Psychological and Social Factors related to Physical Activities and Everyday Activities among South Asian High School Girls in the Toronto Area

by

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy
Dalla Lana School of Public Health
University of Toronto

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Abstract

**Background:** South Asian girls have reported low levels of physical activity (PA) compared to other Canadian adolescents. Potential explanations include omissions in existing PA measures that don’t capture all types of PA, and factors discouraging PA in this group.

**Purpose:** This study examined the quality and quantity of PA; compared PA participation using two self-report methods; and, examined psychosocial and cultural factors associated with PA in adolescent South Asian girls.

**Methods:** 113 participants were recruited from community sources in Toronto. Data were collected using a structured electronic diary (3 weekdays; 2 weekend days) and a self-administered online questionnaire that included the Leisure Time Exercise questionnaire. Diaries were content analyzed and compared to PA reports in the questionnaire. Bivariate and multivariate regression analyses identified factors associated with PA.

**Results:** Diaries revealed that when a range of PA types were captured, like walking activities and chores, PA levels were similar to representative data for Canadian youth. 92% of respondents reported at least 30 minutes of PA per day across their diary entries. However, 19% did not report any PA at the vigorous intensity level, and PA levels were lowest on weekends.
Reports of PA in the diary and questionnaire were inconsistent, with considerably higher levels of PA reported in the questionnaire. Enrolment in physical education, enjoyment, control, fewer barriers, and social provisions were associated with greater PA.

**Conclusions:** Physical activity levels were low, but results did not suggest that South Asian girls are more vulnerable to low levels of activity compared to other Canadian girls. Findings from the diary suggest that PA questionnaires would benefit from including a broader range of activity types with a variety of walking activities, and structured reflections to enhance data quality and minimize the potential for over-reporting. PA levels may be increased through mandatory physical education, curricula that emphasize how girls may engage in vigorous activities outside of classes, and changes to neighbourhood environments that would promote walking.
Acknowledgments

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>3DPAR</td>
<td>3-day Physical Activity Record</td>
</tr>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>CANPLAY</td>
<td>CANadian Physical activity Levels Among Youth</td>
</tr>
<tr>
<td>CCHS</td>
<td>Canadian Community Health Survey</td>
</tr>
<tr>
<td>DPA</td>
<td>Daily Physical Activity</td>
</tr>
<tr>
<td>DRM</td>
<td>Day Reconstruction Method</td>
</tr>
<tr>
<td>DXA</td>
<td>Dual energy X-ray Absorptiometry</td>
</tr>
<tr>
<td>HDL</td>
<td>High Density Lipoprotein</td>
</tr>
<tr>
<td>HSBC</td>
<td>Health Behaviour in School-aged Children</td>
</tr>
<tr>
<td>LTEQ</td>
<td>Leisure Time Exercise Questionnaire</td>
</tr>
<tr>
<td>$M$</td>
<td>Mean</td>
</tr>
<tr>
<td>MET</td>
<td>Metabolic Equivalent of Task</td>
</tr>
<tr>
<td>MVPA</td>
<td>Moderate to Vigorous Physical Activity</td>
</tr>
<tr>
<td>$N$</td>
<td>Number</td>
</tr>
<tr>
<td>n.s.</td>
<td>not significant</td>
</tr>
<tr>
<td>$p$</td>
<td>significance level</td>
</tr>
<tr>
<td>PA</td>
<td>Physical Activity</td>
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<tr>
<td>PACES</td>
<td>Physical Activity Enjoyment Scale</td>
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<tr>
<td>PAQ-A</td>
<td>Physical Activity Questionnaire for Adolescents</td>
</tr>
<tr>
<td>SAPAC</td>
<td>Self-Administered Physical Activity Checklist</td>
</tr>
<tr>
<td>SES</td>
<td>Socio-Economic Status</td>
</tr>
<tr>
<td>$SD$</td>
<td>Standard Deviation</td>
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Chapter 1
Introduction to Youth Physical Activity and Thesis Overview

1 Introduction

Physical activity (PA) has received considerable attention worldwide, both in research and the media because of increasing awareness that day-to-day sources of PA have been largely “engineered” out of our lives. For instance, in developed countries like Canada, the United States, England and Australia, sprawling urban neighbourhoods mean that fewer people live close to locations like schools, workplaces, and grocery stores (Sallis, Millstein, & Carlson, 2011). As a result, it is less feasible for people to walk or cycle for transport and individuals must rely on motorized vehicles. Appliances (e.g., food processors and bread makers) also are commonly used for tasks that previously required manual labour, and prepared foods are affordable and readily available, thereby reducing domestic sources of PA. These lifestyle changes have made leisure a key (and sometimes the only) source of PA for many people.

PA is broadly defined as the movement of skeletal muscle that results in energy expenditure (Ortega, Ruiz, Castillo, & Sjostrom, 2008; Sirard & Pate, 2001), and is one of the main determinants of physical fitness, which affects the functioning of all body systems (Ortega, et al., 2008). Research has identified a range of physical and psychosocial health benefits of PA for individuals across all age groups, and youth in particular (Hills, King, & Armstrong, 2007; Janssen & LeBlanc, 2010; Warburton, Nicol, & Bredin, 2006). Studies focusing on children and youth have shown that participating in physical activities contributes to physical benefits like the development of strong bones and muscles (Boreham & McKay, 2011; Hills, et al., 2007; Janssen & LeBlanc, 2010; MacKelvie, Khan, & McKay, 2002), a healthy muscle to fat ratio (Hills, et al., 2007), and the acquisition of fundamental motor skills like jumping and balancing (Graf et al., 2004). Psychological and social benefits are also emphasized, including the development of moral reasoning (Stephens, Bredemeier, & Shields, 1997), self-confidence and self-esteem (Biddle, Gorely, & Stensel, 2004; Hills, et al., 2007; Hohepa, Schofield, & Kolt, 2006), positive mood and emotions (Janssen & LeBlanc, 2010; Jerstad, Boutelle, Ness, & Stice, 2010; Ortega, et al., 2008), and opportunities to form close relationships with family and friends while experiencing joy and having fun (Hohepa, et al., 2006; Ramanathan & Crocker, 2009). Many of the physical benefits of PA necessitate regular participation at moderate to vigorous intensities of
movement and energy expenditures, whereas psychosocial benefits may result from participation in a wide range of physical activities irrespective of the frequency, intensity, duration or type. Thus, involvement in any PA, regardless of its specific characteristics, plays a valuable role in healthy development.

Population-level research with adults has generally focused on physical outcomes and finds that a lack of regular participation in physical activities contributes to the incidence of heart disease, hypertension, stroke, type II diabetes, osteoporosis, certain cancers, and depression (Cameron, Craig, & Paolin, 2004; Janssen & LeBlanc, 2010). Moreover, risk of death from any cause and from chronic disease is generally highest among the least fit and physically active, and lowest among the most fit and physically active (Warburton, et al., 2006). This strong body of evidence has led to the recommendation that physical activity prescription should become a greater focus of medical school training, and primary care physicians should discuss, promote and prescribe physical activity during each patient visit (Khan, Weiler, & Blair, 2011). A few studies have shown the tracking of PA participation and overall energy expenditures from childhood to adulthood (Craigie, Lake, Kelly, Adamson, & Mathers, 2011; Janz, Dawson, & Mahoney, 2000; Trudeau, Laurencelle, & Shephard, 2004). However, associations between PA participation as a child or adolescent and adult are usually weak because of changing opportunities (i.e., absence of physical education as an adult), changing abilities, and interests with age. However, longitudinal research shows that gaining exposure to a variety of physical activities as a child and adolescent is important to help form healthy habits and “offer opportunities for establishing lifelong involvement in physical activity, independent of the specific type of activity” (Kjonniksen, Torsheim, & Wold, 2008). As well, previous PA participation is a consistent correlate of PA in child and youth studies (Sallis, Prochaska, & Taylor, 2000). This further supports the importance for children and youth to develop interests and gain exposure to a variety of physical activities.

Many socio-demographic factors have been considered in youth PA research, revealing poor participation trends, and subsequently raising concerns over the present and future health of young Canadians. Canadian data indicates that adolescents are presently engaging in low levels of PA and that PA levels tend to decrease from childhood through to adulthood (Active Healthy Kids Canada, 2008, 2011; Bagley, Salmon, & Crawford, 2006; Cameron, et al., 2004; Canadian Fitness and Lifestyle Research Institute, 2007). Moreover, the Canadian Community Health Survey (CCHS) cycles 1.1 and 2.1 (Cameron, et al., 2004) and smaller research studies with
North American populations show that girls report less PA participation than boys at all ages, older youth are less active than younger youth, and the gap between girls and boys is largest among older youth (Bagley, et al., 2006; Bryan & Walsh, 2004; Dumith, Gigante, Domingues, & Kohl, 2011; Nettlefold et al., 2011; Sallis, et al., 2000; Sallis, Zakarian, Hovell, & Hofsetter, 1996).

Using collapsed census categories for “ethnicity” or “race”, cross-sectional surveys in North America indicate that groups of “visible minority” ethnicity/races report lower levels of PA compared to Caucasian populations (Bryan, Tremblay, Perez, Arden, & Katzmarzyk, 2006; Bryan & Walsh, 2004; Gordon-Larsen, McMurray, & Popkin, 2000; Liu et al., 2010; Rhodes, Macdonald, & McKay, 2006; Vuksan et al., 2012). In fact, the CCHS (cycle 1.1) identifies South Asian females ages 12 years and older to be particularly at risk for low levels of PA, with 73% classified as “inactive” (i.e., expending less than 1.5 kilocalories per kilogram of bodyweight per day, roughly equivalent to less than 15 minutes of moderate to vigorous PA) (Bryan & Walsh, 2004). Furthermore, pooled data from cycles 1.1, 2.1 and 3.1 shows the highest prevalence of inactivity among South Asian males and females ages 12 and above (64.9%) compared to all other ethnic groups in Canada (Liu, et al., 2010). However, there is little information on how or why South Asian ethnicity may be related to low levels of PA.

Low levels of PA participation among South Asians is of concern because when compared to other Canadian ethno-cultural subgroups, South Asian adults show a greater prevalence of many chronic disease risk factors including glucose intolerance, higher total cholesterol, higher triglycerides, and abdominal obesity (Anand et al., 2000; Gupta et al., 2002). Emerging evidence also suggests that South Asian youth exhibit higher rates of cardiovascular risk factors compared to other population groups (Vuksan, et al., 2012). The clustering of these risk factors is known as metabolic syndrome, and places South Asian populations at higher risk of cardiovascular disease (Anand et al., 2003). These health concerns take on added importance given that 2006 Census data show that South Asians are the largest ethno-cultural minority group in Canada (Statistics Canada, 2008a).

The limited research on PA among South Asian youth in Canada has highlighted psychosocial factors including social networks (i.e., parents, siblings, friends and cultural communities) and perceptions of support in PA as important correlates of PA participation among females in
particular (Ramanathan & Crocker, 2009; Vertinsky, Batth, & Naidu, 1996). As well, there is a lack of comprehensive information on the major time commitments of South Asian adolescent girls (e.g., extra-curricular activities and part-time jobs), that would help researchers understand the types and extent of PA in which this group engages. We also lack information about potential facilitators (e.g., enrolment in physical education, participation in school sport teams) and barriers (e.g., lack of control over PA choices) related to PA, as well as the potential influence of social factors (e.g., perceptions of support from parents, peers and friends) in supporting or undermining PA. This absence of information creates challenges for educators and policy makers in developing PA promotion strategies to increase PA involvement in this population. As such, the goal of this thesis is to better understand the quality (i.e., location, companions and type), and quantity (i.e., frequency, intensity and duration) of PA participation, and psychological, social and cultural factors associated with PA among South Asian high school girls.

1.1 Research Questions

How do South Asian high school girls spend their time on weekdays and weekends, and what is the role of physical activity (PA) among their everyday activities?

Are perceptions of PA, social networks, religious and cultural heritage associated with the quality and quantity of PA participation?

Does participation in PA differ by junior and senior grade levels and enrolment in physical education classes?

1.2 Research Objectives

The overall objective of this thesis was to examine the quality and quantity of PA in a sample of South Asian high school girls with a focus on comparing weekdays and weekends, and the role that personal, social and structural or environmental factors have in PA behaviours.

1.2.1 Objective 1

a) To examine details of the everyday activities of adolescent girls comparing weekdays and weekends as well as potential differences in activities by grade using a diary method, with a focus on the types, location and companions for PA participation.
b) To examine and compare PA duration and intensity (i.e., vigorous bouts, sweating and moderate to vigorous PA) using two different methods: a diary and recall questionnaire, and also compare PA levels to the Canadian PA guidelines.

1.2.2 Objective 2

To examine the following factors and their relationships to PA:

a) Perceptions of PA enjoyment, parental permission for PA, control over decisions to engage in PA, and barriers to engage in PA.

b) Perceptions of support for PA, attitudes and connectedness to diverse social networks (e.g., friends, families, and peers from other cultures).

c) Religious connections and involvement.

d) Perceptions of cultural and gender-specific attitudes towards PA.

1.3 Thesis Overview

The remaining chapters of the thesis will review research related to the measurement of PA, demographic factors, psychological factors, and South Asian culture, as well as present original data addressing the research objectives described above. Specifically, Chapter 2 will discuss physical, psychological and social health outcomes of PA participation in detail, outline the Canadian recommendations for PA among youth, and synthesize research and key findings on factors related to PA. This chapter will also discuss measures, methods, and health behaviour change theories commonly employed to study PA participation, and outline gaps in our current knowledge. In addition, findings specific to the South Asian population group from census research, leisure studies, and PA studies are presented to substantiate the importance of gaining a better understanding of social factors like culture and religion in relation to PA participation among South Asian high school girls. At the end of the literature review, the study objectives are restated, followed by the hypotheses. Chapters 3 and 4 of the thesis present the methods and results of the research, respectively. Chapter 5 discusses the study findings and the implications of the research, and also presents recommendations for future research, policy and practice, limitations of the research, and conclusions.
Chapter 2
Literature Review

2 Reviewing Literature on Physical Activity and Youth

This chapter is divided into two main sections. The first section outlines health and wellness benefits of engaging in physical activity (PA), the Canadian guidelines for PA among youth (aged 12 to 17 years), and discusses measures and methods employed in PA research. The second section examines factors associated with PA. Demographic factors like age, gender and population (racial/ethnic) groups are discussed followed by health behaviour change theories and key psychological and social factors that have been studied using these theoretical approaches. Findings specific to the South Asian population group are also discussed, with a focus on cultural and religious factors.

2.1 Health & Wellness Benefits of Physical Activity among Youth

Promoting PA has emerged as a critical issue in Canada and worldwide because of increasing rates of chronic disease risk factors among youth like obesity (Public Health Agency of Canada, 2009), and because of well established links between PA and disease prevention (Janssen & LeBlanc, 2010; Tremblay et al., 2010; Tremblay, Warburton, et al., 2011; Warburton, et al., 2006). For example, a recent systematic review showed that risk factors for cardiovascular disease including hypercholesterolemia and high blood pressure that were previously only seen in adult populations are now reported among youth with the lowest levels of fitness as well as youth classified as obese (Janssen & LeBlanc, 2010). At the same time, research has shown that PA interventions can effectively mitigate risk factors for chronic disease. For example, randomized controlled trials with children and youth who were obese or had high cholesterol levels showed that aerobic exercise interventions improved either triglycerides or high density lipoprotein (HDL) cholesterol levels (Janssen & LeBlanc, 2010). As well, a 9-month school-based randomized controlled trial conducted with 50 youth (average age 12.5 years) with body mass indexes above the 95th percentile for their age showed that increased time spent moving during physical education classes along with a modified curriculum (i.e., small classes and a lifestyle focus) led to improved cardiovascular fitness (i.e., maximum oxygen consumption or VO2 max), fat loss, and insulin sensitivity (Carrel et al., 2005). In this study, fat loss was
measured using dual energy x-ray absorptiometry (DXA), and insulin sensitivity was measured using a blood test. At the other end of the spectrum, there is a growing evidence base that sedentary behaviour (e.g., sitting and watching television) may lead to health problems independent of having low PA levels. For instance, a systematic review of 232 studies showed that more than 2 hours of sedentary behaviours per day was associated with a variety of risk factors including increased fat mass and markers of metabolic syndrome (Tremblay, LeBlanc, et al., 2011). Therefore, accumulating evidence points to both engaging in regular PA and reducing sedentary time to alleviate chronic disease risk factors.

Unlike research with adults that tends to focus on the link between PA and disease prevention, literature on youth stems largely from the healthy growth and development literature, including bone development and learning fundamental motor skills. Reviews of research with youth show that the greatest impacts to bone development can be made during adolescence in terms of enhancing bone mineral density and architecture (Boreham & McKay, 2011; Hills, et al., 2007; Janssen & LeBlanc, 2010; MacKelvie, et al., 2002). Although genetic factors play the strongest role, review studies have suggested that environmental factors like diet and participation in specific types and intensities of PA can account for 20 to 40% of the variability in peak bone mass (Boreham & McKay, 2011; Hills, et al., 2007; Janssen & LeBlanc, 2010; MacKelvie, et al., 2002). As an example, one review of 11 experimental studies on bone development showed that as little as 10 minutes per day of resistance or weight-bearing types of activities (e.g., jumping, running, and weight-lifting) led to increases in bone mineral density (Janssen & LeBlanc, 2010). In addition, there is some evidence that self-reported PA at 12 to 18 years of age is associated with bone mineral density among women in later adulthood (Rideout, McKay, & Barr, 2006). Research has also suggested that vigorous and high-impact PA has a stronger osteogenic (i.e., bone-building) potential than moderate PA, likely due to the greater mechanical stresses on the body (MacKelvie, et al., 2002). For instance, a study of 380 healthy adolescents (ages 12.5 to 17.5 years) used curve analysis to examine relationships between moderate and vigorous PA (measured for one week using accelerometers) and bone mass at multiple sites (measured using DXA) (Gracia-Marco et al., 2011). Results showed that daily vigorous PA participation of roughly 30 minutes per day was associated with increased bone density at the hip, intertrochanter, and femoral neck, but 78 minutes of moderate to vigorous PA was needed to see an association with increased bone density at the femoral neck (Gracia-Marco, et al., 2011). In
addition to healthy musculoskeletal development, there is also evidence that participating in physical activities plays an important role in the acquisition of fundamental motor skills. For example, a study of first-grade children ($N = 668$) examined parent-reported regularity of sport and organized PA participation in relation to the development of basic gross motor skills (Graf, et al., 2004). Results showed that children who regularly participated in sport and organized PA achieved the highest combined motor development score for balancing backwards, one-legged obstacle jumping, jumping from side to side, and sideways movements.

Using combinations of observational, experimental and qualitative studies, PA participation has also been linked to a number of outcomes related to psychosocial wellbeing. For instance, research in sport and exercise psychology looking broadly at physical activities of various types and intensities has shown that general PA participation is related to self-confidence and self-esteem (Biddle & Asare, 2011; Biddle, et al., 2004; Hills, et al., 2007; Hohepa, et al., 2006). Focus group research with 44 adolescents (13 to 15 years old) showed that participating in PA was perceived as a way to boost general confidence to “try new things” (Hohepa, et al., 2006). Meta analyses of randomized controlled trials, experimental, and quasi-experimental studies with children and youth have shown that PA participation is associated with small but consistent improvements in self-esteem (Biddle & Asare, 2011). Other research suggests that general PA participation may help to prevent stress and depressive symptoms (Janssen & LeBlanc, 2010; Jerstad, et al., 2010; Norris, Carroll, & Cochrane, 1992). A longitudinal study of 496 adolescent girls (mean age 13 years) over a 6-year period showed that self-reported baseline PA participation outside of physical education classes was related to reduced risk of clinical depressive symptoms over time (Jerstad, et al., 2010). In addition, a cross-sectional study of 147 adolescents (13 to 17 years old) found that self-reported general exercise habits were associated with lower perceived stress and lower depression scores (Norris, et al., 1992). Moreover, a 10-week experimental study with a subset of 60 adolescents suggested that activity intensity was an important factor for alleviating stress. Following the intervention, students who engaged in high intensity aerobic exercise reported significantly lower perceived stress compared to those who engaged in moderate intensity aerobic exercise, flexibility exercise, and those in the control group (Norris, et al., 1992).

With respect to social well-being outcomes, several qualitative studies with youth have shown that making friends and strengthening social networks are cited as key benefits of their PA
participation (Allender, Cowburn, & Foster, 2006; Hohepa, et al., 2006; Humbert et al., 2006; Ramanathan & Crocker, 2009). Findings from a longitudinal study of 10 500 participants (ages 12 to 21) also emphasized social benefits of PA participation (Daniels & Leaper, 2006). Results showed that peer acceptance was associated with participation in physical activities, specifically sports (Daniels & Leaper, 2006). Overall, there is evidence that participating in physical activities is related to adolescent health in ways that extend well beyond disease prevention and physical health to include both psychological and social benefits.

2.2 Physical Activity Recommendations for Health and Wellness

Given the importance of PA to the physical and psychosocial health of youth, considerable attention has been aimed at trying to determine the types and amounts of activities needed for health benefits. The Canadian Society for Exercise Physiology recently updated the Canadian guidelines for PA in January 2011 to reflect current evidence on the dose-response relationship between PA and physical health (Janssen & LeBlanc, 2010), and now provides specific and measurable targets for optimizing health among different age groups. Prior to this update, PA guidelines for Canadian youth were based on the 2002 Physical Activity Guide for Youth (Public Health Agency of Canada, 2002) that recommended increasing PA levels over several months to reach 90 minutes of moderate to vigorous PA (MVPA) per day (e.g., playing a full game of soccer). The 2002 PA Guide for Youth listed examples of moderate and vigorous physical activities, but did not define these intensity levels. Previous International PA Guidelines for youth were lower and recommended expending 6.0 kilocalories per kilogram of body weight daily (Corbin, Pangrazi, & Welk, 1994), roughly equivalent to 60 minutes of MVPA per day (e.g., riding a bicycle for an hour).

Based on recent evidence, the Canadian Society for Exercise Physiology now recommends accumulating 60 minutes of MVPA on a daily basis for children ages 5-11 and youth ages 12-17, and 150 minutes of MVPA per week in bouts of ten minutes or more for adults ages 18 years and older (Canadian Society for Exercise Physiology, 2011a). These Canadian guidelines are the same as the revised International PA guidelines in the Global Recommendations on Physical Activity and Health released in 2011 (World Health Organization, 2011). In addition to recommending a 60-minute duration of daily MVPA for youth, the new Canadian and International PA guidelines provide details about these moderate and vigorous intensity targets.
by defining them as activities that will result in sweating and breathing harder, with vigorous intensity activities leading to an increased sweat response and feelings of being “out of breath” (Canadian Society for Exercise Physiology, 2011b; World Health Organization, 2011). Muscle and bone strengthening activities (e.g., weight bearing activities or resistance training) are also recommended for children and youth at least three days a week, and for adults and older adults at least two days a week. Additionally, school-aged children and youth (5 to 17 years) are recommended to engage in vigorous intensity activities at least three days a week. Therefore, the new PA guidelines (Canadian and International) provide youth with specific targets for frequency (daily), duration (60 minutes), intensity (moderate to vigorous activities daily; vigorous activities for three days per week), and type (muscle and bone strengthening activities for three days per week).

Unfortunately, Canadian data consistently indicates that the majority of youth are falling short of national PA guidelines, while rates of sedentary behaviour are increasing from childhood to adolescence and adulthood (Active Healthy Kids Canada, 2008, 2011; Bagley, et al., 2006; Cameron, et al., 2004; Canadian Fitness and Lifestyle Research Institute, 2007). The 2011 Report Card on Physical Activity for Children and Youth (Active Healthy Kids Canada, 2011) reported that only 7% of Canadian children and adolescents achieved 60 minutes of moderate to vigorous PA (MVPA) per day, and girls ages 15 to 19 had the lowest levels across all age groups. These figures were based on accelerometer-measured data collected over a period of seven consecutive days in the 2007-2009 Canadian Health Measures Survey (Colley, Connor Gorber, & Tremblay, 2010). With such low levels of PA, there is concern that Canadian youth – girls in particular – may decrease their physical fitness and compromise their present and future health. Indeed, data shows that an average 12-year-old Canadian girl in 1981 scored higher in fitness tests for muscular strength (as measured by grip strength) and flexibility (as measured by the sit-and-reach test) compared to her counterpart in 2007-2009 (Tremblay, et al., 2010). As a result, concerns have been raised that the children and youth of today may be the first in history to have poorer quality of life and shorter life expectancy compared to their parents (Olshansky et al., 2005).
2.3 Measurement of Physical Activity

Rigorous methods that allow conclusions to be drawn about whether populations are meeting the PA guidelines, or that provide contextual information on PA preferences and patterns are important for public health research. This section provides an overview of the strengths and limitations of objective and subjective PA assessments in youth PA research, identifies the need for subjective approaches to address the research objectives of the current study, and outlines methods to validate PA assessments. Following this is an examination of subjective approaches, with a focus on the most commonly used type of subjective instrument, the PA recall questionnaire.

2.3.1 Objective and Subjective Assessments of Youth Physical Activity

Methodological approaches that assess quantity of PA participation can be categorized into two general groups: objective methods that are usually based on physiological approaches (e.g., accelerometers, pedometers, and heart rate monitors), and subjective methods that are based on self-report approaches (e.g., PA recall questionnaires and diaries) (Lagerros & Lagiou, 2007; Reilly et al., 2008; Sirard & Pate, 2001). Most objective and subjective methods gather data on frequency, intensity or duration of PA participation in order to derive an estimate of energy expenditure. The decision to use objective or subjective methods of PA assessment for a particular study is largely based on the goals of the research and resources available (Shephard, 2003; Warren et al., 2010).

In general, objective methods are less prone to bias and therefore more precise than subjective methods, as there is a tendency to over-report PA behaviour in subjective assessments (Reilly, et al., 2008). Precise PA assessments through objective measurement are important for intervention studies that require the sensitivity to measure magnitude of PA change, and aim to establish dose-response relationships to health outcomes (D. Richardson, Cavill, Ells, & Roberts, 2011). However, objective PA measurement can be resource intensive (e.g., money, participant and researcher time), limiting its feasibility for large samples.

Three specific objective methods have been identified as criterion standards to validate objective and subjective PA instruments: doubly-labelled water (i.e., estimating total energy expenditure by monitoring the excretion rate of water isotopes); indirect calorimetry (i.e., measuring oxygen
consumption and carbon dioxide production during exercise and rest to estimate energy expenditure) and direct observation (i.e., observing participants engaging in PA during specific periods of time) (Sirard & Pate, 2001). However, all three are time-consuming, the former two are expensive (Lagerros & Lagiou, 2007), and none are practical for use in community research where data on specific types of activities is of interest. Given the challenges of validating PA instruments against the criterion measures, three other objective methods have been identified as secondary validation tools. Heart rate monitors, pedometers, and accelerometers have been validated against the criterion standards and are considered acceptable measures to validate other tools, like subjective measures (Sirard & Pate, 2001). They have been used in some community studies. Heart rate monitors are useful for assessing moderate and vigorous intensity activities, where heart rate shows a strong relationship with oxygen consumption and energy expenditure. At the same time, heart rate monitors are less precise at lower intensity levels, and heart rate may be influenced by other factors, like emotional stressors (Lagerros & Lagiou, 2007). Pedometers count steps travelled by foot, they are best for measuring walking on flat surfaces, step counts are easy to interpret and analyse, and pedometers are inexpensive compared to heart rate monitors and accelerometers (McNamara, Hudson, & Taylor, 2010). However, limitations of using pedometers include the inability to measure activity intensity and duration, and assess bicycling or water-based activities (e.g., swimming). Finally, accelerometers measure the acceleration of the body (usually in two or three axes) within short and specific intervals, making it is possible to estimate frequency, intensity and duration of PA (Lagerros & Lagiou, 2007). Accelerometers have been used to estimate energy expenditure across a variety of sedentary, low, moderate, and vigorous activities, offering some clear advantages over heart rate monitors or pedometers as validation instruments (Robertson, Stewart-Brown, Wilcock, Oldfield, & Thorogood, 2011). At the same time, accelerometers cannot measure activities that do not involve acceleration (i.e., isometric exercises), and similar to the measurement limitations of pedometers, accelerometers may not be worn for water-based activities. This potentially results in an underestimation of PA levels (De Meester, De Bourdeaudhuij, Deforche, Ottevaere, & Cardon, 2011). As noted with other objective measures, heart rate monitors, pedometers, and accelerometers do not provide information on the specific types of activities in which individuals engage.

Subjective instruments, like self-report questionnaires, are shown to provide reliable trends that are useful for population surveillance (Corder et al., 2009; Lagerros & Lagiou, 2007; Sirard &
Pate, 2001). Subjective methods are also helpful to gather perceptions related to PA behaviour and information on the contexts of youth PA participation (e.g., type, and environment) (Reilly, et al., 2008; Shephard, 2003). Furthermore, subjective instruments are generally inexpensive to administer and do not require specialized measurement devices. Although quality of data from subjective instruments may be limited by recall biases (Dominguez-Bergon, Borrell, Nebot, & Plasencia, 1999) and social desirability (Sirard & Pate, 2001), there is a reasonable correspondence between subjective measures and objective measures (Corder, et al., 2009; Lagerros & Lagiou, 2007; Sirard & Pate, 2001). Given that the objectives of the present research study were to understand the quality in addition to the quantity of physical activities, and examine perceptions of a number of factors in relation to PA participation, validated subjective methods were the most appropriate tools to consider.

2.3.2 A Focus on Subjective Approaches to Examining Physical Activity

A growing collection of validated PA instruments has provided researchers with the flexibility to select the most appropriate tools for their population, environment, and areas of interest (Lagerros & Lagiou, 2007). Given that the objectives of the present study were to understand the quality in addition to the quantity of physical activities among high school girls of South Asian heritage, and to examine perceptions of a diverse range of factors in relation to PA participation, subjective approaches were determined to be best suited for collecting data. The next section focuses on the strengths and limitations of the two main types of subjective approaches: diaries and recall questionnaires, and describes commonly used tools.

