

**PHYSICAL ACTIVITY AND SOCIAL CAPITAL  
IN CANADIAN ADOLESCENTS**

Stephen J. Trites  
BA Hons, Carleton University, 2007  
BPE, University of New Brunswick, 1999

A thesis submitted to  
the Faculty of Graduate and Postdoctoral Affairs  
in partial fulfillment of the requirements for the degree of

Master of Arts

in

Health Psychology

Carleton University  
Ottawa, Canada

© 2011 Stephen J. Trites



Library and Archives  
Canada

Published Heritage  
Branch

395 Wellington Street  
Ottawa ON K1A 0N4  
Canada

Bibliothèque et  
Archives Canada

Direction du  
Patrimoine de l'édition

395, rue Wellington  
Ottawa ON K1A 0N4  
Canada

*Your file* *Votre référence*  
ISBN: 978-0-494-83105-2  
*Our file* *Notre référence*  
ISBN: 978-0-494-83105-2

#### NOTICE:

The author has granted a non-exclusive license allowing Library and Archives Canada to reproduce, publish, archive, preserve, conserve, communicate to the public by telecommunication or on the Internet, loan, distribute and sell theses worldwide, for commercial or non-commercial purposes, in microform, paper, electronic and/or any other formats.

The author retains copyright ownership and moral rights in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

#### AVIS:

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque et Archives Canada de reproduire, publier, archiver, sauvegarder, conserver, transmettre au public par télécommunication ou par l'Internet, prêter, distribuer et vendre des thèses partout dans le monde, à des fins commerciales ou autres, sur support microforme, papier, électronique et/ou autres formats.

L'auteur conserve la propriété du droit d'auteur et des droits moraux qui protègent cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

---

In compliance with the Canadian Privacy Act some supporting forms may have been removed from this thesis.

While these forms may be included in the document page count, their removal does not represent any loss of content from the thesis.

Conformément à la loi canadienne sur la protection de la vie privée, quelques formulaires secondaires ont été enlevés de cette thèse.

Bien que ces formulaires aient inclus dans la pagination, il n'y aura aucun contenu manquant.

  
**Canada**

**Abstract**

The present research addressed knowledge gaps about the way that adolescent social capital is operationalized and the multilevel influence of social capital on physical activity in Canadian adolescents. Survey data were collected from the 26,078 Canadian adolescents in grades 6 to 10 participating in the Canadian 2010 Health Behaviour of School-aged Children study. Exploratory Factor Analysis and Confirmatory Factor Analysis were used to develop and validate a set of social capital factors from 26 items that measured perceptions of trust, respect, reciprocity and prosocial behaviour among adolescents in their daily social contexts. Results indicated that social capital has a multilevel influence on adolescent physical activity. Links between social capital and adolescent physical activity showed that context-level neighbourhood social capital positively related to physical activity after individual characteristics and perceptions of social capital were taken into account and that link was mediated by individual socioeconomic status (SES).

## **Acknowledgements**

I am tremendously grateful for the guidance, advice and support of Dr. Frank Elgar who was instrumental in the development and execution of this work. Without Frank's involvement this work would never have been conceived and could not have reached the quality that was attained. I would also like to acknowledge the kind support of the Department of University Advancement at Carleton University and the Office of the Dean of Science at Carleton University. In particular, Paul Chesser, Kathy Arney, Dean Malcolm Butler and Dean John Armitage have all played integral roles by enabling and encouraging me to pursue my academic work. I am also grateful for the constructive input of my thesis examination committee members Dr. Chris Davis, Dr. Stefania Maggi, Dr. Florence Kellner and to the committee Chair, Dr. Tina Daniels, who have all helped to shape the final product. I would also like to acknowledge the kind financial support received through funding from the Public Health Agency of Canada and a Canadian Institutes of Health Research grant to Dr. William Pickett and Dr. Ian Janssen (Queen's University).

Most importantly, I owe a tremendous amount of gratitude to my biggest supporter, my wife, Allison. Thank you for believing in me and in us. And, to our daughter Sydney and her little brother or sister, thank you for inspiring me every day to help make Canada healthier for you and your generation.

**Table of Contents**

Abstract	ii
Acknowledgements	iii
Introduction	1
Methods	22
Research Questions #1 and #2	23
Results—Research Questions #1 and #2	28
Discussion—Research Questions #1 and #2	36
Research Question #3	41
Results—Research Question #3	46
Discussion—Research Question #3	55
Conclusions	59
References	63
Appendix A: HBSC Adolescent Social Capital Scale	73

### **Social Capital and Physical Activity in Canadian Adolescents**

Adolescent physical activity influences adult physical activity, and through it, the public health of the population (Telama, Yang, Viikari, Välimäki, Wanne, & Raitakari, 2005). Over the past thirty years, the fitness of Canadian children and adolescents has significantly deteriorated. Children of all ages and both sexes are taller, heavier, fatter, weaker and less flexible today than they were in 1981 (Tremblay, Shields, Laviolette, Craig, Janssen, & Connor Gorber, 2010). In order to maintain healthy weights and lifestyles, the Canadian Physical Activity Guidelines for Children and Youth recommends at least 60 minutes of moderate to vigorous physical activity (MVPA) each day (or approximately 13,500 steps) (Active Healthy Kids Canada, 2011). The longitudinal Canadian Physical Activity Levels Among Youth (CANPLAY) study showed that 31% of Canadian children and youth (5 – 19 year-olds) met the recommended number of steps daily (Canadian Fitness & Lifestyle Research Institute, 2010). About twice as many boys as girls (9% vs. 4%) get 60 minutes of MVPA at least six days a week and, on average, Canadian children and youth take 11,800 steps a day (Active Healthy Kids Canada, 2011; Canadian Fitness & Lifestyle Research Institute, 2010). Just under half (44%) of children and adolescents get 60 minutes of MVPA on at least three days per week (Active Healthy Kids Canada, 2011). Among children and adolescents, the cohort that is most active is 5 – 10 year old boys, who average approximately 13,217 steps a day, and the least active is 15 – 19 year-old girls, who average less than 9,204 steps a day (Active Healthy Kids Canada, 2011). The decline in physical activity during adolescence is a concern because the influence it has on activity carries into adulthood (Strong, et al., 2005). Physical activity during the early years

improves motor skill development, which increases the likelihood of participating in physical activity over the lifetime (Active Healthy Kids Canada, 2010). A high level of physical activity during adolescence, especially when maintained over a number of years, is associated with a high level of adult physical activity (Telama, et al., 2005).

Physical inactivity and sedentary behaviours (e.g., excessive TV watching and video game use) during childhood are key contributors to overweight and obesity over the lifetime (Strong, et al., 2005; Tremblay & Willms, 2003). According to the US growth curve system, overweight children and adolescents are defined as having a body mass index ( $\text{kg}/\text{m}^2$ ) in the 85<sup>th</sup> to 94<sup>th</sup> percentiles by age group and obesity is classified as a BMI in the greater than 95<sup>th</sup> percentile (Cole, Bellizzi, Flegal, & Dietz, 2000). According to these criteria, over the 25 year period ending in 2004, the prevalence of overweight for Canadian adolescents more than doubled to 29% and the prevalence of obesity tripled to 9% (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006).

Pediatric obesity has adverse effects on the cardiovascular system that are similar to those in adulthood: high blood pressure; high cholesterol and blood-lipid levels, abnormalities in left ventricular mass and/or function, abnormalities in endothelial function (e.g., a precursor to atherosclerosis), and insulin resistance (Reilly, et al., 2003). Most troubling is the evidence that cardiovascular risk factors cluster with pediatric obesity, the presence of each additional risk factor increasing the likelihood of developing cardiovascular disease (Reilly, et al., 2003). Other increased risks associated with pediatric obesity during childhood include an increased risk of developing asthma, a more than two-fold risk of developing type II diabetes, psychological problems such as

low self-esteem and other behavioural problems, and even foot structure abnormalities, amongst others (Reilly, et al., 2003).

Many of the long-term consequences of childhood obesity result from the persistence of obesity and the cardiovascular effects associated with obesity into adulthood. The likelihood of persistence in obesity relates to age of onset (Goran, 2001). Up to 70% of obese pre-pubertal children will become obese adults (Reilly, et al., 2003). Children who are overweight between the ages of 2 - 5 are four times more likely to become overweight adults (Freedman, Kettel Khan, Serdula, Dietz, Srinivasan, & Berenson, 2005). The presence of at least one obese parent also substantially increases the likelihood of obesity persisting from adolescence to adulthood (Reilly, et al., 2003). Regular, moderate to vigorous aerobic physical activity has a moderate to strong inverse relationship with overweight and obesity and is associated with numerous other health benefits for children and youth (Janssen & LeBlanc, 2010; Tremblay & Willms, 2003). Among children and youth, and particularly for those who are “at risk” (e.g., obese, high blood pressure, etc.) aerobic exercises that stress the cardiovascular and respiratory systems improve cholesterol and blood lipid levels, blood pressure, markers of metabolic syndrome (i.e., abdominal obesity, triglycerides, insulin, HDL-cholesterol), and depression (Janssen & LeBlanc, 2010).

### **Multilevel Influences on Adolescent Physical Activity**

Traditionally, research has focused on individual-level and behavioural approaches to the study of physical activity (Cradock, Kawachi, Colditz, Gortmaker, & Buka, 2008). While sex and age are associated with physical activity for children and

adolescents (i.e., boys are more active than girls and all children become less active as they age), three key correlates generalize across cohorts: use of free time for physical activity, enjoyment of physical activity, and family support for physical activity (Sallis, Prochaska, Taylor, Hill, & Geraci, 1999). Multilevel ecological models are used to study adolescent physical activity (and more broadly health) in order to broaden our understanding of the interaction of the individual within a progressively more complex set of interconnected influences (Bronfenbrenner, 1993; Duncan, Duncan, Strycker, & Chaumeton, 2004). The interaction of factors known to positively influence adolescent physical activity occurs between correlates at the individual and behavioural level (e.g., a high motivation and self-efficacy, participation in organized recreational activities), with those at the family level (e.g., a high level of parental socioeconomic status, parental support for physical activity), and at the school and community level (e.g., a high level of neighbourhood safety, access to facilities and programs that promote physical activity) (Canadian Fitness & Lifestyle Research Institute, 2009; Duncan, et al., 2004).

The social environment also plays a particularly important role for children's physical activity, as children have less autonomy over their activities than adults (Freedson & Evenson, 1991). Considering the rate at which obesity has risen to epidemic proportions, it is important to look beyond the individual level and to consider the multilevel influence of the social environment on the individual (Duncan, et al., 2004; Ferreira, Wendel-Vos, Kremers, van Lenthe, & Brug, 2006; Smedley & Syme, 2000;). To help organize and advance scientific inquiry about the social environment and physical activity, Haughton McNeill and colleagues (2006) identified five modifiable dimensions of the social environment, each of which influences physical activity: social support and

social networks; socioeconomic position and income inequality; racial discrimination; social cohesion and social capital; and neighbourhood factors (Haughton McNeill, Kreuter, & Subramanian, 2006). Of these dimensions, social capital has most recently been added to the discussion pertaining to physical activity and presents a unique perspective deserving further investigation.

Social capital, which is a latent social construct operating at (and interacting between) the individual and neighbourhood levels, has only recently been added to the discussion as being related to physical activity and to healthy weights (Cradock, et al., 2008; Moore, Daniel, Paquet, Dube, & Gauvin, 2009; Ueshima, et al., 2010). Social capital has also been linked to a number of other health outcomes and is seen as a powerful social buffer against morbidities associated with the effects of low socioeconomic status (Elgar, Trites, & Boyce, 2010). It is a concept that requires further theoretical refinement based on empirical evidence and may be able to add substantially to multilevel models of adolescent physical activity (Subramanian, Lochner, & Kawachi, 2003; Szreter & Woolcock, 2004).

### **Social Capital**

Social capital is a characteristic of the social environment that influences health at both the individual and neighbourhood levels. It has received considerable attention from public health researchers, including those interested in the relationships with physical activity and sport (Cradock, et al., 2008; Field, 2008; Szreter & Woolcock, 2004). Generally speaking, social capital represents a simple concept: our lives are improved through social relationships (Coleman, 1988; Field, 2008; Putnam, 2000). The central

premise is that each relationship represents an opportunity to access resources that would be otherwise unattainable and as the level of social capital held by individuals in a community increases, so too does the level of trust for one another, so as a result, the social capital of the community also increases. As a result of its multidimensionality, not all of the costs and benefits of social capital accrue to the person making the contact (Putnam, 2000). Some forms of social capital benefit directly those who invest in them, while the “public goods” benefits of social capital are largely enjoyed by people other than the actors themselves (Coleman, 1988).

