 'vulnerable' and in need of protection and often, 'good' parenting is tied in with parental risk assessment or a culture of 'protectionism' (Gill, 2007; Valentine, 2017). Therefore, parents wanting to promote their child's IM (e.g., case of Vancouver father) need to navigate the fine line between allowing their children freedom to explore and practice 'good' parenting by protecting their children from potential danger.

Perceptions of the social environment were an important focus of discussion amongst families in this sample. This is consistent with research demonstrating that social environment-level correlates may be particularly salient for IM including parents' perceptions of safety and social cohesion (Chapter 2) (Christian et al., 2015; Janssen et al., 2016; Johansson, 2006). In this sample, feelings of community and safety played an important role in facilitating IM especially when families engaged in safety discussions addressing concerns (e.g., drugs, traffic, homelessness) raised by family members. While families did express such concerns, they appeared largely moderated by positive perceptions of the social environment - particularly feelings of community, knowing that people in the neighbourhood looked out for each other, and familiarity with neighbours. Speculatively, this may explain why associations between IM and many objective measures of the built environment that might be assumed to be positive (see Chapter 2) are not. Feelings of community and safety are a necessary facilitating precondition

for IM to occur irrespective of objectively measured environmental attributes (see Ding et al., 2011).

Communication within the family unit was crucial for negotiations of IM. Communication allowed for children to display their confidence, skills, or lack thereof and helped parents assess whether their child was ready for greater IM. Interestingly, cell phones (or other messaging-capable devices) were seen as a tool to positively influence IM (Carver et al., 2012; Riazi et al., 2019), a tool for communication between family members (Hjorthol, 2008), and provided parents with a sense of security and social control (Mikkelsen & Christensen, 2009). Research suggests that children's independent travel is much more common once a child turns 13 or 14 years old (Larsen et al., 2015), but for younger children, parents wield more influence over the distance or destinations their children travel to independently. Building communication capacity between parents and children may be crucial for increasing IM; for instance, a cell phone (or other communication device like an iPod) or knowledge that a child's school will call parents if a child does not arrive at school may be ways in which children could be afforded IM earlier.

Multi-level and multi-sectoral approaches should be considered for creating child-friendly cities (Sallis et al., 2015). To target the individual level, supporting parents and partners (e.g., schools) to help children develop the skills (e.g., traffic and cycling safety; communication), competence, and confidence to navigate their neighbourhoods safely remains indicated. At the social level interventions should target ways to build neighbourhood connections and social capital as a way to facilitate IM by increasing familial perceptions of safety. For example, investing in initiatives that help promote neighbourhood connection (e.g., neighborhood grants for the organization of bloc parties) or initiatives like Play Streets, which

have been shown to increase community and provide safe places for play and PA (Umstatted Meyer et al., 2019). To target the built environment level, the implementation of safe cross walks and protected cycling lanes could objectively help make environments safer (Chen et al., 2013) and could influence parents' and children's safety perceptions of the environment. Finally, policies that address broader macro-level factors such as substance use harm reduction initiatives, social welfare, or policies supporting IM like Utah's free range parenting law (Coleman, 2018) may influence IM through mitigating some common concerns raised by parents and children in this study.

4.4.1 Strengths and Limitations

There are several strengths and limitations to this study. Strengths of this study included a relatively large sample size (n=66) in three distinct neighbourhoods varying in urbanization, which allowed for exploring both parents' and children's perspectives on IM and examined these perspectives within family units. Examination of the family unit highlighted the complexities of IM negotiations including parent-parent discussions, which could consequently impact parents-child discussions, as well as drawing attention to varying comfort-levels of family members and how these were addressed within the family. Additionally, this study emphasized how concerns, safety tips and discussions, and understanding of expectations, were salient within the family unit. The qualitative design included novel walk-along interviews with children and face-to-face interviews with parents exploring the similarities and differences of perspectives on IM within the family unit. However, the sample focused on two parent households (n=22) within the Metro Vancouver area, with most participants being of higher socioeconomic status. We acknowledge the privileged nature of our sample. Families in this study appreciated the importance of IM and

were motivated to support IM. An exploration of perspectives of single-parent households, and families varying in socioeconomic status, and living in rural locations or disadvantaged neighbourhoods, and children with low levels of IM would be informative as there may be different perspectives on IM that were not captured by this study. Recent research has highlighted how living in a disadvantaged neighbourhood may impact parents' defensive behaviours (e.g., limiting locations of play, requiring supervision), which limits outdoor play and IM for children and adolescents. These defensive behaviours may arise as a result of parental perceptions of the neighbourhood environment, including perceptions of higher crime or traffic insecurity, poor social capital, or lack of PA resources (e.g., parks, green space) (Kepper et al., 2020). Furthermore, children and parents may have more concerns about stranger danger or traffic and may experience other concerns such as wildlife, hazardous weather (e.g., winter conditions), or other natural environment characteristics (e.g., limited daylight, topography) in different locations. It would also be beneficial to view IM prospectively to examine changes in IM over time rather than relying on recollections to reduce recall bias.

4.5 Conclusion

With the decrease in IM levels in many Westernized countries, it is important to identify the key conditions that may help facilitate IM. The findings suggest that IM still flourishes where and when the conditions are conducive, including: individual characteristics of the child, confidence in their own abilities, as well as parents' confidence in their child's abilities to safely navigate the neighbourhood; parent-parent communication (e.g., discussing range appropriate for child to travel) and parent-child communication (e.g., check-ins, demonstration of skills); the influence of positive interpretations of parents' own childhood on parenting practices; and

positive perceptions of the neighbourhood social environment. Whether these can be modified through intervention or how IM can be supported when these conditions do not exist will require future research attention. Families' awareness and interest in IM is an encouraging basis for future intervention. Based on these findings, it may be particularly important to 1) develop and examine policies and programs to support children's skill training (e.g., cycling and road safety, 'street smarts'), 2) explore strategies to support communication between parents and their child (e.g., toolkit outlining topics of discussion for increasing IM), and 3) focus on strategies to build neighbourhood connections and social capital.

Chapter 5: Conclusion

The overall purpose of this dissertation was to explore children's IM. The main aims were to 1) identify and examine the social-ecological correlates of children's IM and 2) explore the nuances of children's IM from children's and parents' perspectives as a family unit. Three studies were conducted to fulfill these overarching aims with the goal of informing recommendations to address declining levels of childhood IM. This chapter presents the key findings from each study of the dissertation and synthesizes lessons learned across the three studies. The contributions, practical implications, strengths and limitations of the research, and future directions are then presented.

5.1 Study Summaries

This dissertation employed a multi-method approach encompassing a systematic review of the literature, a cross-sectional multi-site school-based study, and a qualitative study incorporating face-to-face interviews with children and their parents. Multi-method approaches are useful when examining complex questions or phenomena and allow for the strengths of both quantitative and qualitative methodologies to come forth (Creswell et al., 2011). While quantitative research allows one to test theories and hypotheses, collect descriptive information, and examine the relationships between variables, qualitative research allows one to focus on the meaning and context of participants' lived experiences, thereby highlighting the setting or context and providing rich, detailed accounts and explanation of how and why phenomena occur (Creswell et al., 2011). Below I have summarized the three studies of this dissertation and how they built upon each other to provide a more comprehensive picture of children's IM.

Study one (Chapter 2) was a systematic review of the current evidence on childhood IM aimed at identifying and categorizing the social-ecological correlates of children's IM. A social-ecological approach was used to categorize the identified correlates and conceptualize the findings. Use of the framework helped emphasize the diversity and multi-level nature of correlates. A number of correlates were associated with children's IM at the individual-level (e.g., child's perception of their competence), interpersonal-level (e.g., low socioeconomic status, sibling), and built environment-level (e.g., urbanization, distance). The social environment-level appeared particularly influential (e.g., social cohesion, parents' perceptions of traffic), denoting that it may be crucial to attend to perceptions and concerns of the social environment when addressing declining IM levels. The review also highlighted that Canadian studies examining correlates of children's IM were geographically limited with most centering around the Greater Toronto and Hamilton Area. Socioeconomic status and urbanization were consistently associated with children's IM and should be accounted for in sampling strategies in future studies.

Study two (Chapter 3) was a multi-site, school-based study that examined the individual, social, and geographic area-level correlates of children's (8-12 years old) IM across Canada. This study built on the review by expanding the geographic location of the study (i.e. Ontario, British Columbia, Québec) and by varying the sampling by socioeconomic status and urbanization. The study was conducted at three sites (Ottawa, Ontario; Vancouver, British Columbia; and Trois-Rivières, Québec) and children from schools varying by urbanization (urban, suburban, rural) and area-level socioeconomic status (high vs low) were recruited to participate. Significant correlates of children's IM were highlighted at all levels of the social-ecological framework as predicted by the results of the systematic review. The findings

emphasized that while some correlates could be considered largely non-modifiable (e.g., child's age, site/location in which a child lives), other modifiable factors (e.g., child and parental perceptions of safety) could be targeted for future research and interventions. Cell phone ownership was positively associated with children's IM. Surprisingly, home ownership, car ownership, and urbanization were not significantly associated with IM (except for suburban areas being negatively associated with boys' IM). The findings from this study emphasized the need for further exploration of the influence of gender and cultural background on children's IM.

Study three (Chapter 4) was a qualitative study that explored children's and parents' perspectives and negotiations of children's IM within the family unit. Data were collected through face-to-face semi-structured interviews with parents and semi-structured walk-along interviews with children. Transcripts were then thematically analyzed. The findings helped shed light on the role of social-ecological factors in influencing children's IM, diversity in family members' perspectives on IM, and negotiations of IM within the family unit. Mothers' perspectives have been predominantly represented in childhood IM literature (Bates & Stone, 2015; Aggio et al., 2017; Alparone & Pacilli, 2012; Prezza et al., 2001). For example, most parent respondents were mothers (80.9%) in study two of this dissertation. Since family members often exist within a family unit, with influential and interdependent interactions between these family members, it is important to consider not only children's perspectives, but also the perspectives of the individuals within the family (e.g., parents). Study three highlighted a series of key preconditions that helped facilitate negotiation of IM between children and their parents. These preconditions included: 1) the influence of positive interpretations of parents' own childhood experiences of IM on their parenting practices, 2) children's individual characteristics (e.g., confidence, maturity, ability to 'think on their feet') viewed positively by

children and parents, 3) communication within the family unit (e.g., parent-parent communication, parent(s)-child communication), and 4) positive perceptions of the neighbourhood social environment. Study one and two highlighted the importance of children's age (with greater IM typically seen in older children) and gender (with greater IM typically seen in boys compared to girls). Interestingly, study three highlighted the complexities of children's individual characteristics; specifically, that other individual characteristics may be more influential. Perhaps this variation reflects different methodological approaches – qualitative investigation allows for the exploration of the complexity of an issue. Children's confidence in their own abilities (e.g., navigating the environment safely) and parents' perception of their child's maturity and abilities (e.g., 'think on their feet', 'street smarts') to navigate their environment were more salient for children's IM than the child's age and gender. See Table 5.1 for summaries of the three studies.

Table 5.1 Summary of studies in dissertation

Chapter	Objective	Design & Methods	Limitations	Main Findings
Chp 2. <i>Social-ecological correlates of children's independent mobility: A systematic review</i>	Systematically review the current literature to identify the social-ecological correlates of children's IM	A systematic review was conducted using a social-ecological framework to categorize correlates of children's IM extracted from included studies. 43 studies were included in the review.	Correlates examined in less than 3 studies were not reported in final results. The review was narrow in geographical span, including research from high income countries.	This review identified a variety of social-ecological correlates consistently associated with children's IM and represents a focus area for future initiatives. Some inconsistently associated variables require further study. A key area for focus is the social environment-level given consistently associated correlates and their modifiable nature. Findings highlight the interrelated nature of correlates and future interventions should adopt multi-levels and multi-sectoral approaches for children's IM.
Chp 3. <i>Correlates of children's independent mobility in Canada: A multi-site study</i>	Identify and describe the social-ecological correlates of children's IM in the Canadian context	A cross-sectional design was adopted for the multi-site school-based study to examine correlates of children's IM nationally in Canada. The sample was composed of 1699 children (8-12 years old) and their parents. Analysis included linear mixed-effects models while controlling for site, area-level socioeconomic status, and type of urbanization.	While school locations were varied by urbanization and socioeconomic status, not all environments were considered (e.g., remote locations). Most parent respondents were women, and most were highly educated. Parent respondents reported children's IM.	A variety of social-ecological correlates of children's IM were identified. Social environment-level correlates (e.g., perceptions of the neighbourhood) may be key 'modifiable' factors to target for future interventions and initiatives. The influence of gender and cultural background are areas that require future examination.

Chapter	Objective	Design & Methods	Limitations	Main Findings
Chp 4. <i>‘Well, you feel more responsible when you’re unsupervised’: Exploring family perspectives on children’s independent mobility</i>	Explore the perspectives of children and parents on children’s IM in Metro Vancouver families	<p>A qualitative study was conducted using face-to-face semi-structured interviews with parents and walk-along semi-structured interviews with children (10-13 years old) in the Greater Vancouver Area.</p> <p>The sample was composed of 22 families (n=44 parents; n=22 children) recruited from neighbourhoods in Vancouver, North Vancouver, and Richmond. Interviews were analyzed using thematic analysis.</p>	Participants in the sample who opted into the study were likely more receptive to children’s IM. While this sample varied in neighbourhoods chosen, it represented a narrow geographic location and urbanization (GVA; mostly urban/suburban). This sample could also be considered privileged (higher socioeconomic status, safe neighbourhoods).	The findings suggest that children’s IM flourishes where and when the conditions are conducive. Four important themes were developed to identify the key conditions that may help facilitate negotiations of IM in the family unit including the role of 1) parents’ own childhood experiences, 2) children’s individual characteristics, 3) communication as a coping strategy, and 4) perceptions of the social environment.