2.3.2.1 Diaries

Diaries are considered one of the most accurate subjective approaches to assessing PA among adults and youth over 10 years of age (Bouchard et al., 1983; Sirard & Pate, 2001). Participants document their daily activities, as they are experienced in their natural context. The short recall periods used in diaries can reduce systematic and random sources of measurement error, thereby increasing validity and reliability of the data (Bolger, Davis, & Rafaeli, 2003). In contrast, there is evidence that longer periods of recall used in some questionnaires (i.e., more than a week) places undue emphasis on the most recent experiences, introducing bias and error into the data (Bolger, et al., 2003).
Diaries can also be used to capture the variability in participants’ schedules as well as the frequency and content of their daily activities and affective responses (i.e., perceptions of PA enjoyment) (Bratteby, Sandhagen, Fan, & Samuelson, 1997; Lelieveld et al., 2008). As such, diaries may be an especially useful method to assess PA when little is known about PA patterns and preferences in a group. For example, diaries offer the possibility to capture comprehensive PA information without predefining or limiting the definition of PA. Researchers can ask participants to report all of their pastimes, regardless of the corresponding levels of physical exertion or duration, and even obtain detailed PA information, like the types, locations and companions for each bout of PA. During analysis, researchers can extract PA information based on specific areas of interest (e.g., activity type and intensity) (Lagerros & Lagiou, 2007). Researchers may also examine weekday and weekend PA participation separately, and identify gaps in a person’s time when PA participation could be introduced. This aspect of the diary approach may be particularly advantageous when developing strategies to encourage PA participation. Thus, the main strengths of the diary approach relate to its accuracy, inclusiveness, and opportunity to collect and analyze contextual information based on specific research goals.

Diaries have seldom been used to explore young people’s PA because of a perceived increased burden to participants (Sirard & Pate, 2001). As well, some researchers have expressed concern that the process of filling out a diary provides immediate feedback to participants and may lead to changes in their PA patterns known as “reactivity” (Lagerros & Lagiou, 2007). Similar to a weekly questionnaire, daily diary recall may also focus on “peak-end” experiences, where participants focus on the most intense physical or emotional experiences, particularly those most proximal to the documentation periods (Bolger, et al., 2003). However, these concerns have not been tested in research with youth where a diary and questionnaire have been compared.

Three types of daily diary designs have generally been used to characterize sampling periods: interval-contingent designs (e.g., hourly), signal-contingent designs (e.g., whenever prompted by pagers or alarms) and event-contingent designs (e.g., following physical education class) (Bolger, et al., 2003). Given the concerns of participant burden in diary studies, researchers in psychology have proposed the Day Reconstruction Method (DRM) as another way of characterizing the sampling period (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004b). This method has been used to study wellbeing, emotions, and daily life working experiences of women in the United States (Kahneman, et al., 2004b; Stone et al., 2006) and may be useful
when applied to the study of PA. DRM combines features of interval and event sampling by asking participants to complete diary entries for each “episode” during their day. Episodes can vary in duration, and transition when one activity ends and another begins (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004a). After indicating wake up and sleep times, participants are asked to think of their day “as a continuous series of scenes or episodes in a film” and to list episodes in three separate time periods: morning, afternoon and evening. Once these episodes have been listed, participants then provide details about each episode based on the goals of the research (e.g., PA duration, type and companions), and respond to structured questions aligned with the study’s research objectives. Unlike interval, signal or event-contingent designs, participants are not expected to complete diary entries at points throughout the day. Instead, before going to bed, participants reflect on the days’ events and answer summary questions. Therefore, using DRM addresses the main limitation of diary designs by reducing participant burden, and may be applied to the study of PA participation.

Although limited in scope, available evidence supports the utility of diaries to assess youth PA. Studies using diaries have analyzed data by categorizing daily activities into levels of energy expenditure and then estimating total daily energy expenditure (Bratteby, Sandhagen, Fan, et al., 1997; Lelieveld, et al., 2008; Sirard & Pate, 2001). The diary protocol administered most often in youth PA studies is the 3-day PA diary developed by Bouchard and colleagues (1983) in Quebec, Canada (Argiropoulou, Michalopoulou, Aggeloussis, & Avgerinos, 2004; Bratteby, Sandhagen, Fan, et al., 1997; Bratteby, Sandhagen, Lotborn, & Samuelson, 1997; Katzmarzyk, Malina, & Bouchard, 1999; Lelieveld, et al., 2008; Machado-Rodrigues et al., 2011; Sirard & Pate, 2001). In the 3-day diary, participants complete two weekday diary entries and one weekend diary entry to assess typical weekly PA patterns. In an entry, participants identify their dominant activity at each 15-minute interval of the day on a scale from 1 = “sleeping” to 9 = “intense manual work, high intensity sport activities or sport competition” (Bouchard, et al., 1983). While the 9-point scale provides an easy way for participants to report all daily activities, it is collected at the expense of contextual information, like specific activity types. Nevertheless, during analysis, participant ratings of intensity can be used to estimate outcome measures based on energy expenditure.

Research has confirmed strong reproducibility of diary results among adolescents (Bouchard, et al., 1983; Machado-Rodrigues, et al., 2011). In addition, the 3-day diary has shown a moderate
relationship with accelerometer data (Machado-Rodrigues, et al., 2011), and has been validated using doubly-labelled water over a period of seven days (Bratteby, Sandhagen, Fan, et al., 1997). Diary methods have also been used in conjunction with objective methods, like accelerometers, to track “non-wear” activities (i.e., in situations where it is not possible to use the device, like swimming) (De Meester, et al., 2011; Ottevaere et al., 2011). Overall, studies that have used diary designs provide evidence of the utility of the diary approach. However, there is a need for more research to develop (and validate) PA diaries that capitalize on the strengths of this approach to capture PA and its context.

2.3.2.2 Questionnaires

The PA recall questionnaire is the most commonly used approach in PA surveillance research because of its low cost, low participant and investigator burden, and ease of administration to large populations (Biddle, Gorely, Pearson, & Bull, 2011). Recall questionnaires may be self-administered, interviewer administered, or, in the case of young children, proxy-reported (i.e., by a parent or caregiver) (Sirard & Pate, 2001). In contrast with diaries, questionnaires typically define PA participation based on intensities where there are physiological changes (e.g., body starts to sweat, heart beats rapidly) and often gather physical activities of a minimum duration (e.g., 10 minutes in the Physical Activity Questionnaire for Adolescents (Kowalski, Crocker, & Faulkner, 1997) and 15 minutes in the Leisure Time Exercise Questionnaire (Godin & Shephard, 1985)).

Disadvantages of questionnaires are that they may lead to an emphasis on leisure time physical activities and sport, and fewer reports of physical activities in other domains like household activities (i.e., chores) (Shephard, 2003) and transport (i.e., walking and cycling to school). Questionnaires also have a higher cognitive demand for recall compared to a diary due to the longer sampling frame (i.e., 3 days, 7 days or 3 months versus 15-minutes or 1-day) (Warren, et al., 2010). Increasing the period of recall may place undue emphasis on the most recent experiences, introducing bias (e.g., social desirability) and error into the data (Bolger, et al., 2003). For instance, it has been suggested that when reporting typical PA patterns, participants are more likely to report their recent or desired activity frequency rather than actual activity frequency (Shephard, 2003). However, as with diaries, there is evidence to show that youth as young as ten years of age can provide questionnaire data that is of acceptable reliability (i.e.,
similar test-retest reports) and validity versus objective measures (Sallis, Buono, Roby, Micale, & Nelson, 1993).

Currently, there are a variety of validated recall questionnaires tailored for adolescents which differ in the wording of the questions, the number of questions, the time-frame for recall, and the methods of calculating energy expenditure, potentially leading to different outcomes. However, despite some differences, several PA questionnaires have been shown to be reliable and have acceptable validity with Canadian and international samples of adolescents when identifying trends and categorizing groups based on activity levels (Bates, 2006; Biddle, et al., 2011; Corder, et al., 2009; Sirard & Pate, 2001). The structure of a self-report PA recall questionnaire typically includes a checklist of physical activities or sports, followed by questions on frequency and duration of participation (Lagerros & Lagiou, 2007). The Physical Activity Questionnaire for Adolescents (PAQ-A) (Kowalski, et al., 1997) provides a good example of this format. One drawback of using a checklist is that the list can never be exhaustive and include relevant activities for every individual in a study sample. This may lead to an underestimation of PA levels. As an alternative, questionnaires have been developed based on activity intensity levels that do not use checklists. A commonly used questionnaire in this format is the Leisure Time Exercise Questionnaire (LTEQ) (Godin & Shephard, 1985). The LTEQ consists of four questions: bouts of mild, moderate and strenuous physical activities over a typical week followed by a question on the frequency of sweating in a typical week. Examples of activities at each intensity level are listed along with physiological cues (i.e., “strenuous activities are fairly exhausting or tiring” and “mild activities require minimal effort”), to help participants categorize their PA participation. During analysis, mild, moderate and strenuous activities are converted into their respective metabolic equivalent of task (MET) values (i.e., mild = 3 METs, moderate = 5 METs and strenuous = 9 METs) to yield a total energy expenditure score. Using this format, activities of all types may be reported, including chores, and unstructured activities in open outdoor areas (e.g., playing in a park) that are typically underrepresented in checklist-questionnaires. Thus, the LTEQ, and other questionnaires that assess PA based on intensity levels, may provide a better assessment of PA levels compared to methods that use predefined checklists when little is known about the prevalent types of physical activities in a population group.
2.3.3 Canadian Surveillance of Physical Activity using Questionnaires

This section describes measures and outlines key trends in youth PA based on the Canadian Community Health Survey and other studies to identify possible gaps in Canadian surveillance of youth PA.

The Canadian Community Health Survey (CCHS) is the largest cross-sectional survey in Canada measuring PA participation. CCHS uses computer-assisted interview techniques and assesses several health behaviours (e.g., PA, smoking, and consumption of fruits and vegetables) among 65 000 Canadians ages 12 and above (Statistics Canada, 2008b). Although PA data were previously collected every two years from 2000-2007, it is now collected annually. In the CCHS (all versions), respondents are given a list of 21 physical activities with an emphasis on structured PA and sport like “swimming,” “downhill skiing or snowboarding” and “exercise class or aerobics,” and asked to select all activities that they had participated in at least once over the previous three months (Statistics Canada, 2007a). If any of the 21 physical activities are chosen, respondents then indicate the frequency of participation and average duration per session. Daily energy expenditure is calculated from the frequency and duration of checklist physical activities using the compendium of metabolic equivalent of task (MET) values (Ainsworth et al., 2011; Ridley, Ainsworth, & Olds, 2008). A MET is an expression of energy cost as a multiple of generalized resting metabolic rate where one MET equals 3.5mL of oxygen per kg*min (Health Canada, 2006). The compendium of MET values lists the specific energy costs for a range of physical activities, with higher MET values associated with higher intensity levels (Ainsworth, et al., 2011). However, these energy costs have largely been estimated from adult populations, with only a subset of activities (35%) derived from energy cost data in youth (Ridley, et al., 2008).

The checklist of activities in the CCHS is similar in content and length to those used in other instruments including the Minnesota Leisure-time Physical Activity Questionnaire (Aaron et al., 1995; M. T. Richardson, Leon, Jacobs, Ainsworth, & Serfass, 1994) that is used for the Canadian Physical Activity Monitor, the Physical Activity Questionnaire for adolescents (PAQ-A) (Kowalski, et al., 1997), and the self-administered physical activity checklist (SAPAC) (Sallis, 1993). However, one major advantage that the SAPAC offers is that it refers to broad categories of structured and unstructured activities and then provides some examples to assist participants.
with activity recall. This permits a wider range of responses compared to the CCHS and other instruments that list specific physical activities. Another potential limitation of the CCHS checklist is that only a few items refer to physical activities that may be done in locations other than designated PA areas and without the use of sporting equipment. Many activities listed require access to facilities like pools (i.e., swimming) and rinks (i.e., ice hockey and ice skating), and use specialized equipment (e.g., bicycle, rollerblades, golf clubs, and skis). The few exceptions to this are walking for exercise, gardening or yard work, and home exercises. Also missing from the CCHS are probes for indoor household chores (e.g., mopping, vacuuming, sweeping) and active play (e.g., swinging in a park, running games) that may be prevalent among youth. This may limit understandings of PA participation among Canadian youth who are not involved in organized sport and PA.

2.4 Socio-Demographic Factors Associated with Youth Physical Activity

Research has identified several important factors related youth PA participation. Studies using objective and subjective methods have shown that socio-demographic factors like socioeconomic status (SES), sex, age and ethnicity/race are key correlates of youth PA participation and may also affect the quality of youth PA experiences. This section reviews research on socio-demographic factors and youth PA (primarily in the Canadian urban context) to outline current knowledge and identify gaps.

2.4.1 Socioeconomic Status

Research on the relationship between family socioeconomic status (SES) and PA participation among youth is a growing area of research. Various individual and neighbourhood-level measures have been used to estimate SES, such as parent level of education, youth perceptions of family wealth, and census data on average employment income within a region. While measures of SES differ from study to study, a general trend is that greater SES is related to increased PA participation (Active Healthy Kids Canada, 2010b; Gordon-Larsen, et al., 2000; Janssen, Boyce, Simpson, & Pickett, 2006; Lowry, Kann, Collins, & Kolbe, 1996; Powell, Slater, & Chaloupka, 2004).

Some evidence suggests that individual SES plays a greater role in youth PA participation than neighbourhood SES (Janssen, et al., 2006). Janssen and colleagues (2006) analyzed a
representative sample of students in grades 6 to 10 \((N = 6684)\) who completed the Canadian Health Behaviour in School-aged Children survey (HBSC) in 2001-2002. Students were categorized as physically active if they self-reported participating in PA for at least 60 minutes on 5 or more days in the previous week and also in a typical week. All other students were categorized as inactive. Individual SES was assessed by perceptions of family wealth (i.e., four levels from “very well off” to “not very well off”) and also by a composite of family affluence (i.e., “low”, “medium” or “high” based on student reports of family car ownership, bedroom sharing, holiday travel, and computer ownership). Neighbourhood SES was defined by census data for a 5 kilometre radius of the student’s school and consisted of three variables: unemployment rate, percentage of adult residents with less than a high school education, and average employment income from the head of the house. Findings showed that lower individual SES variables were related to physical inactivity in the bivariate and multivariate analyses, but not neighbourhood SES (Janssen, et al., 2006). Other research suggests that neighbourhood SES may influence PA quality via the availability of community recreation and sport facilities, but not necessarily PA quantity (Powell, et al., 2004). Findings related to neighbourhood SES might also indicate other barriers that come with low-SES. Focus group research with Canadian adolescents by Humbert and colleagues (2006) found that a primary barrier for PA among low-SES youth was opportunities to be active. Responses from participants revealed that time commitments differed between high- and low-SES youth. High-SES youth were more likely to take part in scheduled activities (e.g., piano lessons), while low-SES youth reported more babysitting and doing housework. Lower-SES youth also needed to travel further distances to access PA settings (Powell, et al., 2004), making time a more salient barrier. Overall, evidence shows that there are positive relationships between SES and PA participation. However, more research is needed on preferred types and locations for PA, and barriers to participation that may limit opportunities for youth to being physically active.

2.4.2 Age, Sex/Gender

Across Canada, age and sex (male or female) have emerged as consistent predictors of youth PA regardless of whether objective or subjective PA measurements are used (Active Healthy Kids Canada, 2011). The CCHS and other studies have shown that boys report greater participation in PA than girls at all ages, younger youth are more active than older youth, and the gap between boys and girls is largest among older youth (Active Healthy Kids Canada, 2011; Bagley, et al.,
2006; Bailey, Wellard, & Dismore, 2005; Bryan & Walsh, 2004; Cameron, et al., 2004; Chung, Skinner, Steiner, & Perrin, 2012; Nelson, Neumark-Sztainer, Hannan, Sirard, & Story, 2006; Sallis, et al., 2000; Sallis, et al., 1996). Moreover, declines in PA with age start sooner with girls compared to boys (Chung, et al., 2012; Nelson, et al., 2006). For example, a 5-year longitudinal study of adolescents (N = 2516) used self-report questionnaires to examine weekly hours of moderate to vigorous PA (MVPA), television viewing, and computer use (Nelson, et al., 2006). Two groups of students participated. A younger cohort (ages 11 to 15 years) was followed from early (junior high school) to mid-adolescence (high school). An older cohort (ages 14 to 18) was followed from mid-adolescence (high school) to late adolescence or young adulthood (post-high school). Findings showed that there were substantial decreases in MVPA during adolescence, particularly among girls. MVPA among girls declined between early to mid-adolescence and continued to decline in late adolescence. Television viewing increased from early to mid-adolescence for girls, and computer use increased from mid- to late-adolescence. In contrast, PA participation decreased at later ages among boys, and occurred between mid-adolescence and late adolescence. At the same time, computer use among boys increased from early to mid-adolescence as well as from mid- to late-adolescence, but there were no differences in television viewing by age. Authors speculated that computer use (for boys and girls) and television viewing (for girls) might have taken away from the time available for MVPA (Nelson, et al., 2006).

There is additional evidence that sedentary pursuits beyond screen time may be particularly important for girls (Bauer, Friend, Graham, & Neumark-Sztainer, 2012). A study from the United States with high school females (N = 283) used a three-day physical activity record (3DPAR) to examine 65 common pastimes. Girls selected their dominant activity in each 30-minute block of time between 6am and midnight for the previous three days. Findings showed that, in addition to watching television, the most frequently reported recreational sedentary behaviours were spending time socializing friends, talking on the phone, and sitting while listening to music. Girls who spent the most time watching television, hanging around with friends, and using the Internet also reported the lowest levels of total PA (Bauer, et al., 2012).

A potential contributor to the widening gap in PA participation between boys and girls as they progress through high school could be enrolment in physical education. However, little research has specifically focused on this, and it is unclear whether adolescents incorporate other physical activities into their schedules once they are no longer enrolled in physical education. Evidence
from Ontario shows that girls are less likely to report enjoyment of physical education classes compared to boys (Klentrou, Hay, & Plyley, 2003). Another study with students ($N = 23,817$) from 73 Ontario high schools showed that a significantly larger percentage of boys were enrolled in physical education (67.0%) compared to girls (57.5%) (Hobin, Leatherdale, Manske, Burkhauser, & Woodruff, 2010). Furthermore, sex remained a significant predictor of enrolment in physical education when behavioural, psychosocial, and environmental factors were considered. Research has also suggested that there are sex differences in PA participation within physical education classes, where boys engage in more health-benefiting high-intensity activities versus girls (Faulkner, Goodman, Adlaf, Irving, & Allison, 2007).

Lower levels of PA reported by girls compared to boys may also may be related to the types of activities in which girls and boys prefer to engage (Cameron, et al., 2004; Sallis, et al., 1996). For instance, a study based on the CCHS and another self-report checklist instrument have shown that girls often report walking, swimming, dancing, playing volleyball and attending exercise classes significantly more often than boys, and boys report bicycling, jogging, weight training, and playing basketball, ice hockey, golf, tennis, baseball or softball significantly more often than girls (Cameron, et al., 2004; Sallis, et al., 1996). Across these studies, many types of physical activities reported by girls were those that would require access to specific recreational facilities, possibly with enrolment fees, which may have limited the frequency and duration of their overall PA levels. In contrast, many of those physical activities reported most often by boys (e.g., bicycling, skateboarding) could be done with minimal cost in public outdoor spaces. Moreover, there were differences in intensity levels of some of the most popular activities reported by boys and girls. Both studies showed that boys reported jogging more often than girls, while girls reported walking more often than boys (Cameron, et al., 2004; Sallis, et al., 1996). However, it is possible that the emphasis on competitive, organized sport and PA in the CCHS and the other self-report checklist resulted in a PA assessment tool with a bias that favoured activities engaged in by boys. A greater understanding of the physical activities of girls is needed.

Another explanation for higher levels of PA among boys compared to girls relates to prevailing social constructions of gender (Active Healthy Kids Canada, 2009; Bailey, et al., 2005; Johnstone & Millar, 2012). Gender is defined as constructions of femininity, masculinity and their associated power differentials (Hall, 2002). Gender has been used as a theoretical concept
to explore differences in social realities experienced by males and females that may in turn influence a range of their behaviours. Although recent changes to sport and physical education practices in North America have made PA more accessible and available to female youth (Johnstone & Millar, 2012), data shows that sex differences in PA participation may persist because of pervasive gender biases (Bartky, 1997; Choi, 2000; Coakley & White, 1992; Malszecki & Cavar, 2000; Young, 1980). A review of theoretical and empirical work on masculinities in Canadian sport and PA found that males were often taught that sport and PA are a male preserve (Malszecki & Cavar, 2000). Other research found that physically active girls were sometimes perceived negatively as being too masculine or aggressive (Vu, Murrie, Gonzalez, & Jobe, 2006). Links between gender and PA practices have generally been explored using qualitative research designs and show that gender-related beliefs and self-perceptions are shaped over time through interaction, exposure and reaction to social environments that include mass media (Fouts & Burggraf, 1999, 2000) and significant others (e.g., families and peers) (Choi, 2000). In turn, these beliefs and self-perceptions may have implications for the quality and quantity of PA participation (Eccles & Harold, 1991; Fredrickson & Harrison, 2005). For example, perceptions of ideal beauty and attractiveness (e.g., being slim) (Ramanathan & Crocker, 2009) may discourage participation in high intensity physical activities that lead to sweating, being out of breath, and muscular bodies (Bartky, 1997; Grieser et al., 2006; W. C. Taylor et al., 1999).

Overall, findings across several studies show that PA levels decline with age, and PA patterns differ between boys and girls. Age-related changes may result from a preference for other activities like sedentary pursuits as youth move through adolescence, but may also be linked with physical education enrolment and engagement. Differences in PA participation among boys and girls may be associated with the types of physical activities that they engage in (including physical education), self-report questionnaire checklists, or constructions of gender. There is a need to further examine perceptions of support for girls to engage in all types of physical activities, including those at high intensities and those considered “masculine,” especially as they get older.
2.4.3 Ethnicity/Race

2.4.3.1 Definitions of Ethnicity and Race

To better understand PA patterns among youth in multicultural nations like Canada, public health researchers have explored concepts of ethnicity and race, often using these terms interchangeably (Azoulay, 2006). Ethnicity has many dimensions and has generally been defined in Canadian census data by aspects of origin or ancestry, race, language, religion, and identity (Statistics Canada, 2010). At a population level, ethnicity has also been described as dynamic and constantly changing, especially in countries like Canada with high rates of immigration (Ballard, 1994). The difficulty in collecting data on ethnicity in national surveys has resulted in at least three different definitions being used, each with conceptual challenges and limitations (Statistics Canada, 2012a). In the 2006 census, participants were asked about the ethnic or cultural origins of their ancestors and were instructed that, “An ancestor is someone from whom a person is descended and is usually more distant than a grandparent” (Statistics Canada, 2010). Up to six ethnic origin responses were retained, which resulted in more than 200 ethnic or cultural groups, including 13 groups of South Asian origin (Statistics Canada, 2008a). Although this measure was open-ended, it may have posed difficulties for some respondents with multiple origins. For others whose families had lived in Canada for many generations, ancestry might have held less importance compared with their Canadian identity.

A second measure of ethnicity refers to the “population group” of a person (Statistics Canada, 2010), and is often used to identify “visible minority” groups. The Canadian Employment Equity Act defines a visible minority as “persons, other than Aboriginal persons, who are not white in race or colour” (Canada, 2012). Before 2009, the “population group” measure was labelled “race,” and defined as physiognomical features (e.g., skin colour) linked with one’s genetic makeup (Statistics Canada, 2012b). In the 2006 Canadian Census, all non-aboriginal individuals were asked to select one or more categories from the following groups: white, Chinese, South Asian, black, Filipino, Latin American, South East Asian, Arab, West Asian, Korean, Japanese or “other” (Statistics Canada, 2006). One issue with this classification is that some categories refer to skin colour (i.e., white, black), some refer to geographic regions and possibly groups with similar cultures (i.e., South Asian, Latin American), and others refer to countries of origin (i.e., Korean, Japanese). Another problem results from the selection of multiple categories, leading individuals to be classified as “multi-racial”, regardless of the categories chosen (Barr-
Anderson et al., 2007). Moreover, small samples from lesser populated racial groups may be collapsed into the “other” classification along with “multi-racial” individuals (Barr-Anderson et al., 2007).

Race-based research along with the term “race” is also highly controversial, which likely explains the adoption of “population group” in recent Canadian surveys and analyses. Some studies have shown that there are greater genetic differences within different racial groupings rather than between them (Azoulay, 2006), bringing research that interprets data along lines of race (i.e., black, white) into question. As well, it is often difficult to identify genetic mechanisms for health trends or risk factors by population groups (Fausto-Sterling, 2008). Thus, the naturalization of race in census and medical studies is questioned as it may reify or even create stereotypes about behaviours and characteristics which may actually be products of history that are “socially constituted and reconstituted on the basis of changing circumstances” (Azoulay, 2006, p.355).

A third definition of ethnicity examines cultural identity. Cultural identity refers to how people perceive themselves, and could include dimensions of origin and sometimes citizenship and language (e.g., French Canadian) (Statistics Canada, 2012a). As the vagueness of questions on identity (“With which ethnic group do you identify?”) may yield a range of ambiguous responses (Statistics Canada, 2012a), census research in Canada has instead relied upon ethnic origin and population group measures of ethnicity (Statistics Canada, 2008a). However, of the three ways of defining ethnicity, cultural identity may be the most useful method to group individuals because cultural attitudes and beliefs systems (e.g., perceived gender roles, spiritual beliefs) may shape behaviours (i.e., physical activities, priorities for leisure-time, and extra-curricular activities). For example, having South Asian ancestry or being categorized within the South Asian population group may not be meaningful in terms of understanding health behaviours (i.e., participation in physical activities) if one doesn’t also perceive being South Asian as an important aspect of their cultural identity. Thus, for the purposes of this thesis, ethnicity was operationalized as cultural identity when participants were recruited. Specifically, high school adolescent girls who self-identified with the ethnic category of “South Asian,” were invited to take part in this research study.
2.4.3.2 Findings on Physical Activity Participation by Ethnicity/Race

Collapsed census categories for ethnicity/race on population-representative surveys of PA in Canada and the United States have shown that populations labelled as “visible minorities” are less active than Caucasian (white) counterparts (Bryan, et al., 2006; Bryan & Walsh, 2004; Gordon-Larsen, et al., 2000; Liu, et al., 2010). For example, the 2000-2001 Canadian Community Health Survey showed that South Asian females (ages 12 and above) were among the least active population groups, with 73% classified as inactive, and South Asian males were the least active ethnic group with 61% inactive (Bryan & Walsh, 2004). Inactivity was defined as expending less than 1.5 kilocalories per kilogram of bodyweight per day (i.e., roughly equivalent to less than 15 minutes of moderate to vigorous PA per day). In another study based on the CCHS, pooled data was analyzed from 2000-2001 and 2003 and eight population groups were examined: white; East or Southeast Asian; West Asian or Arab; South Asian; Latin American; black; North American Aboriginal; and other (Bryan, et al., 2006). Among males and females ages 20 to 64, South Asians were the least likely to report moderate intensity PA (34%), and South Asian women in particular had the lowest prevalence of moderate intensity PA (12%) compared to all other men and women (Bryan, et al., 2006). Yet another study examined cardiovascular risk factors (including inactivity) among Canadians ages 12 and older (Liu, et al., 2010). Even when data were adjusted for a variety of chronic diseases and socio-demographic variables (i.e., sex, education, household income, and immigration status), findings showed that there was a higher prevalence of physical inactivity in “visible minorities” (58.1%) compared to their white counterparts (50.3%), especially among South Asians (62.8%) (Liu, et al., 2010).

Furthermore, although South Asians were most likely to be inactive, data also showed that South Asians were equally likely to have a family income of $80 000 or more compared to people in the white population group, and significantly more likely to have post-secondary education (57.7% vs. 50.5%) (Dogra, Meisner, & Ardern, 2010). These findings suggest that SES may not be a driving factor for low levels of PA among South Asians.

It is unclear why membership to a visible minority group, particularly South Asians, is associated with lower levels of PA. One possibility is that among “visible minority” groups, other activities (e.g., family responsibilities or part-time jobs) take precedence over physical activities. It is also possible that PA is emphasized in white cultures more than in “visible minority” populations, or that the types of activities assessed in population surveys like the Canadian Community Health
Survey do not examine the range of culturally based activity types in which people of visible minorities engage (e.g., cricket) (Burdsey, 2006). Section 2.9 will draw upon census research on South Asians in Canada and research from cultural and leisure studies to examine this issue in more depth.

2.5 Theories of Health Behaviour Applied to Physical Activity

Health behaviour theories of cognition have been used extensively to identify and examine psychological and social factors related to PA participation. Psychosocial factors have been a major focus because unlike most socio-demographic characteristics (i.e., age, sex), these factors can usually be modified (Conner & Norman, 2005). Theories of cognition focus on people’s perceptions, and assume that thoughts precede and may even motivate engagement in healthy behaviours like PA participation (Conner & Norman, 2005). The most commonly used theories of cognition employed in PA research have been the transtheoretical model, theory of reasoned action / theory of planned behaviour, and social cognitive theory (Bauman, Sallis, Dzewaltowski, & Owen, 2002; Nigg & Paxton, 2008). These theories consider many of the same elements, including beliefs about one’s ability to successfully engage in PA (i.e., self-efficacy) and deal with challenges that may arise (i.e., perceived barriers). At the same time, each theory emphasizes different sources of PA motivation and identifies these influential elements using various terms.

In brief, the transtheoretical model posits that people progress through five distinct and ordered stages (i.e., pre-contemplation, contemplation, preparation, action, and maintenance) when adopting regular PA patterns (Prochaska & DiClemente, 1983). A key assumption of the transtheoretical model is that progression through the stages is as a result of an individual’s rational process of weighing the pros and cons (i.e., benefits of PA versus barriers of PA) (Sutton, 2005). Other key processes that individuals draw upon to progress through the stages include building their self-efficacy, and a number of experiential (e.g., raising consciousness and self-re-evaluation) and behavioural processes (e.g., seeking helping relationships and counterconditioning) (Sutton, 2005). In contrast, the theory of reasoned action and theory of planned behaviour emphasize that an individual’s intentions, attitudes and normative beliefs ultimately determine their PA participation, and focus less on stages of processing (Ajzen, 1991; Conner & Sparks, 2005). The theory of planned behaviour extends the theory of reasoned action,
suggesting that perceptions of control over PA also affect intentions. Finally, social cognitive theory aims to understand how individuals make sense of and respond to social situations (Bandura, 1978, 2002, 2004). Key constructs are self-efficacy (i.e., perceived self-confidence in changing behaviour), outcome efficacy (i.e., perception that an outcome is desirable, and social and structural factors that may facilitate or impede behaviours (Bandura, 2004). An important contribution of social cognitive theory is that it emphasizes the roles that significant others and social environments can play in shaping perceptions and behaviour. Because of this emphasis on social influences, social cognitive theory and has been used most often to frame youth PA research and interventions (e.g. Baranowski, Perry, & Parcel, 2002; DiLorenzo, Stucky-Ropp, Vander Wal, & Gotham, 1998; Dishman et al., 2005; Dunton, Schneider, & Cooper, 2007; Neumark-Sztainer, Story, Hannan, Tharp, & Rex, 2003; Strauss, Rodzilsky, Burack, & Colin, 2001; Stucky-Ropp & DiLorenzo, 1993). It is also particularly useful as a model for understanding how South Asian cultures (i.e., an aspect of the social environment) may facilitate or impede PA levels.