Szreter and Woolcock (2004) effectively sum up the empirical case that is being made for social capital as a powerful public health agent:

Social capital has been empirically linked to, among other things, improved child development and adolescent well-being, increased mental health, lower violent crime rates and youth delinquency, reduced mortality, lower susceptibility to binge drinking, to depression, and to loneliness, sustained participation in anti-smoking programs, and higher perceptions of well-being and self-rated health. Where urban neighbourhoods and rural communities (and particular sub-populations) are demonstrably low in social capital, residents report higher levels of stress and isolation, children’s welfare decreases, and there is a reduced capacity to respond to environmental health risks and to receive effective public health service interventions. (p. 651)

Cradock and colleagues (2008) identify the following mechanisms through which social capital influences the health of individuals and neighbourhoods: (1) social influence over health-related behaviours, (2) promoting access to services and amenities, and (3) directly affecting psychosocial processes (Cradock, et al., 2008). In the context of physical activity, social capital is theorized to reinforce behavioural norms that support an active lifestyle, to facilitate activity through safe neighbourhoods and to provide access to programming and facilities that enable people to be physically active (Cradock, et al., 2008).

While social capital as a concept has risen to prominence over the past 25 years, much of what constitutes social capital has been long researched in disciplines such as developmental psychologists, sociologists, economists, educators and others exploring the impact of social relationships on health and wellbeing (Meier, 1999). The role of social capital is as a means of focusing on the influence at both the personal and contextual levels that social relationships based on trust, respect and norms of reciprocity has on our lives. Social capital, therefore, compliments the existing and on-going social research by serving as a conceptual tool for collecting discrete dimensions in order to account for previously unexplained portions of the variance in specific health-related outcomes (Meier, 1999).

### **The Evolution of Social Capital**

The first prominently cited use of the term social capital is by Pierre Bourdieu (1986), a French sociologist who studied the persistence of social class and social hierarchy (Field, 2008). Bourdieu describes social capital as one of the forms of capital,

along with economic capital and cultural capital (Bourdieu, 1986). According to Bourdieu, economic capital is directly convertible to money (i.e., land rights), cultural capital convertible to money under certain conditions (i.e., formalized education) and social capital is convertible into economic capital under certain conditions (i.e., a title of nobility). For Bourdieu, social capital was a tool of the elite to maintain an elevated status within networks of elitists and, at times, allowing people to maintain their status despite a lack of the necessary financial capital (Bourdieu, 1986). Initially, Bourdieu employed only a single indicator of social capital: golf club membership (Bourdieu, 1986). He later expanded the definition of social capital to the following: “social capital is the sum of resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition” (Bourdieu & Wacquant, 1992, p. 248). Bourdieu is criticized for applying his concept of social capital to too narrow a segment of the population, however he is also credited with providing the first hypothesis for explaining the mechanism by which social capital operates (Field, 2008). According to Bourdieu, the value of an individual’s ties depends on the number of connections they can mobilise and the volumes of different capitals possessed by each connection (Bourdieu, 1986). Therefore, social capital, at the individual level, operates through the mobilization of capital of those within our networks.

Much of the development of the concept of social capital is credited to American sociologist James S. Coleman (1988), whose definition of social capital also centres on accessing resources through social connections and extends beyond simply being a “private good” to a “public good” that is accessible to people within social structures at

all income levels. Similar to Bourdieu, Coleman developed the concept of social capital within the context of more conventional, and more tangible, forms of capital, specifically human capital and physical capital (Coleman, 1988). Whereas physical capital refers to physical assets (e.g., tools, machines, houses, etc.) and human capital refers to tangible forms of knowledge (e.g., skills, credentials, work experience, etc.) social capital, according to Coleman, is defined by its function: an actor (e.g., individual, group, community, corporation) achieving its interests through the use of social networks (Coleman, 1988). Coleman's critics point to a lack of empirical evidence for the basis of his theory. However, he is credited with expanding the concept to involve a public aspect that is beneficial to people of all socioeconomic levels and in all communities (Field, 2008).

American political scientist Robert Putnam is unquestionably the most influential promoter of social capital. He is credited with putting social capital on the agenda of policy makers and public health experts around the world with his tremendously influential book *Bowling Alone*, in which he synthesized much of the previous work in the field and popularized the concept through a wealth of evidence on the decline of civic engagement in the United States (Field, 2008). Following the publishing of *Bowling Alone*, there was a dramatic increase in the quantity of articles published on the topic of social capital that persists today (Kawachi, Kim, Coutts, & Subramanian, 2004). Putnam's concept drew heavily on Coleman's work and he defined social capital as referring to "connections among individuals—social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 2000).

Putnam's two forms of social capital have been widely accepted in the theoretical literature: bonding social capital and bridging social capital (Kawachi, et al., 2004). Bonding social capital is the result of inward looking relationships that are characterized by specific reciprocity and a sense of solidarity between members of a homogenous group such as families, close friends and other intimate groups (Putnam, 2000). Bonding social capital, referred to by Putnam as "sociological super glue," is based on strong social ties that create a robust, exclusive in-group loyalty with people who are very similar to ourselves and can also result in strong out-group antagonism (Putnam, 2000). Closure, which represents the interconnectivity of multiple members within a network (i.e., A, B and C are all connected to one another as opposed to A knowing B, A knowing C while B and C are unacquainted) and the interconnectivity of multiple members at each level of an intergenerational network (i.e., if A and B are children who are friends, intergenerational closure is created when the parent of A is connected to the parent of B) creates a set of effective sanctions for monitoring and guiding behaviour and helps to propagate bonding social capital (Coleman, 1988; Putnam, 2000).

Bridging social capital is a more inclusive and outward looking form of social capital characterized by heterogeneous networks of acquaintances that move in different social circles, but remain, more or less social equals (Kawachi, et al., 2004; Putnam, 2000;). Bridging social capital, referred to by Putnam as "sociological WD-40," is valuable for accessing external assets and for information diffusion (Putnam, 2000). It is bridging social capital that results from networking in a business environment and that is most often employed for getting ahead, such as finding employment or getting a promotion (Putnam, 2000). For children, bridging social capital can be generated through

peers who fall into the category of acquaintances and through group and team membership (Putnam, 2000).

A further refinement of bridging social capital has been introduced by Szreter and Woolcock (2004) who argue for a distinct form of social capital that is characterized by the norms of respect and networks of trusting relationships across explicit, formal or institutionalized power or authority gradients in society. Respectful ties with representatives of public and private institutions influence health outcomes and are particularly important in lower socio-economic communities (Szreter & Woolcock, 2004). Linking social capital has been empirically supported and broadly accepted in the literature as particularly important in lower socio-economic communities (Kawachi, et al., 2004; Szreter & Woolcock, 2004). For children, the level of linking social capital is likely reflective of the quality and levels of mutual trust and respect in relationships with authority figures such as teachers, principals, coaches and other leaders.

Coleman was interested in studying the value of social capital as a means toward the creation of human capital and conceived three distinct classes of resources that are accessible via social capital: (1) Obligations, Expectations and Trustworthiness of Structures (2) Information Channels (3) Norms and Effective Sanctions (Coleman, 1988). The first two classes operate at the individual level (a “private good,” according to Coleman) while norms and effective sanctions operate at the community level (a “public good”) (Coleman, 1988). Trustworthiness of the social environment represents the level of confidence among members of a social structure that a good deed will be reciprocated. Within a social structure where trustworthiness is high, the person who does the favour

expects it to be reciprocated in due course and the recipient of the favour understands that there is an obligation to reciprocate (Coleman, 1988). Putnam refines this concept and refers to “specific reciprocity,” an agreement between actors that a specific action will be reciprocated by another specific action (Putnam, 2000). Specific reciprocity leads to individual-level social capital through the accumulation of outstanding obligations (Putnam, 2000; Coleman, 1988). As the number of accumulated outstanding obligations increases so does one’s level of social capital (Coleman, 1988). However, obligations can be intangible as the repayment is often made in a different form than the original act, if it is in fact made at all (Portes, 1998).

The second class of resource accessible via social capital is information (Coleman, 1988). According to Coleman, it takes considerable time and effort to remain current and to have the pertinent information required to make timely decisions. One compensatory tactic is to associate with those who remain current and to glean key highlights through conversation (Coleman, 1988). Via social capital, then, it is possible to gain pertinent information that enables action without investing all of the time and effort that would be required in the absence of the social structure (Coleman, 1988). Weak ties between acquaintances are among the most effective relationships for accessing information, as they provide a breadth of areas of expertise unlikely to exist within our immediate, strong-tie relationships and therefore, accessing information tends to represent a form of bridging social capital (Putnam, 2000). Parents and children with higher levels of bridging social capital would likely have greater awareness of and access to programs and activities for children and youth (Cradock, et al., 2008). Communities where effective communication channels and a high level of social capital exist would,

therefore, be expected to have higher levels of participation in the related programs (Cradock, et al., 2008). In the presence of these community characteristics where parents value physical activity, it would be expected that high levels of child and youth participation in organized physical activity programming, which is positively related with overall levels of physical activity. Further to this, Putnam points out that team sports, along with other community activities where shared interests bring people regardless of share ideologies or ethnicity, provide good venues for developing bridging social capital (Putnam, 2000).

Social norms also represent an important form of public social capital. The social capital that results from a shared understanding of what constitutes acceptable behaviour provides a community with a powerful, invisible hand that encourages certain behaviours and inhibits others (Coleman, 1988). A norm of generalized reciprocity, for instance, where an actor provides assistance to another with the belief that at some point, someone else will assist him/her in the future, represents a very valuable community-level resource (Coleman, 1988; Putnam, 2000). A community that is high in generalized reciprocity is high in trust and, is as a result, more efficient as not every form of social transaction has to be completed immediately (Putnam, 2000).

### **Social Capital and Physical Activity**

While sport researchers and government agencies have focused on the creation of social capital through sport, the focus of the current research is the influence of social capital on participation in physical activity, which sometimes includes sport. Despite a number of methodological inconsistencies, public health researchers generally agree that

social capital plays a role in promoting physical activity and protecting against overweight and obesity (Szreter & Woolcock, 2004). The empirical and theoretical research that, in many cases has independently investigated only one factor or a small selection of factors related to social capital, suggests a complex multilevel relationship between community-level social capital, individual-level social capital and individual physical activity and also addresses the ability of social capital to promote both positive and negative outcomes.

For instance, adolescent physical activity levels are positively related to those of their best friends, and those who take part in physical activity with their best friend at home or in the neighbourhood engage in higher levels of physical activity (Jago, MacDonald-Wallis, Thompson, Page, Brockman, & Fox, 2011). One of the strongest factors associated with increases in physical activity by inactive high school girls is support for physical activity from peers, parents and teachers (Neumark-Sztainer, Story, Hannan, Tharp, & Rex, 2003). Alternatively, Leahy and colleagues (2010) showed that personal relationships influence the risk of being overweight or obese. By investigating characteristics and health norms within personal networks, they found that relationships tend to cluster into homogenous networks so that overweight and obese young adults (18 – 25 year-olds) are more likely to have overweight romantic partners, best friends, family members and casual acquaintances. Further, members of these networks, tended to share common health norms (Leahey, Gokee LaRose, Fava, & Wing, 2010).

At the community-level bonding social capital, represented by social capital in the family and closure between parents within a neighbourhood, is theorized to improve the

ability of a community to enforce healthy norms such as physical activity (Cradock, et al., 2008). Higher levels of bridging social capital in a community is associated with enhanced communication between community members and thought to lead to quicker and more widespread adoption of healthy behaviours (Cradock, et al., 2008). Generalized trust, represented by neighbourhood safety and community order is also associated with participation in recreational programming and level of physical activity (Cradock, et al., 2008; Ueshima, et al., 2010). Alternatively, neighbourhood disorder is negatively associated with sports participation and positively associated with obesity (Stafford, Cummins, Elleway, Sacker, Wiggins, & Macintyre, 2007). A study by Franzini and colleagues (2009) of the social neighbourhood correlates of childhood physical activity and obesity showed that social cohesion and collective efficacy, the availability of a network of neighbours willing to watch out for neighbourhood children, neighbours watching out for each other as well as perceptions of higher neighbourhood safety were all positively related to child physical activity and negatively related to child obesity (Franzini, et al., 2009).

When it comes to linking social capital, Moore and colleagues demonstrated the inverse relation of linking social capital with overweight and obesity by investigating individuals' perceptions of the ability to access resources through a personal network. They showed that individuals with higher levels of linking social capital, represented by access to resources through a vertical and diverse network of professionals, have a lower risk of excess adiposity, overweight and obesity (Moore, et al., 2009). It is also theorized that communities high in linking social capital are able to communally lobby for resources and facilities that support and enable physical activity (Cradock, et al., 2008).