IM = independent mobility

5.2 Contributions

This dissertation makes three important contributions and identifies a range of practical implications which are outlined below.

5.2.1 Contribution #1: Puzzle pieces: Extending the social-ecological approach

This dissertation highlights the diversity of factors that influence children's IM. Studies one through three emphasized the variety and levels of individual, interpersonal, social, and built environment-level correlates of children's IM. Study three specifically featured the complexity of IM within the family unit and the embedded interrelations between individual-, social-, and built environment-level factors. Additionally, each level of the social-ecological framework includes key stakeholders who are in position to influence these factors and consequently, children's IM. Starting at the policy-level, key stakeholders at the federal, provincial/territorial, and municipal levels (e.g., Canadian Ministries of Transport, Diversity and Inclusion and Youth, Children and Family Development, Health, Education, and city councils) may be vital in establishing national and provincial policies that are supportive of children's IM, active transportation, and outdoor play. Stakeholders involved in planning, urban design, and sustainability could play a key part in influencing built environment level factors such as creating walking and cycling infrastructure (e.g., protected bike lanes). At the social environment-level, key stakeholders could include supportive neighbours, community centres, and city councils that can encourage initiatives to help build neighbourhood connections (e.g., block watch, provide community and neighbourhood grants), modify norms around children playing outside, and city design that accounts for the needs of all its citizens including children (e.g., intergenerational spaces for facilitating connections amongst people). At the interpersonal-level, parents are vital

gatekeepers to their children's IM; their attitudes and parenting approaches have the capability of promoting or hindering children's freedom to travel and play outdoors independently. Finally, at the individual-level, children's characteristics such as confidence in their abilities, can be honed with the help of parents, guardians, and partners (e.g., schools) to help children practice how to safely navigate their environments.

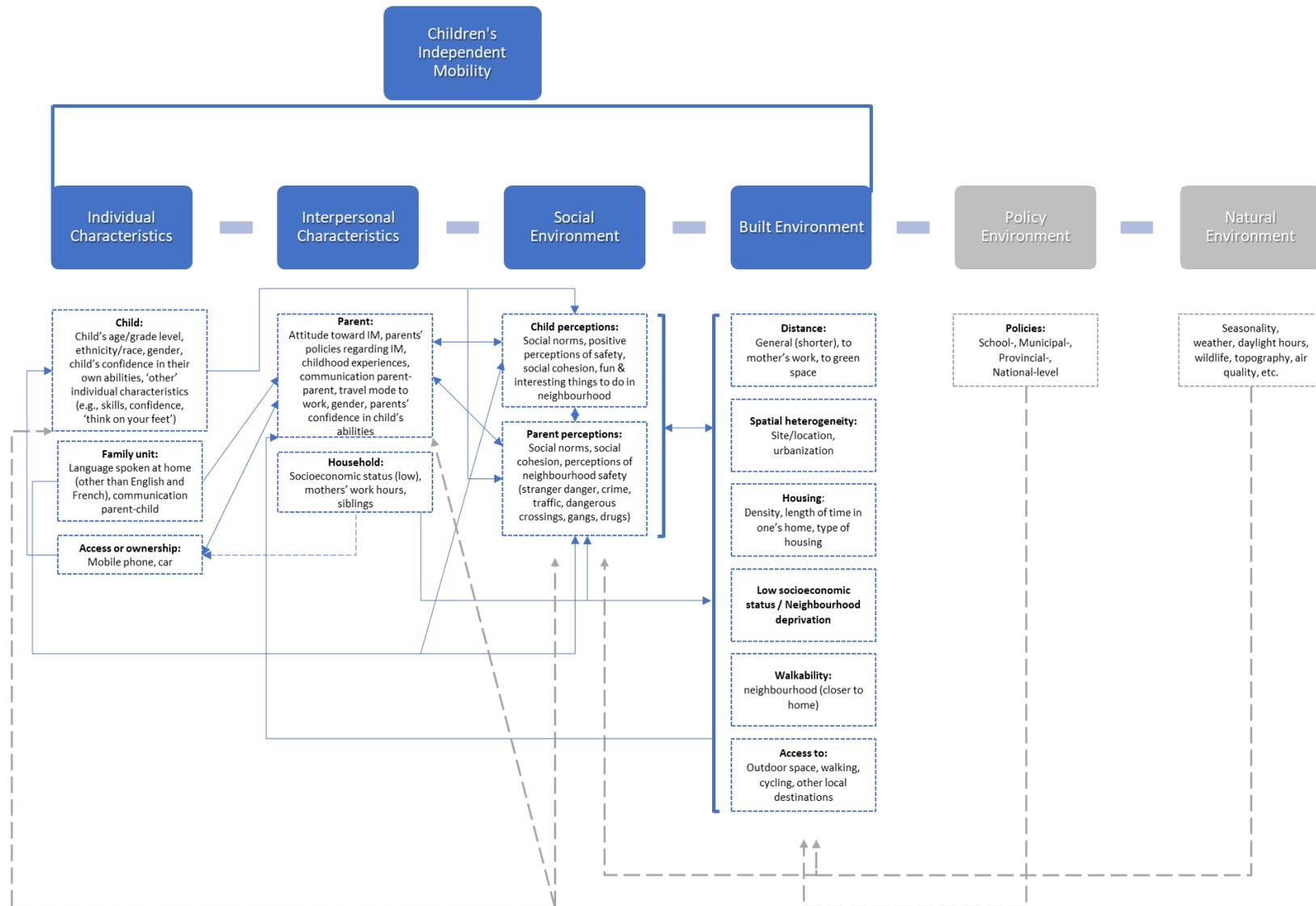
It is important to remember that these levels of influence fit together like pieces of a puzzle, each one connected to the other with the ability to influence one another. For example, a neighborhood that experiences high traffic and lacks crosswalks may in turn impact children and parental perceptions of safety within that neighborhood, consequently negatively impacting children's IM. However, city-level initiatives to reduce traffic, traffic calming measures, and the building of safe crosswalks may improve perceptions of safety. It may also be necessary to view IM collectively. In the way that a child inhabits the family unit, the family unit exists within a certain context (e.g., neighbourhood, community), that neighbourhood is part of city or town (moving up to provincial and national levels), and these settings can be influenced by the present infrastructure and policies that can help facilitate children's IM.

Figure 1.1 presented the social-ecological framework for this dissertation, broadly describing and visually displaying the various levels and factors influencing children's IM. At the start of the thesis, this framework provided a solid platform for organizing and differentiating layers of influence but it did not demonstrate the interactive nature of those layers. While social-ecological frameworks have evolved from simply a visual tool to being utilized for planning interventions (Sallis et al., 2015), the findings from this dissertation draw attention to the complexities of children's IM and demonstrate a need for more detailed representation of how the relationships between factors across layers are interlinked and likely bidirectional. These

complexities may be better addressed using a systems approach which accounts for non-linear relationships between variables, multi-sectors, multi-levels, as well as feedback loops (Mabry et al., 2008). In systems science, a problem is ‘conceptualized as a system of interrelated component parts’ (e.g., the whole puzzle) (Mabry et al., 2008, S218). A systems approach is helpful because it encompasses the multitude of factors involved in a specific problem (e.g., promoting children’s IM) and the relations between these factors (Rutter et al., 2019). Figure 5.1 depicts significant findings from this dissertation, builds upon Figure 1.1, and aims to provide a more explicit, detailed view of the complex associations amongst factors influencing children’s IM. Similar to Badland and colleagues, a systems map of the factors influencing children’s IM was developed (Figure 5.1), with different social-ecological categories and included the significant factors associated with IM in this dissertation. Although not explicitly examined within this dissertation, the policy environment and natural environment levels were also included as these likely have an impact on children’s IM. A systems map is a useful representation of a system with the ability to be ‘dynamic and respond to the changing nature of the problem’ (Allender et al., 2015) and be flexible in its application in diverse settings (Badland et al., 2016). It helps illustrate the multiple levels in a system (e.g., individual factors, social factors, etc.), emphasizes the ‘interconnectedness of the key drivers’ for independent mobility, and depicts how the different parts of the system relate to each other (Rutter et al., 2019. p. 164). Furthermore, it also highlights the need for a variety of partnerships across multiple sectors and identifies key areas for action (e.g., social environment) (Rutter et al., 2019). The flexibility of a systems map also allows for the map to be updated as future research emerges (e.g., longitudinal studies, causal relationships). In Figure 5.1 solid lines depict associations found in this thesis.

Grey boxes/dashed lines depict potential associations that may impact children's IM and require further examination.

Figure 5.1 Social-ecological factors influencing children's independent mobility



As the World Health Organization recommends in their *Active: A technical package for increasing physical activity* document for increasing PA, a ‘whole system’ approach is needed to increase levels of PA (World Health Organization, 2018a). Moving forward, multi-level and multi-sectoral coordinated initiatives will be necessary for targeting children’s IM as will be establishing connections between key stakeholders (e.g., people, organization) in each of these relevant levels who can support and influence factors (e.g., policy, built environment, etc.) related to children’s IM. A ‘whole system’ approach to these initiatives may help by allowing stakeholders to identify their role in the ‘whole system’ and in supporting a shared understanding of the role of others in the system (Rutter et al., 2019).

5.2.2 Contribution #2: Spatial heterogeneity and the role of the child and parental perceptions

An interesting trend throughout the dissertation was the children’s home location and its influence on their IM. In study one, different degrees of urbanization including urban, suburban, and rural environments were consistently positively associated with children's IM. Various studies found positive association between each type of environment and IM due to a variety of reasons (e.g., less traffic, more social cohesion, greater variety and number of places for exploration). Level of urbanization was not significant in study two, except for boys living in suburban environments who had lower levels of IM compared to those living in rural environments. Additionally, in study three, there were no major differences across the neighbourhoods although the neighbourhoods varied in urbanization (e.g., urban, suburban, and urban-suburban mix). These findings highlight that each type of environment can facilitate or impede children’s IM. For example, Kytta’s Bullerby model outlines four different types of

environments (i.e. Bullerby, Wasteland, Cell, and Glasshouse) based on a continuum of affordances and access and each varies in facilitators and/or barriers to IM (e.g., actualization of affordances). For example, ‘Wasteland’ environments, which could refer to some suburban settings, may hinder opportunities for children to be independently mobile because while children may have the license to be independently mobile, the environment lacks things to discover and affordances are limited (Kytta, 2004).

On the other hand, ‘glasshouse’ environments offer a variety of affordances but the area of movement in the environment is restricted for children (e.g., environment that is encompassed by high-speed roadways, lacking sidewalks/crosswalks). A ‘Bullerby’ environment describes an environment that is diverse, and children can freely access (e.g., urban environments with a variety of destinations to explore; rural environments with less traffic and children can freely access the affordances in the environment). As highlighted throughout this dissertation, children’s IM is spatially heterogenous; where a child lives matters, as the environment can impede or help facilitate their IM – and this applies across urban, suburban, and rural macro-settings. Consequently, environments will vary in the amount of change needed to make them conducive for safe exploration by children (e.g., building a safe crosswalk at a single intersection vs creating protected bike lanes in an entire city). Policy development for children’s IM may need to consider localized policy approaches rather than a one-size-fits-all approach.

The setting where a child lives such as neighbourhoods, cities, provinces, and countries can have specific social and cultural norms which may impact children’s IM. The Global Matrix 3.0 (Active Healthy Kids Global Alliance, 2018b), examining the global variation in child and youth PA, shows significant variation between countries regarding overall PA, active play, and active transportation. The Global Matrix assigns letter grades (A+ through F, and

INC=incomplete/insufficient information to assign a grade) for different categories of behaviours related to PA (e.g., overall PA, active transportation, organized sport, etc.). Some countries like Japan, Nepal, Zimbabwe (all scoring A-), Denmark, Finland, Hong Kong, and South Korea (all scoring B+) received high grades for their levels of active transportation. Other countries such as Slovenia, Zimbabwe, Nigeria and the Netherlands demonstrated high levels of overall PA (A-, C+, C, C respectively) in their countries. While countries may vary in their approaches to PA and active transportation, a consistent trend may be the social and cultural norms that support these behaviours (Aubert et al., 2018). For example, Japanese children's high levels of active transportation may stem from the pervasive 'walking to school practice' facilitated by policy that public elementary schools and junior high schools not exceed distances of 4 km and 6 km respectively from student's homes (Active Healthy Kids Global Alliance, 2018a).

Additionally, policies and infrastructure (or lack thereof) may play an important role in facilitating or hindering these behaviours. For instance, one of the Global Matrix 3.0 grades pertains to 'Community & Environment'; this benchmark relates to 'community policy and programming, availability of infrastructure (e.g., parks and playgrounds), neighbourhood safety and the natural environment' (ParticipACTION, 2018) all of which may impact the ease at which children can be physically active, actively travel, or be independently mobile outside. As study two highlighted, Canadian children in Ottawa, Ontario and Vancouver, British Columbia had lower levels of IM compared to Trois Rivières, Québec, highlighting variation in CIM based on location. Children's IM should be considered spatially heterogeneous as pertinent factors influencing children's IM may not operate in a similar manner everywhere. This spatial heterogeneity can potentially arise from variations in 'people's attitudes or preferences or there are different administrative, political or other contextual issues that produce different responses

to the same stimuli over space' (Feuillet et al., 2015, p. 10). When examining interrelated factors influencing a health behaviour, social-ecological models are most useful when they are tailored for that specific health behaviour (Sallis et al., 2015), but also tailored for a specific context (i.e. area specific) as well (Feuillet et al., 2015; Mitra et al., 2010). Broadly, the findings from this dissertation highlight the need to consider the local context or setting where children live when considering future interventions.