2.6 Key Correlates Identified using Health Behaviour Theories

Table 1 lists psychological and social correlates stemming from health behaviour theories that have been identified as consistently associated with PA in reviews of research with youth (Nahas, Goldfine, & Collins, 2003; Sallis, et al., 2000; Van der Horst, Paw, Twisk, & Van Mechelen, 2007; Wallhead & Buckworth, 2004). The first two review papers in Table 1 are systematic reviews of research among adolescents ages 13 to 18, and covered the period from 1970 to 1998 (Sallis, et al., 2000) and 1999 to 2005 (Van der Horst, et al., 2007). These reviews concluded that a particular correlate had strong, consistent evidence if at least 75% of the associations found in the literature were in the same direction. The other two reviews specifically identified important correlates of youth PA that may be modified through physical education (Nahas, et al., 2003; Wallhead & Buckworth, 2004). Although different key correlates were identified across the four review studies, these differences may have resulted from the number of studies reviewed, the period of research covered, and the ways that variables were conceptualized and measured. For example, within the category of psychological correlates, self-efficacy may have been conceptualized as encompassing perceived competence and well as perceived ability to overcome barriers (Bandura, 2004). Similarly, within the social correlates of youth PA, family support may have included aspects of sibling and parental support.
Nevertheless, all of the correlates listed in Table 1 have shown associations with youth PA in the same direction using various measures and across a number of research studies.

To further understand the social cognitive model of behaviour change, Figure 1 shows the key concepts using youth PA data (concepts in italics). For instance, self-efficacy, perceived competence, perceived control and perceived ability to overcome barriers are all measures of the concept of self-efficacy (Bandura, 1978, 2001, 2002, 2004). Achievement expectations, enjoyment, and attitudes towards PA are aligned with the concept of outcome expectations (Bandura, 2004). An intention to be active is a short-term aim (Bandura, 2004), and fits into the concept of goals. Finally, social factors in the model refer to the greater contexts in which PA behaviours occur (Bandura, 2001). The model shows hypothesized direct and indirect paths of the influence that self-efficacy, outcome expectations and social factors may have on PA behaviour. Also important is that social cognitive theory posits that reciprocal relationships exist between constructs (Bandura, 1978, 2001, 2002, 2004). For example, regular engagement in PA (i.e., behaviour) can also enhance beliefs in PA skills (i.e., self-efficacy). However, PA research has generally been concerned with the pathways that explain PA behaviour as the outcome (Luszczynska & Schwarzer, 2005).

Figure 1: Key Psychological and Social Correlates of Youth Physical Activity Framed within Social Cognitive Theory
Table 1: Key Psychological and Social Correlates of Youth Physical Activity (PA) Identified in Research Reviews

<table>
<thead>
<tr>
<th>Key Correlate of Youth Physical Activity</th>
<th>Review Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Psychological</strong></td>
<td>1  2  3</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>Perceived competence</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>Barriers (e.g., ability to overcome or perceiving few barriers)</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>Attitudes towards PA</td>
<td>✓</td>
</tr>
<tr>
<td>Achievement/goal orientation or expectations</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>Enjoyment of PA</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>Intention</td>
<td>✓  ✓  ✓</td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td></td>
</tr>
<tr>
<td>Significant others/general social support</td>
<td>✓  ✓  ✓</td>
</tr>
<tr>
<td>Family support</td>
<td>✓</td>
</tr>
<tr>
<td>Parental support (e.g., involvement, facilitation, encouragement, modeling)</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>Sibling support (e.g., modeling, involvement)</td>
<td>✓</td>
</tr>
<tr>
<td>Friend/peer support</td>
<td>✓</td>
</tr>
</tbody>
</table>

2.7 Psychological Correlates of Youth Physical Activity

2.7.1 Self-efficacy

Self-efficacy is a central concept within several cognitive theories of behaviour and motivation and stems from the work of Albert Bandura (1978, 2001, 2002, 2004). With respect to PA, self-efficacy is defined as the confidence individuals have in their ability to engage in physical activities. This includes an individual’s perceived competence in the skills required for PA, beliefs that they can exert control to be physically active, and their ability to overcome challenges or barriers to be physically active (Dzewaltowski, 1994). Although there is criticism that self-efficacy is framed within a Western, individualist context (Klassen, 2004), Bandura (2002) has countered that a belief in one’s power to act, or agency, remains fundamental to actually producing action (i.e., engaging in PA) and is relevant across cultures. Furthermore, unless individuals are confident that “they can produce desired effects by their actions, they have little incentive to act or to persevere in the face of difficulties” (Bandura, 2004, p. 144). For these reasons, the construct of self-efficacy is depicted as having direct effects on PA behaviour and also indirect effects by shaping outcome expectations and goals.

Self-efficacy has been assessed in PA research using a variety of measures, including multidimensional aspects of self-efficacy (Hay, 1992; Reynolds et al., 1990; Saunders et al., 1997). For example, a 17-item self-efficacy scale has been used to examine support-seeking behaviours (i.e., “I think I can ask my best friend to be physically active with me”), ability to overcome barriers (i.e., “I think I can be physically active no matter how busy my day is”), and ability to prioritize physical activities over alternate pastimes (i.e., “I think I can be physically active even if I could watch TV or play video games instead”) (Saunders, et al., 1997). Other studies have examined particular aspects of self-efficacy, like perceived competence, perceived behavioural control, and ability to face or overcome barriers to PA (Dishman, et al., 2005; Dwyer, Allison, & Makin, 1998; Harter, 1988; Rhodes, Jones, & Courneya, 2002; Sallis, et al., 1996). For example, a 5-item athletic perceived competence scale presents adolescents with structured alternatives to assess their perceptions of ability in athletic endeavours (i.e., “some teenagers do very well at all kinds of sports BUT other teenagers don’t feel that they are very good when it comes to sports”) (Harter, 1988). Participants choose which group of teenagers they are most like and to what degree they are similar (Harter, 1988).
Empirical evidence supports that youth with greater levels of overall or specific self-efficacy engage and persist in significantly more physical activities (Barr-Anderson, et al., 2007; Loucaides, Plotnikoff, & Bercovitz, 2007; Wenthe, Janz, & Levy, 2009). Self efficacy has been associated with weekly PA participation (Reynolds, et al., 1990), and PA performance in fitness tests (Cairney, Hay, Faught, Leger, & Mathers, 2008). Studies have also shown positive relationships to PA when particular aspects of self-efficacy were examined. For example, a study of female adolescents (N = 46) showed that perceived athletic competence was positively associated with PA participation measured by a heart rate monitor and aerobic fitness measured using a treadmill test (Craft, Pfeiffer, & Pivarnik, 2003). In other research, adolescents who felt that they were less competent or prone to making mistakes were less inclined to engage in PA (Coakley & White, 1992). Poorly skilled adolescents feared that they would “get shown up”, “feel stupid” or be “useless,” and were less enthusiastic about engaging in PA. In contrast, those who felt that they could perform well in specific activities, like dance or cycling, were more inclined to participate in them, learn new activities, and engage in PA more often (Coakley & White, 1992). With respect to perceived behavioural control, self-reported questionnaire research (N = 1797) showed that adolescent girls with higher perceptions of control reported more moderate to vigorous PA using the 3-day PA recall and more team sport involvement (Saunders, Motl, Dowda, Dishman, & Pate, 2004). Finally, in a study of over a thousand Toronto high school students, fewer perceived internal barriers were related to higher levels of self-reported vigorous PA participation (Allison, Dwyer, & Makin, 1999).

2.7.2 Outcome Expectations

Within social cognitive theory, outcome expectations are defined as the anticipated consequences of engaging in a particular behaviour (Bandura, 2004). When applied to PA, increased motivation to be physically active should be related to expected positive outcomes like perceived health benefits, enjoyment, and achievement, and the absence of negative outcomes like injury. This is similar to the decisional balance concept from the transtheoretical model (Prochaska & DiClemente, 1983). The three outcome expectations that have been consistently identified as correlates of youth PA: achievement/goal orientations or expectations, attitudes towards PA, and enjoyment, are briefly discussed.
2.7.2.1 Achievement/goal orientations or expectations

The concept of achievement goal orientation stems from achievement goal theory developed within the educational domain (Duda, 1989). It refers to how individuals define success and failure and specifies two dimensions: task orientations and ego orientations. Theorists have explained that someone with a high task or mastery orientation focuses on the behaviour as the outcome and defines success based on whether a task is accomplished (Duda, 1989; Smith, Balaguer, & Duda, 2006). In contrast, someone who has a high ego orientation is concerned with competition and social comparisons. A questionnaire commonly used to assess achievement goal orientations is the 13-item Task and Ego Orientation in Sport Questionnaire (Duda, 1989). Research shows that youth with higher achievement orientations report higher levels of PA (Biddle & Wang, 2003; Smith, et al., 2006). For example, a study of 11 to 16 year old girls in England (N = 516) used cluster analysis to show that girls with the highest scores on task orientation had the highest levels of perceived competence (i.e., self-efficacy) and PA behaviour (Biddle & Wang, 2003). In contrast, girls who had the lowest task orientation but reported high levels of social comparison (i.e., high ego orientation) reported the lowest levels of PA (Biddle & Wang, 2003). Research also suggests that older youth may have stronger ego orientations compared to younger youth, partially explaining lower levels of PA as youth move through adolescence (Horn & Weiss, 1991; Smith, 2003).

2.7.2.2 Attitudes

Attitudes towards PA are defined as beliefs and values related to the outcomes of activity (Bandura, 2004). Depending upon how attitudes are operationalized, they tap into combinations of physical, social and self-evaluative outcome expectations. In a study of eighth-grade girls (N = 1797), attitudes about the benefits of PA were related to greater self-reported moderate to vigorous PA and team sport involvement (Saunders, et al., 2004). Another study operationalized attitudes based on physical outcomes (e.g., healthiness) and self-evaluative outcomes (e.g., pleasantness) (Papaioannou, Karastogiannidou, & Theodorakis, 2004). Results among adolescents in Greece (N = 5991, ages 11 to 17) showed that more than a third of the sample reported that exercising vigorously was good, healthy, useful and pleasant at the highest possible scores. After adjusting for age, gender, and involvement in competitive organized sport, adolescents with positive attitudes towards vigorous PA were somewhat more likely to report
participating in vigorous sports or exercises, and less likely to report sedentary behaviours. However, this was only in the group of adolescents with highly positive attitudes.

2.7.2.3 Enjoyment of Physical Activity

It is not surprising that studies have consistently provided empirical support that shows outcomes like fun and enjoyment are positively associated with youth PA participation (Dunton, Schneider, et al., 2007; Klentrou, et al., 2003; Nahas, et al., 2003; Sallis, et al., 2000; Stucky-Ropp & DiLorenzo, 1993; Wallhead & Buckworth, 2004). Evidence also suggests that increases in PA enjoyment may lead to improvements in cardiovascular fitness (Dunton, Schneider, et al., 2007). A nine-month longitudinal intervention of 122 inactive adolescent girls provided one-semester of supervised in-class PA and health education as well as internet-based self-monitoring tools (Dunton, Schneider, et al., 2007). Data for intervention and comparison groups were collected for three cohorts across three years. Pooled results from intervention and control groups showed that individual positive changes in exercise enjoyment and self-efficacy were associated with improved cardiovascular fitness (Dunton, Schneider, et al., 2007). This suggests that it may be possible to improve PA levels by promoting activities deemed most enjoyable.

Some evidence suggests that perceptions of PA enjoyment may vary by social and structural factors, like physical environments (i.e., location), gender, and population group (i.e., ethnicity/race). A review of research primarily with young adults showed that walking outdoors was associated with greater enjoyment, and intentions (i.e., goals) to be physically active compared with walking indoors (Coon et al., 2011). Other research finds that males report significantly higher levels of enjoyment of physical education compared to girls, and also higher levels of leisure time PA, organized PA, and sport PA (Klentrou, et al., 2003). Finally, there is some evidence to suggest that enjoyment of PA may vary by ethnicity/race. A study in the United States found that white girls reported the highest perceptions of PA enjoyment, which were significantly higher than black and Hispanic girls, even after controlling for socio-economic status and BMI (Grieser et al., 2008). However, studies have not extended these findings to other ethnic groups or countries.
2.7.3 Goals

Goals in social cognitive theory refer to short-and long-term aims and generally are treated as intentions to be active (Bandura, 2004; Luszczynska & Schwarzer, 2005). Intentions have been measured with several scales and include items like, “I intend to be physically active during my free time on most days” and “I plan to be physically active during my free time on most days” (Motl et al., 2002; Saunders, et al., 2004; Trost et al., 2002). Findings from studies showed that intentions were significantly related to self-reported moderate to vigorous PA (Saunders, et al., 2004; Trost, et al., 2002). Moreover, a large study with eighth-grade girls found that behavioural goals or intentions were predicted by outcome expectations (e.g., subjective norms), social factors (e.g., social environments), and self-efficacy (i.e., perceived control) (Trost, et al., 2002). Similar results have been shown in a Canadian sample of elementary school students (Mummery, Spence, & Hudec, 2000).

2.8 Social Correlates of Youth Physical Activity

2.8.1 Social and Structural Factors

Social and structural factors refer to the broader contexts, or social systems, in which cognitions are shaped (Bandura, 2001; Bussey & Bandura, 1999; Luszczynska & Schwarzer, 2005). It includes demographic factors described earlier, PA policies and built environments (Luszczynska & Schwarzer, 2005), significant others, family structures (Bandura, 2001), and by extension, cultural and religious structures. These factors have been theorized to primarily affect PA behaviour indirectly through their influence on self-efficacy, outcome expectations, and goals (Bandura, 2001).

According to social cognitive theory, people within one’s social environment may serve as facilitators of youth PA in numerous ways. They may provide opportunities for PA, stimulate enjoyment, and serve as role models. As well, other people may provide verbal encouragement or persuasion to engage in physical activities. Conversely, others may restrict opportunities for mastery or discourage PA participation.

2.8.1.1 Significant Others

Many studies of youth PA have assessed perceptions of others within a person’s social environment (Hamilton & White, 2008; Motl, Dishman, Saunders, Dowda, & Patel, 2004;
Neumark-Sztainer, et al., 2003; Saunders, et al., 2004). In general, findings indicate that support positively relates to PA participation. This includes social support from parents, peers and teachers (Neumark-Sztainer, et al., 2003). Different types of support have also been examined, including the presence of others, degree of attachment, whether others provide guidance or information, perceived nurturance, social integration, and whether others provide praise or reinforcement. When applied to PA behaviour, research has indicated that greater support in these different areas is positively associated with PA participation, including moderate to vigorous PA and team sport involvement (Hamilton & White, 2008; Saunders, et al., 2004). Perceived support is also associated with greater intention to be active and perceiving oneself as a physically active person (Hamilton & White, 2008).

2.8.1.2 Family Members

Family members are key components of youth social environments. Much of the research on families has focussed on parents, although siblings may exert similar influences on youth PA behaviours (Duncan, Duncan, Strycker, & Chaumeton, 2004; Hohepa, Scragg, Schofield, Kolt, & Schaaf, 2007; Loucaides, et al., 2007; Tucker & Winzeler, 2007). To date, evidence shows that parents and siblings may positively influence the PA participation of youth through numerous pathways, including encouragement and role modeling (Anderssen & Wold, 1992; Coakley & White, 1992; Dwyer et al., 2006; Edwardson & Gorely, 2010; Eyler et al., 2002; Hohepa, et al., 2007; Loucaides, et al., 2007; McGuire, Hannan, Neumark-Sztainer, Cossrow, & Story, 2002; Tucker & Winzeler, 2007; Welk, Wood, & Morss, 2003). However, in a study comparing parents, siblings, and friends, findings indicated that although encouragement from parents played a stronger role in PA among youth compared to siblings, encouragement from friends played a stronger role than family members among senior students (Hohepa, et al., 2007). Role modeling was assessed in a recent study of Canadian high school youth \((N = 1398)\). Researchers asked participants, “Not counting yourself, how many people in your home participate in physical activity?” and “How many of your closest friends participate in physical activity?” (Loucaides, et al., 2007). Findings showed that PA among family members was associated with moderate to vigorous PA and, in line with findings on encouragement, there was evidence that PA among friends may play a stronger role than PA among family members (Loucaides, et al., 2007). In other research, researchers found that children of parents with high levels of PA indicated higher levels of parental influence, and had higher levels of PA
themselves (Welk, et al., 2003). Moreover, children of active parents were more attracted to PA and felt more competent in PA compared to children with inactive parents (Welk, et al., 2003). The researchers concluded that active parents might provide more role modeling, encouragement and facilitation of PA compared to inactive parents. Interestingly, boys reported higher levels of PA than girls as well as higher levels of parental influence (Welk, et al., 2003). This may indicate that parents treated their sons and daughters differently when it came to encouraging, facilitating and being involved in physical activities. Some evidence suggests that parents may have a negative influence on PA and restrict access and opportunities for PA for daughters more than sons. For instance, Coakley and White (1992) interviewed adolescent girls ($n = 26$) and boys ($n = 34$) ages 13 to 23 and results showed that girls almost exclusively cited parental constrains to their sport and PA participation. They felt that parents were more protective of them and monitored their schedules more closely than their male counterparts, which affected their decisions about sport and leisure activities. Boys did not cite such parental constraints on locations, companions, and leisure time related to PA. Girls also noted parents were concerned about safety (e.g., daughters traveling home from sports at night).

In other research, Dwyer et al. (2006) found that even if parents supported their daughters’ PA when they were children, in some cases this support was withdrawn when daughters became older. In this study, focus groups were conducted with 15 to 16 year old girls in Toronto ($N = 73$) (Dwyer, et al., 2006). One participant explained, “Now that I’m older, I can’t just do what I want to do – play with my friends, go out, and play sports. My father says I should be older and ‘settle down’” (Dwyer, et al., 2006, p.81). Some girls also indicated that parents perceived that time for PA competed with time that should be spent doing homework. Moreover, Eccles (1989) has theorized that there is a lack of role models to whom girls can relate within PA settings and that this has impeded the development of positive PA self-images among girls. For example, a study in the United States showed that culture may influence how parents expose their children to PA (Eyler, et al., 2002). Latina women participating in the research indicated that their cultures supported PA pursuits for boys, but not for girls, and that mothers were unable to be role models in PA for their daughters because they lacked familiarity and experience with PA.

Overall, evidence on family members explains that parents and siblings may influence PA in several ways, and this influence may change over time. However, gender and cultural aspects of
family influence have seldom been explored, indicating the need for additional research in these areas.

2.8.1.3 Friends and Peers

Compared to research on parental influences on youth PA, there is less information available on friends and peers (Smith, 2003). However, as noted earlier, some evidence suggests that peers may gain importance over families for PA participation during adolescence (Dunton, Whalen, Jamner, & Floro, 2007; Hohepa, et al., 2007; Loucaides, et al., 2007). Developmental literature supports a focus on friends and peers for perceived social norms and motivated behaviour like PA (Weiss, 1995). Friends and peers have also been identified as consistent correlates of youth PA (Sallis, et al., 2000), and a review of re-emerging themes in sport and exercise psychology over 75 years has indicated that like parents, peers may influence PA through modeling and social support and also by providing fun environments for physical activities (Weiss & Gill, 2005). Furthermore, PA appears to be an appealing context for youth to gain social acceptance and popularity among peers, and provides opportunities for them to build social skills like sportsmanship, taking turns, and fair play (Weiss & Gill, 2005). Studies have shown that youth tend to choose similar pastimes as their friends, and are more physically active with friends than when they are alone (Anderssen & Wold, 1992; Dunton, Whalen, et al., 2007; Humbert et al., 2008; Salvy et al., 2009; Schofield, Mummery, Schofield, & Hopkins, 2007; Voorhees et al., 2005). For example, Dunton and colleagues (2007) analysed longitudinal PA data from high school students ($N = 524$) who completed eight electronic logs for 4 days each over a period of four years. Results showed that exercise was most often reported with friends (43%), then classmates (21%), alone (18%), and with family members (9%), suggesting that friends were the most important companions for PA (Dunton, Whalen, et al., 2007). Other research has shown that peers are important sources of PA encouragement for youth by recognizing accomplishments and enhancing self-esteem (Anderssen & Wold, 1992; Humbert, et al., 2006; Smith, 2003). Focus group research with youth in grades 7 to 12 ($N = 160$) found that friends directly motivated youth to be active also made PA more enjoyable (Humbert, et al., 2008).

On the flipside, other studies have shown that low levels of encouragement and having inactive peers is related to low levels of PA among youth (Dwyer, et al., 2006; Hohepa, et al., 2007; Humbert, et al., 2008; Weiss, Smith, & Theeboom, 1996). For example, a study of social support
among high school youth in New Zealand ($N = 3471$) assessed encouragement from friends and found that youth who perceived low PA encouragement had an increased likelihood of not being physically active (Hohepa, et al., 2007). The nature of peer influences on PA may also change during adolescence, with peers becoming more important for PA among older youth (Hohepa, et al., 2007; Horn & Weiss, 1991; Humbert, et al., 2008; Smith, 2003). Focus group research with youth ($N = 160$) in junior school (grades 7 to 8) and high school (grades 9 to 12) showed that junior students participated in PA for the opportunities to make new friends, while high school students made decisions to participate in PA based on the activity levels of their existing friends (Humbert, et al., 2008). This meant that some youth made decisions to forgo PA if friends were not available (Dwyer, et al., 2006; Humbert, et al., 2008).

Cultural composition of friendship groups may also play an important role in PA participation. Studies on youth friendships in sociology and developmental psychology have suggested that youth in multicultural societies favour friendships with youth of the same ethnicity/race (Giordano, Cernkovich, & DeMaris, 1993; Gonzalez, Herrmann, Kertesz, & Vicsek, 2007; Kao & Joyner, 2004; Phinney, Ferguson, & Tate, 1997; Vaquera & Kao, 2006, 2008). This is not surprising, as “having things in common” is cited as a critical feature of youth friendships (Weiss, et al., 1996), and it is likely that youth perceive that they have similar family lives, values, and cultural practices as others from their population (ethnic/racial) group. However, friendships primarily with those within one’s population group may have implications for PA levels. For example, it is possible that South Asian youth, especially girls, may be among the least active population groups in Canada because they are more likely to be friends with other South Asian girls who, in turn, are more likely to be inactive versus girls from other groups. This highlights that future research should examine the cultural composition of friendship groups and ways that this may influence PA behaviour.

Overall, friends and peers may influence youth PA levels in various ways, including encouragement, role modelling, and involvement. At the same time, because social acceptance may be increasingly important during adolescence, the presence of inactive friends may impede PA participation, especially among older youth.
2.9 Understanding Physical Activity among South Asians

In the previous sections, key demographic, psychological and social correlates of physical activity (PA) were described. Findings from Canadian Community Health Surveys flagged South Asians in Canada, especially females, as a population group with the lowest levels of PA. However, population surveys provide little insight into why this may be the case. The remainder of this chapter presents findings on the South Asian population group from census research and studies on health, leisure and culture to suggest that social factors, particularly family responsibilities, family support, and beliefs about culture and religion may relate to PA participation among South Asian high school girls. As few studies have specifically examined factors related to PA among South Asian adults and youth in Canada, findings from the United Kingdom, the United States and Australia are also examined.

2.9.1 Characteristics of the South Asian Population Group

Canadian census research uses the term “South Asian” to refer to people with ancestry from the Indian subcontinent (Tran, Kaddatz, & Allard, 2005). In the 2006 census, the top country of origin among South Asians was India (69%), followed by Pakistan (7.8%) and Sri Lanka (4.1%) (Statistics Canada, 2008a). Alternate terms used for this group are the “Indian diaspora” and “South Asian diaspora,” reflecting how populations from South Asia have dispersed to countries worldwide (Duschinski, 2004; Hinnells, 2000). Census polls show that the number of South Asians in Canada has been steadily growing. The 2006 census identified South Asians as the largest ethno-cultural minority group in Canada, representing one-quarter of all visible minority groups and 4% of all Canadians, with nearly 30% born in Canada (Statistics Canada, 2008a). Data also showed that the largest concentration of Canadians with South Asian ancestry resided in Ontario (28.9%) and represented 13.5% of the population in the city of Toronto (Statistics Canada, 2008a). The two most recent census surveys (i.e., 2001 and 2006) also showed that South Asian Canadians were likely to be young compared to the overall Canadian population (Statistics Canada, 2008a). Specifically, among the Canadian-born population in Toronto in 2006, the median age of South Asians was only 10 years of age compared to 27 years among all Torontonians (Statistics Canada, 2008a).

Although various countries of origin, immigration circumstances, and number of years in Canada are reflected within the South Asian census category, research suggests that there are common
beliefs within this population group. The 2002 Ethnic Diversity Survey showed that individuals of South Asian heritage felt a strong sense of belonging to their particular ethnic or cultural group (67%), to Canada (88%), and especially to their family (93%) (Statistics Canada, 2007b; Tran, et al., 2005). Furthermore, nearly all respondents reported religious affiliations (i.e., Sikh (28%), Hindu (28%), Muslim (22%), and Christian (16%)) (Statistics Canada, 2007b), and attached a strong sense of importance to their religion regardless of their specific affiliations (Tran, et al., 2005). Research has also shown that irrespective of their country of residence, families of South Asian descent have tended to establish extensive ties with their homeland region or community, and have strengthened or preserved traditional lifestyles and values concerning the family, household, and children (Ballard, 1994; Coward, 2000; Dasgupta, 1998; Hinnells, 2000; Levinson, 1994; Mann, Numrich, & Williams, 2002; Williams, 1988).

2.9.2 Health and Physical Activity Research on South Asians

Accumulating public health research in Canada has found a greater prevalence of cardiovascular and chronic disease risk factors among South Asians when compared to other population groups (Anand, et al., 2003; Anand, et al., 2000; Chiu, Austin, Manuel, & Tu, 2010; Foulds, Bredin, & Warburton, 2012; Gupta, et al., 2002; Liu, et al., 2010; Vuksan, et al., 2012). Empirical findings have also suggested that South Asians exhibit risk factors for cardiovascular disease at lower levels of obesity relative to other population groups, and they may develop cardiovascular disease sooner compared to other groups (Foulds, et al., 2012; Gray et al., 2011; Razak et al., 2007; Vuksan, et al., 2012). Specifically, a study showed that South Asian youth had higher triglyceride levels, and higher plasma lipid ratios compared to youth of European or Chinese descent (Vuksan, et al., 2012). Of concern, these trends were more pronounced in South Asian female adolescents.

There is strong evidence that participation in physical activities may assuage multiple risk factors for cardiovascular disease, including those clustered risk factors known as metabolic syndrome (Janssen & LeBlanc, 2010). However, available research suggests that PA levels may be particularly low among South Asians (Bryan & Walsh, 2004; Liu, et al., 2010; Vuksan, et al., 2012). Pooled data from three cycles of the Canadian Community Health Survey (CCHS) showed that South Asian youth and adults ages 12 and older reported the lowest levels of PA across all population groups in Canada (Liu, et al., 2010). However, it is possible that part of the
differences in reported PA between South Asians and other population groups were related to the conceptualizations of PA and the assessment tools used. For instance, the CCHS emphasizes organized PA typically carried out in designated PA areas, and may not have included relevant activities for South Asians. Inclusion of a broader range of activities or use of a more inclusive measure may minimize differences in self-reported PA levels between population groups. On the other hand, researchers have hypothesized that differences in self-reported PA may be related to beliefs and cultural norms for lifestyle and health behaviours (Liu, et al., 2010), and could reflect aspects of South Asian social environments. Thus, data may represent true discrepancies in PA levels between South Asians and other population groups. Considered together, potential measurement issues and cultural similarities among South Asians warrant further research on factors, particularly social and cultural factors related to PA.

2.9.2.1 Factors Related to Physical Activity among South Asian Adults

Few studies have examined correlates of PA participation among South Asians, such as relationships between PA and cultural beliefs (Daniel & Wilbur, 2011). In one qualitative study, participants reported that their South Asian community placed great importance on family responsibilities and family time, and this posed a barrier to PA participation. One female participant reported, “We are too much engrossed with our family… and we concentrate on our family more than exercise” (Mohan, Wilkes, & Jackson, 2008, p. 118). In another study, some participants explained that setting aside time to be physically active was perceived negatively by their cultural group and interpreted as selfishness. Instead, the social norm was to “prioritize their obligations to kin, such as helping out in family businesses and/or with child care, over the pursuit of their own interests and activities” (Lawton, Ahmad, Hanna, Douglas, & Hallowell, 2006, p. 47). Findings across studies also showed that PA participation was not a priority compared to other activities, like work or relaxation (Kalavar, Kolt, Giles, & Driver, 2004; Lawton, et al., 2006; Mohan, et al., 2008).

2.9.2.2 Factors Related to Physical Activity among South Asian Youth

Research with adults showed that South Asian parents tended to form fairly homogenous social networks in efforts to preserve South Asian cultures and family values. In contrast, research with South Asian youth in Canada, the United States and the United Kingdom has found that youth often actively seek social relationships with peers outside of their ethno-cultural communities.
and wish to participate in the same social activities as their non-South Asian friends (Berry, 2005; Berry, Phinney, Sam, & Vedder, 2006; Talbani & Hasanali, 2000; Tirone & Pedlar, 2000). For example, interview research was conducted with 15 South Asian males and females in Southern Ontario (ages 15 to 22 years) (Tirone & Pedlar, 2000) and 22 South Asian females in Montreal (ages 15 to 17 years) (Talbani & Hasanali, 2000). Although not directly related to physical activities, findings from both studies revealed that parents were protective of their children, and in some cases, parents did not permit them to attend some activities, spend time with friends outside of school hours, or attend activities like school field trips. Such restrictions imposed by parents were a source of frustration to South Asian youth (Talbani & Hasanali, 2000; Tirone & Pedlar, 2000). As extra-curricular physical activities like team sports are often reported to be key sources of PA among youth (Active Healthy Kids Canada, 2011), restrictions on leisure time may also impact PA participation. However, there has been little research to examine friendships with peers outside of South Asian cultures, and participation in extra-curricular activities and pastimes among South Asian youth, with particular attention to those that may be physically demanding or require parental permission.