### **Child and Adolescent Social Capital**

While there is a wealth of literature on the topic of social capital, very little research and theory development has been carried out related to children and adolescents (Wellie & Bruegel, 2009). Coleman's limited approach to explaining child social capital is to describe a subset of bonding social capital that is synonymous with the quality of the relationship between parents and child, and which represents the ability of the child to access resources through the parents (Coleman, 1988). According to Coleman, the level of social capital within the family is determined through the physical presence of parents and the quantity and quality of attention paid to the child. Social capital within the family mediates the accessibility of parents' resources (e.g., human capital, personal and professional networks, etc.) by a child (Coleman, 1988).

While it is likely that parent-child relationships influence levels of social capital, Coleman's view is overly simplistic. Meier (1999) argues that the quality of the parent-child relationship outweighs the structure of the family. Further, it should be acknowledged that children and adolescents are resourceful and active in developing networks with each other and with adults within and outside the family (Leonard, 2005). In essence, adolescents do not rely on their parents to enable them to access resources, but accumulate their own social capital through relationships and communities (Morrow, 1999). In fact, research into prosocial adolescent behaviours shows that one of the main reasons that adolescents display prosocial behaviours is in the pursuit of goals that are intrinsically motivated (Wentzel, Filisetti, & Looney, 2007). Adolescents, therefore, it can be argued, make investments in social capital and create obligations in their peers.

As adolescents age and mature towards autonomy and independence from their parents, they transfer their allegiances increasingly to the peer group, which represents an important component of adolescent social capital (Helve & Bynner, 2007). Peer groups provide youth with the opportunity to resolve identity conflicts and learn social skills, including accumulating social capital, during the maturation towards adulthood (Helve & Bynner, 2007). Siblings, too, may play a role in providing each other with access to resources and, therefore, bonding social capital (Morrow, 1999).

Schools represent a key contextual source of adolescent social capital (Morrow, 1999) and Canadian adolescents spend a large portion of their time at school. Schools are also where adolescents interact most with peers, both close friends and acquaintances, and therefore, represent a source of both bonding and bridging social capital (Morrow, 1999). Relationships with teachers and other administrators can afford access to information and opportunities that enhance the educational performance of children (Meier, 1999). Trusting, respectful relationships across these formalized social gradients represent opportunities for adolescents to access resources through linking social capital (Szreter & Woolcock, 2004).

As the Internet continues to play an increasingly central role in the lives of young people, the use of social media sites and other forms of electronic communication have been shown to increase levels of bridging social capital, particularly for those with low self-esteem and to support, rather than replace, offline contact (Steinfeld, Ellison, & Lampe, 2008; Williams, 2006).

In areas where levels of social capital and trust are high, parents tend to afford their children greater autonomy (Wellie & Bruegel, 2009). As such, neighbourhood social capital plays a role in determining an adolescent's developing independence and sense of self (Wellie & Bruegel, 2009). Many adolescents play important roles in enabling the development of community cohesion and social capital, either directly via their own actions or indirectly by providing connections and networks for their parents and other members of the community (Wellie & Bruegel, 2009).

### **Dark Side of Social Capital**

Despite the number of positive outcomes associated with social capital, many argue that it is neither inherently negative or positive, but instead the ways in which social capital is employed determine the nature of the outcomes. The types of resources, favours and behaviours an individual or group is involved in lead directly and indirectly to either positive or negative outcomes, and sometimes both (Field, 2008; Portes, 1998).

For instance, bonding social capital is, by definition, exclusionary (Putnam, 2000). Groups tend to reinforce in-group traits and solidarity, which can result in positive outcomes for those within the group at the expense of those outside it (Portes, 1998). As an example, a powerful group, rich in bonding social capital, can limit or undermine the social capital of those who are less powerful (Field, 2008). Specific to adolescents, for whom peer acceptance plays such a critical role, friendships are among the most likely to generate negative outcomes for those within the group such as risk taking, and alcohol and drug use (Meier, 1999). Social capital can also have an indirect negative effect. For instance, members of a contact sports team (e.g., football, hockey) may benefit from

increased levels of social capital, but may also get hurt more often as a result of the nature of the group to which they belong. Social capital within a neighbourhood can also lead to dichotomous outcomes. Where high levels of closure and behaviour norms exist between parents, the neighbourhood is likely very safe, but is also likely to be restrictive of personal freedoms and limits personal autonomy and development (Portes, 1998).

### **Operationalizing Social Capital**

There is long-standing debate about how best to operationalize social capital. To date, many studies have used trust as a proxy (Kawachi, et al., 2004). While, trust plays a central role in the concept of social capital, there is little consensus surrounding this relationship (Field, 2008). In some cases, trust is theorized to be a key prerequisite for (or even the source of) social capital (Field, 2008; Subramanian, et al., 2003). In other theories, trust is an outcome of social capital (Putnam, 2000; Woolcock, 2001). Similar to reciprocity, the literature on the topic of trust distinguishes between two forms: (1) particularized trust; and (2) generalized trust (Field, 2008). Particularized trust represents an individual's own perception of a specific actor's trustworthiness based on observations and experiences over time and is likely related to individual-level social capital (Field, 2008). Generalized trust refers to a sense of trust of all individuals and institutions resembling those that an individual has had direct contact with over time, which is likely most related to community-level social capital (Field, 2008). In many relationships, particularly those that operate out of habit or institutional sanctions rather than choice, trust may not necessarily be a prerequisite or outcome of shared norms or functional networks, which brings into question the validity of trust as a proxy for social capital

(Field, 2008). It is conceivable that trust and social capital are independent constructs that act together, so it may be necessary to distinguish between them in order to study the relationship and determine its directionality (Field, 2008)

Other studies have operationalized social capital through measures such as perceived reciprocity, social participation, volunteerism, community attachment, electoral participation and other proxies that are loosely based on social capital theory (Kawachi, et al., 2004). There is a very little empirical evidence towards validating the bridging, bonding and linking model of social capital, despite the widespread popularity of this theoretical model (Kawachi, et al., 2004). Studies seeking to determine the level of fit of the bonding, bridging, linking model of social capital have provided empirical evidence of multi-factored models that apply to the measurement social capital, without any clear consensus on the number or nature of the factors or models (Onyx & Bullen, 2000; Wu, Palinkas, & He, 2010).

Many of the studies which measure adolescent social capital consider either parental social capital as a proxy or consider only the influence of family structure and school and ignore the broader social context, such as friends, social networks and out-of-school activities in the community (Harpham, n.d.; Morrow, 1999). Harpham argues that there is a need to develop exploratory quantitative research towards measuring child and adolescent social capital through contact with adults other than parents; contact with friends; support from their community; sense of belonging; and level of trust of their community (Harpham, n.d.).

Another consideration in the measurement of social capital for any part of the population is the definition of community or neighbourhood (Harpham, n.d.). In contrast to much of the research that focuses on geographically bounded communities, communities for adolescents often constitute communities of friends based around the many places they spend their time, such as school, home, neighbourhoods that are more difficult to define (Morrow, 1999).

### **The Current Research**

While it is broadly accepted that social capital plays a role in determining individual health outcomes, there are considerable knowledge gaps that exist in this field of research. It is unclear how best to operationalize social capital and whether the theoretical, three-factor model (i.e., bonding, bridging and linking) is empirically sound and applicable to adolescents. Further to this, there is considerable complication surrounding the role of trust, specifically whether it is an underlying element of social capital, a prerequisite, an outcome, or all of three. There is also a knowledge gap surrounding the multilevel influence of social capital on adolescent physical activity. The current research seeks to answer three research questions: (1) Is there a parsimonious set of latent factors that underlie measures related to social capital? (2) Can this set of latent social capital factors be replicated across samples of adolescents? (3) Is there an association between social capital and adolescent physical activity?

## **Methods**

### **Participants**

Health Behaviour in School-aged Children (HBSC) is a multinational study that has been conducted every four years since 1982 in collaboration with the World Health Organization Regional Office for Europe ([www.hbsc.org](http://www.hbsc.org)). Canada has participated in the last six HBSC surveys since 1990. The Canadian 2010 HBSC surveyed 26,078 youths (50.8% female) in grades 6 to 10 in all provinces and territories in Canada, except Prince Edward Island and New Brunswick. This cluster sample comprised of students in 1295 classes in 437 schools. Classes were sampled using weighted probability methods to obtain a balanced representation of school population characteristics, such as province/territory, type of school (public or Catholic), language of instruction (English/French) and community size. Students in private and special needs schools and schools for youth in custody were excluded. The survey explored behaviours and social factors that influence physical and psychosocial health. A research ethics board at Queen's University approved the study procedures. Active consent was sought from both parents and children.

### **Procedure**

The questionnaire was administered in classroom settings according to a standardized protocol in February–March 2009. Trained interviewers administered the questionnaire to all students (grades 6 – 10) who attended school on the day of the survey.

## Research Questions #1 and #2

It was hypothesized that there was an underlying set of latent factors that represent adolescent social capital. An exploratory factor analysis (EFA) was performed to summarize relations between the variables and to form a set of factors to be used in subsequent analyses (Thompson, 2004). While there is considerable theoretical basis for hypothesizing the quantity and nature of factors (i.e., bonding, bridging, linking and trust), there is little empirical basis for this model, particularly as it pertains to adolescents, therefore, it is appropriate to begin the research with an EFA of the available data in the HBSC survey (Fabrigar, Wegener, MacCallum, & Strahan, 1999). EFA is often used interchangeably with principal components analysis (PCA), however, EFA is appropriate in this case as the primary objective of the research is not strictly to reduce data, but to form a parsimonious set of factors to use in testing links between social capital and individual differences in physical activity (Fabrigar, et al., 1999). EFA results in some data reduction, which leads to a conservation in the degrees of freedom and a reduced risk of committing Type II errors in the subsequent analysis as well as a reduction in the unreliable variance of the original variables (Thompson, 2004). EFA was employed in order to specify a confirmatory factor analysis (CFA) model for subsequent analyses. Since the 2010 HBSC provides a large sample size (i.e., greater than 200), the sample was randomly split, an EFA was performed on the first half ( $n = 13,028$ ) and subsequently, a CFA was performed on the second half of the sample ( $n = 13,050$ ) (Fabrigar, et al., 1999).

## Measures

Variables (26 in total) representing adolescent bonding social capital, bridging social capital, linking social capital, and trust were identified in the HBSC (Fabrigar, et al., 1999; Thompson, 2004).

Bonding social capital is assessed through variables that seek to determine the quality of relationship between adolescents, their immediate family members and closest friends and the number of close friends. An adolescent's interpretation of the quality of the relationships with those who are closest to them represents the ability to access resources through close ties, which is the definition of bonding social capital (Coleman, 1988; Putnam, 2000). Responses to the question "How easy is it for you to talk to the following persons about things that really bother you?" with nine family members and friends listed "father"; "stepfather (or mother's boyfriend)"; "mother"; "stepmother (or father's girlfriend)"; "older brother(s)"; "older sister(s)"; "best friend"; "friends of the same sex"; "friends of the opposite sex". Responses for each relationship range from "don't have or see this person" (=0) to "very difficult" (=1) to "very easy" (=4). The rationale for the inclusion of these variables in the HBSC is to assess communication with parents and friends. The responses regarding communication with parents and step-parents were summed to create a single variable, "Parent Communication", with values ranging from 0 – 16. Similarly, responses pertaining to older siblings were summed into a "Sibling Communication" variable with values ranging from 0 – 8, and responses related to friends were summed into a "Friend Communication" variable with values ranging from 0 – 12. The level of parental trust was assessed through the agreement with the

statement: “My parents trust me”, with responses ranging from “Strongly disagree” (=1) to “Strongly agree” (=5). Elements of bonding social capital are also assessed through the following questions: “At present, how many close male and female friends do you have?,” with answers ranging from “None” (=0) to “three or more” (=3) separately for both sexes. Electronic and telephone communication with friends is assessed through the question “How often do you talk to your friend(s) on the phone, send them text or email messages or have contact through the internet?” with responses ranging from “rarely or never” (=1) to “everyday” (= 5). Each of these variables was entered into the EFA as independent variables.

Measures of an adolescent’s ability to access resources through loose ties including group membership and through respectful relationships with classmates were entered into the EFA. Membership in clubs or other organizations is measured by answers ranging from “I am not involved in any kind of club or organization” (=0) to involvement in up to seven different types of organizations “Sport club or team”; “Voluntary service”; “Political organization”; “cultural association (music, science or other)”; “church or religious group”; “youth club”; or “other club” (=7). The responses were summed into a single variable, Club Participation, that ranges from 0 to 7, where higher values indicate belonging to more clubs or organizations, which would provide access to a greater quantity of loose ties from which to access resources (Putnam, 2000). The 2010 HBSC also gathers information about loose ties between students and their peers. The following variables, each scored from “strongly disagree” (=1) to “strongly agree” (=5), assess the level of agreement with the following statements; “Most students in my class(es) are kind and helpful”; “When a student in my class(es) is feeling down,

someone else in class tries to help”; “The students in my class(es) treat each other with respect”. These variables related to peer bridging social capital were entered into the EFA as independent variables.