All three studies in this dissertation have consistently emphasized the importance of social environment-level factors as particularly salient to children's IM. Children's and parents' perceptions of the environment in relation to safety, traffic, crime, and/or stranger danger may ultimately influence children's willingness to travel independently or influence parental decision-making in support or against allowing their children freedom to travel or play in their neighborhood independently. Findings from the first study highlighted that positive parental perceptions of safety (e.g., encompassing factors like perceptions of traffic safety, high quality traffic environment, or presence of enough cross walks) were consistently positively associated with children's IM. The second study underscored the significance of parental perceptions of stranger danger (negatively associated with girls' IM) and traffic concern (negatively associated with children's IM). Findings from the third study emphasized that feelings of connection and social cohesion between families, their neighbours, and their neighbourhood helped both children and parents feel comfortable with children's IM.

Other than distance, one systematic review examining GIS measured environmental correlates of active school transportation indicated that objectively measured environmental attributes, that may be associated with perceptions of safety (e.g., busy roads along or cut across the shortest path estimate of a students' route to school). were inconsistently associated with

children's active school transportation (Wong et al., 2011). Given the consistency reported in the associations between perceptions of safety and IM then perceptions of the environment may be more powerful predictors of children's IM. As demonstrated, there are dynamic connections between these factors that collectively form the system; the relationships between the child's home location, the social and cultural norms in that location, as well as the perceptions of the neighbourhood environment; these influence each other and consequently influence a child's IM. As discussed earlier, mapping the system can also help identify key areas of focus. For instance, these findings emphasize a need for future work on addressing children's and parents' concerns and reframing or shifting perceptions of the environment.

This is not to downplay the role of the 'objective' built environment in informing perceptions of safety. The built environment is influential for children's IM, however, it is important to acknowledge that perceptions of the neighbourhood environment are incredibly critical 'because people's perceptions may, in fact, motivate their behavior more than the true nature of the situation' (Davison & Lawson, p. 14). Addressing these social environment levels factors can be done through design of the built environment (e.g., building safe crosswalks, instituting traffic calming measures) which can likely impact children and parents' perceptions of safety within their neighbourhoods. Interventions to promote social cohesion and connection may also positively impact IM. Other research has indicated that both objective characteristics of the environment as well as perceived characteristics of the environments are important for transportation, recreational activity, and physical activity (Hoehner et al., 2005; Carver et al. 2008); again, highlighting the interconnectedness of the 'whole system'.

5.2.3 Contribution #3: Every child is unique: Importance of children's individual characteristics

The influence of gender has been widely discussed within the literature examining correlates of children's IM. The findings from study one in this dissertation suggested that gender was inconsistently associated with children's IM, although the trend pointed to boys having higher levels of IM compared to girls. This was confirmed in study two where boys had significantly higher IM compared to girls. In contrast, study three found no clear difference in IM levels for boys and girls nor differences in parental perceptions in their allowances for IM. Although this difference might be related to the different methodological approaches of each study, children's other individual-level characteristics such as their confidence, ability to 'think on their feet', and skills to safely navigate the environment, appeared more important than children's gender and age in study three. A report by Shaw and colleagues (2015) examining children's IM in 16 countries suggested that despite increased perceived risk for girls, there were no significant differences in boys and girls in levels of IM (Shaw et al., 2015). There are mixed findings within the literature with regard to risk perceptions and capabilities of girls and boys. Valentine found that girls were more often described as 'mature' and 'sensible' while boys were described as 'irrational' and perhaps 'easily led' by peers (Valentine, 1997b). In study two, findings supported differences in perceived fears between boys and girls; parents' perceptions of stranger danger were negatively associated with girls' IM while traffic danger was pertinent to both boys and girls. However, findings from this dissertation suggest that gender-stratified interventions for children's IM may not be necessary. More important to children's IM may be other individual-level characteristics like skills and confidence. These findings highlight a need to develop interventions that help children, regardless of gender, build the confidence and

competence to traverse the environment safely (e.g., road safety class, practicing navigating the environment with a parent, facilitating IM by traveling with friends or siblings).

5.2.4 Practical Implications: Steps for building children’s independent mobility

Findings from this dissertation have highlighted various correlates and potential settings that may influence childhood IM. However, for these findings to have an impact, it is important to consider how they can be translated and disseminated to key knowledge users (e.g., stakeholders, policymakers). Knowledge translation emphasizes the exchange, synthesis, and ethically sound application of knowledge through a series of interactions between researchers and knowledge users with the purpose of improving health (Canadian Institutes of Health Research & Government of Canada, 2005; Graham et al., 2006). As discussed, a ‘systems approach’ also helps identify the sectors and stakeholders involved within the system.

As I will discuss below, there are several key areas of focus for knowledge translation and future interventions including the child (e.g., going beyond common correlates of children’s age and gender to determine whether a child is ready for IM), the neighbourhood and community (e.g., developing and fostering connections between people in the neighbourhood, and learning the neighbourhood including landmarks and destinations), communication and skill-building (e.g., communication between parents and children is a key facilitator of IM as is, the opportunity to practice new found skills (e.g., taking public transit like the bus or SkyTrain)), and adopting a multi-level and multi-sectoral approach (e.g., collaborations between various stakeholders; targeting more than just individual characteristics of the child). Additionally, some practical recommendations for building children’s IM are outlined below (see Table 5.2).

5.2.4.1 Community Leaders

Community leaders may include city councils, mayors, urban planners, school boards, and organizations that may help promote children’s independent travel and play. These are individuals and organizations that develop and influence policies (e.g., creating protected bike lanes, implementing traffic calming, promoting active travel to school, and reallocating road space for pedestrian and cycling traffic) that support IM, active transportation, and outdoor play and consequently, help parents and children feel more at ease in their environment. These community leaders are in positions to support building safe, child-friendly cities that create equal opportunities for all children living there (“Guiding Principles,” 2020).

5.2.4.2 Community Groups

Community groups may include community centres, recreation centres, charities (e.g., YMCA), and schools. These groups are well-positioned to help advocate and support children’s IM by providing children with helpful skills and safe environments to which children can travel to and play. For example, support could include the offering of road and cycling safety workshops and ensuring that children have safe, accessible, and diverse destinations to travel to (e.g., basketball courts at schools, local swimming pool).

5.2.4.3 Neighbourhoods

Neighbourhoods include the people that live and work in them like homeowners, renters, small business owners, and shopkeepers. All these individuals play an important role in creating community connections and committing to creating safe, welcoming spaces for children. Working toward building a sense of community and connection with neighbours (e.g., through

initiatives like neighbourhood projects and block parties) can help foster a safe and friendly environment for everyone.

5.2.4.4 Parents and Guardians

Parents and guardians play an important role as ‘gatekeepers’ to children’s IM. They are in a key position to promote their child’s IM because they know their child best and can engage in discussions about IM including skill-building, safety talks, and discussions to determine when to expand IM. This audience is likely the easiest to target through educational campaigns and related initiatives, but those efforts might be less successful if broader advocacy is unsuccessful in creating the conditions supportive of IM.

5.2.4.5 Building children’s independent mobility

Table 5.2 outlines six recommendations for parents and caregivers in building children’s IM. These recommendations are grounded in the findings of this dissertation, and the ‘Recommendations’ column identifies the respective studies from which the description is crafted.

Table 5.2 Six recommendations for parents and caregivers in building children’s independent mobility

Recommendations	Description
1. Start Early *Study 3	<i>Starting early is important (but it is never too late).</i> More time in the neighbourhood allows both children and parents to gain familiarity with the environment (e.g., streets, neighbours, landmarks). The parent can act as a guide, while helping their child(ren) build important skills. For example, helping children learn how to safely cross the street, ride a bicycle including road safety tips, and how to overcome unexpected situations (e.g., if the child gets lost in the neighbourhood do they know who they can ask for help or how to find their way back home).

Recommendations	Description
<p>2. Know your child *Studies 1, 2, 3</p>	<p><i>Each child is unique.</i> Children vary in terms of confidence, maturity, and environment in which they live (e.g., residential neighbourhood, dense downtown core, rural area) and there is no set age when a child should become independently mobile. Parent(s) and child(ren) should engage in conversations in order to determine when a child is ready to explore their neighbourhood without adult accompaniment and help the child develop the necessary skills to do so safely.</p> <p><i>Questions that can help assess readiness for children’s IM:</i></p> <ul style="list-style-type: none"> • Is my child ready to travel the neighbourhood on their own? • Does the child feel ready to travel independently or do they feel more comfortable traveling with a sibling or friend? • Does the child have the confidence and skills to navigate their environment safely?
<p>3. Know your neighbourhood *Studies 1 and 3</p>	<p><i>Familiarity with the neighbourhood is key.</i> It is beneficial to know neighbours, landmarks, and locations nearby (e.g., school, shops, community centre). Familiarity with the neighbourhood can help put parent(s) and child(ren) at ease through knowledge of local destinations, neighbours to they could ask for help, and more comprehensive environmental knowledge that can aid in navigating the neighbourhood safely. Connections with neighbours and knowledge of the neighbourhood can help build a sense community which could consequently help facilitate children’s IM.</p> <p><i>Questions that can help assess readiness for children’s IM:</i></p> <ul style="list-style-type: none"> • Does the child know which neighbours/people in the neighbourhood they could ask for help? • Are the parent and child aware of neighbourhood destinations for travel and play (e.g., park, library, playground, friend’s house)?
<p>4. Know your neighbourhood community *Studies 1 and 3</p>	<p><i>Gain familiarity with your neighbourhood community to address barriers to children’s IM.</i> Building community connections and social cohesion are important for IM and can help with perceptions of safety. It is also important to have conversations to address barriers to <i>all</i> children’s mobility in order to equitably support all children’s independent movement and play.</p> <p><i>Questions that can help assess readiness for children’s IM:</i></p> <ul style="list-style-type: none"> • How do your children, and all children in your community, experience mobility?

Recommendations	Description
	<ul style="list-style-type: none"> • What are the barriers to IM (e.g., no crosswalks) and what can my community and I do to address these barriers? • Are there advocacy and planning groups available for building inclusive communities?
<p>5. Trial runs *Study 3</p>	<p><i>Once readiness has been established between the child and parent, the next step is trial runs. Take it one step at a time. Parents may want to start by accompanying their child (e.g., walking or cycling) – it allows for parent(s) and the child to become familiar with the neighbourhood. The next step could be practicing the journey from the home to various destinations (e.g., school, park), with the child leading the way. Once the child is familiar with the neighbourhood, they can practice getting to various destinations independently (e.g., traveling to nearest market to pick up a grocery item).</i></p> <p><i>Facilitating trial runs:</i></p> <ul style="list-style-type: none"> • Child can travel with peers (e.g., sibling(s), friend(s)) • Child could check-in (e.g., cell phone, friend’s phone, phone at the destination, or other WIFI enabled device with messaging capabilities (e.g., iPod)) • For school trips, consider starting or participating in a walking/cycling school bus
<p>6. Check-ins *Study 3</p>	<p><i>Re-evaluating the level of IM is crucial. As a child gets older and develops, it is important to check-in regarding their IM.</i></p> <p><i>Questions to reevaluate:</i></p> <ul style="list-style-type: none"> • Does the child have enough IM? • Are they ready for a greater roaming range? For a greater and more variety of destinations to which to travel? To take public transit?

5.3 General Limitations

While this work led to several important contributions and practical implications, there are several limitations that should be noted. A summary of the limitations for each study are provided in Table 5.1, while this section details limitations across the dissertation. The first limitation is based on geographical sampling. As indicated earlier, study one included studies

from around the world however, these studies were all from mainly Western and high income countries. While efforts were made to vary the sampling in study two by accounting for varying degrees of urbanization and area-level socioeconomic status, some environments were not examined (e.g., remote and often rural locations). In study three, while families from three different neighbourhoods were recruited, these neighbourhoods represented the Greater Vancouver Area, consequently representing very urban/suburban environments. It is projected that greater than two-thirds of the world's population will be centered in urban areas by 2050 (United Nations et al., 2019), making these an important setting for study. Therefore, findings from this dissertation may be relevant to other environments and locations that are similar (e.g., high income countries, and cities), but may not be generalizable to other environments (low- and middle-income countries or remote locations).

Additionally, there was a focus on distinct age ranges. Across the three studies, the age range of 10-12 years of age was consistently targeted. Study one found that the age ranges of majority of studies overlapped in the 10-12 years age range, study two focused on ages 8-12 years old, and study three focused on children 10-13 years old. While this age range highlights an important transitional period from childhood to adolescence and a period in which perhaps children are transitioning toward greater IM, it also identifies a limitation of understudied ages, particularly younger elementary-aged children. Cross-sectional studies have consistently shown age to be associated with children's IM. It may be important to examine the IM of younger children, to determine potential ways to help children gain the skills necessary to gain IM earlier. When children are granted the freedom to roam independently earlier, they have more time to practice and consequently, develop the skills and confidence to navigate the environment safely.