Evidence also suggests that South Asian parents may be more restrictive of leisure time for daughters compared to sons (Dasgupta, 1998; Farver, Bhadha, & Narang, 2002; Ramanathan & Crocker, 2009; Vertinsky, et al., 1996). Dasgupta (1998) theorized that different standards may exist for sons versus daughters because South Asians in North America have “transplanted old-world gender ideologies and clearly dichotomized gender roles in their adopted country of residence” (p.956). Stories of dichotomized gender roles in the home emerged in interview and focus group research with first- and second-generation South Asian-Canadian girls ages 15 to 19 (Ramanathan & Crocker, 2009). Participants reported that they and other girls in South Asian families were generally given more responsibilities and chores than boys and felt that these extra chores compromised the time they had available for physical activities (Ramanathan & Crocker, 2009). However, types of pastimes and time spent in chores, family responsibilities and leisure activities were not documented in these studies. As a result, there is a need for further research to examine the range of pastimes that South Asian youth, particularly girls, are involved in and how pastimes and family responsibilities may influence PA participation.
2.10 Summary of Methodological and Knowledge Gaps in Physical Activity Research with South Asian High School Girls

There is strong evidence on the health and wellness benefits of physical activity (PA) participation and relationships between PA and disease prevention. Yet, studies that assess PA levels in youth show that girls are less active than boys, particularly among high school youth, and often fall short of recommended guidelines (Active Healthy Kids Canada, 2011).

Furthermore, population studies have identified that South Asian youth and adults, especially females, report the lowest level of PA after controlling for socioeconomic status. It is not clear whether this reflects shortcomings in PA questionnaires that do not gather the types of PA that are relevant for South Asians, or whether there are aspects of South Asian cultures (e.g., social norms and beliefs about the family) that pose challenges for PA participation and lead to low PA levels in girls. Considered together, there are two main research gaps this thesis will address. First, it will use a more in-depth assessment of PA and gather information on all everyday activities. Second, it will examine a range of factors, particularly cultural factors related to PA among South Asian high school girls, along with demographic, psychological, and social factors identified in previous studies to examine what role they play in understanding PA participation. Many of these factors are drawn from cognitive theories of motivation and will guide discussion of the findings.

Specifically, the following objectives will be addressed:

Objective 1: To examine the quality and quantity of PA among South Asian high school girls

a) To examine details of the everyday activities of adolescent girls comparing weekdays and weekends as well as potential differences in activities by grade using a diary method, with a focus on the types, location and companions for PA participation.

b) To examine and compare PA duration and intensity (i.e., vigorous bouts, sweating and moderate to vigorous PA) using two different methods: a diary and recall questionnaire, and also compare PA levels to the Canadian PA guidelines.
Objective 2: To examine psychosocial factors and their relationships to PA among South Asian high school girls
a) Perceptions of PA enjoyment, parental permission for PA, control over decisions to engage in PA, and barriers to engage in PA.
b) Perceptions of support for PA, attitudes and connectedness to diverse social networks (e.g. friends, families, and peers from other cultures).
c) Religious connections and involvement.
d) Perceptions of cultural and gender-specific attitudes towards PA.

2.11 Hypotheses
Based on previous research, I expect:
Objective 1:

a) PA levels will be higher on weekdays compared to weekend days.
b) Participants in junior grades (9 and 10) will report higher levels of PA (e.g., greater duration, more vigorous bouts, sweating and moderate to vigorous PA) compared to participants in senior grades (11 and 12).
c) PA reports based on the diary and questionnaire will have a high level of concordance.
d) Few participants will be meeting the Canadian PA guidelines.

Objective 2:

a) The following factors will be positively related to PA: enjoyment, control, support for PA, attitudes and connectedness to diverse social networks, cultural and gender-specific attitudes towards PA.
b) The following factors will be negatively related to PA: barriers, parental permission, religious connections and involvement.
Chapter 3
Methodology

3 Participants and Methods

3.1 Recruitment

From January to May 2010, participants were recruited from the Toronto area, Canada in communities where there were high concentrations of South Asian families. Participants were recruited using purposive sampling through physically active (e.g., dance) or sedentary extra-curricular activities (e.g., youth groups at a library) as well as through snowballing techniques to yield a sample with a potential range of PA levels. Recruitment strategies included: advertisements at South Asian cultural festivals (see Appendix F and Appendix G); five-minute presentations at community centres, youth groups, and dance and music classes; emails to various contacts; and participant referrals to the study website by others. Eligibility criteria for the study were: 1) self-identifying as being of South Asian heritage; 2) full-time enrolment in high school (grades 9 to 12); 3) having attended a Canadian school for at least the two previous years; and 4) fluency in English. The requirement to have been enrolled in a Canadian school for at least two years ensured that participants were familiar with the Canadian school system and aware of popular physical activities and pastimes among their peer group. Participants were invited to respond to presentations and recruitment advertisements by emailing or telephoning the investigator or visiting the study website to obtain more information. Provisions were made in case participants did not have access to a computer and the Internet. This included the option of being mailed a copy of study materials.

All study materials and procedures received ethics approval from the University of Toronto Research Ethics Board (REB) (see Appendix A). A website (www.myeverydayactivities.com) was set up with separate sections tailored for potential participants and parents (see Appendix J for screenshots of each page). Parents were encouraged to contact the researchers if they had questions about the study. However, parents were also informed that all participant responses (including their daughter’s) would remain confidential. A consent information letter for participants (see Appendix C) and an information letter for parents (see Appendix H) were available for download from the study website and also emailed directly to participants. Once
participants had a chance to read through the consent information letter and discuss the study with parents (if desired), they were instructed to fill out a secure and encrypted online form to indicate their name, email address, telephone number, and availability for telephone correspondence (see Appendix I). All participants were then contacted by telephone, given a brief overview of the study, and had an opportunity to ask questions before verbally consenting to participate (see Appendix B). Each consenting participant was assigned a unique identifying number to link their diary entries and questionnaire. Participants received a $20 shopping gift card and, if desired, a letter indicating they had voluntarily participated in a research study that could be counted as 1.5 to 2.5 hours toward their Ontario Secondary School Diploma community volunteer requirements.

3.2 Study Design

This study used a cross-sectional design with daily diaries and a self-administered questionnaire to investigate everyday activities of high school girls with South Asian heritage in the Toronto area, Canada. Both the diaries and the questionnaire were administered to participants using the Internet, as all participants had access from home. Because many daily activities, especially physical activities, are known to be weather-dependent, participants who were enrolled at the beginning of recruitment (during winter: January to March 2010) were asked to complete one round of diary entries within a week of signing up for the study and a second round of entries after April 1st when the weather became warmer. The interval between round one and round two ranged from two weeks to two months. Participants who enrolled in the study during the last six weeks of the recruiting phase (i.e., after April 1st) completed either one or two rounds of diary entries, depending on their date of enrolment. Data collection was scheduled to finish at the end of the academic high school year. Therefore, no additional participants were recruited after May 31st. Diaries were emailed as form-fillable Microsoft Word attachments to participants and returned by email (see Appendix D).

Upon completing the assigned rounds of diary entries, a one-time online questionnaire link was emailed to participants. A copy of the questionnaire is available in Appendix E. Questionnaires were administered using web-encrypted Survey Monkey technology (Survey Monkey, 2009) between May 1st and July 4th, 2010. In situations where a participant did not complete a diary entry, partially completed rounds one or two, or completed only round one, the questionnaire
link was emailed to them in the last two weeks of the data collection phase. Each diary entry took approximately ten minutes to complete. The questionnaire took approximately thirty minutes to complete.

The diary and questionnaire were piloted with 10 girls: those in high school as well as those of South Asian heritage. In general, participants indicated that completing diary entries was an enjoyable activity and gave them a chance to reflect upon their day. However, three issues arose during data collection that resulted in changes to the diary method. First, although the study originally asked for a full week (seven days) of diary entries at each round of data collection, many participants indicated they had similar schedules on Monday through Friday and found it repetitive to complete diary entries for each weekday. To reduce participant burden, the diary was altered to a five-day format that included any three weekdays of participants’ choosing, plus Saturday and Sunday. For their weekday choices, participants were encouraged to select days when they were involved in the most extra-curricular activities. Second, an item in the daily diaries that asked participants about their most physically demanding episode sometimes elicited responses with examples of sedentary activities that were cognitively demanding (e.g., calculus class). To minimize errors in interpretation by participants, an additional question was asked about mentally draining activities. Finally, as the school year progressed, there was concern that academic demands would prevent some participants from completing a second round of diary entries. At the same time, it was important to continue recruiting new participants in order to meet sample size requirements. To address this issue, participants enrolling in the last six weeks of the school year were required to complete only one round of diary entries. The first round of diary entries gathered all of the necessary information to address the research objectives, thus, to maximize the sample size for the purposes of this dissertation, the second round of entries is not discussed. However, because warmer weather in spring (April to June) may be more conducive to PA participation versus winter (January to March) (Canadian Fitness and Lifestyle Research Institute, 2010b), analyses of the diary PA outcomes will control for season.

3.3 Daily Diary

3.3.1 Diary Episode Details

A modified version of the Day Reconstruction Method (DRM) was used to capture daily diary information (Kahneman, et al., 2004b). The DRM uses episodic sampling periods to reduce
participant burden while maximizing the collection of relevant data (Kahneman, et al., 2004b). A round of diaries consisted of five entries: three weekdays, particularly those featuring extra-curricular activities, and both weekend-days. Participants were instructed to set aside 10 minutes before going to bed to complete their entries. It was estimated that a full round of diary entries for one week would take less than an hour to complete. While filling out the diaries, participants were asked to think about their day as a series of episodes in a story and to split up those episodes into three different time periods: morning (waking up until noon), afternoon (noon until 6pm), and evening (6pm until bed time). For each episode, participants were asked for a brief description of their activities, start and end times, any companions with whom they shared the activities, and the location of the activities (see Appendix D). Once morning, afternoon and evening episodes were recorded, participants were asked to reflect upon their day and answer summary questions.

3.3.2 Diary Summary Measures

3.3.2.1 Special Activity Episodes: most enjoyable, least enjoyable, most physically demanding, most mentally draining

For each diary entry, four open-ended questions asked participants to list special episodes: 1) their most enjoyable activity, 2) least enjoyable activity, 3) most physically demanding activity, and 4) most mentally draining activity. With the exception of the most physically demanding episode, participants could select “nothing stands out” if no episode was deemed noteworthy to identify as the “most enjoyable” or as another special episode. However, all participants were required to identify their most physically demanding activity of the day, even if they had not engaged in any organized physical activities and were generally sedentary throughout the day.

3.3.2.2 Parental Permission for Activities

For each of the four special episodes identified (e.g., most enjoyable, most physically demanding), respondents were asked: “Did you need permission from your parents to do this activity?” with “yes” and “no” response options.
3.3.2.3 Perceived Control over Activities

Respondents were asked how much control they had in choosing to engage in each of the five special episodes. Responses were on a 5-point Likert-type scale with 1 = none; 2 = a little; 3 = some; 4 = quite a bit; 5 = a great deal.

3.3.2.4 Quantity of Daily Physical Activity Participation: Intensity and Duration

Quantity of PA was examined with two items related to activity intensity and four items on activity duration. For intensity of the most physically demanding episode, respondents were asked to rate their level of exertion on a 15-point modified Borg Rating of Perceived Exertion (Borg, 1998). In the original scale, ratings of exertion range from 6 to 20 and are to be taken during or immediately after exercise. In the present version, the scale was translated to range from 1 to 15, and ratings were estimated at the end of the day. Original scale anchors were used with some additional instructions in parentheses: 1 = no exertion at all; 2 = extremely light; 4 = very light (e.g., easy walking, slowly, at a comfortable pace); 6 = light; 8 = somewhat hard (it was a bit tiring, but you could keep going); 10 = hard; 12 = very hard (very strenuous, and you were tired afterwards); 14 = extremely hard (you could not do it for very long, it was one of the most strenuous activities you’ve ever done); 15 = maximal exertion. The second PA intensity item asked participants, “Did you work up a sweat?” with “yes” or “no” response options.

With respect to total duration of PA, participants were prompted to think of multiple sources of physical activities. One item asked whether participants had gym class that particular day (“yes” or “no”). Two items assessed transportation mode for the school journey. Specifically, participants were asked how they travelled to school and back home from school in separate questions. Response options were: subway; walked or cycled for less than 10 minutes; walked or cycled for more than 10 minutes; by car; by bus; other (specify); did not go to school today. If applicable, participants could select more than one response option. Finally, one item assessed total PA duration as follows: “Think about all of your sources of physical activity today: the physically demanding activities you listed above, chores that made you move around, plus any walking or cycling that you did for at least 10 minutes (e.g., walking at the mall, cycling with friends, etc.). Add it all up and tell us how much physical activity you did in total today.” Six
response options were available: less than 30 minutes; about 30 minutes; about 45 minutes; about an hour; about an hour and 15 minutes; an hour and a half or more.

3.3.2.5 South Asian Everyday Activities

Respondents were asked whether they had participated in any activities related to their South Asian heritage (“yes” or “no”). If participants identified an episode that related to their South Asian heritage (e.g., traditional music or dance classes, language classes, cultural or religious events, and prayer sessions), they were asked three follow-up questions. One question assessed how much they enjoyed the episode. Responses were on a 5-point Likert-type scale with 1 = none; 2 = a little; 3 = some; 4 = quite a bit; 5 = a great deal. The second asked whether it was something they did regularly (weekly, monthly or yearly) with “yes” or “no” response options. The final question examined perceived control in choosing to participate in that episode and used a 5-point Likert-type scale from 1 = none; 2 = a little; 3 = some; 4 = quite a bit; 5 = a great deal.

3.3.2.6 Perceived Control over Free Time

The last three summary questions in the diary entry asked participants for overall perceptions of the control that they, their parents, and others (e.g., teachers, other adults, friends) exerted over their free time. Responses were on a 5-point Likert-type scale with 1 = none; 2 = a little; 3 = some; 4 = quite a bit; 5 = a great deal.

3.4 Final Questionnaire

3.4.1 Demographic Information

Demographic information was gathered from participants in a combination of open-ended and closed-ended questions. Participants were asked for the first three digits of their postal code to identify the neighbourhoods represented in this study. Two open-ended questions assessed height and weight along with units used (feet and inches or centimetres; pounds or kilograms) and was used to calculate the Body Mass Index (BMI) of each participant. Participants were asked if they had any siblings (“yes” or “no”) and if “yes”, identified whether they were brothers/sisters, and their corresponding ages (for up to five siblings). Family religious affinity was gathered using a closed question with six response options: Sikh, Hindu, Muslim, Christian, Other (Jain, Buddhist, etc.), or none. More than one religious category could be selected.
To examine birth country and acculturation, participants were asked whether they, their mother or female guardian, and father or male guardian were born in Canada with “yes” or “no” response options. If “no” was chosen, participants were asked to specify the corresponding birth country in an open-ended question. Two new items were developed specifically for this study to assess acculturation. The first asked how long they had lived in a Westernized country (e.g., Canada, United States, United Kingdom) with five response options: 1 = 0-2 years; 2 = 3-5 years; 3 = 6-8 years; 4 = 9-11 years; 5 = 12+ years. The second item asked participants about the cultural composition of their friend network, “Which of the following statements best describes your friends?” The three possible responses were, “Most of my friends are South Asian”; “I have about the same number of South Asian and non-South Asian friends”; “Most of my friends are not South Asian”.

3.4.2 Physical Activity Participation

PA participation was assessed using Godin and Shephard’s (1985) Leisure Time Exercise Questionnaire (LTEQ) with slight modifications. References to “exercises” were changed to “physical activities” as follows: “Considering a typical 7-day period (a week) how many times on average do you do the following kinds of physical activities for more than 15 minutes during your free time?”. The LTEQ assessed the number of strenuous, moderate and mild bouts of physical activity over a typical week with open response categories. As strenuous intensity activities are equivalent to vigorous intensity activities, and mild intensity activities are equivalent to low intensity activities, they are herein referred to as “vigorous” and “low” for consistency with the Canadian PA guidelines and general PA literature (Canadian Society for Exercise Physiology, 2011b; Tremblay, Warburton, et al., 2011). Sample physical activities were provided to help participants estimate their typical weekly bouts of activities at the three intensity levels. Examples were chosen from the original LTEQ to place less emphasis on organized sports (see Appendix E). For example, sample vigorous physical activities were as follows: “running, jogging, soccer, fast swimming and fast bicycling”.

The LTEQ also asked about the frequency of participation in physical activities in a typical 7-day period that were pursued long enough to work up a sweat. Responses were on a 3-point scale: 1 = often; 2 = sometimes and 3 = never/rarely. This item was reversed so that a higher score referred to more sweating.
Two studies with youth have shown strong test/retest reliability of the LTEQ: $r = 0.81$ (Sallis, et al., 1993) and correlation coefficient of .48 (confidence interval: .30, .63) (Koo & Rohan, 1999). Validation studies have shown an acceptable relationship between the LTEQ and four other self-report surveys: the 7-day PA recall ($r = .39$) (Sallis, et al., 1993), a simple activity rating survey ($r = .32$) (Sallis, et al., 1993), the PAQ-A ($r = .57$) (Kowalski, et al., 1997), and the Perspiration Score ($r = .40$) (Koo & Rohan, 1999). Low but acceptable validity has also been shown for the LTEQ against the objective measures of accelerometers ($r = .23$) and heart rate monitors ($r = .38$) (Chinapaw, Mokkink, van Poppel, van Mechelen, & Terwee, 2010).

### 3.4.3 Perceived Control in Physical Activity

A 3-item scale examined perceived control in PA on a 7-point Likert-type scale (Rhodes, et al., 2002). Items referring to “exercising” were changed to “being physically active”. The first item, “For me, being physically active is…” was anchored with 1 = Extremely difficult and 7 = Extremely easy. The second item, “How much control do you feel you have over being physically active regularly?” was anchored with 1 = Very little control and 7 = Complete control. The final item, “How much I am regularly physically active is completely up to me” was anchored with 1 = Strongly disagree and 7 = Strongly agree. A total control score was calculated. Higher scores indicated greater control over PA participation.

### 3.4.4 Barriers to Physical Activity Participation

A 15-item scale on barriers looked at a variety of factors that may limit PA among children and adolescents including time, energy and skills (Sallis, et al., 1996). Response options were: 1 = never, 2 = rarely, 3 = sometimes, 4 = often 5 = very often. Individual items were ranked to identify which barriers participants faced most often. A mean score was calculated where lower scores indicated that participants did not experience many barriers to PA participation. Internal consistency in previous research using Cronbach’s alpha was 0.86 (Sallis, et al., 1996).

### 3.4.5 Social Provisions for Physical Activity

A 24-item scale measured social provisions in PA, the various ways that people in participants’ lives may support their participation in physical activities (Motl, et al., 2004). This scale tapped into six functions that close relationships with other people may serve: reliable alliance, attachment, guidance, social integration, reassurance of worth, and reciprocal nurturance of
others’ PA. Sample items included: “there is someone I can talk to about physical activity” (guidance), “I am part of a group of people who have the same attitudes about physical activity” (social integration), and “there are people who depend on me to help them be physically active” (nurturance). Response options were: 1 = strongly agree; 2 = agree; 3 = not sure; 4 = disagree; 5 = strongly disagree. Items were reverse coded, and a mean score was calculated so that a higher score referred to more social provisions for PA.

3.4.6 Parental Support for Physical Activity

Three items each assessed support for PA from a mother and father (Kahan, 2005). Sample items were as follows: “My mom encourages me to be physically active” and “My dad approves of me being physically active.” Response options were: 1 = strongly agree; 2 = agree; 3 = not sure; 4 = disagree; 5 = strongly disagree. Items were reverse coded so that a higher score reflected more parental support. Mean scores were calculated for mother and father separately. Internal consistency using Cronbach’s alpha was 0.79 for the mother scale and 0.82 for the father scale in previous research (Kahan, 2005).

3.4.7 Subjective Norms for Physical Activity within one’s Cultural Community

Three items assessed subjective norms for PA participation within one’s cultural community (Rhodes, et al., 2002). Items referring to “exercise” were changed to “be physically active”, and “social network” was modified to specifically refer to one’s “cultural community”. A sample item was, “Most people in my cultural community want me to be physically active”. Responses were anchored with 1 = strongly disagree and 7 = strongly agree. A total mean score was calculated where higher scores indicated favourable norms to engage in physical activities within one’s cultural community. A new item was created with the same response options and analyzed separately: “I feel pressure from my cultural community to refrain from participating in sports or activities that are considered “masculine””. This item was reverse coded, with a higher score indicating support from cultural communities to engage “masculine” physical activities.
3.4.8 South Asian Cultural and Gender-Based Attitudes towards Physical Activity

After reviewing the qualitative literature on PA, gender and South Asian girls, it was apparent that there was a gap in assessing normative beliefs about PA that captured comparisons between South Asians and non-South Asians, intersections of culture and gender. With these gaps in mind, fifteen items exploring intersections of South Asian cultural and gender beliefs towards PA were developed and piloted in this study. Seven items asked participants to compare people of South Asian heritage to those not of South Asian heritage with respect to their attitudes towards physical activities. For example, “My parents have similar attitudes towards physical activities as non-South Asian parents in Canada.” Eight items asked participants to consider intersections of gender and South Asian heritage with respect to PA norms. For example, “Girls who are not from South Asian families usually spend more time being physically active than girls from South Asian families”. Participants were asked to indicate the extent to which they agreed or disagreed with each statement on a five point scale: 1 = strongly agree; 2 = agree; 3 = neither agree nor disagree; 4 = disagree; 5 = strongly disagree. Higher ratings indicated more favourable normative attitudes for South Asians and South Asian girls in physical activities.

3.4.9 Connectedness and Attitudes towards Others

Twenty-one items from the Hemingway Scales measured perceived connectedness (Karcher, 2005). Separate questions asked about friends (6 items); peers from other cultures (3 items); siblings (5 items), and parents (mother = 5 items; father = 5 items). Although the authors suggest randomizing the items, feasibility for use in an Internet survey necessitated that the sub-scales be presented in a fixed order. Example items included: “I have friends I'm really close to and trust completely” (friend sub-scale); “I like getting to know kids from other cultural groups” (peers from other cultures sub-scale); “I enjoy spending time with my brothers/sisters” (siblings sub-scale); “I enjoy spending time with my mother” (mother sub-scale). Responses were on a 5-point Likert-type scale from 1 = not at all; 2 = not really; 3 = sort of true; 4 = true; 5 = very true. Mean scores were calculated for each of the 5 sub-scales. Higher scores indicated stronger perceived connectedness. In the original connectedness to friends scale, the first item was negatively worded and was to be reverse-coded. Feedback from pilot participants indicated that it would be better to begin the questionnaire with a positively worded item, thus question 1 was changed to read as follows: “Spending time with friends is important to me”. Internal consistency of the sub-
scales in previous research using Cronbach’s alpha were: friends $\alpha = 0.71$; kids from other cultures $\alpha = 0.82$; siblings $\alpha = 0.94$; mother $\alpha = 0.83$; and father $\alpha = 0.92$ (Karcher, 2005).

### 3.4.10 Parental Practice Dimensions

Forty-two items examined perceptions of parental practice (Devereux, Bronfenbrenner, & Rodgers, 1969). Previous research showed that items were grouped into three dimensions (Devereux, Bronfenbrenner, & Suci, 1962). A perceived supportive dimension included 13 items per parent and assessed nurturance, principled discipline, instrumental companionship, consistency of expectations, encouragement of autonomy and indulgence. A demanding dimension had 4 items per parent measuring prescription of responsibilities and achievement demands. A controlling dimension had 4 items per parent assessing parental control and protectiveness. Items measuring “punishing practices” were included in the original parent practice scale but removed in the current study because the items were not directly relevant to the research questions and would increase participant burden. In total, 36 items used the response key: 1 = never; 2 = only once in a while; 3 = sometimes; 4 = often; and 5 = very often. The remaining 6 items used the response key: 1 = never; 2 = only once or twice a year; 3 = about once a month; 4 = about once a week; and 5 = almost every day. Example items include: “she comforts and helps me when I have troubles” (mother, supportive dimension); “he expects me to keep my things in order” (father, demanding dimension); “she won’t let me go places because something might happen to me” (mother, controlling dimension). For each of the dimensions, mean scores were calculated for mother and father separately. Items were originally scored from 2 to 10, but were scored from 1 to 5 in this study to be more consistent with other measures. Higher scores indicated stronger parental supportive, demanding, and controlling behaviours and attitudes.

### 3.4.11 Connectedness to Religion

Connectedness to religion was assessed using three items from the Hemingway scale that looked at religious connection (Karcher, 2005). Example questions include “My religion is very important to me”. Responses were on a five-point scale: 1 = not at all; 2 = not really; 3 = sort of true; 4 = true; and 5 = very true. An item reading, “I attend a religious service (at a church)” was modified to refer to “temple, mosque or spiritual centre” instead of “church”. Mean scores were
calculated. Higher scores indicated stronger roles for religion and spirituality. Internal consistency in previous research using Cronbach’s alpha was 0.91 (Karcher, 2005).

3.4.12 Religious Involvement: Frequency of Prayer and Attendance at Religious Services and Activities at a Place of Worship

A single item from the scale of private religious practices (Fetzer Institute and National Institute on Aging Working Group, 1999) was included in the questionnaire and asked about frequency of prayer. It was modified to refer to prayer at a temple, mosque or spiritual centre instead of “church or synagogue”. The remaining items in the original scale assessed religious practices for Christian and Jewish adults, and were not relevant for youth of South Asian heritage. A new item was created asking participants, “How often do you pray privately in places OTHER THAN at a temple, mosque or spiritual centre?” Response options were on a seven-point Likert-type scale: 1 = several times a day; 2 = once a day; 3 = a few times a week; 4 = once a week; 5 = a few times a month; 6 = once a month; 7 = less than once a month. Responses were reverse-coded so that higher scores indicated more prayer. Items were analyzed separately as they assessed different concepts.

Two items captured attendance at religious services or participation in activities (besides religious services) at a place of worship (Fetzer Institute and National Institute on Aging Working Group, 1999). Responses were on a nine-point scale: 1 = never; 2 = less than once a year; 3 = about once or twice a year; 4 = several times a year; 5 = about once a month; 6 = 2-3 times a month; 7 = nearly every week; 8 = every week; 9 = several times a week. Higher scores indicated greater attendance at religious services and greater attendance in activities at a place of worship.

3.5 Data Analysis

3.5.1 Diary Data

3.5.1.1 Coding Scheme for Diary Episodes

Diary episodes were coded separately and then combined to yield some summary information. Episodes were coded for duration, intensity of activity, type of activity, location, and companions in Microsoft Excel (see Appendix L for the complete coding scheme and Appendix N for an example of how episodes were coded). Each activity episode received one duration code
based on the start and finish times indicated by participants: 1 = about 15 minutes; 2 = about 30 minutes; 3 = about 45 minutes; 4 = about an hour; 5 = about an hour and 15 minutes; and 6 = an hour and a half or more.

Eight activity intensity level codes were used based on the nine intensity codes initially created by Bouchard and colleagues (1983) and modified by Lelieveld and colleagues (2008). Specifically, the two highest intensity codes (i.e., level 8 = “recreational sport and leisure time activities with high intensity” and level 9 = “competition sport”) were collapsed into a single category, so that the final coding scheme ranged from lying down (level 1) to sport and leisure activities at the highest intensity or competitions (level 8) (see Appendix L for the full coding scheme). Sedentary intensity activities corresponded to intensity codes 1-3, low to moderate intensity activities used codes 4-6, and vigorous intensity activities were captured by codes 7-8. Because participants often included multiple activities in the same episode, each activity episode received up to three codes from highest to lowest intensity level. For example, if a participant indicated, “walking to the bus stop, waiting for the bus, and sitting on the bus” in the same episode, it received the following three intensity codes: 5 = walking outside, 3 = standing and 2 = sitting. Two independent coders assigned intensity levels for 50% of the “most physically demanding” activity episodes identified by participants. Results were compared for consistency, and any discrepancies were discussed and resolved. Final agreement rates reached 95% (see Appendix M). Therefore, a single coder assigned the remaining activity intensity codes.

For episodes that were identified as the most physically demanding and only received sedentary intensity level codes (codes 1-3), another coding scheme was developed using content analysis to categorize the types of sedentary activities (see Appendix L). During content analysis, an inductive approach was used to classify text (e.g., the episode descriptions) into meaningful categories (Elo & Hyngas, 2007). Specifically, episode descriptions were read several times and distilled into broad categories by a single coder. These categories and key examples were discussed with a second coder to validate the codes. This process was used for all episode details that required content analysis. In the end, seven types of sedentary activities were identified: 1) time spent socializing with family and friends, 2) personal care activities (e.g., brushing teeth and “mirror time” like putting on makeup), 3) hobbies and extra-curricular activities (e.g., reading and practicing violin), 4) homework or classes, 5) cooking or eating, 6) screen time (e.g., time watching television, using a computer, texting on a cell phone), and 7) very low intensity chores
(e.g., making a bed, packing a bag). As episodes often involved multiple activities, each episode received up to three sedentary activity type codes. For example, if participants reported the following: “brushed teeth, washed face, ate breakfast”, this was coded as 2 = personal care activities and 5 = cooking or eating. A complete list of physically demanding episodes at a sedentary intensity level with their associated activity type codes is shown in Appendix N.

For episodes that were identified as the most physically demanding and received at least one low to moderate or vigorous intensity level code, a coding scheme for the type of physical activity was devised (see Appendix L). Using content analysis, three broad categories of low to moderate activities and one category of vigorous intensity activities were identified. Low to moderate intensity activities (intensity codes 4 to 6) were comprised of walking activities (e.g., walking in a shopping mall, walking to school), low to moderate intensity chores (e.g., vacuuming, gardening, collecting recycling at school, wiping tables at a volunteer placement), and unstructured PA and play (e.g., playing “dark tag”, playing in the snow, casual dancing at a party, playing on the swings). All vigorous intensity activities (intensity codes 7 and 8) fell into the broad category of structured PA and dance or sport practices and competitions (e.g., badminton, rugby, and physical education classes). Only the activity of the highest intensity in each episode received a code for the type of physical activity.