An adolescent’s ability to access resources across institutionalized power gradients, was assessed through responses about trust, respect and reciprocity in relationships with teachers. The following variables, which assess the level of agreement with a given statement, are each scored from “strongly disagree” (=1) to “strongly agree” (=5). The statements are: “I feel a lot of trust in my teachers”; “our teachers treat us fairly”. For the purposes of the EFA, each of these variables that is related to linking social capital, were entered independently.

Trust is assessed through responses to a question related to generalized neighbourhood trust agreement from “strongly disagree” (=1) to “strongly agree” (=5) with the following statements: “people say hello and often stop to talk to each other in the street”; “It is safe for younger children to play outside during the day”; “You can trust people around here”; “There are good places to spend your free time (e.g., recreation centres, parks, shopping centres)”; “I could ask for help or a favour from neighbours”. The following two variables assess the generalized trust in a school, each scored from “strongly disagree” (=1) to “strongly agree” (=5), assess the level of agreement with the following statements: “I feel I belong at this school”; “Our school is a nice place to be”. A question that seeks to assess student engagement, “How do you feel about school at present?”, with answers ranging from “I don’t like it at all” (=1) to “I like it a lot” (=4).

For the purposes of the EFA, each of these variables related to trust, were entered independently.

The amount of investment made by adolescents as they actively network and accumulate social capital was assessed through the following prosocial behaviours: “I often do favours for people without being asked”; “I often lend things to people without being asked.”; “I often help people without being asked”; “I often compliment people without being asked.”; “I often share things with people without being asked.” Each of these five statements are responded to based on the amount that they describe what the respondent is like as a person from “Definitely not like me” (=1) to “Definitely like me” (=6). For the purposes of the EFA these variables were entered independently.

### Results—Research Questions #1 and #2

The randomly selected sample ( $n = 13,028$ ) consisted of students who were primarily in grades 6 – 10 (99.1% of the sample was distributed relatively evenly across these grades), with just over half being females (50.7%) and represented all Canadian provinces and territories except New Brunswick and Prince Edward Island. Tables 1 and 2 provide greater detail about the sample distribution across grades and by sex.

Table 1

*Participants included in Exploratory Factor Analysis by School Grade ( $n = 13,028$ )*

Grade	Frequency	Percent
5	34	0.3
6	2525	19.4
7	2620	20.1
8	2634	20.1
9	2645	20.3
10	2497	19.2
11	72	0.6
Total	13028	100

Table 2

*Participants included in EFA by Sex ( $n = 13,028$ )*

Sex	Frequency	Percent
Male	6425	49.3
Female	6601	50.7
Missing	2	0.0
Total	13028	100

An exploratory factor analysis (EFA) was performed using SPSS 19.0 software that employed the maximum likelihood factor extraction procedure (Fabrigar, et al.,

1999). Prior to performing the EFA, missing data were analyzed and replaced by variable means. The assumption of normality was assessed by examining skewness and kurtosis of the distributions of the EFA variables against the normality thresholds (i.e., skewness > 2; kurtosis > 7) (Fabrigar, et al., 1999). Variable distributions are summarized in table 3.

Table 3

*Descriptive statistics of variables included in EFA, organized by a priori social capital classification (n = 13,028)*

HBSC Variable	M	SD	Skew	Kurtosis
<b>Bonding Social Capital</b>				
Parent Communication	6.312	2.550	.783	1.973
Sibling Communication	2.333	2.309	.744	-2.62
Friend Communication	8.757	2.563	-.963	.920
Number of close male friends	2.501	.883	-1.728	1.821
Number of close female friends	2.552	.850	-1.918	2.555
My parents trust me	4.032	.979	-1.133	1.118
How often I talk to friends on the phone or by email	3.727	1.400	-.660	-.954
<b>Bridging Social Capital</b>				
Club Participation	1.443	1.386	1.280	1.842
Most students in my class(es) are kind and helpful	3.426	1.106	-.858	.213
When a student in my class(es) is feeling down, someone else in class tries to help	3.590	1.052	-.614	-.074
The students in my class(es) treat each other with respect	3.240	1.050	-.337	-.345
<b>Linking Social Capital</b>				
I feel a lot of trust in my teachers	3.610	1.071	-.571	-.158
Our teachers treat us fairly	3.643	1.105	-.712	-.056
<b>Generalized Trust</b>				
People say hello and often stop to talk to each other in the street	3.550	1.078	-.615	-.092
It is safe for younger children to play outside during the day	3.957	.9378	-1.013	1.077
You can trust people around here	3.638	1.022	-.595	.052

There are good places to spend your free time	3.729	1.084	-.814	.138
I could ask for help or a favour from neighbours	3.729	1.037	-.749	.227
I feel I belong at this school	3.693	1.090	-.752	.079
Our school is a nice place to be	3.692	1.084	-.757	.096
How do you feel about school at present?	2.890	.8825	-.562	-.301
<b>Prosocial Behaviour</b>				
I often do favours for people without being asked.	3.870	1.420	-.217	-.666
I often lend things to people without being asked.	3.351	1.493	.152	-.831
I often help people without being asked.	3.952	1.443	-.307	-.668
I often compliment people without being asked.	4.224	1.475	-.551	-.552
I often share things with people without being asked.	3.904	1.486	-3.25	-.736

A promax oblique rotation was performed to determine the factored solution with the best simple structure. This was selected over an orthogonal rotation as an oblique rotation will allow for the factors to correlate and will provide information about these correlations, while, in the absence of correlation between variables, the two methods produce nearly identical results (Fabrigar, et al., 1999). Promax rotation is more appropriate for large datasets. The Kappa was set at the recommended value of 4 (Tataryn, Wood, & Gorsuch, 1999). The scree plot indicated that five factors should be retained in the model. The factor loadings produced a 21 item, five-factor solution that accounted for 49% of the variance (Table 4). Five of the variables (parent communication, sibling communication, my parents trust me, number of close male friends, and club membership) yielded weak loadings on all factors and were eliminated from subsequent analyses. All other items loaded primarily on one factor (loadings between .430 and .834).

The five factors were labeled based on their content and alignment with adolescent social capital literature: (1) personal social capital; (2) school social capital; (3) neighbourhood social capital; (4) bridging social capital; (5) peer bonding social Capital. The factors were correlated (Table 6) and all but peer bonding social capital, which had adequate internal consistency (Table 7). It is likely that the small number of items in the Peer Bonding Scale (=3) reduced its alpha value (Cortina, 1993). Taken together, the five factors make up the HBSC Adolescent Social Capital Scale (Appendix A).

Table 4

*Rotated Pattern Matrix for the HBSC Adolescent Social Capital Scale (n = 13,028)*

Item	Factor				
	1	2	3	4	5
	Personal	School	Neighbour	Bridging	Bonding
Help others	<b>.834</b>	.007	-.020	-.005	.028
Do favours for others	<b>.789</b>	-.002	-.028	-.002	-.101
Lend things to others	<b>.741</b>	-.082	.003	.038	-.054
Share things with others	<b>.645</b>	.023	.037	.000	.113
Compliment others	<b>.642</b>	.058	.011	-.013	.167
Club membership	.127	.044	.099	-.043	.096
School is a nice place to be	-.028	<b>.829</b>	-.009	.009	.035
I belong at this school	-.059	<b>.761</b>	.019	.015	.127
I trust my teachers	-.023	<b>.640</b>	.006	-.025	-.090
Teachers treat us fairly	-.023	<b>.639</b>	-.013	.052	-.129
Like school at present	.081	<b>.572</b>	-.038	-.040	.039
You can trust people around here	-.018	-.002	<b>.763</b>	.017	-.028
Safe for children to play outside	-.026	-.061	<b>.735</b>	-.023	-.044
I could ask for help from neighbours	.050	.041	<b>.612</b>	-.025	.020
People say 'hello'	.014	-.067	<b>.555</b>	.026	.072
Good places to spend free time	-.010	.116	<b>.398</b>	.010	.005
Students treat others with respect	-.030	-.017	-.008	<b>.826</b>	-.016
Most students are kind and helpful	-.021	.022	-.002	<b>.682</b>	.015
When a student is feeling down, someone else tries to help	.088	.039	.011	<b>.579</b>	.047
Easy to communicate with friends	.028	.011	.019	-.018	<b>.554</b>
Frequency of talking to friends on the phone or email	.006	-.084	-.005	.024	<b>.535</b>
Number of close female friends	.047	.070	-.019	.006	<b>.430</b>
Number of close male friends	-.094	-.028	.035	.042	.280
Easy to communicate with parents	-.022	.006	-.008	-.012	.058
Easy to communicate with siblings	-.005	-.063	-.057	-.013	.157
My parents trust me	.080	.175	.113	.033	-.111
% Variance	19.468	10.209	7.810	6.528	5.136
Eigenvalue	5.062	2.654	2.031	1.697	1.335

*Note:* See Appendix A for complete wording of items and response categories.

Table 5

*Correlation Matrix of Adolescent Social Capital Factors resulting from EFA (n = 13,028)*

Factor	1	2	3	4
1. Personal SC	-			
2. School SC	.270	-		
3. Neighbourhood SC	.238	.365	-	
4. Bridging SC	.228	.552	.343	-
5. Peer Bonding SC	.128	-.037	.127	.158

Table 6

*Descriptive statistics of the five Adolescent Social Capital Scale factors resulting from Exploratory Factor Analysis (n = 13,028)*

	# items	M (SD)	Skewness	Kurtosis	Alpha
Personal SC	5	19.30 (5.79)	-.242	-.250	.850
School SC	5	17.53 (3.97)	-.625	.240	.814
Neigh SC	5	18.60 (3.65)	-.514	.910	.749
Bridging SC	3	10.26 (2.62)	-.513	-.042	.748
Peer Bonding SC	3	15.04 (3.61)	-.872	.625	.437

Based on the findings of the EFA in research question 1, it was hypothesized that a five-factor model of adolescent social capital would be confirmed through a confirmatory factor analysis (CFA) (Fabrigar, et al., 1999). The second half of the randomly sampled 2010 HBSC data ( $n = 13,050$ ) to confirm the latent constructs, the variables that reflect the factors and whether the factors are correlated (Thompson, 2004).

The analysis was performed using AMOS 19.0. Maximum likelihood estimation, which applies maximum likelihood theory to the sample covariance matrix to estimate the population covariance matrix and then derives factors to reproduce that matrix rather than the sample covariance matrix, was employed (Thompson, 2004).

To corroborate the fit statistics, the comparative fit index (CFI) and the root mean square error of approximation (RMSEA) were examined. The CFI assesses model fit relative to an independence model, with a value of greater than .90 being indicative of a good fit (Bentler & Bonett, 1980). The root mean square error of approximation (RMSEA) estimates how well the model parameters will reproduce the population covariances, with a value of less than .08 indicating a good fit (Hu & Bentler, 1999). Due to the large sample size, the  $\chi^2$  statistical significance test was not used, because of an increased risk of committing a type I error (Thompson, 2004). With these criteria the five-factor model was a good fit to the data (CFI = .931; RMSEA = .047). The internal consistency of the five subscales mirrored that of the EFA (Table 7). Factor loadings and correlations between factors are shown in Figure 1.