Another limitation to draw attention to is the privileged sample in the third study of this dissertation. The sample was predominantly highly educated with high household income, and most children within the sample enjoyed higher levels of IM. There is a need to also focus on families and children who have low levels of IM. These families may experience different barriers limiting children's freedom for independent travel including barriers related to the built environment (e.g., lack of green spaces), social environment (e.g., higher perception of crime). Yet, this limitation also points to the challenge of capturing perceptions and experiences of families with low IM. For example, as part of knowledge translation efforts, I helped develop a documentary, *Running Free: Children's Independent Mobility*. During the process of recruiting for the documentary, we (the documentary team) faced difficulty in recruiting families with low levels of IM. Families whose children have low IM may have greater concerns that may consequently limit levels of IM. These concerns may stem from judgment from others (e.g., neighbours, other parents), living in an environment not conducive or supportive of children roaming independently, or fear of being reported to Ministry of Children and Family Development (e.g., story of Vancouver father whose children were banned from traveling by bus, described in Chapter 1.3). It is important to use appropriate methods to recruit children with low IM so that these perspectives and experiences are not overlooked. Previous studies examining 'hard-to-reach', low income, or minority groups (Bonevski et al., 2014; Carroll et al., 2011; Cui et al., 2019) have stressed the importance of using community partners, forming partnerships with these partners (whether people or organizations), providing appropriate training for the research team who should include individuals with appropriate linguistic and cultural skills and background to the target population. Additionally, participants may be more

willing to participate if they see the practical application of the research being conducted such that either specific policies, services, and/or resources are developed from the resulting findings.

5.4 Future Directions

5.4.1 A need for prospective longitudinal and experimental studies

While this dissertation furthered understanding of the correlates of children's IM, it is important to note that the included studies only provided a 'snapshot' at a single time point through the cross-sectional nature of the designs. The current literature and the studies included in this dissertation have identified important correlates of children's IM. Cross-sectional studies are useful in determining if associations exist between independent and outcome variables, however, no information regarding temporal relationships can be established and consequently, no causality or direction can be established. There is a need for prospective longitudinal studies that can help establish how childhood IM develops and expands through childhood. There have been few studies that have examined IM longitudinally; these include Carver and colleagues (2014) examining IM on the journey to school and a study by Veitch and colleagues (2017) examining associations between individual, social and physical environmental factors and children's active transportation and IM over a two-year period. While longitudinal studies can be costly and require an extended time commitment, they may be important in moving the field of children's IM forward by helping to identify what mediates changes in children's IM, by pinpointing important time periods to target in future interventions, and by improving our understanding of changes in IM.

Additionally, with the growth of literature on children's IM, there has been ample work done on identifying correlates of children's IM. However, to the best of my knowledge there

have not been many experimental studies aimed at increasing children's IM. With the identification of numerous social-ecological factors, it may be worth exploring how best to increase children's IM. As findings from this dissertation highlight, focusing on individual characteristics of the child including building children's confidence and their skillset for navigating the environment (e.g., road safety, cycling safety) and social environment factors like children's and parental perceptions of safety and perceptions of confidence (e.g., parents' perception that their child is confident in their own abilities) may be important starting points for experimental studies. More specifically, can we intervene and increase the IM of children at various ages, and do changes in IM lead to other important developmental outcomes?

Furthermore, cross-sectional studies have well-established a link between children's increasing age and IM. A commonly studied age range as seen in studies one through three is 10-12 years old, as this is a key period during which a child transitions to adolescence. However, evidence suggests that the age at which children are granted the freedom to travel independently has risen compared to earlier generations (e.g., parents, grandparents) (Bhosale et al., 2015; Hillman et al., 1990). As children's IM has been associated with a number of physical, social, and cognitive benefits (Mackett et al., 2007; Rissotto & Tonucci, 2002; Tranter & Whitelegg, 1994), it may be important to further explore the consequences of delayed freedom to travel and play independently. Future work on children's IM may include observational studies following children over time and observing differences in children who gained IM earlier compared to children who were granted the freedom to roam freely later in their lives.

5.4.2 A need for further examination of social and cultural norms

This dissertation highlighted a need for further examination of social and cultural norms and their relationship with children's IM. Study one found a consistent association between ethnicity and/or race and children's IM, but also highlighted that few studies examined these factors and their influence on IM. Additionally, in study two, there was a significant negative association between language spoken at home (besides co-official languages of English and French) and children's IM, which may allude to social and cultural norms. For example, differences in social and cultural norms could influence household structures (e.g., single-parent households, living with extended family like grandparents or aunts/uncles), community make up (e.g., family and friends living in close proximity) (Chaudhury, 2017), transportation modes commonly used (He and Giuliano, 2017), and parental concerns about the neighbourhood environment (Lin et al., 2017). For example, the presence of extended family within the household may limit children's IM as more family members are available to escort the child to a destination (e.g., school, friend's house). On the other hand, having family and friends in proximity may increase opportunities for the child to be independently mobile since there are other children to play with and there may be a sense of more 'eyes on the street' looking out for children in the neighbourhood. Race and ethnicity are also intertwined with socioeconomic status (e.g., education, income) (American Academy of Pediatrics, 2000), which may consequently impact where a family lives as well as parental perceptions of safety and decision-making for granting their child freedom to be outside within their local environment. In study three, nearly three-quarters of the participants self-identified as White (74.2%) followed by Asian (19.7%) and while the representation of race was not equal in this sample, no major differences between families were observed. However, this could have arisen from the similarities in household

income, similar levels of children's IM, and social norms in each of these families' respective neighbourhoods.

Future efforts to examine ethnicity and/or race, and by extension social and cultural norms, may be needed to better understand how these impact children's IM through influencing of parental decision-making (McMillan, 2005). Shaw et al. (2015) examined children's IM levels in 16 countries and interestingly, while evidence showed a decline in IM levels, the level of decline varied between countries. For example, countries like Finland, Germany, Norway, and Sweden demonstrated higher level of IM than other countries such as Australia, Portugal, Italy, and South Africa (Shaw et al., 2015). These differences may represent differences in cultural attitudes, behaviours, and social and cultural norms that either can facilitate children's IM or hinder it.

In Chapter 1, I described the Vancouver father who was faulted for allowing his children to ride the bus independently. Recently, that father, Adrian Crook, won his case in British Columbia's Court of Appeal. The Court found that the 'province's director of child and family services doesn't have the authority to order a Vancouver man to supervise his children on public transit.' (Proctor, 2020). The resolution of this case is encouraging and may point toward shifting social norms that may be more supportive of children's IM. However, this shift may be context specific; children's IM is not universal. There is a need to examine IM in different contexts as has been shown in this dissertation and the broader literature. This highlights a need to study children's IM within a variety of contexts as these may differ between countries and locations. This may include variability in quality of the local infrastructure for walking and cycling, public transportation systems, and influence of social and cultural factors.

5.4.3 A need to examine existing policies and development of future policies that support children's independent mobility

Study one highlighted the lack of emphasis on policy level factors that may influence children's IM. As demonstrated by a 16-country report examining children's IM, there were few policies explicitly referring to children's IM (Shaw et al., 2015). Moving forward, it may be necessary to more clearly incorporate legislation and policies that are supportive of children's freedom to travel and play independently. For example, in Utah, United States, a law was recently revised to update the definition of 'neglect' so that children traveling independently would not qualify as being neglected (Coleman, 2018; Child Neglect Amendments, 2018). Differences in IM levels in different countries may stem from the presence or lack of policies that facilitate or hinder children's freedom to travel and play in their neighbourhoods and cities without parental supervision. In many cases, policies may have an indirect effect on IM and be implemented without childhood IM initially in mind. In Oslo, Norway, over the course of several years, the city took steps to reduce and remove vehicular traffic from the downtown core and replaced on-street parking with bike lanes and sidewalks. In doing so, they have dramatically reduced traffic fatalities and cyclist deaths (Walker, 2020). While not directly addressing children's IM, the city may have consequently created conditions conducive for children traveling independently (e.g., lowering traffic fatalities, reducing children and parental concerns around traffic). Another example is Davis, California where the city is centered around facilitating cycling including specific traffic lights for cyclists, bike lanes, and reduced speed limits (*Davis Bike and Pedestrian Infrastructure* / *City of Davis, CA*, 2020). These policies and initiatives help facilitate active travel in local settings, and additionally may help increase perceptions of safety as well as helping make environments more human-centric. As Tranter and

Whitelegg explained, ‘there is a need to prioritize human use of space rather than motorized use of space’ (Tranter & Whitelegg, 1994, p. 273) especially when considering children’s safety and freedom to travel and play in their neighbourhoods.

There is a need for policies ranging from the local through to the national level that are supportive and impact children’s IM. It is also necessary to identify, examine, and evaluate the influence of these policies on children’s IM, with the aim of reversing the downward trend of IM levels. Steps in this direction may involve placing children at the heart of planning, either through participatory processes of involving children and young people in design of public space that they will use, or keeping children at the heart of design (Bishop & Corkery, 2017; Robbé, 2017; UNICEF Innocenti Research Centre, 2004). Involving children may foster a sense of ownership over the project, as well as empowerment and confidence when they are able to see the results of their contributions. Benefits for the community would include a sense of pride in local children who have helped contribute to the design of outdoor environments that meet children’s needs and interests (Robbé, 2017). Furthermore, it could be important to explicitly incorporate children’s IM and PA into official community plans, which are policy documents developed by municipalities to help guide the development of physical, environmental, economic, social and cultural development within a municipality (Hassan et al., 2018). A study by Hassan and colleagues (2017) examining official community plans for policies supportive of PA found that these official community plans, which can impact public health, rarely explicitly referred to policies supportive of PA. Policy development for children’s IM may want to build on findings from Hassan et al. and advocate for the inclusion of clear policies that could support IM including plans for active transportation, cycling-friendly initiatives, built environment features

(e.g., adequate lighting, proximity to public open spaces), and active and safe routes to and from school.

5.4.4 Children's independent mobility in a time of pandemic

When I began working on this dissertation, I could hardly anticipate the effects COVID-19 would have on the world and children's IM. The World Health Organization declared COVID-19 a pandemic on March 11, 2020 (World Health Organization, 2020f). To curb the spread of the virus, countries around the world began instituting 'stay-at-home' protocols, which varied between countries and regions (e.g., provinces, states, municipalities). These public health protocols included 'social' or 'physical' distancing (i.e. staying 2 meters away from other people not in your household), washing your hands (i.e., for at least 20 seconds), and wearing a mask when in public settings (CDC, 2020). Additionally, to mitigate the impacts of COVID-19, other restrictions were put in place including the banning of mass gathering (e.g., greater than 50 people), closure of schools, provincial parks, campgrounds, playgrounds, gyms, and recreation centres (Government of British Columbia, 2020). However, these restrictions have had unintended consequences of greatly impacting PA levels globally. Early in the pandemic, FitBit Inc. published results from its 30 million global users finding a 7% to 38% decline in PA rates (i.e. steps counts) worldwide during the week ending in March 22, 2020 (*The Impact Of Coronavirus On Global Activity*, 2020). While countries varied in levels of PA decline, there was a distinct decrease in PA worldwide (Tison et al., 2020). The World Health Organization has recommended that individuals stay active during COVID-19 (World Health Organization, 2020g), however, worldwide the implementation of public health protocols have been varied and may have reduced opportunities to be physically active, especially for children. For example,

Public Health Canada and health authorities called for the closures of parks and playgrounds throughout the country. Figure 5.2 depicts one playground in Vancouver, British Columbia that was taped off by the City of Vancouver as a result of public health restrictions.

Figure 5.2 Vancouver, BC playground during COVID-19 pandemic



Source: Negin Riazi taken March 23, 2020

5.4.4.1 Decline in children’s physical activity

The impact on children’s PA has been dramatic. In Canada, prior to the pandemic 15% of Canadian children were meeting all movement behaviours (PA, screen time, and sleep) recommendations from the 24-Hour Movement Guidelines for Children and Youth (5-17 years), however, only 4.8% of children (5-11 years old) and .8% of youth (12-17 years old) were meeting the guidelines during the pandemic (ParticipACTION, 2020). These findings were from a national survey of 1,472 Canadian parents who reported that their children were engaging in lower levels of PA, higher sedentary behaviour (e.g., leisure screen time), less outside time, and

more sleep compared to before the introduction of restrictions (Moore et al., 2020; Outdoor Play Canada, 2020).

Consequently, there is growing concern about the long-term impacts of ‘stay-at-home’, ‘lockdown’, ‘shelter-in-place’ measures implemented globally on the mental and physical health of children (Allen, 2020). While the World Health Organization has highlighted the importance of staying active (World Health Organization, 2020, 2020g), in many parts of the world, the public health protocols recommended ‘stay-at-home’ practices, consequently restricting where people could be physically active (e.g., walking in the streets, parks, gyms). More notably, not all children had access to outdoor space (e.g., backyard, courtyard), limiting the space in which they could be active and be outdoors. A recent study emphasized the importance of parks and open spaces in providing children with opportunities to engage in outdoor activity, play, and recreation during the pandemic (Mitra et al., 2020). Additionally, children’s outdoor time may be contingent on parents’ work and work-from-home schedules and therefore may be scheduled around parents’ meetings and work hours further restricting time outside. These public health measures aimed at curbing the spread of the virus have consequently limited opportunities, spaces, and children’s agency to be outdoors. As public health restrictions ease, children cycling or engaging in outdoor activities will likely rebound, but we need to be planning ahead for possible returns to lockdown conditions.

5.4.4.2 Children’s independent mobility moving forward

Moving forward, with the eventuality of consequent waves of this pandemic and the uncertainty of future pandemics, it is critical to consider how children can adapt to these conditions without losing their IM. Children’s IM may be more important than ever in helping

provide them with opportunities to be outside and active. Instead of restricting IM, it will be necessary to educate children on how to safely navigate the outside world and how to make the environment as safe as possible for them. For example, learning about the COVID-19 restrictions based on where families live and having conversations with child(ren) about how to safely be outside while still following physical distancing and hygiene guidelines (e.g., remain 2 meters away from others, no physical contact with others, regular handwashing) will be vital for children's IM in a time of pandemic. However, it is not unlike the recommendations outlined earlier that stressed providing children with ample opportunities to learn and practice newfound skills for IM. COVID-19 research is currently underway, and recommendations for how to be safe outside may be updated in the future. Another consideration is that lockdown or stay-at-home measures will dramatically limit social interactions with friends, family, and neighbours. Is having IM less attractive to children if they have no one to be independently mobile with? How then do we address this dilemma moving forward?