Location and companion codes were also developed using content analysis as described above. Ten location codes were identified, including home, school, work or volunteer location, designated PA areas (e.g., basketball court), and other (e.g., restaurant, movie theatre, doctor’s office) (see Appendix L). Up to three location codes were assigned per episode in order of the duration of the activity (i.e., most time spent in an activity to least time spent in an activity). For example, if participants indicated that they went to a coffee shop between their math and geography classes, this was coded as 2 = school and 10 = other.

Eleven companion codes were also developed, including being alone, with friends, parents, siblings, relatives and teachers (see Appendix L). Coding reflected the relationship to the participant, not the number of companions. For instance, whether a participant was with one friend or three friends, they received a single code (2 = friend). Each episode received up to three companion codes. For example, if a participant indicated that they were with a friend, their mother and sister, they received three codes (2 = friend; 3 = parents; 4 = sibling).
Finally, episodes could also receive “special episode” codes for the most fun, least fun, most physically demanding, most mentally draining episode as well as episode related to their South Asian heritage. Participants identified these special episodes in their diary summary questions. An additional code was assigned to any episode identified as most physically demanding that was also an extra curricular activity. Examples of extra curricular activities included lessons (e.g., dance, violin, swimming, piano, language), club activities at school, volunteer activities (e.g., at the local library or hospital), school or community sports (e.g., badminton, soccer), tutoring, and part-time jobs (e.g., life guarding, delivering newspapers).

3.5.1.2 Creating the Database
Once diary episode details were coded and finalized as described above, data were imported into SPSS 20 software, a quantitative data management system. As the first step, grade information (9 to 12) was imported from the telephone screener contact information (see Appendix B). Participants were collapsed into two groups based on junior (9 and 10) or senior (11 and 12) grades to facilitate comparisons between younger and older girls. Next, diary variables related to the quality and quantity of PA participation were calculated separately for weekdays (three entries), weekend days (two entries), and across all five diary entries. Three participants had incorrectly completed four weekday entries instead of three, and only one weekend entry instead of two. For these participants, weekday and weekend variables were calculated from four entries and one entry, respectively. Relationships between the ratings of perceived exertion and activity intensity codes were examined using Pearson correlations ($r$). Although there are no definitive cut-offs regarding the strength of associations, relationships were interpreted to be small/low at $r < .30$; moderate at $.30 \leq r < .65$; and high/strong at $r \geq .65$. If these variables were strongly correlated, a single variable was chosen to carry forward for further analysis to avoid redundancy.

3.5.1.3 Diary Physical Activity Outcome Variables: Total Minutes of Physical Activity, Vigorous Bouts of Physical Activity, and Sweat Frequency
Weekday, weekend and overall PA duration in minutes was calculated from the diary entries. The first response category was originally “1 = less than 30 minutes” and was interpreted to be 15 minutes as all other response categories were in 15-minute increments (i.e., 2 = 30 minutes, 3
= 45 minutes, 4 = 60 minutes, 5 = 75 minutes, 6 = 90 minutes). For two participants, average PA duration across all diary entries was calculated from four entries only due to missing data. Average PA duration overall was calculated from five entries for all other participants.

Intensity of the most physically demanding activities identified in the diary entries was captured in three ways. The first measure of intensity level examined whether participants reported sweating during the most physically demanding task (0 = no, 1 = yes). The second measure was the rating of perceived exertion reported by participants on a scale from 1 to 15. The third measure categorized intensity level of the most physically demanding episode based on its description on a scale from 1 to 8 where 1-3 = sedentary; 4-6 = low to moderate; and 7-8 = vigorous. Although all participants were instructed to identify their “most physically demanding” episode for each diary entry even when they only engaged in low-intensity activities, a small number of participants neglected to identify a physically demanding episode on particularly sedentary days. In cases where the most physically demanding episode was not identified, individual diary entries were examined, and the episode that received the highest intensity code was selected. If multiple episodes were tied for the highest intensity, one episode was randomly selected to represent the most physically demanding episode of the day.

Total bouts of sedentary, low to moderate and vigorous activities reported as the most physically demanding were summed as well as the total number of days where sweating was reported. The proportion of the most physically demanding activities categorized at sedentary, low to moderate, and vigorous intensity levels and the proportion of days with sweating reported during the most physically demanding activity was also calculated for each participant on weekdays, weekends, and overall.

3.5.1.4  Diary Independent Variables

Three variables were created based on participant-identified special episodes from the open-ended summary questions: the most physically demanding activities that were also identified as a) related to their South Asian heritage, b) most enjoyable, and c) least enjoyable. An additional variable was created based on the study-assigned special episode code for extra-curricular activities.
Four variables were created based on closed-ended summary questions examining enrolment in physical education classes (“yes” or “no”); mode of travel to or from school (walking for at least 10 minutes or other modes); proportion of physically demanding activities that participants indicated “yes” for needing parental permission; and, average control over the most physically demanding activities (average score of the 5-point scale).

3.5.2 Merging Questionnaire Data into the Database

Questionnaire data were downloaded from Survey Monkey as an excel spreadsheet and imported into SPSS 20 software, a quantitative data management system. Questionnaire data was merged with diary data using the participant identification number.

3.5.2.1 Screening the Questionnaire Data

As a first step in analyzing quantitative data from the questionnaire, all items were screened for missing data. For questionnaire items using Likert-type responses, the electronic tools did not permit responses outside the range of acceptable answers; thus, it was not necessary to screen for out of range responses. Total scores were calculated for scales with no more than 10% missing data. Body Mass Index (BMI) was derived from height and weight responses that were converted into metres and kilograms, respectively (i.e., BMI = weight (kg)/height (m²)). BMI values were categorized into severe thinness, thinness, normal, overweight and obesity according to International age-based z-scores (World Health Organization, 2007).

Prior to testing hypotheses for both objectives 1 and 2, independent variables were examined with the purpose of reducing the total number of variables to maximize the power to detect meaningful differences in the final multivariate analyses. First, internal consistency of each questionnaire scale was examined using Cronbach’s alpha (α). Measures with poor internal consistency (α < .70) were dropped from further analysis. Descriptive characteristics (range, frequencies, M or proportion, and SD) were calculated for questionnaire and diary measures to test independent variables for their adherence to the assumptions of normality and to lay the groundwork for subsequent analyses. Measures with poor variability (i.e., lacking a range of scores and skewed with floor or ceiling effects) were dropped from further analysis. A measure was considered skewed if the sample mean score fell into the bottom or top 20% of the scale (e.g., mean scores of less than 2 or greater than 4 on a 5-point scale). Bivariate relationships
among the independent variables were examined using Pearson correlations ($r$) to detect less informative and highly correlated variables. Main effects were examined using independent samples $t$-tests or paired samples $t$-tests (wherever appropriate), and interpreted as significant at $p<.05$.

3.5.2.2 Questionnaire Physical Activity Outcome Variables: Vigorous Bouts of Physical Activity, Metabolic Equivalent of Task Score, and Sweat Frequency

Intensity of PA participation was captured in the final questionnaire using the Godin-Shephard Leisure Time Exercise Questionnaire (LTEQ) and resulted in three outcome measures: bouts of vigorous PA, a moderate to vigorous metabolic equivalent of task (MET) score, and sweat frequency. All three PA outcome measures were calculated with the Canadian PA guidelines in mind (Canadian Society for Exercise Physiology, 2011b). Three open-ended questions in the LTEQ assessed bouts of low, moderate and vigorous intensity activities in a typical week. Bouts of vigorous intensity activities were carried forward as an outcome measure of PA. Next, typical moderate and vigorous PA (MVPA) participation was converted into a (MET) score (i.e., $(\text{moderate bouts} \times 5 \text{ METs}) + (\text{vigorous bouts} \times 9 \text{ METs}) = \text{total MVPA score}$) (Godin & Shephard, 1985). Finally, sweat frequency in a typical week was assessed using a single item from the LTEQ on a three-point scale: 1 = never/rarely, 2 = sometimes, 3 = often.

3.5.3 Examining the Objectives using the Diary and Questionnaire

3.5.3.1 Objective 1a: Everyday Activities and the Most Physically Demanding Activities in the Diaries

Frequencies of activity types, locations, and companions for the most physically demanding activities were calculated for weekdays, weekend days and across all diary entries. Six types of physically demanding activities were analyzed in more detail: physical education, walking to or from school, chores, unstructured PA and play, South Asian activities, and extra-curricular activities.

3.5.3.2 Objective 1b: Analyzing and Comparing the Quantity of Physical Activity Participation Reported in the Diaries and Questionnaire

Participants’ adherence to the Canadian PA guidelines was examined. The guidelines indicate that youth should engage in at least 60 minutes of moderate to vigorous PA (MVPA) on a daily
basis, specifies that all MVPA should lead to at least a little sweating, and further indicates that youth should engage in vigorous PA at least three days a week (Canadian Society for Exercise Physiology, 2011b). To address the 60-minute duration guideline, the PA duration outcome variable from the diary was used; however, moderate to vigorous intensities were not specified in the original question. Thus, the total duration of daily PA reported by participants may have included low intensity activities. Nevertheless, the sample frequency of reporting a minimum of 60 minutes each day in the diary was calculated to examine adherence to the duration guideline. With respect to the guideline to sweat everyday, the frequency of reporting sweating during the most physically demanding activity across all five diary entries was calculated. In the questionnaire, data indicated whether participants were physically active enough to sweat “often”, “sometimes” or “never” in a typical week, but did not assess whether the response option of “often” was equivalent to “daily”. Nevertheless, the sample frequency of reporting sweating “often” in the questionnaire was calculated to examine adherence to the sweat guideline. Finally, the sample frequency of reporting at least three bouts of vigorous activities was calculated from the vigorous bouts outcome variables from both the diary and questionnaire. As well, because the guidelines recommend MVPA on a daily basis, an additional sample frequency was calculated based on the questionnaire PA outcome of total MVPA MET score. Assuming that participants met the requirement to engage in three bouts of vigorous PA in a typical week and engaged in at least one bout of moderate PA on each of the remaining four days, this would have resulted in an overall score of 47 METs ((three bouts of vigorous PA x 9 METs) + (four bouts of moderate PA x 5 METs)). Therefore the sample frequency of achieving at least 47 METs was calculated to examine adherence to daily MVPA. Concordance in reports of sweat frequency and total bouts of vigorous activities in the diary and questionnaire was examined using one-way random intraclass correlations (Yen & Lo, 2002).

3.5.3.3 Objective 2: Examining Psychosocial and Demographic Factors and their Relationships to the Physical Activity Outcomes

An exploratory factor analysis was conducted on the 15-item scale exploring South Asian heritage, gender and PA. Frequencies, means and standard deviations were calculated for each item to examine whether data met assumptions of normality. As all items were new and developed for this study, a conservative definition of skewness was used. Items where more than 50% of the sample indicated that they strongly disagreed/disagreed or strongly agreed/agreed
were considered skewed, and dropped from the factor analysis. Next, the underlying structure of the items was examined using maximum likelihood exploratory factor analysis with orthogonal rotation (Osborne & Costello, 2005). Following guidelines of Osborne & Costello (2005), a two-factor solution was specified based on the structure of the scale. The communality estimates, scree plot, and factor correlation matrix were examined to determine whether there were two meaningful factors that explained the latent structure of the items. The pattern and structure matrices were examined to assess the stability of the two-factor solution. Internal consistency of the final solution(s) were examined using Cronbach’s alpha. Scale score(s) were carried forward as independent variables.

A bivariate correlation matrix was generated for all psychological and social variables with acceptable internal consistency and a range of responses. The correlation matrix was inspected to ensure that there were no issues of multicollinearity. In cases where variables were strongly correlated, a single variable was chosen to carry forward for further analysis. Once again, the purpose was to reduce the total number of explanatory variables to maximize power.

Final analyses were conducted using four separate PA outcomes: 1) PA duration (diary); 2) vigorous bouts (diary); 3) moderate to vigorous PA score (questionnaire); and, 4) sweat frequency (questionnaire). The determination of these outcome variables is discussed in the results.

Bivariate regression analyses were used to examine relationships between the diary and questionnaire measures with the PA outcomes. Variables that showed a significance level of $p \leq 0.10$ were retained for inclusion as independent variables for the multivariate regression analyses. Separate multivariate linear regressions were used to examine the association of the independent measures on the four PA outcomes. All variables were entered simultaneously with list-wise deletion. List-wise deletion was selected for the bivariate and multivariate analyses to ensure that comparisons could be made across the associated variables among participants with

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1 Multivariate regression analyses were also run with variables showing a significance level of $p \leq 0.20$ in the bivariate analyses; however, due to lack of power because of the small sample, two of the four models were not significant. Therefore the final multivariate regression models only used independent variables that were significant in the bivariate models at $p \leq 0.10$. 
complete data. Explanatory variables were interpreted for all significant regression models ($p<.05$).

### 3.6 Power Calculations and Sample Size

Overall, there were multiple independent variables that assessed eight broad concepts: 1) enjoyment, 2) control, 3) barriers, 4) support for PA (from family), 5) attitudes and connectedness to friends, 6) attitudes and connectedness to family, 7) attitudes and connectedness to peers, 8) cultural and gender-specific attitudes towards PA. Given the lack of existing data on PA patterns of South Asian high school girls, it was not possible to calculate the specific power needed to detect differences in the independent variables for each PA outcome (PA duration, vigorous bouts, moderate to vigorous PA score, and sweat frequency). However, power to detect differences in this study will be examined prior to multivariate analyses by Pearson correlations between the independent variables and the PA outcomes. In addition, Cohen (1992) recommends a power level of .80 and an alpha level of .05 for general use in behavioural research, and provides values to detect a small ($R = .14$), medium ($R = .36$) and large ($R = .51$) effect size using multivariate regression analyses. Therefore as a guideline to detect a medium effect size in PA levels in this study with 8 main concepts of interest, the minimum number of participants needed for this study was calculated to be 107 participants (Cohen, 1992).
4 Results of the Everyday Activities Study

4.1 Recruitment and Sample

One hundred and fifty participants were initially enrolled in the study (see Figure 2). Results showed that participants learned about the study through Indian dance classes (17.3%), youth groups (32.7%), Indian violin classes (12.0%), or were referred to the study website from friends or other participants (38.0%). Two participants were excluded either because of difficulties with understanding English (1 participant) or lack of South Asian heritage (1 participant). Thirty-five participants did not submit any diary entries, thus the final sample size was 113.

Overall, 88 of 113 (77.9%) participants submitted a full set of five diary entries for a total of 440 entries, and 73 of 88 (83.0%) also completed the final questionnaire. Fifty-six of 88 (63.6%) completed their diary entries in the winter (January to March) and the remaining 32 (36.4%) completed their diary entries in the spring (April to June). One participant submitted four weekday entries and one weekend entry, while all others correctly submitted three weekday and two weekend entries. Therefore, there were a total of 267 weekday entries and 173 weekend entries. Of the 25 participants who did not submit a full set of diary entries, 14 completed the final questionnaire, yielding a total of 73+14 = 87 participants who completed the final questionnaire. It should also be noted that a total of 92 participants completed part of the questionnaire, but 4 quit while answering questions in Section A that examined relationships with other people (see Appendix E). Therefore diary results are reported with an N of 88 and final questionnaire results are reported with an N of 87.

4.2 Sample Characteristics

There were roughly equal groups of participants from each of the four high school grades with an average age of 15.8 years (see Table 2). Most of the participants (78.4%) had been in Canada or another Westernized country for at least 9 years, and roughly half (51.3%) were born in Canada. None of the participants’ parents were born in Canada. There were no significant differences between respondents and non-respondents with respect to their grade or number of years in
Canada. The majority of participants (89.5%) had at least one sibling. Results of the new item regarding the cultural composition of participants’ friend network showed that responses were distributed across the three options: most of my friends are South Asian (36.0%), I have about the same number of South Asian and non-South Asian friends (40.0%), and, most of my friends are not South Asian (24.0%). In terms of religious affiliations, all of the participants chose at least one religious grouping to describe their family beliefs even though they had the option to choose “none”. Most of the participants indicated that their families were Hindu (65.8%), 18.4% indicated that they were Sikh, and a few reported being Muslim (5.3%), Christian (3.9%), Jain, Buddhist or having multiple faiths (6.6%). Using the BMI classifications of the World Health Organization (World Health Organization, 2007), 80.3% of the participants were considered healthy, 15.5% were overweight or obese and 4.2% were underweight (thinness).

Figure 2: Data Completion Tree
Table 2: Sample Characteristics (N = 88)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>M (SD)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (range 14-18 years)</td>
<td>15.8 (1.2)</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>23 (26.1)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>23 (26.1)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>22 (25.0)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>20 (22.8)</td>
<td></td>
</tr>
<tr>
<td>Number of Siblings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only child</td>
<td>8 (10.5)</td>
<td></td>
</tr>
<tr>
<td>One sibling</td>
<td>48 (63.2)</td>
<td></td>
</tr>
<tr>
<td>Two or more siblings</td>
<td>20 (26.3)</td>
<td></td>
</tr>
<tr>
<td>Years in Canada or other Westernized country</td>
<td>12.2 (4.2)</td>
<td></td>
</tr>
<tr>
<td>&lt; 9 years</td>
<td>19 (21.6)</td>
<td></td>
</tr>
<tr>
<td>&gt;=9 years</td>
<td>69 (78.4)</td>
<td></td>
</tr>
<tr>
<td>Participants born in Canada</td>
<td>39 (51.3)</td>
<td></td>
</tr>
<tr>
<td>Parents (mother or father) born in Canada</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Cultural composition of friend network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most South Asian</td>
<td>27 (36.0)</td>
<td></td>
</tr>
<tr>
<td>Same South Asian and non-South Asian</td>
<td>30 (40.0)</td>
<td></td>
</tr>
<tr>
<td>Most not South Asian</td>
<td>18 (24.0)</td>
<td></td>
</tr>
<tr>
<td>Religious Affiliations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hindu</td>
<td>50 (65.8)</td>
<td></td>
</tr>
<tr>
<td>Sikh</td>
<td>14 (18.4)</td>
<td></td>
</tr>
<tr>
<td>Muslim</td>
<td>4 (5.3)</td>
<td></td>
</tr>
<tr>
<td>Christian</td>
<td>3 (3.9)</td>
<td></td>
</tr>
<tr>
<td>Other (Jain, Buddhist, multiple)</td>
<td>5 (6.6)</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Body Mass Index Classifications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe thinness (&lt;-3 SD)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Thinness (-3 to &lt;-2 SD)</td>
<td>3 (4.2)</td>
<td></td>
</tr>
<tr>
<td>Healthy (-2 to &lt;+1 SD)</td>
<td>57 (80.3)</td>
<td></td>
</tr>
<tr>
<td>Overweight (+1 to &lt;+2 SD)</td>
<td>9 (12.7)</td>
<td></td>
</tr>
<tr>
<td>Obesity (&gt;+2 SD)</td>
<td>2 (2.8)</td>
<td></td>
</tr>
</tbody>
</table>

Note: sample N varies based on missing data and source (i.e., diary or final questionnaire)
4.3 Everyday Activities and the Quality of Physical Activity Participation (Objective 1a)

**Objective 1a:** To examine the details of everyday activities of adolescent girls comparing weekdays and weekend days and grade using a diary method, with a focus on the types, location and companions for physical activity (PA) participation.

4.3.1 Types of Everyday Activities

Participants provided a great depth of information on their everyday activities in the diary including personal care activities, social activities, and activities at school (see Table 3). Participants also identified most and least enjoyable daily activities, and activities related to their South Asian heritage (see Table 4). Perceptions of most and least enjoyable activities will be explored further as a part of Objective 2. In general, weekdays were dominated by school-based activities like classes, team sports, and club activities with friends and classmates; weekend days were mostly spent in unstructured leisure activities at home like watching television, browsing the Internet, and spending time with friends, siblings or parents. Participants reported involvement in extra-curricular activities on both weekdays and weekend days, including piano, violin and dance class, as well as volunteer work at a hospital, library or community centre. Participants also reported time spent doing homework and studying on both weekdays and weekend days.
Table 3: Sample Everyday Activities Reported by Participants in the Diary Entries

<table>
<thead>
<tr>
<th>Activity Category</th>
<th>Sample Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal care activities</td>
<td>- Washing my hair</td>
</tr>
<tr>
<td></td>
<td>- Changed, [put on] makeup, straightened hair, texting [on cellphone]</td>
</tr>
<tr>
<td></td>
<td>- Brushing [teeth], dressing, sleeping</td>
</tr>
<tr>
<td></td>
<td>- Brush my teeth, drink my coffee, have a shower, get ready, do my hair and makeup</td>
</tr>
<tr>
<td>Social activities</td>
<td>- Walked to Tim Hortons [coffee shop], met up with friends, drank French vanilla [coffee] and ate donuts</td>
</tr>
<tr>
<td></td>
<td>- My friends and I were eating dinner</td>
</tr>
<tr>
<td></td>
<td>- Watching TV, talking on phone, chatting, drinking milk</td>
</tr>
<tr>
<td></td>
<td>- Talking on the phone with my sister</td>
</tr>
<tr>
<td></td>
<td>- Eat a snack, watch the Olympics, check email, chat with friends online</td>
</tr>
<tr>
<td></td>
<td>- Hanging out with friends; talking about interesting things that happened the night before; rushing off to class once bell rings</td>
</tr>
<tr>
<td></td>
<td>- Went to grandparents house for Grandfather’s 78th birthday, ate dinner, went home</td>
</tr>
<tr>
<td>Activities at school</td>
<td>- Leaving second period class and going to third period World religion class, doing textbook work</td>
</tr>
<tr>
<td></td>
<td>- Talked a lot with friends, friend braided hair, walked to History class, went to assembly, came back to History class</td>
</tr>
<tr>
<td></td>
<td>- Ate lunch, studied for math quiz at the library</td>
</tr>
<tr>
<td></td>
<td>- Geography group project; Worked on log in math class</td>
</tr>
<tr>
<td></td>
<td>- Trigonometry: functions; Law: Civil law suit defenses</td>
</tr>
<tr>
<td></td>
<td>- Going to afterschool Zonta club meeting, listening to guest speakers, organizing awareness events</td>
</tr>
<tr>
<td></td>
<td>- Complete my assignment for Mock trial club, preparing an opening statement for a law competition</td>
</tr>
<tr>
<td></td>
<td>- Talked with librarians, processed books, helped librarian process hard cover large book, joked [around] a lot</td>
</tr>
</tbody>
</table>

Note: Each bullet refers to an episode description in a participant’s diary entry.
Table 4: Most Enjoyable and Least Enjoyable Activities, as well as Activities Related to South Asian Heritage

<table>
<thead>
<tr>
<th>Activity Category</th>
<th>Sample Activities</th>
</tr>
</thead>
</table>
| Most enjoyable activities also identified as most physically demanding | - Dressed for gym and played volleyball
- Went outside and fooled around in the snow
- School project: carving wood; drilling; nailing; sanding
- We went to Pacific Mall and were looking around and window-shopping; we bought Pocky [snacks] and explored
- Practicing a dance for a show called Culturefest
- Listening to iPod [music player], went biking around neighbourhood
- Learning how to ski
- My friends and I were making up a series of dances for a party and we had to rehearse for quite some time
- Painting the backdrop for a senior play
- Bike riding
- Walked home with my friends and stopped by a pizza store to have pizza |
| Examples of other enjoyable activities                  | - Reading
- I watched the movie “She's the Man” on my DVD player. It was good to relax after a long day
- Went to the store to buy samosas then went to the Mall with friends to hang out then shop; hung out at school, played on the computer
- Watching Olympic Hockey, American Idol
- Environment Club Meeting and Lunch: helping to run the meeting; getting volunteers for the next event; eating lunch with friends
- Change into comfortable clothes, freshen up, eat lunch while watching T.V.
- Ate a small lunch and then went to see a talent show that the school was holding in the auditorium
- Helping my mom by making dinner
- Choir: Started learning new repertoire for the Spring Concert |
<table>
<thead>
<tr>
<th>Activity Category</th>
<th>Sample Activities</th>
</tr>
</thead>
</table>
| Least enjoyable activities also identified as most physically demanding | - Vacuuming all the carpets  
- Helping mom prepare food, heating things up, etc.  
- Mom dropped me by car a block away from school, and I walked the rest  
- Gym: Circuits, stretching, warm ups  
- Got a coffee from Tim Hortons [coffee shop], listened to music, got into a car accident, waited for parents to come to settle the accident with man, drove home  
- Shopping for appliances; looked at different house appliances; ended up buying [some]  
- Cleaned my room, the washrooms, and family room |

| Examples of other least enjoyable activities | - Wrote Physics exam  
- Saying bye to cousins, aunt, uncle and grandmother; doing dishes; getting ready for bed  
- Completing scholarship forms and checking emails  
- Homework: Continuing to complete assignments from school and studying for different tests  
- Walking to bus terminal; Riding bus; Walking to orthodontist  
- Band: playing the flute  
- Time to prepare the house for our guests: I cleaned the house, cleaned the mirrors, the windows, and polished the furniture |

| South Asian activities also identified as most physically demanding | - Dressed appropriately for dance class; attended my Bharatanatyam dance class; talked to my friend (who is also a student)  
- Youth activities, hanging out with friends, prayers (Aarti)  
- After my dad arrived home, I took the bus to dance class where I learned the basic Bhangra moves |

| Examples of other South Asian activities | - Classical Indian Violin class: learning new songs, and learning different theories in music and about different composers  
- Praying before leaving to learn how to drive [a car] with my G1 [license] with my father in a parking lot  
- At vocal class where I learn Carnatic music  
- Watched TV, Hindi soap operas  
- At place of worship; participated in the prayers held there  
- Cooked Indian food, ate with family  
- Reading the Quran with an online tutor |
Notes: Each bullet refers to an episode description in a participant’s diary entry.

Activities denoted “most physically demanding” were identified by participants and do not necessarily correspond with a high intensity level; all other activities are denoted as “other”.

Most enjoyable activities, least enjoyable activities as well as activities related to South Asian heritage were identified by participants in open-ended summary questions at the end of each diary entry.

Activities denoted in one category sometimes overlapped with another category (i.e., a South Asian activity could also be a participant’s most enjoyable activity of the day).

4.3.2 Types of Physically Demanding Activities

Across the 440 diary entries, a wide range of activities were identified as the most physically demanding activity of the day including structured PA and dance or sport practices and competitions (e.g., badminton, physical education classes, soccer, weight training and body pump classes, 37.7%); walking indoors and outdoors (e.g., shopping and walking to school, 27.1%); chores (e.g., cleaning the house, gardening, and vacuuming, 11.8%); and unstructured PA and play (e.g., ping pong, playing on the swings at a park, and playing dark tag, 7.0%). At the same time, a number of relatively sedentary activities (e.g., eating lunch, getting out of bed, playing the violin and showering) were reported as the most physically demanding activity of the day in 16.4% of the diary entries. The following sections provide more information about six physically demanding activity types: physical education classes, walking to and from school, chores, unstructured PA and play, South Asian activities, and extra-curricular activities. As well, the range of relatively sedentary activities is described.

4.3.2.1 Physical Education Class

Twenty-seven (30.7%) participants were enrolled in physical education at the time of the study. Physical education classes were reported in 64 (24.0%) of the weekday entries, and of these, it was identified as the most physically demanding activity in 51 (79.7%) entries. It was suspected that enrolment in physical education might significantly overlap with grouped grade, since physical education is mandatory for grade 9 students in Ontario. Not surprisingly, two-thirds of the grade 9 participants were enrolled in physical education at the time of the study, while none of the grade 12 participants were enrolled. When junior and senior grades were grouped and compared, significantly more participants in grades 9 or 10 (50.0%) were enrolled in physical
education compared to participants in grades 11 or 12 (10.0%), \( t(86) = 4.52, p<.01 \). Thus, there was some overlap between enrolment in physical education and grade, but the two factors were independent. While addressing the remaining study objectives, participants were split into groups based on junior (9 and 10) or senior (11 and 12) grades, and also based on enrolment (“yes”) or lack of enrolment (“no”) in physical education.

### 4.3.2.2 Walking to or from School

Although 22 (25.0%) of the participants walked for at least 10 minutes to or from school on at least one weekday, in total, only 50 (9.4%) out of a possible 267 round trips were walked, and these were mostly on the trip home from school (37 trips). The remaining school trips were completed by passive modes of transport like sitting in a car, bus or subway. Furthermore, walking to or from school was the most physically demanding activity of the day in 15 (5.6%) of the 267 weekday entries. Participants in junior grades were equally likely to walk to or from school at least once compared to participants in senior grades (28% versus 21%, \( t(86) = .73, p = .47 \)). Participants enrolled in physical education showed a trend of walking to or from school more often compared than participants who were not enrolled (37% versus 20%, \( t(86) = .1.75, p = .09 \)). However, participants who completed their diaries in spring were significantly more likely to report walking to or from school compared to participants who completed their diaries in winter (38% versus 18%, \( t(86) = -2.07, p<.05 \)).

### 4.3.2.3 Chores

Chores were cited as the most physically demanding activity of the day in at least one entry for 37 (42.0%) participants, and represented 11.8% of all diary entries. More than twice as many chores were reported on weekend days (37 entries) when compared to weekdays (15 entries). Participants in junior grades were more likely to report chores as their most physically demanding activity in at least one diary entry (54%) compared to participants in senior grades (29%), \( t(86) = 2.51, p<.05 \). Participants who were enrolled and not enrolled in physical education were equally likely to report chores as their most physically demanding activity (44% versus 41%, \( t(86) = .30, p = .77 \)). Similarly, participants who completed their diaries in spring were equally likely to report chores at least once compared to participants who completed their diaries in winter (47% versus 39%, \( t(86) = -.69, p = .49 \)).
4.3.2.4 Unstructured Physical Activity and Play

Unstructured PA and play was cited as the most physically demanding activity of the day in at least one entry for 26 (29.5%) participants, and represented 7.0% of all diary entries. A similar number of unstructured PA and play activities were cited on weekdays (13 entries) and weekend days (18 entries). Participants in grades 9 and 10 showed a trend of reporting more unstructured PA and play compared to participants in grades 11 and 12 (33% versus 26%, $t(86) = .52, p=.06$). Participants enrolled and not enrolled in physical education were equally likely to report that they engaged in unstructured PA and play (33% versus 28%, $t(86) = .51, p=.61$). As well, participants who completed their diaries in spring were equally likely to report unstructured PA and play at least once compared to participants who completed their diaries in winter (27% versus 34%, $t(86) = -.74, p = .46$).