Table 7

*Descriptive statistics for the HBSC Adolescent Social Capital Scale factors resulting from Confirmatory Factor Analysis (n = 13,050)*

	# items	<i>M</i> ( <i>SD</i> )	Skewness	Kurtosis	Alpha
Personal SC	5	19.22 (5.72)	-.245	-.224	.851
School SC	5	17.48 (3.97)	-.582	.200	.815
Neigh SC	5	18.58 (3.54)	-.477	.904	.742
Bridging SC	3	10.24 (2.59)	-.480	-.036	.748
Peer Bonding SC	3	15.02 (3.55)	-.908	.787	.438

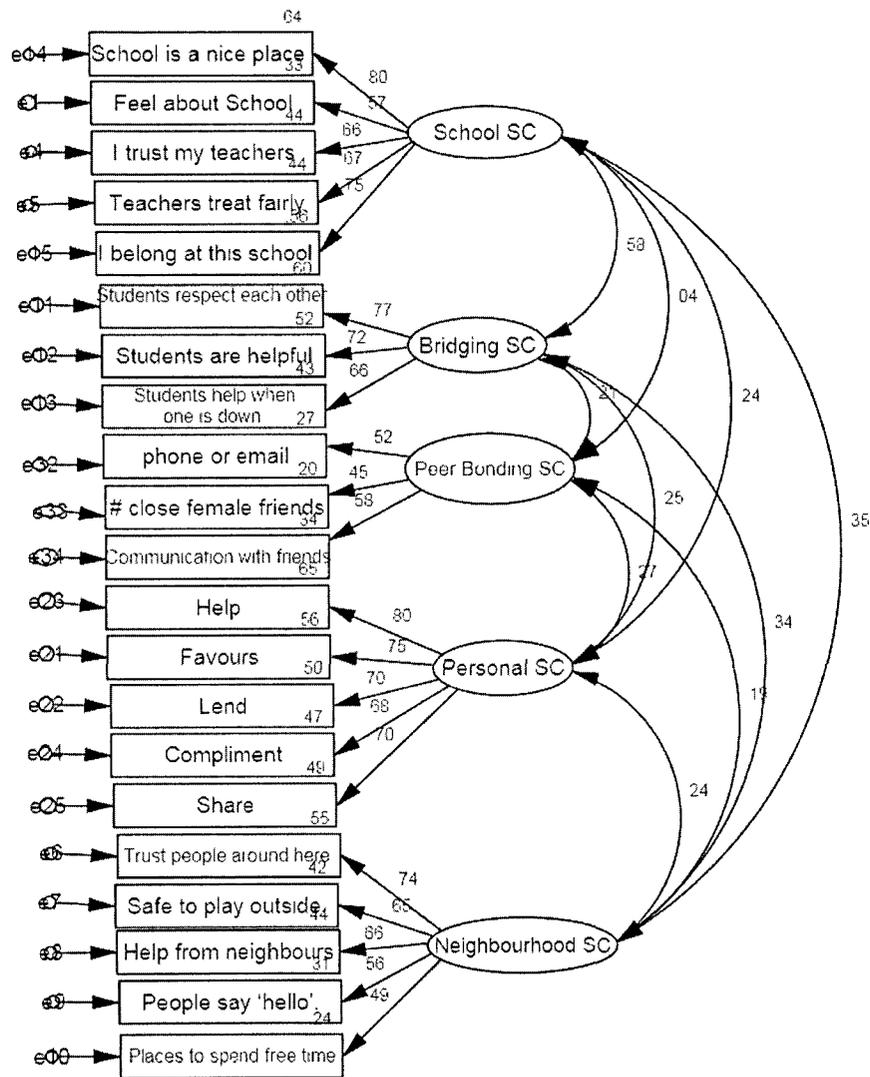


Figure 1. Confirmatory Factor Analysis of the HBSC Adolescent Social Capital Scale ( $n = 13,050$ ). Values shown on paths between variables represent standardized  $\beta$  coefficients. Other values are error terms.

### **Discussion—Research Questions #1 and #2**

Adolescent social capital is unique and differentiated from the adult social capital described in the literature. Based on content from the HBSC survey, adolescent social capital takes on five distinct forms that are correlated with one another. The forms of social capital represent the behaviours, relationships and contexts through which adolescents access and accumulate social capital.

Three forms of adolescent social capital operate as individual constructs: (1) personal social capital, which represents an individual's perception of his or her own investment towards the accumulation of social capital through prosocial behaviour; (2) bridging social capital, which represents an individual's perception of the level of trust, respect and reciprocity that exists among acquaintances of equal social standing; and (3) peer bonding social capital, which represents the quality of relationship between close friends. Two forms of adolescent social capital are contextual in nature: (4) neighbourhood social capital, which represents the individual's perception of the amount of generalized trust that exists in the neighbourhood in which he or she lives; and (5) school social capital, which represents the individual's perception of generalized trust that exists within the school as well as the general quality of the relationship between students and teachers at the school.

The five-factor model provides an empirical basis for the future study of adolescent social capital. It extends the theory of social capital by generating a model that incorporates and reorganizes the four elements (i.e., bonding, bridging, linking, and trust)

that are central in the social capital literature while addressing aspects of social capital that are unique to children and adolescents (i.e., school environment, peer bonding).

The exploratory factor analysis generated a five-factor scale for measuring adolescent social capital that was confirmed by the confirmatory factor analysis. The five factors support the popular theoretical belief that social capital represents both individual and collective constructs (Coleman, 1988; Putnam, 2000). Further to this, the five-factor model reflects elements that are central to the adolescent social capital literature. The results identified a personal social capital factor that supports Coleman's position that by doing favours and other prosocial behaviours for others, an individual is able to accumulate obligations to be repaid in the future. This is akin to building social capital that is specifically accessible to the individual and supports the theory that adolescents actively build social capital (Coleman, 1988; Morrow, 1999). Personal social capital supports empirical child development literature that shows adolescent prosocial behaviours are motivated in part by intrinsic goal pursuit and social norms (Wentzel, Filisetti, & Looney, 2007). The variables from the HBSC upon which the personal social capital scale is based are not site or relationship specific, and therefore, this factor represents an adolescent's perception of the frequency of his or her own voluntary participation in prosocial behaviour regardless of setting or relationship. The inclusion of personal social capital in the HBSC Adolescent Social Capital Scale represents a contribution to the social capital and adolescent social capital literature as it is a factor that is unique to this model.

Peer bonding social capital supports the commonly-cited form of bonding social capital and tailors it to reflect the importance of close peer relationships to adolescents (Morrow, 1999; Putnam, 2000). Peer bonding social capital represents the quantity and quality of relationships with close friends and the frequency of contacting friends via email and phone. In contrast to Putnam's bonding social capital, which is characterized by close relationships with those who are like us including family members and close friends, peer bonding social capital variables loaded separately from parent and sibling communication variables (Putnam, 2000). This divergence likely reflects the relative importance of peers in the lives of adolescents (Morrow, 1999). Interestingly, the peer bonding social capital scale includes the variable that assesses the number of close female friends but not the variable assessing the number of close male friends. This likely reflects previous findings in adolescent research that shows that relationships with girls, and in particular adolescent boys who have platonic relationships with girls, are associated with an orientation towards seeking help, or resources, from others (Stanton-Salazar & Urso Spina, 2005). Peer bonding social capital also includes the measure of frequency of contacting friends via phone and email, which is shown to be supportive of face-to-face contact and is often reflective of time spent setting up personal contact (Steinfeld, et al., 2008; Williams, 2006).

The bridging social capital factor aligns well with Putnam's theoretical bridging social capital (Putnam, 2000). It represents the sense of trust, respect and reciprocity among acquaintances and is indicative of an individual's perception of the ability to access resources through weak ties.

Neighbourhood social capital represents a sense of generalized trust within the area where an individual lives. By loading together in the EFA, the results further validate the scale that exists within the HBSC and has been shown to be related to such outcomes as mental and physical health, life satisfaction and risk taking among others behaviours (Boyce, Davies, Gallupe, & Shelley, 2008; Elgar, et al., 2010).

School social capital represents the variables associated with generalized trust within the school along with variables that align well with linking social capital about the quality of relationships between students and teachers. Schools represent a key context for adolescents as these are where they spend the majority of their time (Morrow, 1999) and teachers are a key intermediary between students and the school.

The addition of neighbourhood social capital and school social capital as stand-alone forms of social capital represents a contribution to the adolescent social capital literature. Previous research has used trust as a proxy for social capital (Kawachi, et al., 2004), whereas the current five-factor model indicates that both trust where you live and trust at school are unique factors that are correlated and complementary to the individual forms of adolescent social capital (i.e., Personal, Peer Bonding, Bridging) .

The analysis did not generate a factor representing family or parental social capital. While families and parents undoubtedly play critical roles in the lives of adolescents, the relationship is very complex and may differ greatly from the relationships with peers, teachers, and others. One explanation for this is offered by Portes (1998), who theorizes that the most common function of social capital is as “a source of network-mediated benefits beyond the family.” He posits that parental support

of child development leads to cultural capital, while assets gained through membership in networks is more appropriately called social capital (Portes, 1998).

### Research Question #3

A multilevel methodological framework was used to quantify individual- and community-level social capital and to examine its links to individual physical activity (Subramanian, et al., 2003). Traditionally, when analyzing the relationships between the varying forms of social capital and health outcomes, despite the dichotomous public and private nature of social capital, research has tended to focus exclusively at the individual level or to rely on aggregated individual scores to represent a community-level measure (Kawachi, et al., 2004; Subramanian, et al., 2003). However, as noted above, not all of the benefits of social capital accrue to those who invest in it, and in many instances entire communities benefit from the efforts (and social capital) of very few (Coleman, 1988). It is for this reason that aggregated individual social capital underestimates community-level social capital (Subramanian, et al., 2003; Szreter & Woolcock, 2004). Schools play an important contextual role in the daily lives of adolescents and are the context through which much of their social capital is accessed (Morrow, 1999). Therefore, the multilevel analysis on the HBSC 2010 data ( $n = 26,078$ ) was undertaken to assess individual adolescents nested within schools (Subramanian, et al., 2003).

### Measures

The social capital scales were constructed to match the HBSC Adolescent Social Capital Scale (Appendix A).

For the purpose of multilevel modelling, additional measures from the 2010 HBSC were introduced to the analysis. Socio-economic status (SES), which is a predictor

of physical activity (Canadian Fitness & Lifestyle Research Institute, 2009), was assessed through the Family Affluence Scale, which is four-variable, self-report scale that includes the following questions: “Does your family own a car, van or truck?” (“No” = 0; “Yes, one” = 1; “Yes, two or more” = 2); “Do you have your own bedroom for yourself?” (“No” = 0; “Yes” = 1); “During the past 12 months, how many times did you travel away on holiday with your family?” (“Not at all” = 0; “Once” = 1; “Twice” = 2; “More than twice” = 3); and “How many computers does your family own?” (“None” = 0; “One” = 1; “Two” = 2; “More than two” = 3). The FAS scale has been validated by a number of studies and corresponds with objective measures of wealth. The FAS has better criterion validity and is less affected by non-response bias than longer SES assessments that rely on child reports of household income or parental occupation (Currie, Molcho, Boyce, Holstein, & Torsheim, 2008).

Physical activity, the dependent variable in the multilevel analysis, is assessed through a single-item measure of Moderate-to-Vigorous Physical Activity (MVPA). Participants answered the question “Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?” (from “0 days” = 0 to “7 days” = 7). This item has been shown to be reliable and to correlate with accelerometer data from US adolescents (Prochaska, Salis, & Long, 2001).

## Data Analysis

Data analysis was performed using hierarchical linear modeling software (HLM). The analysis modelled the level 2 (*j*) characteristics (i.e., school level) along with level 1 (*i*) individual characteristics and assessed the nature of the relations and interactions between them (Subramanian, Jones, & Duncan, 2003). In order to assess these relationships, I employed a full multilevel model with random intercepts and random slopes similar to the following:

$$Y_{ij} = \beta_0 + \beta_1 X_{1j} + \beta_2 X_{2ij} + \beta_3 X_{3ij} + u_3 + r$$

Where  $Y_{ij}$  represents an individual's physical activity response,  $\beta_0$  represents a constant mean value;  $\beta_1$  gives the average change in physical activity for a unit change in variable  $X_1$  at the contextual level (e.g., neighbourhood  $sc_j$ );  $\beta_2$  gives the average change in physical activity for a unit change in variable  $X_2$  at the individual level (e.g., age, gender, SES<sub>*ij*</sub>, etc);  $\beta_3$  gives the average change in physical activity for a unit change in variable  $x_3$  at the individual level (e.g., personal  $sc_{ij}$ ) and  $u_3$  represents the random contextual differences after allowing for random individual variation ( $r$ ).

The underlying logic of this simplified model (i.e., only containing 1 variable) was expanded upon to carry out the analysis of the relations between individual-level and school-level variables on physical activity. Three HLM models were tested. In Model 1 the following independent variables were entered as predictors of the physical activity: school grade, sex, sport club participation, personal social capital (level 1 and 2), school social capital (level 1 and 2), neighbourhood social capital (level 1 and 2), peer bonding

social capital (level 1 and 2) and bridging social capital (level 1 and 2). Model 2, which was designed to explore the possibility that SES may act as a mediator, added SES (level 1) to the list of predictors in Model 1. Model 3 was designed to test the interaction effects between levels 1 and 2 of the social capital variables and of the SES variables. This model consisted of the same predictors as Model 2 as well as the six interaction terms.

Individual-level variable data (i.e., level 1) were standardized in SPSS and were entered into the HLM models using the grand-mean centering method. School-level variables were created in SPSS by aggregating individual-level variables based on school, then converting these aggregates scores to z-scores. School-level variables were also entered into the HLM model using the grand-mean centering method. Level 1 social capital variables (i.e., personal social capital, neighbourhood social capital, school social capital, bridging social capital, peer bonding social capital) were treated as random variables. Mediation analysis was performed using the Sobel method for HLM (Zhang, Zyphur, & Preacher, 2009).