As it stands, places around the world are slowly easing restrictions and people's 'bubbles' are expanding to allow contact with more people. However, with another potential wave of COVID-19 cases on the way, it is important to discuss how children can adapt to these times. It is heartening that research has shown that it is less risky to be outdoors than indoors with proper physical distancing. According to the Canadian Paediatric Society, 'the major risk factor for acquiring COVID-19 infection in childhood is household exposure' (Canadian Paediatric Society, 2020, para. 4) or in other words, inside in shared living quarters. While acknowledging that it may be more difficult for children to 'hang out' with their friends in close proximity, it is still possible, especially with expanding 'bubbles.' Children can still travel independently, with siblings, or peers while maintaining physical distancing. For example, walking around the local

park or cycling while maintaining physical distancing. Steps can also be taken to make the environment as safe as necessary and conducive for people to be outside while maintaining physical distancing. For example, advocating for outdoor time (CBC News, 2020), keeping parks accessible to the public (Parks Canada Agency, 2020), and supporting efforts to open streets and allocate more space for pedestrians and cyclists to be outside (City of Vancouver, 2020; Little, 2020). Moving forward, it will be important to take steps to ensure children are safe during the pandemic without limiting their IM.

5.5 Summary

The series of studies in this dissertation have provided a window into the factors influencing children's IM and shed light on the complexities of it. This dissertation represented a multi-method approach to examining children's IM. Although a social-ecological framework provided a basis for this research, the results highlighted the need to augment such a framework with a 'systems' approach. Findings highlighted that improving children's IM may not require expensive retrofitting of existing neighbourhood environments – while built environment features (e.g., cross walks, sidewalks) are important, targeting the social environment, specifically building perceptions of safety, social connections, neighbourhood connection and cohesion may help create conducive environments for children to roam freely. Future directions should focus on building neighbourhood connections, developing policies supportive of children's IM, and conducting longitudinal and experimental studies that can help in determining causality and improving children's IM. This dissertation builds on existing evidence on correlates of children's IM, highlighting the complexities of IM, and the need for multi-level and multi-sectoral initiatives for future promotion of children's IM.

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Appendices

Appendix A

A.1 Criteria for quality assessment

Criteria	Description	N (%)
Objectives	Were the objectives or hypotheses of the research stated?	43 (100)
Study design	Was the study design appropriate for the research undertaken (e.g., cross sectional or longitudinal study, or intervention study with cross sectional analysis)	43 (100)
Target population	Was the target population defined?	43 (100)
Random sample	Was a random sample of the target population taken?	15 (35)
Response rate	Was the response rate 60% or more?	19 (44)
Participant selection	Was the participant selection described?	43 (100)
Participant recruitment	Was the participant recruitment described or referred to?	43 (100)
Participant numbers	Were the numbers of participants at each stage of the study reported? (authors should report at least numbers eligible, numbers recruited, numbers included/excluded from analysis)	42 (98)
Participant inclusion/exclusion	Were criteria for inclusion and/or exclusion of participants in the analysis used?	33 (77)
Study population	Was the study population sufficiently described? (minimum description =sample size, gender, age and an indicator of socioeconomic status)	43 (100)
Variables	Were the measures of IM described?	43 (100)
Data sources	Did the authors describe the source of their data? (e.g. questionnaire, survey, interview, focus group, direct observation, accelerometry, GPS)	43 (100)

Data collection	Did the authors describe how the data were collected? (e.g. by mail., computer, face to face, objective measurement)	43 (100)
Measurement (IM)	Were reliable and valid measures of IM used?	15 (35)
Statistical methods	Were appropriate statistical methods used and described?	43 (100)
Adjustments	Were covariates/confounders controlled for in the analysis? (the authors should present confounder-adjusted estimates)	37 (86)
Missing data	Were the numbers/percentages of participants with missing data for IM reported AND did at least 80% of enrolled participants provide complete data in order to be included in the analysis	20 (47)

Criteria for quality assessment and number (%) of studies scoring points (either .5 or 1) for each criterion.

A.2 Social-ecological correlates of children's independent mobility in this review

		Related to Children's Independent Mobility			Summary Code		
	Correlate of IM	Studies	Association (- / +)	Unrelated to Children's Independent Mobility	Association	Related/ Unrelated	% Studies
Individual Child Characteristics							
	Age	Aggio et al., 2017; Alparone et al., 2012; Broberg et al., 2013 <i>b</i> ; Buliung et al., 2017; Carver et al., 2012; Chaudhury et al., 2017; Christian et al., 2015 (i,ii), 2016; Cordovil et al., 2015; Fyhri et al., 2009; Ghekiere et al., 2017; He et al., 2017; Herrador-Colmenero et al., 2017; Janssen et al., 2016; Johansson, 2006 (i,ii); Kytta et al., 2015 (i-iii); Lam et al., 2014; Larsen et al., 2015; Mammen et al., 2012; Mitra et al., 2014; Pacilli et al., 2013; Prezza et al., 2001; Stark et al., 2018; Veitch et al., 2008 (i,ii); Wolfe et al., 2016	+	Broberg et al., 2013 <i>a</i> ; Carver et al., 2013; Herrador-Colmenero et al., 2017; Lin et al., 2017	++	30/35	86%
		Carver et al., 2013	-				
	Gender (boy)	Aggio et al., 2017; Alparone et al., 2012; Broberg et al., 2013 <i>a</i> ; Carver et al., 2012, 2013 (Australia), 2014; Christian et al., 2015, 2016; Cordovil et al., 2015 (i,ii); Fyhri et al., 2009; Ghekiere et al., 2017; Kytta, 2004 (Belarus); Lopes et al., 2014 (i,ii); Mitra et al., 2014; Pacilli et al., 2013; Prezza et al., 2001; Schoeppe et al., 2016 <i>a</i> ; Villanueva et al., 2014; Wolfe & McDonald, 2016)	+	Bhosale et al., 2017 (i,ii); Broberg et al., 2013 <i>b</i> ; R. N. Buliung et al., 2017; Carver et al., 2013; Chaudhury et al., 2017; He et al., 2017; Herrador-Colmenero et al., 2017; Huertas-Delgado et al., 2018; Janssen et al., 2016; Johansson, 2006; Kytta, 2004 (Finland); Lam et al., 2014; Lin et al., 2017; Lopes et al., 2014 (i,ii); Mammen et al., 2012; Stark et al., 2018; Veitch et al., 2008; Wolfe et al., 2016	??	23/44	52%

	Correlate of IM	Related to Children's Independent Mobility		Unrelated to Children's Independent Mobility	Summary Code		
		Studies	Association (- / +)		Association	Related/ Unrelated	% Studies
	Gender	Veitch et al., 2008	-				
	Ethnicity and/or race	Aggio et al., 2017; Chaudhury et al., 2017; Mammen et al., 2012; Mitra et al., 2014; Wolfe et al., 2016	+	He et al., 2017; Janssen et al., 2016; Lin et al., 2017)	++	5/8	63%
	Perceived competence	Fyhri & Hjorthol, 2009; Johansson, 2006; Villanueva et al., 2012, 2014	+		++	4/4	100%
	Access or ownership of car	Carver et al., 2014 (T2, b); Cordovil et al., 2015; Fyhri et al., 2009; He et al., 2017; Johansson, 2006; Kyttä et al., 2015; Lin et al., 2017; Mammen et al., 2012	-	Buliung et al., 2017; Carver et al., 2014; Fyhri et al., 2009; Mammen et al., 2012	--	8/13	62%
		He et al., 2017	+				
Interpersonal Characteristics							
<i>Parents' Characteristics</i>	Parent age			Christian et al., 2015; Ghekiere et al., 2017; Schoeppe et al., 2016b	0	0/3	0%
	Parent gender	Schoeppe et al., 2016b (Women)	-	Christian et al., 2015; Ghekiere et al., 2017	0	1/3	33%
	Parent educational level	Schoeppe et al., 2016b (Low)	-	Christian et al., 2015; Fyhri et al., 2009; Janssen et al., 2016	00	1/4	25%
	Socioeconomic status (Low)	Aggio et al., 2017; He et al., 2017 (i-iii); Lam et al., 2014 (i,ii); Loo et al., 2015	+	Ghekiere et al., 2017; Janssen et al., 2016; Mammen et al., 2012; Wolfe et al., 2016	++	6/10	67%
	Work status or employment status	He et al., 2017 (i-iv)	+	Fyhri et al., 2009; He et al., 2017 (Father); Mammen et al., 2012; Mitra et al., 2014; Stark et al., 2018 (Father)	00	4/12	36%

	Correlate of IM	Related to Children's Independent Mobility		Unrelated to Children's Independent Mobility	Summary Code		
		Studies	Association (- / +)		Association	Related/ Unrelated	% Studies
		Buliung et al., 2017 (Parent; stay-at-home father)(i,ii); Kytta et al., 2015	-				
	Parents' perception of child confidence	Ghekiere et al., 2017 (i,ii); Villanueva et al., 2012, 2014	+	Veitch et al., 2017(i,ii)	??	4/7	57%
		Curtis et al., 2015	-				
	Parents' perception of active school travel benefits	Mammen et al., 2012(i,ii)	+	Mammen et al., 2012 (i-iii)	??	2/5	40%
	Parents' attitude toward independent mobility	Alparone et al., 2012; Curtis et al., 2015; Johansson, 2006; Mitra et al., 2014	+		++	4/5	80%
		Curtis et al., 2015	-				
	Encouragement	Carver et al., 2014 (T2, g)	-	Carver et al., 2014 (i,ii); Ghekiere et al., 2017 (i-iii)	00	1/6	17%
<i>Parents' Behaviour</i>	Parents' PA level	Santos et al., 2013	+	Ghekiere et al., 2017; Janssen et al., 2016 (i,ii)	00	1/4	25%
	Parents' policies regarding independent play/travel	Carver et al., 2014 (T1, T2, b)	+	Carver et al., 2014	+	2/3	67%
		Carver et al., 2012 (g)	-				
<i>Household characteristics</i>	Household structure			Janssen et al., 2016; Schoeppe et al., 2016b; Wolfe et al., 2016 (i,ii)	00	0/4	0%
	Sibling(s)	Carver et al., 2014 (T1); Christian et al., 2015 (i,ii), 2016 (i-xi); Johansson, 2006; Lin et al., 2017	+	Christian et al., 2015; He & Giuliano, 2017; Janssen et al., 2016; Wolfe et al., 2016	++	16/21	76%
		Loo et al., 2015	-				
Social environment							

		Related to Children's Independent Mobility			Summary Code		
	Correlate of IM	Studies	Association (- / +)	Unrelated to Children's Independent Mobility	Association	Related/ Unrelated	% Studies
<i>Children's perceptions</i>	Children's positive perceptions of safety	Buliung et al., 2017; Herrador-Colmenero et al., 2017; Villanueva et al., 2012 (g), 2014	+	Huertas-Delgado et al., 2018(i-iv)	??	4/8	50%
	Children's negative perceptions of safety			Buliung et al., 2017; Huertas-Delgado et al., 2018 (i-vii)	00	0/8	0%
	Interest	Veitch et al., 2017; Villanueva et al., 2012 (b)	+	Veitch et al., 2017	+	2/3	67%
	Social norms	Veitch et al., 2017; Villanueva et al., 2014(i,ii)(g)	+	Veitch et al., 2017; Villanueva et al., 2012	??	3/6	50%
		Curtis et al., 2015	-				
<i>Parents' perceptions</i>	Parents' positive perceptions of safety	Carver et al., 2014 (T1); Huertas-Delgado et al., 2018; Janssen et al., 2016; Johansson, 2006; Mitra et al., 2014; Santos et al., 2013; Villanueva et al., 2012 (b), 2014 (b)	+	Ghekiere et al., 2017; Lin et al., 2017; Mammen et al., 2012; Prezza et al., 2001; Villanueva et al., 2012	++	8/13	62%
		Huertas-Delgado et al., 2018	-				
	Parents' negative perceptions of safety	Alparone et al., 2012 (Mother); Carver et al., 2014 (T1); Christian et al., 2015 (i,ii); Veitch et al., 2017	-	Carver et al., 2014 (T2); Mitra et al., 2014 (i,ii); Villanueva et al., 2014	??	5/9	56%
	Concern (stranger danger)	Foster et al., 2014 (g); Huertas-Delgado et al., 2018 (i,ii); Mitra et al., 2014	-	Foster et al., 2014 (b); Huertas-Delgado et al., 2018 (i,ii); Johansson, 2006; Santos et al., 2013	00	4/12	33%
		Fyhri et al., 2009; Huertas-Delgado et al., 2018	+				
	Concern (crime)	Janssen et al., 2016; Mammen et al., 2012	-	Christian et al., 2015 (i-iii); Ghekiere et al., 2017; Huertas-Delgado et al., 2018 (i,ii); Prezza et al., 2001; Wolfe et al., 2016	00	2/10	20%
	Concern (traffic)	Buliung et al., 2017(i-ii); Carver et al., 2014 (T1); Ghekiere et al., 2017 (g); Huertas-Delgado et al., 2018 (i-ii);	-	Carver et al., 2014 (T2); Christian et al., 2015; Huertas-Delgado et al.,	??	11/24	46%