In summary, participants in junior grades were more likely to be enrolled in physical education classes and cite chores as their most physically demanding activity compared to participants in senior grades. Participants who completed their diaries in the spring were more likely to walk to or from school compared to participants who completed their diaries in the winter. Finally, chores were cited less often on weekdays compared to weekend days.

4.3.2.5 Physically Demanding Activities related to South Asian Heritage

Thirty-four (38.6%) participants indicated that their most physically demanding activity of the day was also related to their South Asian heritage on at least one out of their five diary entries (see Table 3 for sample activities). Overall, 48 (10.9%) of the 440 diary entries indicated South Asian activities that were the most physically demanding, with equal representation on weekdays and weekend days (24 entries each). Among these activities, nearly two thirds referred to a form of dancing (31 entries) including Bharatanatyam, Bhangra, Bollywood, dancing in a culture show at school, and dancing at an Indian wedding reception. However, in the remaining entries, participants identified sedentary activities as their most physically demanding activity of the day, like classical Indian violin or singing practice and lessons (6 entries); and, various other activities including praying, an activity with their spiritual centre youth group, a social get together with other South Asian people, or teaching at a heritage class (11 entries). Participants in junior grades were equally likely to report that their most physically demanding activity was related to their South Asian heritage as participants in senior grades (37% vs. 40%, $t(86) = -.34, p = .74$).
4.3.2.6 Physically Demanding Extra-curricular Activities

Nearly half (47.7%) of participants reported physically demanding activities that were also categorized as extra-curricular activities in at least one of their diary entries. Overall, 71 (16.1%) out of 440 entries indicated physically demanding activities that were also extra-curricular activities, with a similar number reported on weekdays (39 entries) and weekend days (32 entries). Examples included dance lessons and practices, volunteer work in a community garden or hospital, part time work lifeguarding or delivering newspapers, participating in cadets training, sport lessons (e.g., swimming) and practices (e.g., soccer, badminton and rugby). Participants in grades 9 and 10 were equally likely to report extra-curricular physically demanding activities as participants in grades 11 and 12 (48% each).

4.3.2.7 Types of Sedentary Activities Identified as the Most Physically Demanding

Sedentary activities were cited as the most physically demanding of the day at least once for 47 (53.4%) participants, and represented 16.4% of all diary entries. Although sedentary activities fell into seven different categories, participants often cited more than one category of activity in their episode (see Appendix N for a complete list of activities and type codes). Personal care activities (e.g., brushing teeth, showering and getting dressed) were reported most often (45.8%), followed by cooking and eating (30.6%), screen time (e.g., watching television, texting on a cell phone and using a computer) (22.2%), hobbies and extra-curricular activities (e.g., singing, practicing violin and reading) (19.4%), spending time with friends and family (15.3%), homework and classes at school (13.9%) and very light chores (e.g., making a bed, and packing or unpacking a backpack) (5.6%). Further analysis of the relatively sedentary activities with respect to the day of the week, season, grade, and enrolment in physical education is found as a part of the results for Objective 1b.

4.3.3 Location of the Most Physically Demanding Activities

Table 5 shows that participants engaged in their most physically demanding activities in a variety of settings. Across the five diary entries, the two most important locations for physically demanding activities were home (28.9%) and school/school grounds (e.g., a gymnasium) (24.5%). Home gained in importance on the weekend (39.9% of all physically demanding activities) while school fell in importance (4.0% of physically demanding activities). For both
weekdays and weekends, unstructured outdoor spaces like streets or a park received the second highest ranking at 26.2% and 19.7%, respectively. Participants reported that walking in a mall/store/plaza was their most physically demanding activity more often on weekend days (12.7%) compared to weekdays (1.5%). Designated PA areas outside of the school and school grounds, like a dance studio, ski resort, soccer field, or indoor beach volleyball courts were cited in only 10.9% of all diary entries.

Table 5: Locations for the Most Physically Demanding Activities

<table>
<thead>
<tr>
<th>Location</th>
<th>Across all entries (N = 440)</th>
<th>Weekdays (N = 267)</th>
<th>Weekend days (N = 173)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Home</td>
<td>127</td>
<td>28.9</td>
<td>58</td>
</tr>
<tr>
<td>School/school grounds</td>
<td>108</td>
<td>24.5</td>
<td>101</td>
</tr>
<tr>
<td>Streets or park</td>
<td>104</td>
<td>23.6</td>
<td>70</td>
</tr>
<tr>
<td>Designated PA area (e.g., dance studio)</td>
<td>48</td>
<td>10.9</td>
<td>27</td>
</tr>
<tr>
<td>Mall/store/plaza</td>
<td>26</td>
<td>5.9</td>
<td>4</td>
</tr>
<tr>
<td>Other (e.g., library, banquet hall)</td>
<td>10</td>
<td>2.3</td>
<td>3</td>
</tr>
<tr>
<td>Friend/Relative House</td>
<td>10</td>
<td>2.3</td>
<td>2</td>
</tr>
<tr>
<td>Work/volunteer location</td>
<td>4</td>
<td>0.9</td>
<td>2</td>
</tr>
<tr>
<td>Spiritual centre</td>
<td>3</td>
<td>0.7</td>
<td>0</td>
</tr>
</tbody>
</table>

Notes: Locations are ranked by importance across the five diary entries. These rankings differ on weekdays and weekends.

4.3.4 Companions for the Most Physically Demanding Activities

Table 6 lists the range of companions for the most physically demanding activities across five diary entries as well as on weekdays or weekend days. Participants could cite more than one category of companion with whom an activity took place (e.g., friends and siblings). The most frequently cited companions on weekdays were friends (38.6%), followed by classmates, teammates or clubmates (36.7%) and a teacher or coach (33.7%). On weekends, the most frequently cited companions for the most physically demanding activities were family members:
parents (39.9%) and siblings (29.5%), though friends were still important and ranked third (21.4%). Across both weekdays and weekends, about 20% of all physically demanding activities were carried out by participants without others (i.e., alone), indicating that companions were not always present or important for engaging in physically demanding activities.

Table 6: Companions for the Most Physically Demanding Activities

<table>
<thead>
<tr>
<th>Companion</th>
<th>Across all entries (N = 440)</th>
<th>Weekdays (N = 267)</th>
<th>Weekends (N = 173)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Friend(s)</td>
<td>140</td>
<td>31.8</td>
<td>103</td>
</tr>
<tr>
<td>Classmates, teammates, or clubmates</td>
<td>117</td>
<td>26.6</td>
<td>98</td>
</tr>
<tr>
<td>Teacher or coach</td>
<td>110</td>
<td>25.0</td>
<td>90</td>
</tr>
<tr>
<td>Parent(s)</td>
<td>95</td>
<td>21.6</td>
<td>26</td>
</tr>
<tr>
<td>Alone</td>
<td>91</td>
<td>20.7</td>
<td>58</td>
</tr>
<tr>
<td>Sibling(s)</td>
<td>83</td>
<td>18.9</td>
<td>32</td>
</tr>
<tr>
<td>Other (e.g., people at volunteer placements)</td>
<td>28</td>
<td>6.4</td>
<td>19</td>
</tr>
<tr>
<td>Relative(s)</td>
<td>20</td>
<td>4.5</td>
<td>5</td>
</tr>
<tr>
<td>Family friend(s)</td>
<td>9</td>
<td>2.0</td>
<td>2</td>
</tr>
<tr>
<td>Grandparent(s)</td>
<td>6</td>
<td>1.4</td>
<td>1</td>
</tr>
<tr>
<td>Boyfriend</td>
<td>1</td>
<td>0.2</td>
<td>1</td>
</tr>
</tbody>
</table>

Notes: Participants could cite multiple companions for physically demanding tasks. Hence, categories are not mutually exclusive and percentages do not add up to 100%.

Each category may include multiple individuals. For example, “friend” may refer to 1 friend or multiple friends.

4.4 Quantity of Physical Activity Participation in the Diary and Questionnaire (Objective 1b)

Objective 1b: To examine and compare the duration and intensity of PA using two different methods: a diary and recall questionnaire, and compare activity levels to the Canadian PA guidelines.
4.4.1 Results of the Diary Physical Activity Outcomes

4.4.1.1 Physical Activity Duration

The average duration of PA reported across the five diary entries was 55.5 minutes ($SD = 18.4$) (see Table 7). Although the observed range was from 15 to 90 minutes, only seven participants (8.0%) reported less than 30 minutes of PA across their five diary entries. Participants reported a significantly higher duration of PA on weekdays ($M = 57.8$ minutes, $SD = 22.0$) compared to weekends ($M = 51.0$ minutes, $SD = 24.6$), $t(87) = 2.19, p < .01$. There was a trend where participants who completed their diaries in the spring tended to engage in physical activities of a greater duration, but this was not significant ($p = .07$). A trend was also seen where participants enrolled in physical education tended to engage in physical activities longer compared to those not enrolled, but this too was not significant ($p = .10$). However, girls enrolled in physical education reported significantly more time doing physical activities in their weekday entries compared to those not enrolled ($M = 66.0$, $SD = 21.9$ versus $M = 54.1$, $SD = 21.2$, $t(86) = 2.39$, $p < .05$). There were no significant differences in PA duration in the weekend entries of girls enrolled and not enrolled in physical education or between girls in junior and senior grades.

Table 7: Daily Average Duration of Physical Activity

<table>
<thead>
<tr>
<th>Physical Activity Outcome</th>
<th>$N$</th>
<th>Minutes $M (SD)$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average PA Duration</td>
<td>88</td>
<td>55.5 (18.4)</td>
<td></td>
</tr>
<tr>
<td>Day of the week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weekday</td>
<td>88</td>
<td>57.8 (22.0)</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>weekend</td>
<td>88</td>
<td>51.0 (24.6)</td>
<td></td>
</tr>
<tr>
<td>Season completing diaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>winter</td>
<td>56</td>
<td>52.9 (17.1)</td>
<td>n.s.</td>
</tr>
<tr>
<td>spring</td>
<td>32</td>
<td>60.3 (19.4)</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 10</td>
<td>46</td>
<td>54.6 (17.1)</td>
<td>n.s.</td>
</tr>
<tr>
<td>11 – 12</td>
<td>42</td>
<td>56.7 (19.5)</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>27</td>
<td>60.5 (16.6)</td>
<td>n.s.</td>
</tr>
<tr>
<td>no</td>
<td>61</td>
<td>53.5 (18.6)</td>
<td></td>
</tr>
</tbody>
</table>

Notes: The observed range was 15 to 90 minutes.

n.s. = not significant
4.4.1.2 Intensity Levels and Sweating During the Most Physically Demanding Activity

Participant ratings of perceived exertion (RPE) were compared to the codes for intensity level during the most physically demanding activity. They were found to have a strong relationship or be on the cusp of having a strong relationship using Pearson correlations at \( p < .01 \) for each diary entry: Day 1, \( r = .68 \); Day 2, \( r = .63 \); Day 3, \( r = .71 \); Day 4, \( r = .70 \) and Day 5, \( r = .74 \). As study intensity codes were consistently assigned, RPE was dropped from further analyses.

Based on the intensity codes, a range of intensity levels was reported during the most physically demanding activity (see Table 8). Figure 3 illustrates the proportion of sedentary, low to moderate and vigorous intensity levels along with their major categories of activity types (described as a part of Objective 1a). Across the sample, there were two participants (2.3%) who reported the lowest intensity levels, and engaged in sedentary activities in four of their entries, and a low to moderate intensity activity in their remaining entry. Five participants (6.8%) engaged in only low to moderate intensity activities, 17 participants (19.3%) did not reach a vigorous intensity level, and 6 (7.2%) did not sweat even once during their most physically demanding activity according to their diary entries.

On weekdays and weekend days, there were significant differences in the proportions of activities at sedentary, low to moderate and vigorous intensity levels, as well as reports of sweating during the most physically demanding activity. Specifically, on weekdays compared to weekend days, half as many sedentary intensity activities were reported (13% versus 22%, \( t(87) = -2.34, p < .05 \)); fewer low to moderate intensity activities (39% versus 56%, \( t(87) = -3.06, p < .01 \)); more than twice as many vigorous activities (49% versus 20%, \( t(87) = 5.77, p < .01 \)); and more reports of sweating (58% of the entries versus 36% of the entries, \( t(70) = 3.48, p < .01 \)).

Participants who completed their diary entries in the spring showed a trend of reporting more vigorous activities (\( p = .12 \)) and reported sweating significantly more often during their most physically demanding activity (\( M = 2.9, SD = 1.4 \)) compared to those who completed their entries in the winter (\( M = 2.1, SD = 1.2 \), \( t(81) = -2.67, p < .01 \)). Participants in junior grades showed a trend of reporting more vigorous activities compared to participants in senior grades, though this was not statistically significant (\( p = .11 \)).
Participants enrolled in physical education showed a trend of reporting fewer relatively sedentary activities in their diary entries overall when compared to those not enrolled ($p = .06$), but there were no significant differences when weekday and weekend entries of these two groups of girls were examined separately. Conversely, participants not enrolled in physical education reported significantly more activities at a low to moderate intensity level across all days ($M = 2.5, SD = 1.3$), when compared to those who were enrolled ($M = 1.8, SD = 1.0$), $t(86) = 2.6, p<.05$. This difference was driven by the higher number of low to moderate activities reported on weekdays by girls not enrolled in physical education ($M = 1.5, SD = 1.04$) versus those who were enrolled ($M = .41, SD = .75$), $t(86) = -4.95, p<.01$. At the same time, girls enrolled in physical education reported higher levels of low to moderate activities on the weekend ($M = 1.37, SD = .74$ versus $1.02, SD = .74$), $t(86) = 2.07, p<.05$). When vigorous intensity activities were examined, girls enrolled in physical education reported more vigorous bouts overall ($M = 2.7, SD = 1.1$ versus $M = 1.5, SD = 1.3$, $t(86) = -4.1, p<.01$) and on weekdays ($M = 2.44, SD = .91$ versus $M = 1.00, SD = .59$, $t(86) = 7.10, p<.01$) compared to those not enrolled. However, all girls were equally likely to engage in vigorous activities on the weekend. Finally, while there were no significant differences in the total number of days where sweating was reported or reports of sweating on weekends between those who were enrolled and not enrolled in physical education, girls in physical education reported more days with sweating on weekdays ($M = 2.22, SD = .93$ versus $M = 1.36, SD = 1.03$), $t(86) = 3.71, p<.01$.

Figure 3: Types and Intensities of Activities Reported as Most Physically Demanding
Table 8: Intensity Levels and Sweating during the Most Physically Demanding Activities by Day of the Week, Season, Grade and Enrolment in Physical Education

<table>
<thead>
<tr>
<th>Physical Activity Outcome</th>
<th>N</th>
<th>Percentage or Mean days (SD)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary diary entries (range 0 – 4)</td>
<td>88</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Day of the week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weekday</td>
<td></td>
<td>13%</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>weekend</td>
<td></td>
<td>22%</td>
<td></td>
</tr>
<tr>
<td>Season completing diaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>winter</td>
<td>56</td>
<td>0.9 (1.0)</td>
<td>n.s.</td>
</tr>
<tr>
<td>spring</td>
<td>32</td>
<td>0.6 (1.0)</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 10</td>
<td>46</td>
<td>0.7 (0.8)</td>
<td>n.s.</td>
</tr>
<tr>
<td>11 – 12</td>
<td>42</td>
<td>1.0 (1.1)</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>61</td>
<td>1.0 (1.1)</td>
<td>n.s.</td>
</tr>
<tr>
<td>yes</td>
<td>27</td>
<td>0.5 (0.6)</td>
<td></td>
</tr>
<tr>
<td>Low to moderate diary entries (range 0 – 5)</td>
<td>88</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td>Day of the week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weekday</td>
<td></td>
<td>39%</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>weekend</td>
<td></td>
<td>56%</td>
<td></td>
</tr>
<tr>
<td>Season completing diaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>winter</td>
<td>56</td>
<td>2.4 (1.4)</td>
<td>n.s.</td>
</tr>
<tr>
<td>spring</td>
<td>32</td>
<td>2.2 (1.1)</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 10</td>
<td>46</td>
<td>2.2 (1.0)</td>
<td>n.s.</td>
</tr>
<tr>
<td>11 – 12</td>
<td>42</td>
<td>2.4 (1.5)</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>61</td>
<td>2.5 (1.3)</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>yes</td>
<td>27</td>
<td>1.8 (1.0)</td>
<td></td>
</tr>
</tbody>
</table>
### Physical Activity Outcome

<table>
<thead>
<tr>
<th>Physical Activity Outcome</th>
<th>N</th>
<th>Percentage or Days M (SD)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigorous diary entries (range 0 – 5)</td>
<td>88</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td><strong>Day of the week</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weekday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weekend</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Season completing diaries</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>winter</td>
<td>56</td>
<td>1.7 (1.3)</td>
<td>n.s.</td>
</tr>
<tr>
<td>spring</td>
<td>32</td>
<td>2.2 (1.3)</td>
<td></td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 10</td>
<td>46</td>
<td>2.1 (1.1)</td>
<td>n.s.</td>
</tr>
<tr>
<td>11 – 12</td>
<td>42</td>
<td>1.6 (1.5)</td>
<td></td>
</tr>
<tr>
<td><strong>Enrolment in physical education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>61</td>
<td>1.5 (1.3)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>yes</td>
<td>27</td>
<td>2.7 (1.1)</td>
<td></td>
</tr>
<tr>
<td><strong>Sweat days (range 0 – 5)</strong></td>
<td>83</td>
<td>48%</td>
<td></td>
</tr>
<tr>
<td><strong>Day of the week</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weekday</td>
<td>80</td>
<td>58%</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>weekend</td>
<td>82</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td><strong>Season completing diaries</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>winter</td>
<td>52</td>
<td>2.1 (1.2)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>spring</td>
<td>31</td>
<td>2.9 (1.4)</td>
<td></td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 10</td>
<td>46</td>
<td>2.4 (1.3)</td>
<td>n.s.</td>
</tr>
<tr>
<td>11 – 12</td>
<td>42</td>
<td>2.3 (1.5)</td>
<td></td>
</tr>
<tr>
<td><strong>Enrolment in physical education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>56</td>
<td>2.3 (1.3)</td>
<td>n.s.</td>
</tr>
<tr>
<td>yes</td>
<td>27</td>
<td>2.7 (1.4)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
Episodes where participants were mostly sitting or standing were considered to be sedentary.
Day of the week percentages were calculated based on two weekend days and three weekdays.
Differences in day of the week, season, grade, and enrolment in physical education were examined using independent samples t-tests.

n.s. = not significant
### 4.4.2 Results of the Questionnaire Physical Activity Outcomes

#### 4.4.2.1 Vigorous Bouts, Metabolic Equivalent of Task Score and Sweating

Results of the anomaly analysis in the questionnaire showed that one participant was an outlier for moderate and vigorous PA, reporting 15 bouts each. As a total of 30 bouts of moderate and vigorous PA (MVPA) were unlikely in a typical seven-day period (i.e., equivalent to more than four bouts per day), this participant’s PA data was excluded from further analysis. Three other participants were also identified as outliers for vigorous PA at 7, 8 and 10 bouts in a typical week. However, when combined with bouts of moderate activity, they reported a total of 10, 13, and 15 bouts of moderate to vigorous PA, which indicated very high but possible PA participation within a seven-day period. Inspection of the three participants’ most physically demanding activities in their diary entries suggested that their vigorous activities may have been overestimated, as all three reported sedentary activities in at least one entry, and not one of them was involved on school sport teams. Nevertheless, PA values from these three participants were retained for further analysis.

Nearly all participants (95.2%) reported at least some moderate or vigorous PA in a typical week. Of the four participants (4.8%) who received an MVPA score of zero, between 3 and 7 bouts of low intensity PA were reported. Ten participants (12.0%) reported no vigorous intensity activities. On average, participants reported fewer than four bouts of moderate PA and fewer than three bouts of vigorous PA in a typical week, yielding an average moderate to vigorous PA (MVPA) score of 42.9 METs ($SD = 20.9$) (see Table 9). The average sweat frequency reported by participants was 2.2 ($SD = 0.6$) out of 3, with 32.1% reporting that they sweat often, 56.0% sometimes and 11.9% never/rarely.
Table 9: Typical Physical Activity (PA) Participation in the Questionnaire

<table>
<thead>
<tr>
<th>PA Outcome Variable</th>
<th>N</th>
<th>Observed Range</th>
<th>Mean (SD)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low intensity activities</td>
<td>83</td>
<td>0 – 10</td>
<td>5.3 (2.4)</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 10</td>
<td>43</td>
<td></td>
<td>4.7 (2.4)</td>
<td>n.s.</td>
</tr>
<tr>
<td>11 – 12</td>
<td>36</td>
<td></td>
<td>5.8 (2.3)</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>48</td>
<td></td>
<td>5.5 (2.3)</td>
<td>n.s.</td>
</tr>
<tr>
<td>yes</td>
<td>24</td>
<td></td>
<td>4.8 (2.5)</td>
<td></td>
</tr>
<tr>
<td>Moderate intensity activities</td>
<td>83</td>
<td>0 – 7</td>
<td>3.7 (2.2)</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 10</td>
<td>43</td>
<td></td>
<td>3.8 (2.2)</td>
<td>n.s.</td>
</tr>
<tr>
<td>11 – 12</td>
<td>36</td>
<td></td>
<td>3.4 (2.2)</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>48</td>
<td></td>
<td>3.3 (2.1)</td>
<td>n.s.</td>
</tr>
<tr>
<td>yes</td>
<td>24</td>
<td></td>
<td>4.0 (2.1)</td>
<td></td>
</tr>
<tr>
<td>Vigorous intensity activities</td>
<td>83</td>
<td>0 – 7</td>
<td>2.8 (1.7)</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 10</td>
<td>43</td>
<td></td>
<td>3.0 (1.6)</td>
<td>n.s.</td>
</tr>
<tr>
<td>11 – 12</td>
<td>36</td>
<td></td>
<td>2.6 (1.9)</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>48</td>
<td></td>
<td>2.5 (1.8)</td>
<td>n.s.</td>
</tr>
<tr>
<td>yes</td>
<td>24</td>
<td></td>
<td>3.3 (1.5)</td>
<td></td>
</tr>
<tr>
<td>Moderate to vigorous PA score (METs)</td>
<td>83</td>
<td>0 – 84</td>
<td>42.9 (20.9)</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 10</td>
<td>43</td>
<td></td>
<td>47.3 (22.5)</td>
<td>n.s.</td>
</tr>
<tr>
<td>11 – 12</td>
<td>36</td>
<td></td>
<td>40.2 (23.9)</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>48</td>
<td></td>
<td>39.2 (21.9)</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>yes</td>
<td>24</td>
<td></td>
<td>52.1 (24.7)</td>
<td></td>
</tr>
</tbody>
</table>
A somewhat different pattern of results was seen in the questionnaire PA outcomes compared to the diary. Participants in junior grades reported a significantly higher sweat frequency during PA in the questionnaire \((M = 2.3, SD = 0.6)\) compared to participants in senior grades \((M = 2.0, SD = 0.6)\). Similarly, participants enrolled in physical education reported a significantly higher sweat frequency in the questionnaire compared to those not enrolled \((M = 2.4, SD = 0.5 \text{ versus } M = 2.1, SD = 0.7)\). This trend was only seen in weekday diary entries, not on weekend entries or overall.

With respect to vigorous PA, both the diary and questionnaire showed no significant differences in vigorous bouts reported by junior and senior participants. Participants enrolled in physical education showed a trend of reporting higher vigorous PA bouts in the questionnaire compared to those not enrolled \((M = 3.3 \text{ bouts}, SD = 1.5 \text{ versus } M = 2.5 \text{ bouts}, SD = 1.8)\). However, unlike the diary results, these differences were not statistically significant \((p = .09)\). The MVPA score was examined in the questionnaire only. The trend of reporting higher moderate and vigorous activities among participants enrolled in physical education yielded significantly higher MVPA scores compared to those not enrolled \((M = 52.1, SD = 24.8 \text{ versus } M = 39.2, SD = 21.9, t(70) = -2.23, p<.05)\). These higher MVPA scores correspond with diary results regarding the higher levels of low to moderate activities on weekends, and vigorous activities overall and on weekdays reported by participants enrolled in physical education compared to those not enrolled.

No significant differences in the MVPA score were found between junior and senior students.

### 4.4.3 Comparing the Diary and Questionnaire Physical Activity Outcomes

This section discusses the six different PA outcomes (three each from the diary and questionnaire). The first step was to examine adherence to the Canadian PA guidelines using
diary and questionnaire data, followed by a comparison of common outcomes (sweat frequency and vigorous PA) reported using the two different assessments. Finally, the relationships between the diary and questionnaire outcomes were examined with the aim of selecting distinct PA outcomes for further analysis with the independent variables.

4.4.3.1 Adherence to the Canadian Physical Activity Guidelines according to the Diary and Questionnaire

The diary and questionnaire PA data were examined in terms of the guidelines developed for youth by the Canadian Society for Exercise Physiology (2011b). The guidelines recommend 60 minutes of PA at a moderate to vigorous intensity level every day, and specify that MVPA will lead to sweating. Using the diary and questionnaire information, Table 10 shows the number and proportion of participants meeting aspects of the PA guidelines. According to the diary entries, few participants reported 60 minutes of daily PA (13.6%), daily sweating (6.8%), and just over one-third of participants engaged in vigorous intensity activities at least three times per week (37.5%). Participants who completed their diary entries in the spring were significantly more likely to be physically active for 60 minutes and sweat every day versus those who completed their diary entries in the winter. There were no significant differences between junior and senior students in meeting aspects of the PA guidelines in the diary entries. Finally, participants who were enrolled in physical education were significantly more likely to sweat every day and also engage in three bouts of vigorous PA compared to those not enrolled.

A considerably larger percentage of participants met aspects of the PA guidelines based on questionnaire data versus the diary data. Specifically, one-third of the sample (32.1%) reported sweating “often,” 56.6% engaged in at least three vigorous intensity activities, and 43.4% engaged in sufficient MVPA with a score of 47 METs in a typical week. As shown in the diaries, participants in junior grades were equally likely to report sweating “often” and engage in three bouts of vigorous PA in the questionnaire as those in senior grades. In contrast to the diary findings of greater adherence to the sweat guideline among those enrolled in physical education, there were no differences in sweat frequency in the questionnaire based on enrolment physical education. At the same time, similar to the diary entries, participants who were enrolled in physical education were significantly more likely to reach the recommended three bouts of vigorous PA and also achieve sufficient MVPA in a typical week compared to those not enrolled.
Table 10: Participants Meeting Aspects of the Physical Activity (PA) Guidelines According to the Diary (N = 88) and Questionnaire (N = 87)

<table>
<thead>
<tr>
<th>Guideline Aspect</th>
<th>n</th>
<th>Proportion (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIARY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 minutes of PA per day</td>
<td>12</td>
<td>13.6</td>
<td></td>
</tr>
<tr>
<td>Season completing diaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>winter</td>
<td>4</td>
<td>7.1</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>spring</td>
<td>8</td>
<td>25.0</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-10</td>
<td>6</td>
<td>13.0</td>
<td>n.s.</td>
</tr>
<tr>
<td>11-12</td>
<td>6</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>7</td>
<td>11.4</td>
<td>n.s.</td>
</tr>
<tr>
<td>yes</td>
<td>5</td>
<td>18.5</td>
<td></td>
</tr>
<tr>
<td>Sweating daily</td>
<td>6</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>Season completing diaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>winter</td>
<td>0</td>
<td>0.0</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>spring</td>
<td>6</td>
<td>18.8</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-10</td>
<td>3</td>
<td>6.5</td>
<td>n.s.</td>
</tr>
<tr>
<td>11-12</td>
<td>3</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>2</td>
<td>3.3</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>yes</td>
<td>4</td>
<td>14.8</td>
<td></td>
</tr>
<tr>
<td>Three bouts of vigorous PA</td>
<td>33</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td>Season completing diaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>winter</td>
<td>18</td>
<td>32.1</td>
<td>n.s.</td>
</tr>
<tr>
<td>spring</td>
<td>15</td>
<td>46.9</td>
<td></td>
</tr>
<tr>
<td>Grouped grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-10</td>
<td>20</td>
<td>43.5</td>
<td>n.s.</td>
</tr>
<tr>
<td>11-12</td>
<td>13</td>
<td>31.0</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>16</td>
<td>26.2</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>yes</td>
<td>17</td>
<td>63.0</td>
<td></td>
</tr>
<tr>
<td>Guideline Aspect</td>
<td>n</td>
<td>Proportion (%)</td>
<td>p</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>----</td>
<td>----------------</td>
<td>-------</td>
</tr>
<tr>
<td>QUESTIONNAIRE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweating often</td>
<td>27</td>
<td>32.1</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-10</td>
<td>17</td>
<td>39.5</td>
<td>n.s.</td>
</tr>
<tr>
<td>11-12</td>
<td>8</td>
<td>21.6</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>13</td>
<td>26.5</td>
<td>n.s.</td>
</tr>
<tr>
<td>yes</td>
<td>10</td>
<td>41.7</td>
<td></td>
</tr>
<tr>
<td>Three bouts of vigorous PA</td>
<td>47</td>
<td>56.6</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-10</td>
<td>27</td>
<td>62.8</td>
<td>n.s.</td>
</tr>
<tr>
<td>11-12</td>
<td>18</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>23</td>
<td>47.9</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>yes</td>
<td>19</td>
<td>79.7</td>
<td></td>
</tr>
<tr>
<td>Moderate to vigorous PA score ≥ 47 METs</td>
<td>23</td>
<td>53.4</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-10</td>
<td>11</td>
<td>30.6</td>
<td></td>
</tr>
<tr>
<td>11-12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enrolment in physical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>14</td>
<td>29.2</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>yes</td>
<td>15</td>
<td>62.5</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Questionnaire N varies based on missing data.

n.s. = not significant

MET = metabolic equivalent of task

4.4.3.2 Comparing Sweat Frequency and Vigorous Bouts Reported in the Diary and Questionnaire

The next step in comparing the diary and questionnaire PA outcomes was to examine the intraclass correlations between sweat frequency and vigorous intensity activities. The purpose of
calculating the intraclass correlation was to determine the concordance of participant responses in the diary and questionnaire.