In Model 1, it was hypothesized that the variables school grade and sex would be negatively related to physical activity (Active Healthy Kids Canada, 2011). In terms of social capital, it was hypothesized that, at level 1 and level 2, the following would be positively related to physical activity: neighbourhood social capital (Franzini, et al., 2009; Stafford, et al., 2007); peer bonding social capital (Jago, et al., 2011), bridging social capital (Cradock, et al., 2008) school social capital (Moore, et al., 2009; Duncan, et al., 2004) and personal social capital (Broderson, Steptoe, Williamson, & Wardle, 2005). Based on the theoretical assumption that social capital accrues within a community and

influences more than those who invest in it (Coleman, 1988), it was hypothesized that the forms of social capital that predict physical activity at level 1 will also positively predict physical activity at level 2. In Model 2, it was hypothesized that SES (level 1) would positively predict physical activity. In Model 3, it was hypothesized that the multilevel interaction between the forms of social capital and ses (e.g., *personal scij* x *personal scj*) would positively influence physical activity.

### Results—Research Question #3

All participants in the Canadian HBSC 2010 survey were included in the HLM analysis ( $N = 26,078$ ). Participants represented all provinces and territories in Canada, except for New Brunswick and Prince Edward Island (Table 8). Statistics describing the sample are displayed in Tables 9 – 11.

Table 8

*Participants by Home Province/Territory ( $N = 26,078$ )*

Province or Territory	Frequency	Percent
British Columbia	3547	13.6
Alberta	2930	11.2
Saskatchewan	819	3.1
Manitoba	970	3.7
Ontario	10367	39.8
Quebec	6212	23.8
Newfoundland/Labrador	403	1.5
Nova Scotia	743	2.8
Northwest Territories	34	0.1
Nunavut	26	0.1
Yukon	27	0.1
Total	26078	100

Table 9

*Participants by Sex ( $N = 26,078$ )*

Sex	Frequency	Percent
Male	12815	49.1
Female	13254	50.8
Missing	9	0.0
Total	26078	99.9

Table 10

*Participants by Grade (N = 26,078)*

Grade	Frequency	Percent
5	64	0.2
6	5101	19.6
7	5205	20.0
8	5266	20.2
9	5395	20.7
10	4904	18.8
11	143	0.5
Total	26078	100

In terms of physical activity level, overall 22.7% report meeting the recommendation of 60 minutes of MVPA per day (Table 11) and the grand mean is 4.43. This percentage is higher than independent physical data sources in Canada indicate and is likely the result of a self-report bias (Kohl, Fulton, & Casperson, 2000). Broken down by sex, boys ( $M = 4.79$ ) report being physically active for 60 minutes a day more often in the last week than girls ( $M = 4.19$ )  $t(26,077) = 24.121, p < .001$ , mean difference = .605, 95% CI of mean difference = .556, .655 (Table 12). By cohort, males are more active than females in grades 6 through 10 (Table 13). Grades 5 and 11 and proportionally underrepresented, otherwise it is likely that girls would be significantly less active too. Over 50% of all respondents report participation in sport clubs (50.8%), with slightly more boys (50.8%) than girls (49.1%) participating.

Table 11

*Number of Days Last Week with at least 60 Minutes of Physical Activity*

Number of Days	Frequency	Percent
0	952	3.7
1	1456	5.6
2	2363	9.1
3	3392	13.0
4	3679	14.1
5	4620	17.7
6	3301	12.7
7	5837	22.4
Missing	478	1.8
Total	26078	100

Table 12

*Number of Days Last Week with at least 60 Minutes of Physical Activity by Sex*

Number of Days	Boys		Girls	
	Frequency	Percent	Frequency	Percent
0	425	3.3	527	4.0
1	552	4.3	904	6.8
2	893	7.0	1467	11.1
3	1412	11.0	1980	14.9
4	1679	13.1	1999	15.1
5	2265	17.7	2354	17.8
6	1732	13.5	1570	11.8
7	3601	28.1	2235	17.1
Missing	258	2.0	219	1.7
Total	12,815	100	13,254	100

Table 13

*Comparison of mean number of days out of the last 7 with at least 60 minutes of moderate to vigorous physical activity, by grade and sex*

Grade	Boys Mean PA	Boys SD	Girls Mean PA	Girls SD	Df	F
5	4.69	1.958	4.40	1.968	63	0.33
6	4.97	1.984	4.58	1.954	4979	50.65*
7	4.90	1.985	4.39	1.980	5082	84.28*
8	4.78	1.987	4.09	2.000	5162	158.06*
9	4.77	2.010	4.08	1.981	5304	159.64*
10	4.56	2.028	3.83	2.056	4853	54.07*
11	4.01	2.010	3.84	2.162	138	0.24

\*  $p < .001$

In terms of SES, the scale ranges from 0 – 9, with larger values representing higher level ( $M = 6.10$ ,  $sd = 1.70$ ). Personal social capital ranges from a low of 5 to a high of 30 ( $M = 19.26$ ,  $sd = 5.75$ ); School social capital ranges from a low of 5 to a high of 24 ( $M = 17.50$ ,  $sd = 3.97$ ); Neighbourhood Social Capital ranges from a low of 5 to a high of 25 ( $M = 18.59$ ,  $sd = 3.60$ ); Peer Bonding Social Capital ranges from a low of 1 to a high of 20 ( $M = 15.03$ ,  $sd = 3.58$ ); Bridging Social Capital ranges from a low of 3 to a high of 15 ( $M = 10.25$ ,  $sd = 2.60$ ). The five social capital measures (level 1) and SES (level 1) are all correlated (Table 14).

Table 14

*HBSC Adolescent Social Capital Scale Factor correlation matrix (N = 26,078)*

Factor	1	2	3	4
1. Personal SC	-			
2. School SC	.202	-		
3. Neighbourhood SC	.192	.276	-	
4. Bridging SC	.201	.459	.264	-
5. Peer Bonding SC	.185	.014	.118	.133

All correlations are significant,  $p < .001$

### **Multilevel analysis**

The multilevel analysis (Table 14) produced a multilevel regression model for predicting adolescent physical activity. The data were standardized and then grand mean centered prior to calculating the models. Each of the significant predictor variables represents the amount and direction of change in an individual's level of physical activity as a result of a one unit change in that predictor. For instance, in Model 1, as a participant enters a subsequent grade, the amount of physical activity is predicted to decrease 0.07 units. Similarly, if a participant joins a sport club after not having been a member, his or her physical activity is predicted to increase by 0.23 units. Model 1 ( $\sigma^2 = 0.817$ ) accounts for 13% of the variance in physical activity. The intraclass coefficient (0.056) tells us that 5.6% of the variance is due to level 2 effects. Based on the significant predictors, Model 1 produces the following hierarchical linear model for predicting adolescent physical activity:

$$PA_{ij} = \beta_{00} + \beta_{01}(\text{Neighbourhood } SC_j) + \beta_{10}(\text{Grade}_{ij}) + \beta_{20}(\text{Gender}_{ij}) + \beta_{30}(\text{Personal } SC_{ij}) + u_3 + \beta_{40}(\text{Neighbourhood } SC_{ij}) + u_4 + \beta_{50}(\text{Bridging } SC_{ij}) + u_5 + \beta_{60}(\text{Peer Bonding } SC_{ij}) + u_6 + \beta_{70}(\text{Sport Club}_{ij}) + r$$

All of the variables that were entered into Model 1 were also entered into Model 2 along with SES at level 1. The Model 2 results show that the only significant variable from Model 1 that is no longer significant in Model 2 is Neighbourhood Social Capital (level 2). All other predictors remain in the model. Model 2 ( $\sigma^2 = 0.813$ ) accounts for 14.1% of the variance in physical activity. The intraclass coefficient (0.062) indicates that 6.2% of the variance is due to level 2 effects. Based on the significant predictors, Model 2 produces the following hierarchical linear model for predicting adolescent physical activity:

$$PA_{ij} = \beta_{00} + \beta_{10}(\text{Grade}_{ij}) + \beta_{20}(\text{Gender}_{ij}) + \beta_{30}(\text{Personal } SC_{ij}) + u_3 + \beta_{40}(\text{Neighbourhood } SC_{ij}) + u_4 + \beta_{50}(\text{Bridging } SC_{ij}) + u_5 + \beta_{60}(\text{Peer Bonding } SC_{ij}) + u_6 + \beta_{70}(\text{Sport Club}_{ij}) + \beta_{80}(\text{SES}_{ij}) + u_8 + r.$$

Model 3, into which the interaction terms between level 1 and level 2 social capital variables was entered, showed no significant differences from Model 2 and did not account for any additional variance ( $\sigma^2 = 0.813$ ).

Table 14

*Hierarchical linear models of physical activity, predicted by individual and community-level variables, social capital and socioeconomic status*

Variable (level)	Model 1		Model 2		Model 3	
	b (SE)	T	b (SE)	T	b (SE)	T
Constant	1.03(0.07)	14.18**	1.02(0.01)	13.99**	1.00(0.07)	13.71**
<i>Level 1:</i>						
School Grade	-0.07(0.01)	-7.89**	-0.07(0.01)	-7.72**	-0.06(0.01)	-7.45**
Gender (male)	-0.32(0.01)	-23.31**	-0.32(0.01)	-23.22**	-0.32(0.01)	-23.19**
Personal	0.11(0.01)	17.56**	0.11(0.01)	17.25**	0.11(0.01)	17.30**
School	-0.00(0.01)	-0.38	-0.00(0.01)	-0.36	-0.00(0.01)	-0.50
Neighbourhood	0.07(0.01)	9.72**	0.06(0.01)	8.99**	0.06(0.01)	9.18**
Bridging	0.02(0.01)	2.24*	0.02(0.01)	2.35*	0.01(0.01)	1.92
Peer Bonding	0.10(0.01)	15.59**	0.09(0.01)	14.76**	0.09(0.01)	14.72**
Sport Club	0.23(0.01)	31.57**	0.22(0.01)	30.63**	0.21(0.01)	30.58**
SES	-	-	0.05(0.01)	8.52**	0.05(0.01)	8.03**
<i>Level 2:</i>						
Personal	-0.03(0.06)	-0.55	-0.03(0.06)	-0.54	-0.04(0.06)	-0.67
School	-0.08(0.04)	-1.76	-0.08(0.04)	-1.78	-0.07(0.04)	-1.57
Neighbourhood	0.09(0.05)	2.01*	0.07(0.05)	1.44	0.02(0.05)	0.31
Bridging	-0.01(0.05)	-0.17	0.00(0.05)	-0.02	0.02(0.06)	0.30
Peer Bonding	0.08(0.04)	1.82	0.07(0.04)	1.49	0.04(0.04)	0.37
SES	-	-	-	-	0.09(0.04)	2.10*
<i>Cross-level interactions:</i>						
Person*Person					0.03(0.03)	1.05
School*School					-0.02(0.02)	-0.74
Neigh*Neigh					0.02(0.02)	1.09
Bridge*Bridge					-0.03(0.02)	-1.38
Bond*Bond					-0.03(0.02)	-1.23
SES*SES					-0.01(0.02)	-0.38
Level 1 variance	0.817		0.813		0.813	
Level 2 variance						
Intercept	0.040		0.038		0.037	
Personal slope	0.001		0.001		0.001	
School slope	0.003		0.003		0.003	
Neigh slope	0.002		0.002		0.002	
Bridge slope	0.001		0.001		0.000	
Bond Slope	0.002		0.002		0.002	
Sport Club	0.004		0.005		0.005	
SES	-		0.002		0.001	
Intraclass coefficients	0.061		0.062		0.059	

\*p &lt; .05 \*\*p &lt; .01.

The mechanism underlying the change in neighbourhood social capital (level 2) between Model 1 and Model 2 was explored through mediation analysis (Krull & MacKinnon, 2001). Multilevel mediation modeling allows for testing mediated effects in clustered datasets and can accommodate initial and mediator variables measured at either the group or the individual level (Krull & MacKinnon, 2001). Using a 2→1→1 multilevel mediational model, I analyzed whether neighbourhood social capital ( $X_j$ ) affects the individual-level mediator SES ( $M_{ij}$ ), which in turn affects individual-level physical activity ( $Y_{ij}$ ) (Krull & MacKinnon, 2001) (Figure 2).