		Related to Children's Independent Mobility			Summary Code		
	Correlate of IM	Studies	Association (- / +)	Unrelated to Children's Independent Mobility	Association	Related/Unrelated	% Studies
		Johansson, 2006 (i-ii); Mammen et al., 2012; Villanueva et al., 2012; Wolfe et al., 2016)		2018 (i-iv); Janssen et al., 2016 (i,ii); Mitra et al., 2014 (i,ii); Prezza et al. (Mothers), 2001; Veitch et al., 2017 (i,ii)			
	Social cohesion	Alparone et al., 2012 (Mothers); Prezza et al., 2001; Villanueva et al., 2012 (b); Wolfe et al., 2016	+	Lin et al., 2017	++	4/5	80%
	Informal social control			Carver et al., 2014; Foster et al., 2014; Johansson, 2006; Lin et al., 2017; Prezza et al., 2001; Wolfe et al., 2016	00	0/6	0%
	Social norms	Christian et al., 2015 (i,ii)	-	Ghekiere et al., 2017; Mitra et al., 2014	??	2/4	50%
Built and physical environment							
<i>Density</i>	Destination density	Broberg et al., 2013a	+	Wolfe et al., 2016 (i-iii)	00	1/4	25%
	Road density	Carver et al., 2014 (T2; g)	-	Buliung et al., 2017; Carver et al., 2014 (i-iv); Larsen et al., 2015; Wolfe et al., 2016 (i-iii)	00	1/10	10%
	Population density	Broberg et al., 2013a	+	He et al., 2017 (i-iii)	00	1/5	20%
		Larsen et al., 2015	-				
	Housing/residential density	Broberg et al., 2013a; Broberg et al., 2013b; Wolfe et al., 2016	+		++	3/5	60%
		Broberg et al., 2013a; Broberg et al., 2013b	-				
<i>Destinations</i>	Walking and cycling infrastructure	Veitch et al., 2017	+	Ghekiere et al., 2017; Johansson, 2006; Mammen et al., 2012; Veitch et al., 2017 (i-iii)	00	1/7	14%
	Green space	Alparone et al., 2012	+	Broberg et al., 2013a; Broberg et al., 2013b;	00	1/7	14%

	Correlate of IM	Related to Children's Independent Mobility		Unrelated to Children's Independent Mobility	Summary Code		
		Studies	Association (- / +)		Association	Related/ Unrelated	% Studies
				Veitch et al., 2017 (i, ii); Villanueva et al., 2012 (i,ii)			
	Other local destinations (shopping centre, community centre, supermarket, rec centre, retail shop, school, smaller food store)	Villanueva et al., 2012 (i-iv, b)	+	Christian et al., 2015; Ghekiere et al., 2017; Villanueva et al., 2012 (i-iv); Wolfe et al., 2016	??	4/11	36%
<i>Design</i>	Type of housing	Broberg et al., 2013 <i>b</i> ; He et al., 2017 (i,ii); Prezza et al., 2001(i,ii)	+	Buliung et al., 2017; Lin et al., 2017 (i-iii)	??	5/10	50%
		He et al., 2017	-				
	Length of residency in one's home	Larsen et al., 2015; Mitra et al., 2014; Prezza et al., 2001	+	Buliung et al., 2017; Lin et al., 2017	++	3/5	60%
	Access to outdoor space/walking/cycling	Carver et al., 2012 (i,ii)	+	Carver et al., 2014	+	2/3	67%
	Walkability (girl)	Villanueva et al., 2012, 2014	+		+	2/3	67%
		Carver et al., 2014 (b)	-				
	Urbanization	Kyttä et al., 2015 (suburban); Loo et al., 2015 (suburban); Lopes et al., 2014 (i,ii, highly urbanized) Lopes et al., 2014 (i-v, non-urbanized); Lopes et al., 2014 (i-v, moderately urbanized)	+	Cordovil et al., 2015; Fyhri et al., 2009; Ghekiere et al., 2017; Kyttä, 2004; Mammen et al., 2012; Schoeppe et al., 2016 <i>b</i>	++	14/22	64%
		Alparone et al., 2012; Lopes et al., 2014	-				
<i>Diversity</i>	Land use mix	Carver et al., 2014 (T2, g)	+	Buliung et al., 2017; Ghekiere et al., 2017	0	1/3	33%
	Socioeconomic status / neighbourhood socioeconomic deprivation (low income)	Mitra et al., 2014; Veitch et al., 2008 (i,ii)	+	Carver et al., 2014	+	3/4	75%

	Correlate of IM	Related to Children's Independent Mobility		Unrelated to Children's Independent Mobility	Summary Code		
		Studies	Association (- / +)		Association	Related/ Unrelated	% Studies
<i>Distance</i>	Distance (short)	Aggio et al., 2017; Buliung et al., 2017; Cordovil et al., 2015; Fyhri et al., 2009 (i,ii); He et al., 2017; Lin et al., 2017; Loo et al., 2015; Mammen et al., 2012	+	Larsen et al., 2015	++	9/11	82%
		Broberg et al., 2013 <i>b</i>	-				
	Distance/deviation to mother's work	He et al., 2017 (i,ii)	+	He et al., 2017 (He & Giuliano, 2017)	+	2/3	67%
	Distance/deviation to father's work	He et al., 2017 (He & Giuliano, 2017)	-	He et al., 2017 (i,ii)	0	1/3	33%
	Proximity to green space	Christian et al., 2015 (i,ii); Prezza et al., 2001; Villanueva et al., 2012 (b)	+		+	4/4	100%

IM=independent mobility; PA=physical activity. Broberg et al., 2013*a* = Broberg, Kyttä, & Fagerholm: Child-friendly urban structures: Bullerby revisited; Broberg 2013*b* = Broberg, Salminen, & Kyttä: Physical environmental characteristics promoting independent and active transport to children's meaningful places; Schoeppe 2015*a* = Schoeppe, Tranter, Duncan, Curtis, Carver, & Malone: Australian children's independent mobility levels: secondary analyses of cross-sectional data between 1991 and 2012; Schoeppe 2015*b* = Schoeppe, Duncan, Badland, Rebar, & Vandelanotte: Too far from home? Adult attitudes on children's independent mobility range

A.3 Summary characteristics of included studies in review (n=43)

Author Year Country <i>Data from...</i>	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
Aggio et al. 2017 United Kingdom <i>MCS</i>	Cross-sectional	n=3856*	7 years	Outcome variable IM (play outside without close supervision) PA Measurement Survey; Waist-worn accelerometry Independent variable Socio-demographics; behavioural (sedentary behaviour); environmental (proximity to friends and family); social (Strengths and Difficulties Questionnaire) Measurement Survey	Children who are older, living in poverty, who live in proximity to friends and family, are white British have, and have fewer pro-social behaviours, and more externalizing conduct problems, and fewer internalizing problems, had greater odds of having independent outdoor play.
Alparone et al. 2012 Italy	Cross-sectional	n=313* Mothers Mean age 37.50 years	8-10 years G (51.4%); B (48.6%)	Outcome variable IM index Measurement Questionnaire Independent variable Socio-demographics; Maternal perception of social danger; positive potentiality of outdoor autonomy; neighbourhood relations; sense of community Measurement Questionnaire	Mother's perception of positive potentiality of outdoor autonomy was + associated with IM. Social danger perception and birth order were – associated and child age was + associated with IM.
Bhosale 2017 New Zealand	Cross-sectional	n=500* Mean age 43.9±5.8 years F=373; M=118	n=544* 12.2 ±.6 years G=272; B=257	Outcome variable IM (mobility licenses and index) Measurement Questionnaire Independent variable	Parents had greater IM than their children and a greater number of mobility licences. Bike ownership increased and number of organized activities decreased generationally.

Author Year Country <i>Data from...</i>	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
				Socio-demographics; active transportation; organized activities; bicycle/car ownership; parents' past IM behaviour Measurement Questionnaire	
Broberg et al. (a) 2013 Finland	Cross-sectional		n=1837* 5 th and 7 th grade 10-12 years; 13-15 years B (>50%)	Outcome variable IM (accompaniment to affordances) Measurement Survey Independent variable Environmental likeability, Bullerby grid; GIS-based environmental measures Measurement Survey Mapping activity	Increasing housing density and population around an affordance was + associated with accessing the affordance independently. Floor area ratio was – associated with independent access to affordances.
Broberg et al. (b) 2013 Finland	Cross-sectional		n=901* Year 5 (47%) 11 years; Year 8 (53%) 14 years	Outcome variable IM (accompaniment to each meaningful place) Measurement softGIS survey Independent variable Socio-demographics, physical environment measured factors (GIS) Measurement softGIS survey	Single-family housing, longer distances from public transport and sports facilities, and dense residential structures were + associated with IM. Big buildings and public transport hubs and increasing distance from home to school were – associated with IM.
Buliung 2017 Canada <i>BEAT</i>	Cross-sectional	n=651* (to school) n=708* (from school)	n=651* (to school) n=708* (from school) 9-13 years Mean age 11 years G (50%); B (50%)	Outcome variable IM (travel independently/escorted) Measurement Activity travel survey Independent variable Socio-demographics; environment; parent and child perceptions of safety Measurement Activity travel survey; route mapping	A number of variables are associated with IM including distance, age, gender, traffic volume and flexible parental work schedules.

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
Carver et al. 2012 Australia	Cross-sectional	n=891*	n=688* Primary schoolchildren n=430 G (52%); M(48%) Mean age 10.4±1.2 Secondary schoolchildren n=258 G (48%); B (52%) Mean age 13.7±1.0 School year 3-10	Outcome variable IM (travel mode to/from school/weekends, accompaniment, mobility licences score) (0-6 scale) Measurement Policy Studies Institute (PSI) international IM Study Child & parent surveys Independent variable Socio-demographics, Settlement types (urban/rural), mobility licences Measurement PSI Child & parent survey	IM had no significant differences in settlement type (urban/rural). Mobile phone ownership + associated with mobility licences in boys attending urban primary schools. Mobility licences were + associated odds of walking/cycling independently in boys and primary school girls (not significant for girls in rural areas). Access to outdoor play spaces was + associated with mobility licences for urban boys and rural primary girls.
Carver et al. 2013 Australia	Cross-sectional	n=1239* Mothers (88%)	n=784* Primary schoolchildren Mean age=10.4±1.2 n=455* Secondary schoolchildren Mean age=13.7±1.0 10-12 years English and Australian children G (50%); B (50%)	Outcome variable IM (mobility licences (0-6 scale); actual mobility Measurement Child & parent questionnaire Independent variable Urbanization (rural, urban); household car access; mobility licenses Measurement Child & parent questionnaire	Mobility licences were + associated with higher levels of IM on non-school journeys (both primary/secondary) and walking/cycling independently to school (primary schoolchildren).
Carver et al. 2014 Australia <i>SPEEDY</i>	Longitudinal	n-1121*	n=1121* (T1) G (57%); B (43%) n=491* (T2: 1-year follow-up) G (61%); B (39%) 9-10 years	Outcome variable IM (travel mode to school; accompaniment) Measurement Child & parent questionnaire Independent variable Socio-demographics; environment characteristics (GIS); perceptions of social and physical environment; neighbourhood	Boys had higher IM compared to girls, but difference diminished with age. Longitudinally, land use mix was + associated and proportion of main roads and parental encouragement were – associated with girls' IM. Number of siblings was + associated with IM at T1. Parents allowing children to play outside anywhere in

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
				walkability score; parental rules about child's PA Measurement Child & parent questionnaire	neighbourhood was + associated and household car access was – associated longitudinally with boys' IM.
Chaudhury et al. 2017 New Zealand <i>KITC</i>	Cross-sectional	n=240*	n=240* 9-12 years	Outcome variable IM (time, origin, destination, travel mode, accompaniment); parental licence of freedom score (1-10 scale) Measurement Child travel diaries; Parent telephone interview Independent variable Demographics; Public Open Space (POS) quality/quantity Measurement Parent telephone interview; POSAI (environmental audit tool)	Child age and degree of mobility licences + associated with IM to a POS. Ethnicity was also significantly associated with independent trip to POS.
Christian et al. 2014 Australia <i>TREK</i>	Cross-sectional	n=727*	n=727* 10-12 years Years, 5,6,7	Outcome variable IM (15 local destinations, active independent travel)(0-15 scale) Measurement Child & parent questionnaire Independent variable Socio-demographics; PA, local walking and outdoor play; dog walking Measurement Child & parent questionnaire Accusplit AH120 Pedometer	Dog walkers were more independently mobile than non-dog walkers.
Christian et al. 2015 Australia <i>RESIDE</i>	Cross-sectional	n=305*	n=181 8-15 years	Outcome variable IM (parent report; travel to/from various destinations) Measurement Parent survey Independent variable	Distance (e.g., to school, local park), perception of an unsafe neighbourhood, and unsupportive parenting social norms were – associated with IM.

Author Year Country <i>Data from...</i>	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
				Physical environment (GIS), social environment (i.e. neighbourhood perceptions) Measurement Parent survey	
Christian et al. 2016 Australia <i>RESIDE</i>	Cross-sectional	n=305*	n=181 8-15 years mean age 10.7(±2.1)	Outcome variable IM (parent report; travel to/from various destinations) Measurement Parent survey Independent variable Siblings/older siblings; dog ownership Measurement	Having an older sibling, older sibling of the same gender, owning a family dog were + associated with IM to a variety of destinations.
Cordovil et al. 2015 Portugal	Cross-sectional	n=1099* Mothers (82%)	n=1099* 8-15 years Primary n=660 G (51%); B (49%) mean age =9.8±1.5 Secondary n=439 G (57%); B (43%) mean age=13.8±1.6	Outcome variable IM (mobility licences; travel mode; IM on weekends) Measurement Portuguese version of Policy Studies Institute (PSI) international IM Child & parent questionnaire Independent variable Socio-demographics; distance home to school; school setting Measurement PSI Child & parent questionnaire	Age was + associated with IM. Gender did not influence IM except in number of independent activities done on the weekend. Rural settings were + associated with IM compared to urban settings. Distance was – associated with IM and having no car access was positively associated to IM.
Curtis et al. 2015 Australia	Cross-sectional	n=273*	n=273* 9-13 years G (64.8%); B (35.2%)	Outcome variable IM (travel mode to school; other locations) Measurement Child & parent questionnaire Independent variable Socio-demographics; built environment Measurement Child & parent questionnaire	Distance to school is associated with IM. Children who actively travel live closer to school and associated with more metropolitan, denser, and more walkable environments. 800 m ped-shed ratio, densities, and distance to school are associated with IM.