Sweat frequency reported in the diary and questionnaire showed only a small intra-class correlation at ICC_{(1,2)} = .21, \( p<.05 \). Moreover, a significantly lower proportion met the sweat guideline according to their diary (5.5%) compared to the questionnaire (31.5%) at \( t(72) = -4.21, p<.01 \). Vigorous bouts of PA reported in the diary and questionnaire also showed only a small intraclass correlation at ICC_{(1,2)} = .36, \( p<.01 \). As shown with reports of sweating, participants were significantly less likely to meet the three vigorous bouts of PA guideline in their diary (40.3%) versus the questionnaire (58.3%), \( t(71) = -2.84, p<.01 \). Overall, participant reports of sweating and vigorous PA in the diary and questionnaire were not consistent.

### 4.4.3.3 Determining Unique Physical Activity Outcomes for Multivariate Regression Analyses

Associations between the PA outcomes derived from the diary and questionnaire were examined next. The total sample that completed both the diary and questionnaire was 73 participants. However, complete data on all six PA outcomes was only available from 69 participants (see Table 11). With the exception of the average PA duration in minutes from the diary and sweat frequency from the questionnaire showing no relationship, all other PA outcomes derived from the two assessments showed positive relationships with one another (see Table 11). Notably, there was a large overlap between two diary PA outcomes and two questionnaire PA outcomes. Vigorous PA bouts in the diary approached a strong positive correlation with reports of sweating in the diary at \( r = .62, p<.01 \); vigorous bouts in the questionnaire showed a strong positive relationship with the moderate to vigorous PA (MVPA) score from the questionnaire \( r = .83, p<.01 \). As vigorous PA bouts in the diary were based on study-defined codes for intensity level and therefore had no missing data, it was carried forward instead of the diary sweat days for the multivariate analyses. Of the two highly correlated questionnaire PA outcomes, the MVPA score was carried forward for the multivariate analyses because it captured vigorous PA bouts and also moderate PA. Overall, four PA outcomes were carried forward for multivariate analysis: average PA duration (diary), vigorous bouts (diary), sweat frequency (questionnaire) and MVPA score (questionnaire).
Table 11: Correlations among Physical Activity Outcomes in the Diary and Questionnaire 
(N = 69)

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIARY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Average PA duration</td>
<td>.43**</td>
<td>.59**</td>
<td>.24</td>
<td>.22</td>
<td>.03</td>
<td></td>
</tr>
<tr>
<td>2. Vigorous bouts</td>
<td></td>
<td>.69**</td>
<td>.44**</td>
<td>.31*</td>
<td>.42**</td>
<td></td>
</tr>
<tr>
<td>3. Sweat days</td>
<td></td>
<td></td>
<td>.33**</td>
<td>.26*</td>
<td>.28*</td>
<td></td>
</tr>
<tr>
<td><strong>QUESTIONNAIRE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Vigorous bouts</td>
<td></td>
<td></td>
<td></td>
<td>.84**</td>
<td>.47**</td>
<td></td>
</tr>
<tr>
<td>5. Moderate to vigorous PA score (METs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.48**</td>
<td></td>
</tr>
<tr>
<td>6. Sweat frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: **p < .01; *p < .05

PA = physical activity
MET = metabolic equivalent of task

4.5 Psychosocial Factors and Physical Activity among South Asian High School Girls (Objective 2)

4.5.1 Perceptions of Physical Activity Enjoyment, Control and Barriers (Objective 2a)

**Objective 2a:** To examine perceptions of PA enjoyment, parental permission for PA, control over decisions to engage in PA, and barriers to engage in PA.

Descriptive characteristics for perceptions of enjoyment, parental permission, control, and barriers to PA are presented in Table 12. Psychometrics of the measures, including internal consistency using Cronbach’s alpha levels is also described.

4.5.1.1 Perceptions of Enjoyment and Control in Physically Demanding Activities in the Diary

The proportion of physically demanding activities identified as most enjoyable was 23.6%. Most enjoyable physically demanding activities included structured PA and dance or sport practices and competitions, like gym class, ultimate Frisbee, track and field, soccer, Cadets training; unstructured PA and play like playing in the snow, cycling around the neighbourhood; walking activities, like shopping; and various other tasks like volunteer work with a spiritual youth group, class projects, and hanging out with friends. The proportion of physically demanding activities
identified as least enjoyable was 4.8%. Least enjoyable physically demanding activities primarily consisted of chores around the house such as vacuuming, cleaning the house, and washing dishes. Overall, physically demanding activities also identified as the most enjoyable were engaged in for an average of 68.2 minutes, with 41.3% at a vigorous intensity level, while those physically demanding activities that were also identified as least enjoyable were engaged in for an average of only 46.4 minutes, with 19% at a vigorous intensity level. With respect to parental permission, the proportion of physically demanding activities with this requirement was 25.5%. However, participants also reported relatively high levels of control over their physically demanding activities across the five diary entries ($M = 3.47$, $SD = .84$).

4.5.1.2 Perceptions of Physical Activity Control and Barriers in the Questionnaire

The 3-item control over PA scale (Rhodes, et al., 2002) showed poor internal consistency ($\alpha = .63$) and was dropped from further analysis. However, the concept of control was still assessed using the single item daily control measure from the diary described in the previous section. The 15-item barriers to PA scale (Sallis, et al., 1996) showed excellent internal consistency ($\alpha = .85$) and yielded a range of scores (1.2 to 4.2), with a mean score of 2.42 ($SD = .62$) out of 5. Looking at individual items, girls tended to report that barriers to PA included a lack of time and energy, as well as a lack of company, lack of enjoyment from exercise, and lack of self-discipline. Mean scores for a fear of injury, lack of good health, discouragement from others, or lack of knowledge or skills tended to be lower than other items, suggesting that these were not perceived as barriers for girls.
Table 12: Descriptive Characteristics for Perceptions of Physical Activity Enjoyment, Parental Permission, Control and Barriers

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>N</th>
<th>Items</th>
<th>Scale max</th>
<th>Percentage or $M (SD)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diary: physically demanding activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most enjoyable</td>
<td>88</td>
<td>5</td>
<td>5</td>
<td>23.6%</td>
</tr>
<tr>
<td>Least enjoyable</td>
<td>88</td>
<td>5</td>
<td>5</td>
<td>4.8%</td>
</tr>
<tr>
<td>Parental permission</td>
<td>83</td>
<td>5</td>
<td>5</td>
<td>25.5%</td>
</tr>
<tr>
<td>Control</td>
<td>84</td>
<td>5</td>
<td>5</td>
<td>3.47 (0.84)</td>
</tr>
<tr>
<td>Questionnaire: physical activity participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control over physical activity</td>
<td>84</td>
<td>3</td>
<td>7</td>
<td>4.99 (1.07)</td>
</tr>
<tr>
<td>Barriers to physical activity</td>
<td>84</td>
<td>15</td>
<td>5</td>
<td>2.42 (0.62)</td>
</tr>
</tbody>
</table>

Notes: The control measure in the diary ranged from 1 = none to 5 = a great deal. Control over physical activity in the questionnaire ranged from 1 to 7 where 7 was equivalent to “extremely easy”, “complete control” or “strongly agree”. Internal consistency for the control over physical activity scale was $\alpha = .63$. Barriers to physical activity ranged from 1 = never to 5 = very often. Internal consistency for the barriers scale was $\alpha = .85$.

4.5.2 Support for Physical Activity and Connectedness to Social Networks (Objective 2b)

Objective 2b: To examine perceptions of support for PA, connectedness to diverse social networks (e.g. friends, families, and peers from other cultures) and perceptions of parental practices.

Descriptive and psychometric characteristics for perceptions of support for PA, connectedness to social networks, and perceptions of parental practices are presented in Table 13.

4.5.2.1 Support for Physical Activity

The 24-item social provisions scale (Motl, et al., 2004) showed excellent internal consistency ($\alpha = .88$), and participants reported a range of scores, with a total mean score of 3.76 ($SD = .46$). As higher values indicated stronger agreement with the presence of social provisions, results showed that participants tended to perceive that they had positive relationships with other people when it came to support to engage in physical activities. Highest rated individual items referred to the
nurturing roles that participants played in the PA participation of others. Measures of support for PA from mother and father (Kahan, 2005) also showed excellent internal consistency ($\alpha = .94$ and $\alpha = .91$, respectively). However, both scales reached ceiling effects showing very high levels of support (range = 2.33 to 5.00 each; $M = 4.40$, $SD = .65$ for mother; $M = 4.46$, $SD = .58$ for father), and were dropped from further analyses. A 3-item scale examined perceived norms for PA within one’s cultural community (Rhodes, et al., 2002). This scale showed poor internal consistency ($\alpha = .65$) and was therefore dropped from further analyses. A single item that was developed to examine perceived norms for participants to engage in “masculine” physical activities reached a ceiling effect with very high levels of support ($M = 5.83$ out of 7, $SD = 1.56$) and was also dropped from further analyses. Overall, participants in this study reported that other people positively supported their physical activities.

4.5.2.2 Connectedness to Social Networks and Perceptions of Parental Supportive, Demanding and Controlling Practices

Five sub-scales from the Hemingway measure examined connectedness to social networks (Karcher, 2005). These sub-scales were connectedness towards friends (6-items), siblings (5-items), peers from other cultures (3-items), and mother and father (5-items each). They all showed acceptable internal consistency (see Table 13). Connectedness towards friends, siblings and peers from other cultures approached ceiling effects with mean scores greater than 4 on 5-point response scales, and were therefore dropped from further analyses. Mother and father scales both showed a range of responses and indicated positive perceptions of connectedness (mother: $M = 3.87$, $SD = .70$; father: $M = 3.63$, $SD = .75$). Overall, participants reported relatively high levels of connectedness and positive attitudes towards their friends, siblings, mother, father, and peers from other cultures.
Table 13: Descriptive Characteristics for Measures of Support for Physical Activity, Connectedness to Social Networks, and Parental Practices

<table>
<thead>
<tr>
<th>Measure</th>
<th>N</th>
<th>Items</th>
<th>Internal Consistency</th>
<th>Range</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for Physical Activity (PA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social provisions</td>
<td>83</td>
<td>24</td>
<td>-</td>
<td>.88</td>
<td>2.63, 5.00</td>
</tr>
<tr>
<td>Mother support for PA</td>
<td>84</td>
<td>3</td>
<td>.79</td>
<td>.94</td>
<td>2.33, 5.00</td>
</tr>
<tr>
<td>Father support for PA</td>
<td>80</td>
<td>3</td>
<td>.82</td>
<td>.91</td>
<td>2.33, 5.00</td>
</tr>
<tr>
<td>Norms for PA within South Asian communities</td>
<td>83</td>
<td>3</td>
<td>-</td>
<td>.63</td>
<td>1.00, 7.00</td>
</tr>
<tr>
<td>Norms for “masculine” PA</td>
<td>82</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1, 7</td>
</tr>
<tr>
<td>Connectedness to Social Networks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friends</td>
<td>86</td>
<td>6</td>
<td>.71</td>
<td>.87</td>
<td>1.83, 5.00</td>
</tr>
<tr>
<td>Siblings</td>
<td>76</td>
<td>5</td>
<td>.94</td>
<td>.91</td>
<td>1.60, 5.00</td>
</tr>
<tr>
<td>Mother</td>
<td>81</td>
<td>5</td>
<td>.83</td>
<td>.73</td>
<td>2.00, 5.00</td>
</tr>
<tr>
<td>Father</td>
<td>76</td>
<td>5</td>
<td>.92</td>
<td>.79</td>
<td>2.00, 5.00</td>
</tr>
<tr>
<td>Peers from other cultures</td>
<td>87</td>
<td>3</td>
<td>.82</td>
<td>.88</td>
<td>2.67, 5.00</td>
</tr>
<tr>
<td>Parental Practice Dimensions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother supportive</td>
<td>81</td>
<td>13</td>
<td>-</td>
<td>.86</td>
<td>1.85, 5.00</td>
</tr>
<tr>
<td>Father supportive</td>
<td>77</td>
<td>13</td>
<td>-</td>
<td>.87</td>
<td>2.31, 5.00</td>
</tr>
<tr>
<td>Mother demanding</td>
<td>83</td>
<td>4</td>
<td>-</td>
<td>.44</td>
<td>2.50, 5.00</td>
</tr>
<tr>
<td>Father demanding</td>
<td>76</td>
<td>4</td>
<td>-</td>
<td>.53</td>
<td>2.50, 5.00</td>
</tr>
<tr>
<td>Mother controlling</td>
<td>82</td>
<td>4</td>
<td>-</td>
<td>.71</td>
<td>1.50, 5.00</td>
</tr>
<tr>
<td>Father controlling</td>
<td>77</td>
<td>4</td>
<td>-</td>
<td>.70</td>
<td>1.50, 5.00</td>
</tr>
</tbody>
</table>

Notes: Internal consistency was measured using Cronbach’s alpha.

Social provisions, and mother and father support for PA ranged from 1 = strongly disagree to 5 = strongly agree.

Norms for PA within South Asian communities and norms for “masculine” PA ranged from 1 = strongly disagree to 7 = strongly agree.

All sub-scales on connectedness to social networks ranged from 1 = not at all to 5 = very true.

Parental practice dimensions ranged from 1 = never to 5 = very often/almost every day.
Three subscales (dimensions) of parenting practices were measured for both mothers and fathers: supportive (13-items), demanding (4-items), and controlling practices (4-items) (Devereux, et al., 1969). Results are presented in Table 13. Perceptions of mother supportive practices ($\alpha = .86$) and father supportive practices ($\alpha = .87$) showed acceptable internal consistency, and results indicated high perceptions of parent supportive practices with mean scores of 3.77 ($SD = .66$) and 3.67 ($SD = .69$) for mothers and fathers, respectively. Perceptions of mother demanding practices ($\alpha = .44$) and father demanding practices ($\alpha = .53$) both showed poor internal consistency and were therefore dropped from further analyses. Perceptions of mother controlling practices ($\alpha = .71$) and father controlling practices ($\alpha = .70$) showed acceptable internal consistency, and results indicated high perceptions of parental controlling practices with mean scores of 3.49 ($SD = .84$) and 3.19 ($SD = .87$) for mothers and fathers, respectively. Overall, results showed high levels of parent supportive and controlling practices.

4.5.3 Connectedness to Religion and Religious Involvement (Objective 2c)

Objective 2c: To examine religious connections and involvement.

The 3-item connectedness to religion measure (Karcher, 2005) showed good internal consistency ($\alpha = .85$), yielded a range of scores, and indicated that participants held positive feelings of connectedness towards their religion(s) ($M$ of 3.79, $SD = 1.03$) (see Table 14). In addition to this measure, 4 items assessed frequency of religious involvement, including 3 previously developed items (Fetzer Institute and National Institute on Aging Working Group, 1999) and 1 new item. A range of responses was reported for all four items. Results of the new item showed that on average, participants prayed in places outside of a spiritual centre (i.e., at home) at least once a week ($M = 5.43$, $SD = 2.32$). However, participants tended to pray at a spiritual centre only about once a month ($M = 3.57$, $SD = 1.50$). Participants also indicated that spiritual centres served as venues for services about once a month ($M = 5.16$, $SD = 1.80$), and served as venues for other activities about 2-3 times per month ($M = 3.99$, $SD = 2.25$).
Table 14: Connectedness to Religion and Religious Involvement

<table>
<thead>
<tr>
<th>Measure/Item</th>
<th>N</th>
<th>Items</th>
<th>Observed Range</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectedness to religion</td>
<td>86</td>
<td>3</td>
<td>1.33, 5.00</td>
<td>3.79 (1.03)</td>
</tr>
<tr>
<td>Prayer in spiritual centre</td>
<td>86</td>
<td>1</td>
<td>1, 8</td>
<td>3.57 (1.50)</td>
</tr>
<tr>
<td>Prayer outside of spiritual centre</td>
<td>86</td>
<td>1</td>
<td>1, 8</td>
<td>5.43 (2.32)</td>
</tr>
<tr>
<td>Religious services</td>
<td>85</td>
<td>1</td>
<td>1, 9</td>
<td>5.16 (1.80)</td>
</tr>
<tr>
<td>Activities at spiritual centre</td>
<td>85</td>
<td>1</td>
<td>1, 9</td>
<td>3.99 (2.25)</td>
</tr>
</tbody>
</table>

Notes: Connectedness to religion ranged from 1 = not at all to 5 = very true. Internal consistency of the connectedness to religion scale was $\alpha = 0.85$.

Prayer in a spiritual centre and outside of a spiritual centre ranged from 1 = never to 8 = several times a day.

Religious services and activities at a spiritual centre ranged from 1 = never to 9 = several times a week.

4.5.4 Results of the Exploratory Factor Analysis: Perceptions of Cultural and Gender-specific Attitudes towards PA (Objective 2d)

Objective 2d: To examine perceptions of cultural and gender-specific attitudes towards PA.

As described in the Methodology (Chapter 3), new items were developed to examine normative beliefs related to the PA participation of South Asian girls. Fifteen items were generated that tapped into two separate concepts, and were piloted in this study (see Table 15). The first concept examined perceived PA attitudes held by Canadians identifying with South Asian cultures. This included attitudes towards PA among South Asian parents and communities, and comparisons between South Asians and non-South Asians with respect to their PA attitudes and levels of participation (items 1 to 7). The second concept examined intersections of cultural and gender-based attitudes towards PA participation of South Asian girls. This included comparisons between South Asian girls and boys with respect to their PA levels and PA support from their parents and communities, and also comparisons between the PA levels of girls who are from South Asian and non-South communities (items 8 to 15).
Table 15: New Items Examining Perceptions of Cultural and Gender-specific Attitudes towards Physical Activity ($N = 76$)

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item</th>
<th>$M (SD)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>My parents have similar attitudes towards physical activities as non-South Asian parents in Canada.</td>
<td>3.49 (1.19)</td>
</tr>
<tr>
<td>2</td>
<td>My South Asian cultural and religious community is generally supportive of physical activities for girls.</td>
<td>3.87 (0.87)</td>
</tr>
<tr>
<td>3</td>
<td>South Asian parents hold similar attitudes towards physical activities as non-South Asian parents in Canada.</td>
<td>3.41 (0.98)</td>
</tr>
<tr>
<td>4</td>
<td>Being physically active is a priority for many people of South Asian descent.</td>
<td>3.12 (0.91)</td>
</tr>
<tr>
<td>5*</td>
<td>Most South Asian fathers do not participate in physical activities.</td>
<td>3.25 (1.07)</td>
</tr>
<tr>
<td>6*</td>
<td>Most South Asian mothers do not participate in physical activities.</td>
<td>2.79 (1.12)</td>
</tr>
<tr>
<td>7*</td>
<td>My friends who are not South Asian are more physically active than my friends who are South Asian.</td>
<td>2.84 (1.17)</td>
</tr>
<tr>
<td>8*</td>
<td>Girls who are not from South Asian families usually spend more time being physically active than girls from South Asian families.</td>
<td>2.82 (1.03)</td>
</tr>
<tr>
<td>9*</td>
<td>South Asian parents are more likely to discourage their daughters from being physically active compared to their sons.</td>
<td>3.33 (1.11)</td>
</tr>
<tr>
<td>10</td>
<td>Girls and boys in my cultural community spend about the same time being physically active.</td>
<td>3.16 (1.03)</td>
</tr>
<tr>
<td>11*</td>
<td>South Asian girls are not expected to be as physically active as South Asian boys.</td>
<td>2.86 (1.12)</td>
</tr>
<tr>
<td>12*</td>
<td>Non-South Asian parents are more encouraging of their daughter’s physical activities than South Asian parents.</td>
<td>3.01 (1.13)</td>
</tr>
<tr>
<td>13*</td>
<td>It is easier for Canadian girls that are not from South Asian backgrounds to be physically active.</td>
<td>3.20 (1.19)</td>
</tr>
<tr>
<td>14</td>
<td>South Asian parents treat boys and girls the same when it comes to physical activity.</td>
<td>3.12 (1.06)</td>
</tr>
<tr>
<td>15*</td>
<td>Based on my experience, South Asian girls are usually less physically active than other girls.</td>
<td>2.88 (1.19)</td>
</tr>
</tbody>
</table>

Notes: Items were originally scored on a five-point Likert scale with 1 = strongly agree and 5 = strongly disagree.

*Items 5 to 9, 11 to 13 and 15 were negatively worded and reverse-coded during analysis. For the final calculation of the scale score, all items were reversed so that higher values referred to more support for South Asian girls to be physically active.
All items were examined for normality. Results showed that two items (items 1 and 2) were positively skewed with 54.9% and 70.8% participants indicating that they strongly agreed or agreed with the items: “My parents have similar attitudes towards physical activities as non-South Asian parents in Canada” and “My South Asian cultural and religious community is generally supportive of physical activities for girls”. These items were dropped from further analysis. Pearson correlations among the remainder of the items showed that most items were significantly associated with one another (see Appendix O). Correlations ranged from \( r = .12 \) (\( p = .32 \)) to \( r = .75 \) (\( p < .01 \)).

Because the new items were thought to assess two separate concepts, a two-component maximum likelihood factor analysis was tested. However, commonalities between the items were high at .40 and above, and the two factors were moderately correlated with each other at \( r = .50 \). In addition, the scree plot showed a steep drop-off after the first factor (Eigen value = 5.93, explaining 45.6% of the variance), and the pattern and structure matrices indicated that the two-factor solution was unstable. For these reasons, a single factor solution was examined. The final solution used for exploratory purposes was a single 13-item scale with excellent internal consistency at \( \alpha = .90 \), range = 1.92 to 5.00, \( M = 3.06 \) (\( SD = .73 \)).

### 4.5.5 Bivariate Correlations between the Psychosocial Factors

Measures with an acceptable range of responses and internal consistency were carried forward for bivariate correlation analyses (see Appendix P). Pearson correlations ranged from \( r = -.002 \) (\( p = .99 \)) to \( r = .82 \) (\( p < .001 \)). For the most part, the psychosocial variables were either not associated with one another, or showed only low to moderate associations. This suggested that most measures were assessing separate constructs, and were carried forward for bivariate and multivariate regression analyses.

However, the measure of connectedness to mothers was strongly associated with the supportive dimension of mothers’ parenting practices (\( r = .71 \), \( p < .01 \)). Similarly, the measure of connectedness to fathers was strongly associated with the supportive dimension of fathers’ parenting practices (\( r = .82 \), \( p < .01 \)). As mother and father supportive dimensions had higher levels of internal consistency (\( \alpha = .86 \) and \( \alpha = .87 \)) compared to connectedness to mothers and fathers (\( \alpha = .73 \) and \( \alpha = .79 \)), the connectedness variables were dropped from further analyses. In addition, the controlling dimension of mothers’ and fathers’ controlling practices were strongly
correlated with one another ($r = .74, p < .01$). Thus, they were combined into an 8-item measure of parent controlling practices with responses ranging from 1.33 to 5.00, a mean score of 3.79 ($SD = 1.03$), and acceptable internal consistency ($\alpha = .83$).

In summary, six questionnaire measures were not carried forward because of ceiling effects: 1) Mother support for PA, 2) Father support for PA, 3) Norms for “masculine” activities”, connectedness to 4) Friends, 5) Siblings, and 6) Peers from other cultures. Three measures were not carried forward because of poor internal consistency: 1) Support for PA from cultural communities, 2) Mother demanding dimension, and 3) Father demanding dimension. Finally, two measures were not carried forward because of strong correlations with other variables: 1) Connectedness to mothers, and 2) Connectedness to fathers. Fifteen psychosocial factors were carried forward for further analyses including four measures from the diary: the proportion of most physically demanding activities categorized as 1) Most enjoyable, 2) Least enjoyable, 3) Parental permission, and 4) Control associated with the most physically demanding activity. Eleven measures from the questionnaire were carried forward: 1) Barriers to PA, 2) Social provisions for PA, 3) Cultural and gender-specific attitudes towards PA; 4) Mother supportive dimension, 5) Father supportive dimension, 6) Parent controlling dimension, 7) Connectedness to religion, 8) Prayer in a spiritual centre, 9) Prayer outside of a spiritual centre, 10) Attendance at religious services, and 11) Activities at a spiritual centre.

4.5.6 Relationships between the Psychosocial Factors and the Physical Activity Outcomes

In the final group of analyses, psychosocial factors as tapped by the measures described in the previous section were examined in relation to the four PA outcomes using bivariate regressions followed by multivariate regressions. In addition to the psychosocial factors, three demographic characteristics were examined in relation to the PA outcomes: grade, enrolment in physical education, and cultural composition of friendship groups. Other demographic characteristics (i.e., presence of a sibling, years in Canada, religious affiliation, and BMI) were not included because of a lack of variability within the sample on these measures. Season (winter or spring) was also examined for the diary outcomes.
4.5.6.1 Results of the Bivariate Analyses

Separate bivariate regression analyses were run for each independent variable on the two diary outcomes (i.e., PA duration and diary vigorous bouts) and the two questionnaire outcomes (i.e. moderate to vigorous PA (MVPA) score and sweat frequency). Variables were carried forward to the multivariate regression analyses if they were significant at \( p \leq .10 \) for at least one of the four PA outcomes examined. Table 16 shows the results of the bivariate regressions. Due to the need for complete data from both the diary and questionnaire in the bivariate regression analyses, data are reported from a sample of 69 participants.

Four psychosocial variables were carried forward: Most enjoyable physically demanding activity (diary), Control associated with the most physically demanding activity (diary), Barriers to PA (questionnaire), and Social provisions (questionnaire). More minutes of PA were reported among participants with a higher proportion of most enjoyable physically demanding activities \( (p < .05) \), but no trends were seen for vigorous bouts, MVPA score, or sweat frequency. Participants reporting greater control over their physically demanding activities reported a significantly higher MVPA score \( (p < .05) \), and also showed a trend of reporting more vigorous bouts \( (p < .10) \). Participants who perceived more barriers to PA participation reported a significantly lower MVPA score and sweat frequency \( (p < .05) \), and also showed a trend of reporting fewer vigorous bouts \( (p < .10) \). Finally, participants with greater social provisions for PA reported significantly higher levels of PA based on all four PA outcomes \( (p < .05) \).

Results also showed that the three demographic variables were related to at least one of the four PA outcomes at \( p \leq .10 \). Grade was significantly related to one PA outcome, sweat frequency \( (p < .05) \), such that participants in senior grades reported sweating less often than participants in junior grades. In comparison, participants enrolled in physical education reported significantly more sweating, vigorous bouts and MVPA score \( (at \ p < .05) \), and also showed a trend of reporting higher PA duration \( (p < .10) \) versus those not enrolled. Therefore, to maximize power for the final multivariate regression analyses, grade was dropped from further analysis. The cultural composition of friendship network was related to both questionnaire outcomes. Specifically, participants with mostly South Asian friends reported a significantly lower MVPA score \( (p < .05) \), and showed a trend of sweating less frequently \( (p < .10) \) compared to participants with mostly non-South Asian friends. There was a trend in PA duration by season, as participants who
completed their diaries in spring reported more minutes of PA compared to those who completed their diaries in winter ($p<.10$), but no relationship emerged with the number of vigorous PA bouts reported. Season was not examined for the questionnaire outcomes because all questionnaires were completed in spring.

Next, bivariate correlations were examined for the four psychosocial variables carried forward, three demographic variables, and season (see Table 17). Participants enrolled in physical education classes were more likely to have completed their diary entries in the spring ($r = .44$, $p<.01$) and not surprisingly, reported having less control over their PA participation ($r = -.29$, $p<.05$) compared to those not enrolled. Having a friend network composed of mostly South Asians was associated with fewer social provisions ($r = -.44$, $p<.01$). However, having an equal number of South Asian and non-South Asian friends was associated with having more social provisions ($r = .39$, $p<.01$). In addition, participants who experienced more barriers to PA participation reported having fewer social provisions ($r = -.32$, $p<.01$).

4.5.6.2 Results of the Multivariate Analyses

Multivariate regressions were first run for the two diary outcomes (PA duration and vigorous bouts) using the psychosocial variables, demographic variables, and season. Results showed that season was not a significant predictor for either duration or vigorous bouts. Therefore, final multivariate regressions were re-run for the diary outcomes without season to permit comparisons across all four PA outcomes, and maximize the power to detect differences in this small sample. Results are reported from a sample of 65 participants with complete data, and presented in Table 18. Based on the Pearson correlations between the final six explanatory variables and the four PA outcomes (see Appendix Q), the power to detect differences at an alpha level of .05 with a sample of 65 participants ranged from low at 0.37 (i.e., control and duration) to very strong at 0.94 (i.e., enrolment in physical education and diary vigorous bouts) (Chang, 2011).

Physical education was the only independent variable significantly associated with all four PA outcomes, with participants who were enrolled in physical education reporting more minutes of PA, more vigorous bouts, a higher MVPA score, and sweating more often compared to those not enrolled. Composition of the friend network and barriers to PA were also significantly associated with sweat frequency. Participants who reported fewer barriers reported sweating more often in a
typical week. In addition, participants with a predominantly South Asian group of friends reported sweating less often in a typical week compared to participants with mostly non-South Asian friends. Participants who reported greater control over their physically demanding activities reported significantly more vigorous bouts in the diary, and significantly higher MVPA scores in the questionnaire. Finally, although social provisions for PA was significantly related to all four PA outcomes at the bivariate level, it was no longer significantly related to any of the outcomes when other independent variables were taken into account. In total, the multivariate models accounted for 26%, 18% and 17% of the variance in vigorous bouts, MVPA score, and sweat frequency respectively. The percentage of the variance in PA duration explained by the multivariate model was 7%, but this was not significant ($p = .13$).
Table 16: Bivariate Regression Coefficients for the Explanatory Variables on the Physical Activity (PA) Outcomes (N = 69)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>d</th>
<th>g</th>
<th>q</th>
<th>d</th>
<th>g</th>
<th>q</th>
<th>d</th>
<th>g</th>
<th>q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent controlling dimension</td>
<td>0.04</td>
<td>1.18</td>
<td>1.12</td>
<td>1.20</td>
<td>0.00</td>
<td>1.98</td>
<td>0.00</td>
<td>1.98</td>
<td>0.00</td>
</tr>
<tr>
<td>Parent supportive dimension</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Cultural and gender-specific attitudes</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Cultural and gender-specific attitudes towards PA</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Parental permission</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Least enjoyable activity</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Most enjoyable activity</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Equal South Asian and not</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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</tr>
<tr>
<td>Most friends are South Asian</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
</tr>
<tr>
<td>Composition of friend network</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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</tr>
<tr>
<td>Season</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Environment in physical education</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Grade</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
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</tr>
</tbody>
</table>

Note: The table includes coefficients for various characteristics, such as parental support, cultural attitudes, gender-specific attitudes, and other factors, related to physical activity outcomes. The coefficients are presented in various cells, indicating the strength and direction of the relationships.
Season was only examined for PA duration and diary vigorous bouts as all questionnaires were completed in spring.