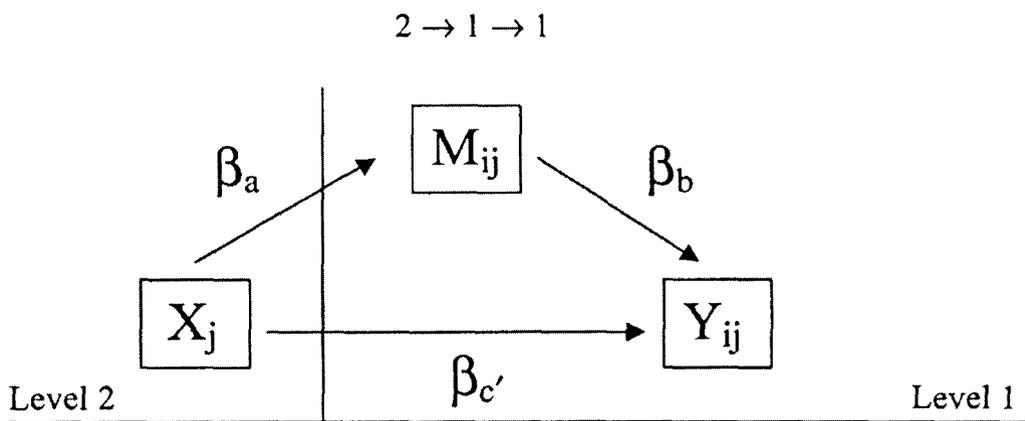


Figure 2. Multilevel mediation model (Krull & MacKinnon, 2001)

Following the procedure outlined by Krull and MacKinnon (2001), a regression equation was calculated to predict the mediator (level 1 SES;  $M_{ij}$ ) from the initial variable, level 2 neighbourhood social capital ( $X_j$ ), using the following multilevel equation:

$$\text{Level 1: } M_{ij} = \beta_{0j} + \beta_a X_j + r_{ij}$$

$$\text{Level 2: } \beta_{0j} = \beta_{00} + u_{0j}$$

A regression equation predicting physical activity ( $Y_j$ ) from both level 2 neighbourhood social capital ( $X_j$ ) and the mediator, level 1 SES ( $M_j$ ) was also calculated:

$$\text{Level 1: } Y_j = \beta_{0j} + \beta_c X_j + \beta_b M_j + r_j$$

$$\text{Level 2: } \beta_{0j} = B_{00} + u_{0j}$$

The product,  $\beta_a \beta_b$ , represents the affect of neighbourhood social capital (level 2) on SES (level 1) and, in turn, the affect of SES (level 1) on physical activity. Significance testing was performed using the Sobel method for HLM (Zhang, et al., 2009) and indicated a partial indirect effect between level 2 neighbourhood social capital ( $B_a = 0.506$ ;  $SE_a = 0.05$ ) and level 1 SES ( $B_b = 0.122$ ;  $SE_b = 0.006$ ) and physical activity ( $z = 9.00$ ;  $p < .001$ ).

### **Discussion—Research Question #3**

Adolescent physical activity is associated with adolescent social capital both individually and contextually. The current research supports the application of an empirically developed multi-factored model of adolescent social capital to the study of adolescent physical activity and provides empirical support for the use of social capital as a multilevel construct. The current research expanded upon the base of knowledge in the field of adolescent physical activity research by showing the positive relation of personal social capital (level 1), neighbourhood social capital (level 1 and level 2), bridging social capital (level 1) and peer bonding social capital (level 1) on adolescent physical activity.

Research Question #3 sought to employ the HBSC Adolescent Social Capital Scale to explore the relation between adolescent social capital and physical activity through a multilevel regression model. Based on the five-factor model of adolescent social capital at level 1 (i.e., individual) and level 2 (i.e., school) as well as established individual level predictors (i.e., grade level, gender, sport club involvement), multilevel regression models were calculated to determine the association with adolescent physical activity. The variables grade level, gender, personal social capital (level 1), neighbourhood social capital (level 1 and 2), bridging social capital (level 1) and peer bonding social capital (level 1) all positively predicted physical activity. When SES (levels 1) was entered into the model, neighbourhood social capital (level 2) was removed, but all of the level 1 predictors remained in the model. In terms of the variables that were not included in the Model, four of the five contextual (i.e., level 2) social capital variables (personal, school, bridging and peer bonding) were not significant

predictors. None of the interaction terms between social capital variables (e.g., personal  $sc_y$  x personal  $sc_j$ ) predicted physical activity. This is interpreted to mean that, when it comes to physical activity, social capital operates primarily at the individual level. At the individual level, school social capital was the only variable that was not associated with adolescent physical activity. School social capital represents an individual's perception of his or her own relationships with teachers and his or her sense of generalized trust at school and is not reflective of curriculum or attitude towards physical activity. As this data indicates a lack of relation, as opposed to a negative or positive relation, with physical activity, it is possible that those students who score higher on school social capital may be engaged in a wider-array of activities at school that may include a moderate level of physical activity.

The research indicates that as an individual's perception of these diverse forms of social capital (i.e., personal, neighbourhood, bridging, and peer bonding) increases, so too does that individual's level of physical activity. Due to the active role that adolescents play in developing their networks and in accumulating social capital (Leonard, 2005), the forms of social capital that relate to physical activity represent modifiable social factors (Haughton McNeill, Kreuter, & Subramanian, 2006). For instance, based on the linear models, it is predicted that by doing more favours for others (i.e., personal social capital) or by communicating more with close friends (i.e., peer bonding social capital) that an individual will become more physically active. This may represent an oversimplification of adolescent reality. As Meier (1999) points out, adolescent friendships and behavioural norms within peer groups represent a very strong influence on adolescent behaviours, and, therefore, as a means of increasing physical activity, it is likely that social capital is

most effectively accumulated with others who are physically active or who share health and behavioural norms that support physical activity (Jago, et al., 2011; Neumark-Sztainer, et al., 2003). In cases like these, social capital is theorized to operate through communication about opportunities to participate in physical activity and support for physical activity behaviours (Cradock, et al., 2008).

At the contextual level, neighbourhood social capital (level 2) related to adolescent physical activity. This represents a unique and potentially important finding of the current research that supports previous theoretical and empirical research (Cradock, et al., 2008; Franzini, et al., 2009; Stafford, et al., 2007; Ueshima, et al., 2010). Specifically, changes in the neighbourhood social capital (level 2) in the area where a person lives, while all other variables remain constant, is associated with a change in adolescent physical activity. That is to say that if an individual's perception of neighbourhood social capital (level 1) remains unchanged while the overall neighbourhood social capital (level 2) where he or she lives increases (i.e., the mean level of neighbourhood social capital as perceived by all of the neighbours rises), that individual's level of physical activity is predicted to increase. This demonstrates the multidimensionality of social capital and the contextual influence of social capital on individual health outcomes.

Mediation analysis showed a partial indirect effect from level 2 neighbourhood social capital on physical activity via level 1 SES. Physical activity researchers have previously identified SES as an individual-level predictor of physical activity (Canadian Fitness & Lifestyle Research Institute, 2009). In this case, however, it is demonstrated that one mechanism through which neighbourhood social capital (level 2) relates to

physical activity is through SES (level 1). Put another way, the association between neighbourhood social capital and physical activity appears to be facilitated through individual SES. The implication is that financial means enable higher SES adolescents to access more of the resources and opportunities to be physically active that are generated through neighbourhood social capital.

## Conclusions

Social Capital is a multidimensional latent construct that is positively linked to a wide-range of adolescent health outcomes including physical activity (Coleman, 1988; Putnam, 2000; Szreter & Woolcock, 2004). The HBSC Adolescent Social Capital Scale refines the understanding of adolescent social capital and provides researchers with an instrument for assessing levels of social capital according to an empirically-derived model that builds off of the theoretically popular bonding, bridging, linking model of social capital (Putnam, 2000; Szreter & Woolcock, 2004), while also incorporating the multilevel (i.e., public good vs private good) nature commonly referenced in the literature (Coleman, 1988) and addressing aspects unique to adolescents (Morrow, 1999). The HBSC Adolescent Social Capital Scale identifies five independent and correlated forms of social capital: personal social capital; bridging social capital; peer bonding social capital; neighbourhood social capital; and school social capital. These represent an individual's perceptions of trust, reciprocity and respect within the relationships and contexts of his or her daily life as well as the perception of his or her investments made towards accumulating social capital. Through the use of multilevel modeling, the HBSC Adolescent Social Capital Scale can be applied towards assessing the influence of the five forms of social capital at contextual levels as well as individual levels on a wide range of health outcomes.

In response to the dramatic increase in the rates of adolescent overweight and obesity over the last 30 years, the social environment is being increasingly studied as it relates to adolescent physical activity. By applying the HBSC Adolescent Social Capital

Scale to the study of physical activity, four individual-level forms of social capital and one contextual-level form of social capital were shown to positively predict adolescent physical activity. Personal social capital, bridging social capital, peer bonding social capital and neighbourhood social capital (level 1 and 2) are all positively related to physical activity. Further analysis indicates that the relation between neighbourhood social capital (level 2) and physical activity can be partially explained by individual SES, which is a well-established correlate of physical activity.

Over the past 30 years, the fitness of Canadian children and adolescents has significantly deteriorated. Relatively few children and adolescents meet the daily recommended level of moderate to vigorous physical activity, which is concerning as each age group becomes less active as it progresses from one year to the next. While a high level of physical activity during adolescence is associated with a high level of adult physical activity (Telama, et al., 2005), physical inactivity and sedentary behaviours during adolescence are key contributors to overweight and obesity over the lifetime (Strong, et al., 2005; Tremblay & Willms, 2003). As a result of its influence on adult physical activity, adolescent physical activity plays a critical role in determining the public health of the population (Telama, et al., 2005). It is, therefore, imperative that researchers work to better understand the factors that are supportive of adolescent physical activity in an effort to reverse these trends in physical activity.

The strengths of the current research are the large sample size ( $N = 26,078$ ), the reliable and validated measures from the HBSC and the use of multilevel models which enabled the modelling of random effects and the analysis of predictors at two levels of

influence. The current research was limited by the cross-sectional design, which inhibits the ability to make inferences about causal or temporal relations between variables. Further limitations include *post-hoc* identification of variables intended to assess social capital within the HBSC, which allows for less specificity than data purposefully collected for the study of social capital. The study is also limited by the self-report nature of the measures, in particular the use of a self-report physical activity measure likely overestimated reality.

The current research concludes that social capital has a multilevel relationship with adolescent physical activity. Operating both as a private good and a public good, four forms of social capital at the individual level (personal, bridging, peer bonding, neighbourhood) and one form at the contextual level (neighbourhood) positively relate to physical activity. An increase in any of these forms of social capital is predicted to result in an increase in physical activity. These are potentially important findings that may be applied towards improving levels of physical activity and fitness of Canadian adolescents in the short term and towards improving the public health of the nation in the longer term.

It is believed that these varying forms of individual-level social capital work to reinforce behavioural norms that support an active lifestyle, to facilitate activity through safe neighbourhoods and to provide access to programming and facilities that enable people to be physically active (Cradock, et al., 2008). Future research might address questions of whether these truly are the mechanisms through which social capital operates and whether the influence of the varying forms of social capital is dependent on demographics (e.g., gender, age), physical environment (e.g., urban vs. rural), personal

correlates of physical activity (e.g., personal motivation, parental support), types of physical activity (e.g., organized vs. pick-up games; team vs. individual activity) or other factors.

### References

- Active Healthy Kids Canada. (2010). Healthy Habits Start Earlier Than You Think. The Active Healthy Kids Canada Report Card on Physical Activity for Children and Youth. Toronto, ON.
- Bentler, P., & Bonett, D. G. (1980). Significance Tests and Goodness of Fit in the Analysis of Covariance Structures. *Psychological Bulletin*, 88 (3), 588-606.
- Bourdieu, P. (1986). The Forms of Capital. In J. E. Richardson, *Handbook of Theory and Research for the Sociology of Education* (pp. 241-258). New York: Greenwood Press.
- Bourdieu, P., & Wacquant, L. J. (1992). *An Invitation to Reflexive Sociology*. Chicago: University of Chicago Press.
- Boyce, W. F., Davies, D., Gallupe, O., & Shelley, D. (2008). Adolescent Risk Taking, Neighborhood Social Capital and Health. *Journal of Adolescent Health*, 43 (3), 246-252.
- Broderson, N. H., Steptoe, A., Williamson, S., & Wardle, J. (2005). Sociodemographic, Developmental, Environmental, and Psychological Correlates of Physical Activity and Sedentary Behavior at age 11 and 12. *Annals of Behavioral Medicine*, 29 (1), 2-11.

- Bronfenbrenner, U. (1993). Ecological Models of Human Development. In M. Gauvain, & M. Cole, *Readings on the Development of Children (2nd Edition)* (pp. 37-43). New York: Freeman.
- Canadian Fitness & Lifestyle Research Institute. (2009). *Kids Can Play*. Ottawa: CFLRI.
- Cole, T. J., Bellizzi, M. C., Flegal, K. M., & Dietz, W. H. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal*, 320 (7244), 1240-1243.
- Coleman, J. S. (1988). Social Capital in the Creation of Human Capital. *The American Journal of Sociology*, Vol. 94, Supplement: Organizations and Institutions: Sociological and Economic Approaches to the Analysis of Social Structure, S95-S120.
- Cortina, J. M. (1993). What is Coefficient Alpha? An Examination of Theory and Applications. *Journal of Applied Psychology*, 78 (1), 98-104.
- Currie, C., Molcho, M., Boyce, W., Holstein, B., & Torsheim, T. R. (2008). Researching Health Inequalities in Adolescents: The Development of the Health Behaviour in School-Aged Children (HBSC) Family Affluence Scale. *Social Science & Medicine*, 66 (6), 1429-1436.
- Cradock, A. L., Kawachi, I., Colditz, G. A., Gortmaker, S. L., & Buka, S. L. (2008). Neighborhood Social Cohesion and Youth Participation in Physical Activity in Chicago. *Social Science & Medicine*, 68 (3), 427-435.