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
Foster et al. 2014 Australia <i>TREK</i>	Cross-sectional	n=1231*	n=1231* 10-12 years	Outcome variable IM (15 local destinations; accompaniment) (0-15 scale) Measurement Child & parent questionnaire Independent variable Socio-demographics; informal social control; parental fear of strangers, social and built environment (GIS) characteristics Measurement Child & parent questionnaire	Parental fear of strangers was – associated with IM. Informal social control was + associated with IM.
Fyhri et al. 2009 Norway	Cross-sectional	n=1282* F (55%); M (45%)	Children in age range of 6-12 years	Outcome variable IM (school trip; sport activities; travel mode; accompaniment) (1-9 scale) Measurement NTS 2005 travel survey parent report Child survey Independent variable Socio-demographics; distance to various destinations; traffic; parents' experience of safety; child's experience of safety Measurement NTS 2005 travel survey parent report Child survey	Parents car use, number of cars, and work hours, and distance to school and sports were – associated with IM. Parents' and children's safety experience on school and leisure trip + associated with IM. Seasonality was also associated with IM.
Ghekiere et al. 2017 Belgium	Cross-sectional	n=1286* Mothers (77%)	Children in age range of 10-12 years	Outcome variable IM (distance child could cycle alone for transport) Measurement Parent online questionnaire Independent variable Demographics; psychosocial factors; neighbourhood environmental perceptions Measurement Parent online questionnaire	Boys had more IM compared to girls. Parent perceptions of child's cycling and traffic skills, perceptions of neighbourhood traffic safety were + associated with IM (the latter only true for girls). Age was + associated with IM. Perceptions of cycling skills + associated with IM for boys in high urbanized areas. Parental cycling for

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
					transport was – associated with IM among low SES girls.
He et al. 2017 United States	Cross-sectional	Total school trips n=3172* Total households n=2039 Two –parent households n=1491 father-headed n=115 mother-headed n=418 Other types n=15	School age children	Outcome variable IM (independent trips, alone or with siblings, by non-motorized mode; child driving him or herself; child travelling by bus) Measurement 2001 Southern California Association of Governments (SCAG) Post Census Regional Household Travel Survey Independent variable Socio-demographics; Parent employment/working arrangements; distance home, school, parents' workplace Measurement 2001 SCAG Post Census Regional Household Travel Survey	Distance to parents' work was + associated with IM to school, especially for distance to mothers' workplace and children walking to school independently. Child age is + associated with walking/cycling independently and driving. Number of siblings and car availability was – associated with IM and active commuting. Children from low SES households are more likely to take the bus then be chauffeured by the mother. Single family housing – associated with taking the bus and multi-family residential land + associated with walking/cycling alone or with siblings.
Herrador-Colmenero 2017 Spain	Cross-sectional		n=652* F (n=313); M (n=339) 6-12 years	Outcome variable IM (accompaniment on journey to school) Measurement Questionnaire Independent variable Socio-demographics; accompaniment mode, safety perceptions, mode of commuting Measurement Questionnaire	Children who were older were more likely to travel independently to school and had better safety perceptions compared to younger children. Accompanied children and less understanding of safety issues compared to children who actively commuted independently.
Huertas-Delgado 2018 Belgium BEPAS	Cross-sectional	n=291* 41.4±8.9 years Mothers (76.5%)	n=291* 12-15 years Mean age 13.2±1.0 years G (54.7%)	Outcome variable IM (time spent independently traveling for walking, cycling public transport) Measurement Questionnaire Independent variable	Parents reported greater negative perception of traffic and crime related safety. For adolescents, parents' traffic and crime related perceptions were associated with adolescents' IM, but not active IM.

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
				Socio-demographics; perceived neighbourhood environmental factors Measurement Questionnaire	
Janssen et al. 2016 United States	Cross-sectional	n=497* American parents	Children in age range of 6.9-11.9 years	Outcome variable IM (range child can travel; accompaniment) Measurement Parent survey Independent variable Socio-demographics; interpersonal/family level characteristics; perceptions of neighbourhood safety Measurement Parent survey	Child age and parents' perception of neighbourhood safety were + associated with IM. Parents' fear of crime was – associated with IM.
Johansson et al. 2006 Sweden	Cross-sectional	n=357* Mothers (78%) Travel diary completed n=248	Children in age range of 8-11 years Mean age = 9.6 years G (50%); B (50%)	Outcome variable IM (travel mode) Measurement Parent questionnaire; travel diary Independent variable Socio-demographics; environmental trust; interpersonal trust; social environment (sense of community); physical environment (traffic, foot/cycle paths) Measurement Parent questionnaire	Parent attitude toward independent travel (+), traffic environment (+), car access (-), and child age (+) were associated with children's independent journeys.
Kyttä et al. 2004 Finland	Cross-sectional	n=223* Finland n=80 Belarus n=147	n=223* 8-9 years Finland n=80 Mean age=8.5 years Belarus n=147 Mean age=8 years	Outcome variable IM (mobility licences; actual mobility) Measurement Child questionnaire & interviews; parent questionnaire Independent variable Socio-demographics; environment characteristics (community type) Measurement	The degree of mobility licence was + associated with children's actual mobility (Finnish data). Degree of urbanisation was – associated with mobility licences. Gender (boy) was + associated with actual mobility (Belarusian data).

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
				Child questionnaire & interviews; parent questionnaire	
Kyttä et al. 2015 Finland	Cross-sectional	Second sample n=306*	n=821* 7-15 years Second sample n=306* 8-10 years	Outcome variable IM (mobility licences, actual mobility; independent weekend activities) Measurement Child & parent survey Independent variable Socio-demographics; settlement type; Measurement Child & parent survey	Children in suburban and large towns had higher IM than inner city, small town, and rural children. Child age + associated with IM. No significant association between genders, except girls in small town setting had fewer mobility licences. Access to a car was – associated with IM.
Lam et al. 2014 Hong Kong	Cross-sectional	n=1672* Families Parent-report	n=2110 6-12 years	Outcome variable IM (accompaniment to school; dichotomous variable yes/no) Measurement Travel Characteristic Survey 2002 Independent variable Socio-demographics, family, environmental characteristics Measurement Travel Characteristic Survey 2002	Child age was positively associated with IM while distance was negatively associated with IM. Median household income (low SES +), family structure (single parent +), mother's working status (+), employment of a domestic helper (-), neighborhood settlement type (rural +), and density of school places.
Larsen et al. 2015 Canada	Cross-sectional	n=1016 Final sample with complete data n=559*	Children of elementary school age	Outcome variable IM (walking independently) Measurement Telephone survey on school travel Independent variable Socio-demographics; social environment; environment characteristics (GIS) Measurement Telephone survey on school travel	Child's age was + associated with IM. Population density was – associated with independent walking. Neighbourhood age was associated with IM in that location of one's home modifies the relationship between age and IM. Intersection density was – related to travel mode (walking). Distance was – associated with children walking (vs driving).
Lin et al. 2017	Cross-sectional	n=239*	n=254* 8-13 years	Outcome variable IM (travel mode and accompaniment)	Parental perceptions of neighbourhood cohesiveness and

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
New Zealand <i>KITC</i>				Measurement Travel diary Parent computer-aided telephone interview Independent variable Perceptions of neighbourhood safety, cohesion, connection Built environment Measurement Parent computer-aided telephone interview Objective measures ArcInfo 9.3	connectedness were positively associated with IM. Proximity to school was also associated with independent trips.
Loo et al. 2015 Hong Kong	Cross-sectional	n=2110	n=2110* 6-12 years	Outcome variable IM (independent trips to school) Measurement Travel Characteristics Survey 2002 Independent variable Socio-demographics and environmental characteristics Measurement Travel Characteristics Survey 2002	Children from higher SES households were more likely to have less independent trips to school.
Lopes et al. 2014 Portugal	Cross-sectional	n=1099*	n=1099* (16 schools) 9-14 years Grade 3-10	Outcome variable IM Measurement International child independent mobility questionnaires Independent variable Socio-demographics Psychosocial factors (Fear perceptions, sense of community) Urbanization Measurement International child independent mobility questionnaires	Increasing urbanization decreased the odds of independent mobility. Parental fear of traffic and stranger danger were commonly cited concerns for parents.
Mammen et al. 2012	Cross-sectional	n=1016	6-14 years Unescorted walkers	Outcome variable	Unescorted children were significantly older, English

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
Canada		n=490* (lived within 2km of school used for analysis) Parents	G (52.3%); B (47.7%)	IM (travel mode reported as escorted vs unescorted) Measurement Self-reported survey by Metrolinkx Independent variable Socio-demographics Parental attitudes/perceptions toward active school travel Measurement Self-reported survey by Metrolinkx	predominantly spoken at home, and lived closer to school. Parental fears of stranger danger and bullying were associated with children being escorted to school.
Mitra et al. 2014 Canada <i>BEAT</i>	Cross-sectional	n=795* n=686 (valid accelerometry data)	Grade 5 and 6 G (53.46%); B (46.54%)	Outcome variable IM Measurement Questionnaire Independent variable Socio-demographics, Parental attitudes toward transportation mode; perceptions of neighbourhood environment PA Measurement Questionnaire Accelerometry	Positive parental neighbourhood perceptions of safety increased chances of children's IM. Boys and older children more likely to have more IM than girls and younger children.
Pacilli et al. 2013 Italy	Cross-sectional	n=589* Parents	n=589* 10-15 years G (49%); B (51%)	Outcome variable IM (7 questions; did not refer to school route) Measurement Questionnaire (Child) Independent variable Socio-demographics, environmental, psychosocial characteristics Sense of community (Child) Parenting style (Parent) Measurement Questionnaire (Child & Parent)	Age was + associated with IM, while gender (i.e. female) was – associated with IM.

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
				Parental Styles Scale (Parent)	
Prezza et al. 2001 Italy	Cross-sectional	n=251* Mothers Mean age 39	n=251 7-12 years Mean age 9.41 G (47%); B (53%)	Outcome variable IM (to/from school; outside play; to/from destinations; overall score from 5 partial scores) Measurement Semi-structured interview Independent variable Neighbourhood relations/sense of community Environmental factors Measurement Child's frequentation of peers Neighbourhood Relations Scale Italian Scale of Sense of Community	Older children and boys have significantly higher IM compared to younger children and girls. Greater IM was also experience by children whose mothers had stronger neighbourhood relations, lived in a building with a courtyard, near a park, or in a new neighbourhood.
Santos et al. 2013 Portugal SALTA	Cross-sectional	n=354* Mothers (74%); Fathers (23.2%)	n=354* Mean age 11.63(.85) G (66%); B (44%)	Outcome variable IM (child report visitation/accompaniment of 11 destinations (5 point Likert scale)) Measurement Survey (Child) Independent variable Parental PA Perceptions of neighbourhood safety Measurement Survey (Parent) IPAQ	Parents' PA and perception of sidewalk and street safety were significantly associated with children's IM.
Schoeppe et al. (a) 2015 Australia	Cross-sectional	Data drawn from* 1991: n=1360 1993: n=298 2010: n=341 2011: n=113 2012: n=301	8-13 years* Mean age 10 years 1991: n=1273 1993: n=476 2010: n=421 2011: n=131 2012: n=305	Outcome variable IM (child actual mobility; parent licences for IM) Measurement Surveys (Child & Parent)	Younger children and girls were less likely to travel to from home to school independently. Overall, the findings suggest that IM has declined in Australian children from 1991 to 2012.

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
Schoeppe et al. (b) 2015 Australia	Cross-sectional	n=1293* (1164 with complete data) Australian adults Mean age 55.8(15.6) F (48%); M (52%)	8-12 years	Outcome variable IM (distances child should be able to travel/play outdoors independently) Measurement Queensland Social Survey (QSS) Independent variable Socio-demographics, adult attitudes, urbanization Measurement Queensland Social Survey (QSS)	More than half of adults (62%) would restrict children's independent travel to <500m from home and 74% of adults would restrict children's independent outdoor play to <500m from home. Women and adults with lower education were more likely to restrict IM (travel & play) to shorter distances (<500m).
Stark 2018 Austria	Cross-sectional	n=380*	n=380* 6-9 years G (49%)	Outcome variable IM (mobility licenses) Measurement Survey; travel diary Independent variable Socio-demographics; parents' occupation; car ownership; frequency of accompaniment to school and travel modes Measurement Survey	Parents' attitudes towards active independent mobility influence children's travel patterns as well as distance, age, type of school are also associated.
Veitch et al. 2008 Australia	Cross-sectional		n=212* 8-12 years 8-9 years (49%); 10-12 years (51%) G (51%); B (49%)	Outcome variable IM (child report were walk/ride without adult) Measurement Survey (Child) Behavioural maps of neighbourhood (Child) Independent Individual characteristics Distance (direct/computer generated measurement) Measurement Survey (Child) Mapping activity (Child)	Older children (vs younger children) were more likely to go to 3+ places independently. Children in lower SES environments reported higher IM in number of locations visited and distance traveled.