Duncan, S. C., Duncan, T. E., Strycker, L. A., & Chaumeton, N. R. (2004). A Multilevel Approach to Youth Physical Activity Research. *Exercise and Sports Sciences Reviews*, 32 (3), 95-99.

Elgar, F., Trites, S., & Boyce, W. (2010). Social Capital Reduces Socioeconomic Differences in Child Health: Evidence from the Canadian Health Behaviour in School-aged Children Study. *Canadian Journal of Public Health*, 101 (Suppl. 3), S23-S27.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the Use of Exploratory Factor Analysis in Psychological. *Psychological Methods*, 4 (3), 272-299.

Ferreira, I. V., Wendel-Vos, W., Kremers, S., van Lenthe, F. J., & Brug, J. (2006). *Obesity Reviews*, 2 (2).

Field, J. (2008). *Social Capital, Second Edition*. New York: Routledge.

Franzini, L., Elliott, M. N., Cuccaro, P., Schuster, M., Gilliland, M. J., Grunbaum, J. A., et al. (2009). Influences of Physical and Social Neighborhood Environments on Children's Physical Activity and Obesity. *American Journal of Public Health*, 99 (2), 271-278.

Freedman, D. S., Kettel Khan, L., Serdula, M. K., Dietz, W. H., Srinivasan, S. R., & Berenson, G. S. (2005). The Relation of Childhood BMI to Adult Adiposity: The Bogalusa Heart Study. *Pediatrics*, 115 (1), 22-27.

- Freedman, D. S., Srinivasan, S. R., Valdez, R. A., Williamson, D. F., & Berenson, G. S. (1997). Secular Increases in Relative Weight and Adiposity Among Children Over Two Decades: The Bogalusa Heart Study. *Pediatrics*, *99* (3), 420-426.
- Freedson, P., & Evenson, S. (1991). Familial Aggregation in Physical Activity. *Research Quarterly for Exercise and Sport*, *62* (4), 384-389.
- Goran, M. I. (2001). Metabolic Precursors and Effects of Obesity in Children: A Decade of Progress, 1990 - 1999. *American Journal of Clinical Nutrition*, *73* (2), 158-171.
- Harpham, T. (n.d.). *Measuring the Social Capital of Children*. UK: Department for International Development.
- Haughton McNeill, L., Kreuter, M. W., & Subramanian, S. V. (2006). Social Environment and Physical Activity: A Review of Concepts and Evidence. *Social Science & Medicine*, *63* (4), 1011-1022.
- Helve, H., & Bynner, J. (2007). Social Capital and Young People. In H. Helve, & J. Bynner, *Youth and Social Capital* (pp. 1-10). London: Tufnell Press.
- Hu, L.-t., & Bentler, P. R. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6* (1), 1-55.

- Jago, R., MacDonald-Wallis, K., Thompson, J. L., Page, A. S., Brockman, R., & Fox, K. R. (2011). Better with a Buddy: Influence of Best Friends on Children's Physical Activity. *Medicine & Science in Sports & Exercise*, 43 (2), 259-265.
- Janssen, I., & LeBlanc, A. G. (2010). Systematic Review of the Health Benefits of Physical Activity and Fitness in School-aged Children and Youth. *International Journal of Behavioral Nutrition and Physical Activity*, 7 (40), 1-16.
- Kawachi, I., Kim, D., Coutts, A., & Subramanian, S. (2004). Commentary: Reconciling the Three Accounts of Social Capital. *International Journal of Epidemiology*, 33 (4), 682-690.
- Kohl, H. W., Fulton, J. E., & Casperson, C. J. (2000). Assessment of Physical Activity among Children and Adolescents: A Review and Synthesis. *Preventive Medicine*, 31, S54-S76.
- Krull, J. L., & MacKinnon, D. P. (2001). Multilevel Modeling of Individual and Group Level Mediated Effects. *Multivariate Behavioral Research*, 36 (2), 249-277.
- Leahey, T. M., Gokee LaRose, J., Fava, J. L., & Wing, R. R. (2010). Social Influences Are Associated With BMI and Weight Loss Intentions in Young Adults. *Obesity*.
- Leonard, M. (2005). Children, Childhood and Social Capital: Exploring the Links. *Sociology*, 39 (4), 605-622.
- Meier, A. (1999). *Social Capital and School Achievement Among Adolescents*. University of Wisconsin-Madison.

- Moore, S., Daniel, M., Paquet, C., Dube, L., & Gauvin, L. (2009). Association of Individual Network Social Capital with Abdominal Adiposity, Overweight and Obesity. *Journal of Public Health, 31* (1), 175-183.
- Morrow, V. (1999). Conceptualising social capital in relation to the well-being of children and young people: a critical review. *The Sociological Review, 47* (4), 744-765.
- Neumark-Sztainer, D., Story, M., Hannan, P. J., Tharp, T., & Rex, J. (2003). Factors Associated with Changes in Physical Activity. *Archives of Pediatrics & Adolescent Medicine, 157* (8), 803-810.
- Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J., & Flegal, K. M. (2006). Prevalence of Overweight and Obesity in the United States, 1999-2004. *Journal of the American Medical Association, 295* (13), 1549-1555.
- Onyx, J., & Bullen, P. (2000). Measuring Social Capital in Five Communities. *The Journal of Applied Behavioral Science, 36* (1), 23-42.
- Portes, A. (1998). Social Capital: Its Origins and Applications in Modern Sociology. *Annual Review of Sociology, 24*, 1-24.
- Prochaska, J. J., Salis, J. F., & Long, B. (2001). *Archives of Paediatrics & Adolescent Medicine, 155*, 554-559.
- Putnam, R. D. (2000). *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster.

Reilly, J., Methven, E., McDowell, Z., Hacking, B., Alexander, D., Stewart, L., et al.

(2003). Health Consequences of Obesity. *Archives of Disease in Childhood*, 88, 748-752.

Sallis, J. F., Prochaska, J. J., Taylor, W. C., Hill, J. O., & Geraci, J. C. (1999). Correlates

of Physical Activity in a National Sample of Girls and Boys in Grades 4 through 12. *Health Psychology*, 18 (4), 410-415.

Smedley, B., & Syme, S. (2000). *Promoting Health: Intervention Strategies from Social*

*and Behavioral Research*. Washington, DC: National Academies Press.

Stafford, M., Cummins, S., Elleway, A., Sacker, A., Wiggins, R. D., & Macintyre, S.

(2007). Pathways to Obesity: Identifying Local, Modifiable Determinants of Physical Activity and Diet. *Social Science & Medicine*, 65 (9), 1882-1897.

Stanton-Salazar, R. R., & Urso Spina, S. (2005). Adolescent Peer Networks as a Context

for Social and Emotional Support. *Youth & Society*, 36 (4), 379-417.

Steinfeld, C., Ellison, N. B., & Lampe, C. (2008). Social Capital, Self-Esteem, and Use

of Online Social Network Sites: A Longitudinal Analysis. *Journal of Applied Developmental Psychology*, 29 (6), 435-445.

Strong, W. B., Malina, R. M., Blimke, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., et

al. (2005). Evidence Based Physical Activity for School-Age Youth. *Journal of Pediatrics*, 146 (6), 732-737.

- Subramanian, S., Jones, K., & Duncan, C. (2003). Multilevel Methods for Public Health Research. In I. Kawachi, & L. F. Berkman, *Neighborhoods and Health* (pp. 65-111). New York: Oxford University Press.
- Subramanian, S., Lochner, K. A., & Kawachi, I. (2003). Neighborhood Differences in Social Capital: A Compositional Artifact or a Contextual Construct? *Health and Place*, 9 (1), 33-44.
- Szreter, S., & Woolcock, M. (2004). Health by Association? Social Capital, Social Theory, and the Political Economy of Public Health. *International Journal of Epidemiology*, 33 (4), 650-667.
- Tataryn, D. J., Wood, J. M., & Gorsuch, R. L. (1999). Setting the Value of K in Promax: A Monte Carlo Study. *Educational and Psychological Measurement*, 59 (3), 384-391.
- Telama, R., Yang, X., Vikari, J., Valmaki, I., Wanne, O., & Raitakari, O. (2005). Physical activity from childhood to adulthood: a 21-year tracking study. *American Journal of Preventive Medicine*, 28 (3), 267-273.
- Thompson, B. (2004). *Exploratory and Confirmatory Factor Analysis: Understanding Concepts and Applications*. Washington, DC: American Psychological Association.

- Tremblay, M. S., Shields, M., Laviolette, M., Craig, C. L., Janssen, I., & Connor Gorber, S. (2010). Fitness of Canadian children and youth: Results from the 2007-2009 Canadian Health Measures Survey. *Health Reports, 21* (1), 1-14.
- Tremblay, M., & Willms, J. (2003). Is the Canadian Childhood Obesity Epidemic Related to Physical Inactivity? *International Journal of Obesity, 27*, 1100-1105.
- Ueshima, K., Fujiwara, T., Takao, S., Suzuki, E., Iwase, T., Doi, H., et al. (2010). Does Social Capital Promote Physical Activity? A Population-Based Study in Japan. *PLoS ONE, 5* (8), e12135.
- Wellie, S., & Bruegel, I. (2009). Children's 'Place' in the Development of Neighbourhood Social Capital. *Urban Studies, 46* (3), 629-643.
- Wentzel, K. R., Filisetti, L., & Looney, L. (2007). Adolescent Prosocial Behavior: The Role of Self-Processes and Contextual Cues. *Child Development, 78* (3), 895-910.
- Williams, D. (2006). On and Off the 'Net: Scales for Social Capital in an Online Era. *Journal of Computer-Mediated Communication, 11* (2), 593-628.
- Woolcock, M. (2001). The Place of Social Capital in Understanding Social and Economic Outcomes. *Isuma: Canadian Journal of Policy Research, 2* (1), 11-17.
- World Health Organization. (2000). *Obesity: Preventing and Managing the Global Epidemic*. World Health Organization.

Wu, Q., Palinkas, L. A., & He, X. (2010). An Ecological Examination of Social Capital Effects on the Academic Achievements of Chinese Migrant Children. *British Journal of Social Work, 40* (8), 2578-2597.

Zhang, Z., Zyphur, M. J., & Preacher, K. J. (2009). Testing Multilevel Mediation Using Hierarchical Linear Models. *Organizational Research Methods, 12* (4), 695-719.

### Appendix A: HBSC Adolescent Social Capital Scale

1. How easy is it for you to talk to the following persons about things that really bother you? (0 = don't have or see this person, 1 = very difficult, 2 = difficult, 3 = easy, 4 = very easy"

- Best friend
- Friends of the same sex
- Friends of opposite sex

2. At present, how many close female friends do you have? (0 = none, 1 = one, 2 = two, 3 = three or more)

3. Here are some statements about the students in your class(es). Please show how much you agree or disagree with each one. (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree)

- Most of the students in my class(es) are kind and helpful
- When a student in my class(es) is feeling down, someone else in class tries to help
- The students in my class(es) treat each other with respect

4. Please show how much you agree or disagree with each one. (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree)

- I feel a lot of trust in my teachers
- Our teachers treat us fairly
- School is a nice place to be
- I feel I belong at this school

5. For each item, mark the box that best describes what you are like as a person. (1 = Definitely not like me, 6 = Definitely like me)

- I often do favours for people without being asked.
- I often lend things to people without being asked.
- I often help people without being asked.
- I often compliment people without being asked.
- I often share things with people without being asked.

6. Please say how you feel about these statements about the area where you live. (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree)

- People say 'hello' and often stop to talk to each other in the street
- It is safe for younger children to play outside during the day
- You can trust people around here
- There are good places to spend your free time (e.g., recreation centres, parks, shopping centres)
- I could ask for help or a favour from neighbours

7. How do you feel about school at present (1 = I don't like it at all, 2 = I don't like it very much, 3 = I like it a bit, 4 = I like it a lot)

8. How often do you talk to your friend(s) on the phone, send them text or email messages or have contact through the internet (1 = rarely or never, 2 = 1 or 2 days a week, 3 = 3 or 4 days a week, 4 = 5 or 6 days a week, 5 = everyday)