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
Veitch et al. 2017 Australia <i>READI</i>	Longitudinal Baseline (2007-08) T1 (2010) T2 (2012)	n=311 (T1)* Mothers Mean age 41.3(8.4)	n=311 (T1)* n=207 (T2)*; 184/179 analyzed (local destinations/school) 5-12 years Mean age 12(2.1)(T1) G (55%); B (45%)	Outcome variable IM (child report travel mode for trips to school, active/nonactive, accompaniment; 4 destinations (0-10 scale); walking/cycling to local destinations (0-20 scale)) Measurement Questionnaire (Child) (T1 & T2) Independent variable Objective measures of neighbourhood (GIS) Individual, social, Perceived neighbourhood attributes Measurement Survey (Mother)(T1)	Parental perceptions of safety, distance to walking and tracks and enjoyment of walking/cycling were longitudinally associated with IM on the school journey. Mother and child's agreement that other children they know walk/cycle to school was also + associated with IM travel.
Villanueva et al. 2012 Australia <i>TREK</i>	Cross-sectional	n=1314*	n=1480* 10-12 years G (51%); B (49%)	Outcome variable IM (15 activities; child report participation/visitation; parent report accompaniment)(0-15 scale) Measurement Questionnaire (2007) (Child & Parent) Independent variable Objective environmental factors (GIS) Perceived social, individual, environmental factors (Child & Parent) Measurement Questionnaire (2007) Mapping activity (Child)	Parents' perceptions of living near a busy road, decreased odds of children's IM. Girls who lived in well-connected and low traffic neighbourhoods had increased IM. Boys who had access to local recreation or retail destination also experienced higher IM. Boys who lived near shopping centers or community services had lower levels of IM.
Villanueva et al. 2014 Australia <i>TREK</i>	Cross-sectional	n=1314 *	n=1480 * 10-12 years G (52%); B (48%)	Outcome variable IM (15 activities; child report participation/visitation; parent report accompaniment) (0-15 scale) Measurement Questionnaire (2007) (Child & Parent) Independent variable School-specific walkability index (GIS)	High walkability was + associated with girls' IM. Parents' and child's confidence in child's ability to walk independently was * associated with higher levels of IM. Parent perceptions of safe neighbourhood road crossings were + associated with boys' IM.

Author Year Country Data from...	Study Design	Parent Sample	Child sample	Variables / Measurement	Results
				Perceived social, individual, environmental factors (Child & Parent) Measurement Questionnaire (2007)	
Wolfe et al. 2016 United States	Cross-sectional	n=305 *	10-14 years Mean age 12(1.4) G (51%); B (49%)	Outcome variable IM (7 mobility licenses) (0-7 scale) Measurement Survey (2006-2007) (Parent) Independent variable Parental perceptions of environment Built environment Child & household characteristics Measurement Survey (2006-2007) (Parent)	Age is + associated with IM and Hispanic children experience more restrictions of IM. Parental perceptions of social cohesion and safety are + associated with IM. Housing unit density was + associated with IM.

GIS – Geographic Information Systems software; READ – Resilience for Eating and Activity Despite Inequality; KITC – Kids in the City; SALTA – Environmental Support for Leisure and Active Transport; RESIDE – RESIDENTial Environment Study; MCS – Millennium Cohort Study; BEPAS – Belgian Environmental Physical Activity Study; PA – Physical activity; IPAQ – International physical activity questionnaire; Broberg et al., 2013a = Broberg, Kyttä, & Fagerholm: Child-friendly urban structures: Bullerby revisited; Broberg 2013b = Broberg, Salminen, & Kyttä: Physical environmental characteristics promoting independent and active transport to children’s meaningful places; Schoeppe 2015a = Schoeppe, Tranter, Duncan, Curtis, Carver, & Malone: Australian children’s independent mobility levels: secondary analyses of cross-sectional data between 1991 and 2012; Schoeppe 2015b = Schoeppe, Duncan, Badland, Rebar, & Vandelanotte: Too far from home? Adult attitudes on children’s independent mobility range; T1 = Time 1; T2 = Time 2; F = female; M = male; g = girl; b = boy; + = positively; - = negatively. IM = independent mobility; PA = physical activity.

Appendix B

B.1 Individual-level correlates of children's independent mobility using complete cases.

Correlate	Girls (n=931)			Boys (n=762)		
	β	95% CI		β	95% CI	
Child Characteristics						
Child grade level	0.621 ^{***}	0.491	0.751	0.596 ^{***}	0.443	0.749
Child illness	-0.281	-0.793	0.232	-0.390	-0.882	0.102
Mobile phone ownership	0.401 [*]	0.083	0.719	0.353	-0.059	0.765
Household Characteristics						
Parent age	-0.328 ^{**}	-0.562	-0.094	0.086	-0.175	0.347
Parent gender	-0.031	-0.278	0.216	-0.215	-0.519	0.088
Parent work status (not working vs working)	0.530 ^{**}	0.191	0.869	0.150	-0.224	0.524
Parent education	0.179	-0.142	0.500	-0.224	-0.625	0.176
Language spoken (English/French vs other language)	-0.577 ^{***}	-0.873	-0.280	-0.453 ^{**}	-0.778	-0.129
Car ownership	-0.203	-0.904	0.499	0.070	-0.633	0.773
Home ownership	-0.226	-0.507	0.056	0.108	-0.229	0.446
Siblings (no sibling vs sibling(s))	0.000	-0.286	0.287	0.046	-0.279	0.370
Parent Travel Mode to Work						
Walk	-0.193	-0.539	0.152	0.220	-0.202	0.643
Bike	0.478 [*]	0.058	0.897	0.202	-0.348	0.753
Public transit	-0.204	-0.572	0.163	-0.518 [*]	-0.921	-0.116
Car	-0.200	-0.459	0.059	0.044	-0.278	0.366

Significant correlates are bolded: * p<.05, ** p<.01, *** p<.001; CI: Confidence Interval; β : Unstandardized regression coefficients

B.2 Social environment-level correlates of children's independent mobility using complete cases.

Correlate	Girls (n=931)			Boys (n=762)		
	β	95% CI		β	95% CI	
Child Perceptions						
Neighbourhood safety	0.170**	0.047	0.294	0.260**	0.110	0.410
Child worried about...						
Traffic	0.033	-0.290	0.356	-0.225	-0.595	0.144
Getting lost	-0.237	-0.576	0.102	-0.397*	-0.769	-0.025
Bullying	0.099	-0.254	0.453	0.299	-0.111	0.709
Strangers	-0.125	-0.442	0.193	0.001	-0.314	0.316
Feeling they are not old enough to go about on their own	-0.094	-0.484	0.296	-0.285	-0.772	0.203
Not knowing what to do if someone speaks to them	-0.142	-0.454	0.169	-0.360*	-0.710	-0.010
Parent Perceptions						
Most adults in the neighbourhood look out for other people's children in the area	0.024	-0.106	0.154	0.044	-0.098	0.186
People in the area make me afraid to let child play outdoors	-0.081	-0.206	0.044	-0.038	-0.176	0.099
Worried about risk of child being injured in a traffic accident	-0.523***	-0.679	-0.366	-0.399***	-0.569	-0.229
Barriers to child walking or cycling						
No sidewalks or bike lanes	0.002	-0.013	0.017	0.005	-0.010	0.020
Route does not have good lighting	-0.003	-0.016	0.009	-0.001	-0.020	0.017
Too much traffic around the home	0.007	-0.003	0.018	0.003	-0.017	0.023
One or more dangerous crossing	-0.011*	-0.022	-0.001	0.002	-0.009	0.014
Unsafe due to crime (strangers, gangs, drugs)	0.002	-0.016	0.020	0.002	-0.032	0.037
Child gets bullied, teased, harassed	-0.001	-0.017	0.015	-0.014	-0.032	0.005

Significant correlates are bolded: *p<.05, **p<.01, ***p<.001; CI: Confidence Interval; β : Unstandardized regression coefficients

B.3 Geographical and area-level correlates of children’s independent mobility using complete cases

Correlate	Girls (n=931)			Boys (n=762)		
	β	95% CI		β	95% CI	
Site						
Ottawa, Ontario	-1.311 ^{***}	-1.719	-0.904	-1.081 ^{***}	-1.582	-0.580
Vancouver, British Columbia	-1.376 ^{***}	-1.767	-0.985	-1.218 ^{***}	-1.691	-0.745
Trois Rivières, Québec	0	.	.	0	.	.
Urbanization						
Urban	-0.207	-0.669	0.256	-1.582 [*]	-1.071	-0.002
Suburban	-0.281	-0.702	0.141	-1.691 ^{**}	-1.276	-0.264
Rural	0	.	.	0	.	.
Walkability						
400 m	0.072 ^{**}	0.023	0.122	-0.007	-0.065	0.051
1600 m	-0.070 [*]	-0.128	-0.013	0.032	-0.028	0.092
Socioeconomic status						
	-0.178	-0.503	0.146	-0.135	-0.528	0.258

Significant correlates are bolded: ^{*}p<.05, ^{**}p<.01, ^{***}p<.001; CI: Confidence Interval; β : Unstandardized regression coefficients

Appendix C

C.1 Interview Guide - Children



Map-Elicitation Interview Questions:

PART 1 objective: Go over the daily maps together and compare them against the daily surveys. This is to clarify the periods of independent mobility. **Record the interview.** [In the beginning of the recording, state your name, the date of the interview, the participant code and the segment of the interview]

- How did you get from A to B? With who? How long did it take?
- What did you do there? With who? For how long?

PART 2 objective: To understand children's perspectives towards their outdoor environment and independent mobility, and what they want in their neighborhood.

General background:

- What are some of your favourite *fun things** to do after school and on the weekend, and how much time do you spend doing these? (Query indoors vs. outdoors activities, with who).
- In a typical week in spring and summer, how much time do you spend doing fun things? With who? (your parents, siblings, friends) (If necessary, query weekday vs. weekend).
- Where do you usually go to hang out or play outside? What do you do? With who?

**Fun thing* means any kind of activities that you find enjoyable and amusing. This may include but not limited to playing at the playground, drawing or painting, playing a sport together, taking a hike, working a puzzle etc.

Children's unsupervised outdoor play:

- In a typical week in spring and summer, how much time do you spend outside playing? How much of this time is without your parent(s) or another adult around?
- How far from home are you allowed to go without your parent(s) or another adult around? Do you ever go past that point?
- What kinds of things are you allowed to do without your parent(s) or another adult around?
- How do you feel about playing outside without your parent(s) or another adult around?

- What would make you feel more comfortable going outside without your parents or another adults around?
- Do boys and girls play outside differently?

Children’s perceptions of their neighborhood and built environments:

- Are there things you’d like to do in your neighbourhood that you don’t get to do? What are some of the things that make it difficult for you to do these things?
- Do you feel safe playing outside in your neighbourhood? What concerns you the most?
- Do you find your neighbors friendly?

Go-Along Interview Questions:

Objective: Ask children to take you on a tour around their neighborhood, and take pictures of places they want to tell you about. ***Record the interview and wear a GPS watch for the tour.*** [In the beginning of the recording, state your name, the date of the interview, the participant code and the segment of the interview]

- Where: where do you usually hang out? Your favorite or least favorite place to hang out? Places that are meaningful to you? Any of your friends live close to you?
 - Who: Who do you usually play with here (friends, siblings, parents, by yourself)?
 - What: What do you usually do when you hang out here? Favorite thing to do when hanging out here? Things that you would like to do but you can’t?
 - Why: Why do you like/dislike this place? What is special about this place? How does it make you feel when you play here?
- Give \$80 honorarium to the child and get his/her signature on the corresponding honorarium receipt.
 - Debriefing
 - Complete research field notes part III – child interview.

C.2 Interview Guide - Parents



Objective: This is to better understand parents' perspectives towards children's outdoor play (independent or supervised) and their perceptions of built environment – as well as how different factors (e.g., individual and social factors) impact children's outdoor play. **Record the interview.** [In the beginning of the recording, state your name, the date of the interview, the participant code]

General background:

- What are some of your favourite things to do with [child]? (If necessary, query indoors vs. outdoors activities).
- In a typical week, how much time do you spend doing *fun things** with [child]? (If necessary, query weekday vs. weekend, summer vs. winter).
- Are there things you'd like to do with [child] that you don't have a chance to do now? What are some of the things that make it difficult for you to do these things with [child]?

**Fun thing* means any kind of activities that your child finds enjoyable and amusing. This may include but not limited to playing at the playground, drawing or painting, playing a sport together, taking a hike, working a puzzle etc.

Children's unsupervised outdoor play:

- What does 'unsupervised play' mean to you?
- In a typical week in spring and summer, how much time does [child] spend outside playing after school hours? On the weekend? How much of this time is *unsupervised*?
- Where do you think [child] is when [child] is playing outside unsupervised? What do you think [child] is doing?
- How far from home is [child] allowed to go without supervision?
- What kinds of things is [child] allowed to do without supervision?
- How do you feel about [child] playing outside without you or another adult around?
- What things concern you about [child] going out unsupervised?
- At what age did you let your child go out unsupervised?
- Would you feel differently if [child] was a [opposite gender]?

Parents' perceptions of their neighborhood and built environments:

- What things would make you more comfortable in allowing [child] to go out unsupervised? (If necessary, query attitudes toward neighbourhood, social circumstances, built environment).
- Do you feel connected to your neighbours? (i.e. would someone be there to help your child while they were playing in your neighbourhood?)
- Do you feel safe in your neighborhood? Do you feel safe for [child] in your neighborhood?
- What types of crime concern you for [child]'s safety? Do you feel there is a lot of crime in your neighborhood?