Reference category: most of my friends are not South Asian

Reference category: not enrolled in physical education

Reference category: winter

Reference category: junior grade

Notes: unstandardized coefficient = \( b \), standardized coefficient = \( \beta \), significance = \( p \)

<table>
<thead>
<tr>
<th>Reference: Activities at a spiritual centre</th>
<th>Religious services</th>
<th>Prayer outside of a spiritual centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.06 - 0.96</td>
<td>0.17</td>
<td>0.14</td>
</tr>
<tr>
<td>1.17</td>
<td>0.71</td>
<td>0.37</td>
</tr>
<tr>
<td>1.22</td>
<td>0.44</td>
<td>0.05</td>
</tr>
<tr>
<td>0.75</td>
<td>0.03</td>
<td>0.04</td>
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<tr>
<td>0.65</td>
<td>0.17</td>
<td>0.14</td>
</tr>
<tr>
<td>0.26</td>
<td>0.17</td>
<td>0.14</td>
</tr>
<tr>
<td>1.71</td>
<td>0.71</td>
<td>0.37</td>
</tr>
<tr>
<td>0.81</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>0.59</td>
<td>0.06</td>
<td>0.04</td>
</tr>
</tbody>
</table>

**p \leq 0.05, *p \leq 0.10.
### Table 17: Correlations Among Explanatory Variables Related to at Least One Physical Activity (PA) Outcome at \( p > .10 \) (\( N = 65 \))

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Enrolment in physical education</td>
<td>19</td>
<td>0.02</td>
<td>0.09</td>
<td>-0.06</td>
<td>-0.29</td>
<td>*</td>
<td>0.03</td>
<td>0.22</td>
</tr>
<tr>
<td>2. Season</td>
<td>0.08</td>
<td>0.27</td>
<td>*</td>
<td>-0.15</td>
<td>-0.14</td>
<td>0.15</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>3. Most friends are South Asian</td>
<td>0.59</td>
<td>*</td>
<td>-0.12</td>
<td>0.02</td>
<td>0.13</td>
<td>-0.44</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>4. Equal South Asian and not</td>
<td>0.07</td>
<td>-0.08</td>
<td>-0.13</td>
<td>0.39</td>
<td>**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diary</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Most enjoyable</td>
<td>-0.19</td>
<td>-0.20</td>
<td>**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Control over PA</td>
<td>-0.1</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Barriers to PA</td>
<td>0.21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Questionnaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Social Provisions for PA</td>
<td>0.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Notes: Variables 3 and 4 refer to the cultural composition of the friend network.

\* \( p < 0.05 \), \** \( p < 0.01 \)
Table 18: Multivariate Regression Coefficients for the Explanatory Variables on the Physical Activity (PA) Outcomes (N = 65)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Diary Vigorous Bouts</th>
<th>Moderate to Vigorous PA Score</th>
<th>Physical Activity Duration</th>
<th>Sweat Frequency</th>
<th>Enrolment in Physical Education</th>
<th>Most Friends are South Asian</th>
<th>Most Enjoyable Activity</th>
<th>Control over PA</th>
<th>Barriers to PA</th>
<th>Social Provisions for PA</th>
<th>Composition of Friend Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>d</td>
<td>1.00</td>
<td>-0.06</td>
<td>-0.04</td>
<td>0.03</td>
<td>1.00</td>
<td>-0.04</td>
<td>1.00</td>
<td>-0.04</td>
<td>1.00</td>
<td>-0.04</td>
<td>1.00</td>
</tr>
<tr>
<td>f</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>q</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Notes: unstandardized coefficient = $\beta$, standardized coefficient = $\beta$, significance = $d$, significant coefficient = $q$. Reference category: not enrolled in physical education

Reference categories: not enrolled in physical education $>0.10$, 1 reference category: not enrolled in physical education, $>0.05$

$^a$ Reference category: most of my friends are not South Asian

$^b$ Reference category: not enrolled in physical education

$^c$ Reference category: equal South Asian and not South Asian

$^d$ Reference category: not enrolled in physical education

$^e$ Reference category: not enrolled in physical education, most of my friends are not South Asian

$^f$ Reference category: not enrolled in physical education, equal South Asian and not South Asian

$^g$ Reference category: not enrolled in physical education, not enrolled in physical education, most of my friends are not South Asian

$^h$ Reference category: not enrolled in physical education, not enrolled in physical education, equal South Asian and not South Asian

$^i$ Reference category: not enrolled in physical education, not enrolled in physical education, not enrolled in physical education, most of my friends are not South Asian

$^j$ Reference category: not enrolled in physical education, not enrolled in physical education, not enrolled in physical education, equal South Asian and not South Asian

$^k$ Reference category: not enrolled in physical education, not enrolled in physical education, not enrolled in physical education, not enrolled in physical education, most of my friends are not South Asian

$^l$ Reference category: not enrolled in physical education, not enrolled in physical education, not enrolled in physical education, not enrolled in physical education, equal South Asian and not South Asian

Adjusted $R^2$ = .07; model was not significant, $F(7, 58) = 1.69, p = .13$

Adjusted $R^2$ = .26; model was significant at $F(7, 58) = 4.22, p < .01$

Adjusted $R^2$ = .18; model was significant at $F(7, 58) = 2.94, p < .01$

Adjusted $R^2$ = .17; model was significant at $F(7, 58) = 2.89, p < .05$
Chapter 5
Discussion

5 Key Findings and Implications of The Everyday Activities Study

5.1 Overview

This study comprehensively examined physical activity (PA) participation in a purposive sample of South Asian high school girls with the aim of learning more about how these adolescent girls spent their time and how demographic, psychological, social, and cultural factors may be related to their PA levels. Over the last 10 years, PA has become a key area of interest because of strong links between regular PA participation, fitness, and healthy development with short and long-term health outcomes. Particular interest with youth has stemmed from the notion that a lifestyle pattern of PA adopted from a young age will be more likely to continue into adulthood. Low levels of PA reported in recent population studies in Canada have flagged adolescents, especially senior high school students and females of South Asian heritage as vulnerable to a steep drop off in PA levels. However, it wasn't clear to what extent activity levels were related to the different measures used to assess PA, or what variables, especially psychological perceptions, social and cultural factors might relate to PA in South Asian adolescent girls. This study contributes to our understanding of PA and lifestyle patterns of South Asian adolescent girls by showing that, although structured PA and sport and extra-curricular activities like South Asian dancing were important, PA in this sample largely came from domains other than leisure, including education (i.e., physical education classes), transport and occupations (e.g., walking to school and walking at part-time jobs or volunteer work). It also raised issues related to measurement of PA with findings that daily diary information didn’t always correspond well with information assessed from the questionnaire. In addition, this study found that although many girls reported that PA was enjoyable and that they had considerable social support and provisions for PA in their lives, PA levels were often low. This was especially true when metrics like sweating were used to measure PA compared to total activity duration. Factors associated with PA were enrolment in physical education, perceptions of control, and barriers like not having enough time for PA. These findings are helpful in creating and assessing future PA promotion strategies, as well as in identifying areas in need of further research.
5.2 Study Findings Framed by Social Cognitive Theory

The research objectives and selection of independent variables examined in this study were guided by Social Cognitive Theory, psychosocial research on youth PA, and studies specifically on South Asian girls. Much of the literature on youth PA has focussed on social factors like support from families and friends (Nahas, et al., 2003; Sallis, et al., 2000; Van der Horst, et al., 2007; Wallhead & Buckworth, 2004). While this study supports findings related to the importance of enjoyment, control and confidence to overcome barriers (or experience few barriers), it also suggests that youth PA research needs to give more prominence to structural variables like enrolment in physical education, the presence/availability of outdoor spaces like streets and parks, and neighbourhood characteristics. Figure 4 revisits the social cognitive model of PA and specifies key factors related to PA participation that were demonstrated in this South Asian sample of high school girls (factors in italics). This chapter discusses the components and implications of this revised model.

![Diagram of Social Cognitive Model]

**Figure 4: Key Factors related to Physical Activity among South Asian Girls framed by Social Cognitive Theory**
5.3 Quality of Physical Activity Participation

5.3.1 Types of Physical Activities

Using a diary that provided girls with the opportunity to report their daily activities in depth, the results showed that girls engaged in a wide variety of activity types that are often captured in existing PA questionnaires. However, more inclusive examples and broad categories of physical activities could enhance existing self-report PA instruments. For example, the most frequently reported category of PA in this study was structured physical activities like physical education, sport and dance (37.7%), with forms of South Asian dancing making a substantial contribution. Population questionnaires, like the Canadian Community Health Survey, usually do not explicitly ask about physical education classes, and the item referring to dance is often worded as “popular or social dance” (Statistics Canada, 2007a). In the present study, 10.9% of all activities identified by participants as physically demanding were also related to their South Asian heritage, and of these, two-thirds referred to a form of dance (e.g., Bharathanatyam, Bhangra and Bollywood). While this finding relates to participant recruitment from South Asian dance classes, it also highlights that some types of PA may be particularly important or common within some cultures. This suggests that PA questionnaires may benefit from including prompts such as “culturally-based dancing” to make PA questionnaires more relevant to culturally diverse youth in Canada. Similarly, “walking for exercise” is generally listed as an activity type in PA assessments, but checklists often do not capture walking as a form of transportation to school, walking around destinations of interest like shopping malls, and walking during part-time jobs and volunteer activities (e.g., delivering newspapers) which emerged in this sample of adolescent girls. It may be that individuals completing PA questionnaires only consider walking when it is a separate activity aimed at exercising, and not walking that occurs as part of getting to and from destinations like school, or when it is incorporated into other activities. Given that walking indoors and outdoors was the second highest category of activity reported in this study (27.1%), and walking at a mall, store or plaza was cited in 12.7% of weekend days, greater attention to the variety of walking activities and examples of what is meant by walking is warranted in future PA assessments.

Results of the diaries also revealed that some physical activities that were mentioned by respondents are not usually captured in PA questionnaires or studies with adolescents. These
included play, chores, and physically demanding extra-curricular activities. Unstructured PA and play is generally thought of as a pastime for young children, with developmental benefits like acquisition of speech and basic social skills like sharing (Active Healthy Kids Canada, 2012). However, 29.5% of adolescent girls in this study reported unstructured PA and play at least once, including playing games in a park or backyard with friends, younger siblings, or cousins. This suggests that spontaneous games are played throughout adolescence, at least some of the time, and should be represented in adolescent PA surveys. It also supports recommendations from Active Healthy Kids Canada (2012) to increase the availability of “play spaces” for teenagers, and unscheduled time that they may spend with one another. Similarly, although PA through household and outdoor chores is usually associated with adult populations, especially women, chores emerged as an important type of PA among adolescent girls in the present study, with 42% reporting an activity like shovelling the snow or doing the laundry as their most physically demanding activity at least once. Finally, a number of extra-curricular activities were reported by study participants that are often not included in PA surveys, like physically demanding volunteer work (e.g., tending to a community garden), part-time jobs (e.g., lifeguarding), and involvement in clubs that require physical training (e.g., cadets). A possible explanation for the omission of activities across a variety of domains in PA assessments is that research has often framed PA to be a motivated and intentional behaviour (Weiss, 1995). As research starts to examine incidental, transport and everyday activities (e.g., walking activities, chores, and physically demanding volunteer work), the prominent role that intentions and goals are given in health behaviour theories like Social Cognitive Theory, Theory of Reasoned Action, and Theory of Planned Behaviour (Ajzen, 1991; Bandura, 2004; Conner & Sparks, 2005; Luszczynska & Schwarzer, 2005) may need to be enhanced to include other reasons for behaviour. Overall, further research is needed to broaden our understanding of physically demanding youth commitments outside of the school setting. Adolescent self-report PA questionnaires could provide more inclusive examples and categories of activities, prompt participants to think about physical activities beyond sports and recreation, and help participants to reflect on their lifestyle that may include physically demanding volunteer positions, part-time jobs, and other extra-curricular activities.

5.3.1.1 The Importance of Physical Education

One of the main findings in this study was the important role that physical education classes played in keeping participants physically active. Social Cognitive Theory posits that physical
education, as a structural factor, may promote PA levels by facilitating opportunities to be active and by providing positive PA experiences (Bandura, 2001; Luszczynska & Schwarzer, 2005). In support, data showed that physical education classes were reported in 64 (24.0%) of the weekday entries, and of these, it was identified as the most physically demanding activity in 51 entries (79.7%). This means that, among those girls who were enrolled in physical education, their class was almost always the most physically intense part of their day. Moreover, enrolment in physical education was significantly associated with all three outcomes that captured weekly PA intensity (i.e., vigorous PA participation, MVPA, and sweat frequency), and physical education was often identified as the most enjoyable activity of the day. Of concern however, was that results also showed that there was a drop off in physical education enrolment between junior and senior grades, with no grade 12 girls enrolled in physical education. Although we do not know whether physical education drives PA levels or whether more active girls enrol in physical education, these findings point to the need to re-examine the amount of PA required in high schools. This is in line with advocacy efforts of a number of organizations (Canadian Paediatric Society, 2002; Heart and Stroke Foundation of Canada, 2008; Mandigo, 2010). Presently in Ontario, only one physical education credit is required between grades 9 and 12 (Government of Ontario, 2011), with most students completing this credit in grade 9. Ontario school boards have shown some commitment towards increasing PA levels among students through education and was one of the first provinces to mandate a daily physical activity (DPA) policy requiring 20 minutes of MVPA during the school day for students in kindergarten to grade 8 (Government of Ontario, 2011). However, Ontario’s single credit requirement for secondary students falls short of provinces like Manitoba where physical education is mandated each year from kindergarten to grade 12 (Active Healthy Kids Canada, 2010a, 2011; Manitoba Education and Training, 2000). Also important to note is that Manitoba’s physical education program for senior students includes out of class PA practicums where students are expected to document a certain number of hours of PA outside of their school environment (Government of Manitoba, 2007). By mandating PA beyond school hours and facilities, students may be motivated to adopt an active lifestyle that contributes to lifelong physical activities and ultimately, better health.
5.3.1.2 The Walk to High School: An Underused Opportunity for Physical Activity

As previously mentioned, walking was the second-most popular type of PA in this sample of South Asian girls. This is consistent with Canadian population studies with youth, adults and older adults (Bryan & Katzmarzyk, 2009; Cameron, et al., 2004). At the same time, although walking was frequently cited, it appeared to be underused as a mode of transportation. For example, the diaries showed that 25.0% of participants walked to or from school at least once, but less than 10.0% of all school trips were walked, with the majority of these on the journey home. Possible reasons for not walking to school could be that youth feel rushed in the mornings and don’t leave enough time to walk to school, or that parents are able to drive their daughters to school on the way to work. This latter possibility is known as “trip chaining,” and studies have shown that this is perceived to be convenient for parents (Buliung, Faulkner, Beesley, & Kennedy, 2011), and also convenient for sons and daughters as it saves them time on the journey to school (Faulkner, Richichi, Buliung, Fusco, & Moola, 2010). Social Cognitive Theory offers another explanation where social norms may affect intentions and behaviour (Bandura, 2001; Dzewaltowski, Estabrooks, & Johnston, 2002; Luszczynska & Schwarzer, 2005). For instance, it is known that social norms have shifted over the last few decades to create a culture of motorized transport (Buliung, Mitra, & Faulkner, 2009). Thus, it is possible that girls in this study who lived close to school did not intend to or even consider the possibility of walking to school because getting a ride or taking the bus was the expected behaviour. Social Cognitive Theory also suggests that behaviours, like walking to school, will be consistent only if individuals are confident to overcome barriers across a variety of situations. It appears that the winter season presented perceived barriers for walking to school that were not overcome, as participants in this study reported walking significantly more often in the spring than in winter. Cold weather, sidewalks not cleared of ice and snow, and inadequate street lighting on dark winter mornings may have posed impediments or perceived barriers for active school travel in the winter. Other Canadian research shows that inclement weather is the primary reason that parents choose to drive their sons and daughters to school (Buliung, et al., 2011). Municipalities can help to foster a culture of walking by creating policies that ensure that sidewalks along major routes to high schools are given priority for snow clearing and maintenance. As well, public health messaging and PA promotion efforts can also target walking to and from high school as an easy way to increase regular PA among adolescents.
Canadian studies and interventions related to walking for the school journey have primarily focused on elementary school children (Buliung, et al., 2011; Green Communities Canada, 2010), with few studies that consider adolescents (Buliung, et al., 2009; Canadian Fitness and Lifestyle Research Institute, 2011b; Green Communities Canada, 2012a; Pabayo & Gaouvin, 2008). A common approach of active school transportation interventions for children and youth is to involve students in the program planning and implementation, and consider ways of making active modes of travel more convenient than motorized modes for those who live close enough to walk or cycle to school (Green Communities Canada, 2012a, 2012b). These programs give greater control to children and youth, but active school travel has generally not been institutionalized in provincial school board policies or municipal transportation policies. To date, only one Canadian province, Nova Scotia, has included active transportation in its Healthy Living Educational outcomes (Nova Scotia Department of Education, 2011). At the same time, these curricular outcomes are only for elementary students and do not apply to high school youth. There remains a gap in formalized active transport to school initiatives for adolescents, and research on rates of active school travel among adolescents. The Physical Activity Monitor is the only Canadian population-based survey that examines travel mode for the school journey among adolescent youth (Canadian Fitness and Lifestyle Research Institute, 2011b). However, it relies on parent-reports and does not distinguish between the trips to and from school. When considered together with findings of the present study, future research should ask high school youth about their school travel, and examine barriers and facilitators related to walking to high school separately from factors associated with walking back home. Curricular outcomes for high school youth and municipal transportation policies can also consider ways of integrating active school transportation.

5.3.1.3 Relatively Sedentary Types of Activities Reported as the Most Physically Demanding

An important finding in this study was that when participants were asked for their most physically demanding activity each day, many girls selected what was actually a sedentary activity. Specifically, more than half (53.4%) of the sample were mostly sitting or standing and exerting very little energy on at least one of their diary days. These “lazy days” comprised more than one-fifth of weekend entries (22%) and 13% of weekday entries. Similar weekday and weekend trends have been shown in previous research (Active Healthy Kids Canada, 2011). This
is of concern because prolonged sedentary behaviours during leisure time have been shown to be a major risk factor for adverse health outcomes like metabolic disease and obesity independent of low participation in moderate to vigorous PA (Tremblay, LeBlanc, et al., 2011). Relatively sedentary activities identified in the present study fell into diverse categories, with personal care activities reported nearly half the time, cooking or eating reported nearly one-third of the time, and “screen time” (i.e., computer use, texting on a cell phone, and watching television) reported just over one-fifth of the time. Other commonly reported activity types at a very low level of physical exertion were hobbies like singing and playing the violin, socializing with family and friends, and doing homework or classwork. The bulk of available research on sedentary behaviours among adolescents has targeted screen time (Tremblay, LeBlanc, et al., 2011). Only a few studies have focused in detail on other activities that would be classified as sedentary, like “communication time” (e.g., talking on the phone) (Bauer, et al., 2012; Leatherdale, 2010; Leatherdale & Wong, 2008) and socializing with friends (e.g. hanging out) (Bauer, et al., 2012). Evidence is emerging that some of these non-screen sedentary pursuits may be more important for girls when compared to boys. For example, research in Ontario found that girls reported higher levels of communication time compared to boys, while boys reported more screen time compared to girls (Leatherdale & Wong, 2008). Therefore, findings of this study add to this emerging body of literature and suggest that health promotion messages that encourage youth to reduce their screen time may be missing other sedentary areas of life critical to adolescent girls (i.e., “mirror time” or time devoted to personal grooming). These findings also point to the need to distinguish between relatively sedentary activities that are obligatory (e.g., eating and bathing), committed (e.g., homework) and discretionary (e.g., applying makeup and watching television), and examine the amount of time available and time spent in each of these activities on weekdays and weekends.

5.3.2 Key Locations: Physically Demanding Activities at Home and Outdoors

The primary location for physically demanding activities identified by participants was the home. Previous studies have often focused on schools and designated areas for sport and fitness. Although schools were highlighted as important locations in 24.5% of all diary entries, designated PA areas were only used 10.9% of the time. The home was cited in 28.9% of all entries, and not surprisingly, played an even greater role on weekends (39.9% of entries). As
noted earlier, many of the activities in the home environment are largely missing from assessments of adolescent PA and include domestic chores, unstructured play activities with siblings and other relatives, and practicing dance for upcoming performances. In addition to homes, outdoor spaces like streets and parks were critical locations for PA, receiving the second-highest ranking on both weekdays and weekend days. Frequently cited types of activities in outdoor spaces were walking, running, cycling, and playing in the park with friends. Social Cognitive Theory conceptualizes locations for physical activities as structural factors, and theorizes that structural factors indirectly influence PA levels, for example, by shaping one’s intentions to be active (Bandura, 2001). It is also theorized that self-efficacy beliefs, like confidence to engage in activity, overcoming barriers to being active, and control over PA influences our preferences regarding PA sites (Luszczynska & Schwarzer, 2005). Study findings on the types of activities that were carried out in homes and outdoor spaces supports these aspects of Social Cognitive Theory, as many were individual activities with inherently high levels of control (e.g., walking and running), and required minimal skill (e.g., playing with family members and chores). Furthermore, key locations for PA in this study (i.e., home and outdoor spaces) had few barriers for access, and designated PA areas were seldom used. Availability of parks and outdoor spaces and its association with intentions to be active was not examined in this study, but would lend further support to Social Cognitive Theory.

Previous research supports the present findings that outdoor locations are important for PA among children and youth (Canadian Fitness and Lifestyle Research Institute, 2011a; Dunton, Whalen, et al., 2007; Koorts et al., 2011; Oreskovic et al., 2012; Rainham et al., 2012). However, there is some indication that outdoor spaces are often better suited for children and do not adequately meet the needs of Canadian adolescents (aged 13 to 17 years) (Canadian Fitness and Lifestyle Research Institute, 2011a). This suggests that additional research is needed to gather adolescent preferences for land-use in public spaces so that outdoor areas are more conducive to their activity purposes. Depending upon the types of neighbourhoods in which adolescents live (i.e., rural, suburban or urban), there may be different challenges for accessing or using public spaces (Rainham, et al., 2012). For example, an innovative study in Halifax, Nova Scotia using global positioning systems (GPS) and accelerometers found that urban and suburban students (grades 7 to 9) primarily accumulated moderate to vigorous PA (MVPA) by using active modes of travel within their communities (Rainham, et al., 2012). Rural students primarily engaged in
MVPA at school and at home (Rainham, et al., 2012). At the same time, urban students accumulated more than three times and more than five times the amount of MVPA by commuting when compared to suburban and rural students, respectively. Therefore, in rural and suburban areas, it may prove beneficial to build community trails through parks that lead to high schools, shopping malls or stores (cited as a location for physically demanding activities on 12.7% of weekend days), and other locations of interest (e.g., libraries and community centres), thereby providing opportunities for teenage girls to use active forms of transportation more often. In all types of neighbourhoods, it may be helpful to ensure that there are racks where teenagers can secure their bicycles, and picnic benches in parks where they can socialize with friends after playing active games.

5.3.3 Families as Critical Companions for Physically Demanding Activities

The current study examined whether other people were present when participants engaged in PA. Many PA studies with youth have focussed on supportive aspects of others like verbal encouragement, role modelling, facilitation (e.g., driving youth to organized physical activities or purchasing equipment), or the general value that others place on PA (Anderssen & Wold, 1992; Hohepa, et al., 2007; Loucaides, et al., 2007). This study also suggests that time spent with others was a key social factor for PA. Developmental research explains that friends play a large role in shaping PA (Weiss, 1995). Interestingly, results of this study indicated that family members were also critical in the daily physical activities of adolescent girls. Specifically, friends were the most frequently cited companions for physically demanding activities overall (31.8% of entries), but when parents and siblings were combined, 40.5% of all physically demanding activities, and 69.4% of weekend physically demanding activities were with one’s immediate family. This is in contrast with previous research that describes a shift away from family members and towards friends or peers as key influences on PA levels when children transition to teenagers (Hohepa, et al., 2007; Horn & Weiss, 1991; Humbert, et al., 2008; Smith, 2003). It is possible that the emphasis on family members in the present study was related to the particular sample of girls in this research or to the South Asian heritage of the sample (Ramanathan & Crocker, 2009; Talbani & Hasanali, 2000). Thus, it may be possible to examine cultural aspects of PA participation or family support for PA by examining the ways that families
spend time together. Additional research with samples of South Asian girls and adolescents from other cultures would illuminate these findings.

Results with respect to companions may also be related to the specific range of activity types reported in this study compared to previous research. For example, it is likely that participants engaged in chores around the house and leisure walks with family members, and possibly walked to or from school with siblings. Previous research with children has also shown that physical activities with family members usually tend to be unstructured rather than structured types of physical activities (Rhodes, Naylor, & McKay, 2010). At the same time, the percentage of PA spent with family members may be somewhat misleading given that sedentary activities were also designated as the most physically demanding activities on some occasions (e.g., watching television or eating). This may have inflated the proportion of physical activities with family members as companions. Finally, the study findings showed that many girls were physically active on their own, suggesting that companions were not always important for PA in adolescent girls. For instance, roughly one-fifth of physically demanding activities on weekdays and weekend days were carried out alone. These often included practicing for dance classes, and individual sports like swimming and running. Together, these findings suggest that greater attention on the role of the family in future research as well as additional efforts to target families as a means of increasing PA is needed.

5.4 Quantity of Physical Activity Participation

5.4.1 Duration and Intensity of Physical Activity Participation and Meeting the Canadian Physical Activity Guidelines

Findings examining the quantity of PA showed that PA participation varied across the sample, with larger variation in PA outcomes measuring intensity levels compared to duration. For example, most (92.0%) participants spent an average of 30 minutes or more doing physical activities across the diary entries, with an average daily duration of 55.5 minutes. However, nearly one-fifth of the sample (19.3%) did not report any vigorous intensity activities in the diary. Twelve percent reported no vigorous intensity activities, and 4.8% also reported no moderate intensity activities in the questionnaire. Larger differences between activity intensity levels versus duration may have resulted from the range of low to moderate and vigorous intensity activities that were permissible to include as part of the total daily PA duration. As well,
no minimum duration was required (e.g., 10 minutes or 15 minutes) in order for an activity to be counted towards the total time spent in physical activities. For example, participants may have accumulated 30 minutes of PA in a day by walking to a bus stop on the way to and from school (10 minutes each), playing on the swings in a park after school (5 minutes), and then washing dishes after dinner (5 minutes). However, none of these activities would have been coded as vigorous in the diary, and it is unlikely that participants would have considered them to be vigorous bouts in the questionnaire. Nevertheless, results clearly show that all participants regularly spent time engaged in low or moderate intensity physical activities, but not all of them participated in vigorous intensity activities. A lack of vigorous PA participation is problematic because there is some indication that activities at this intensity level confer benefits to bone, muscle and cardiovascular health beyond low or moderate intensity activities (Janssen & LeBlanc, 2010). Thus, more research is needed to examine and promote vigorous PA participation among adolescent girls.

There was some disagreement in the findings related to activity intensity levels and sweating. Although all moderate and vigorous intensity activities were assumed to lead to sweating (Canadian Society for Exercise Physiology, 2011b), questionnaire results showed only a moderate association between the MVPA score and sweat frequency ($r = .48$). This could mean that girls did not always sweat when they engaged in physical activities at a moderate to vigorous intensity level. However, it is more likely that some of the bouts of moderate to vigorous PA that participants reported were not sufficiently sustained to tax the cardiovascular system and lead to sweating. For example, when participants reported half an hour of PA, it is possible that they were working at a low intensity level for the most part, and were at a moderate or vigorous intensity for only a few minutes. There is some evidence that sporadic and short bouts of MVPA as little as five minutes at a time is associated with health benefits among youth like weight control, possibly through breaking up sedentary time (Mark & Janssen, 2009). Yet, the general consensus is that stressing the cardiovascular and respiratory systems so that the body begins to sweat has the greatest benefits on fitness level, and other physical health outcomes like cholesterol, blood lipids, blood pressure, and weight control (Janssen & LeBlanc, 2010). Therefore more research is needed on the optimal duration for a sustained bout of MVPA to better enhance the understanding of different outcome measures of PA and their inter-relationships.
As previously mentioned, PA recommendations for daily action (i.e., sweating and 60 minutes of PA per day) were poorly met in this sample of adolescent girls. Only 6.8% reported sweating and 13.6% were physically active for at least 60-minutes in each diary entry. At the same time, a larger proportion of the sample (more than one-third in the diary and more than one-half in the questionnaire) met the aspect of the guideline stipulating three bouts of vigorous physical activities per week. This indicates that the regularity of sustained MVPA needs to be a focus of future PA promotion strategies. In addition, it is important to note that overall adherence to the Canadian guidelines in this sample of South Asian high school girls was similar to nationally-representative data for youth (Active Healthy Kids Canada, 2011), and higher than nationally-representative data for girls (Colley, et al., 2010). Thus, current study findings do not replicate previous studies showing that South Asian girls are more vulnerable to physical inactivity than other high school girls or youth (Bryan & Walsh, 2004; Liu, et al., 2010). Given the small sample of participants in this study, more data is needed to reconcile the differences in findings and whether particular cultures should be targeted.

### 5.4.1.1 Active Weekdays and Relaxing Weekends

As hypothesized, lower intensity and duration of activities and fewer days with sweating were reported on weekend days compared to weekdays. Although diaries clearly showed that more discretionary leisure-time was available on weekends, a preference for sedentary activities may have limited participation in weekend MVPA. It is also possible that participants spent more time sleeping on the weekend compared to school nights, though time spent sleeping was not analyzed. There is an emerging literature on the importance of regular sleep patterns for healthy behaviours among school aged youth, including regular PA (Active Healthy Kids Canada, 2012; Brug et al., 2012; Noland, Price, Dake, & Telljohann, 2009; A. W. Taylor, Winefield, Kettler, Roberts, & Gill, 2012; Vaezghasemi, Lindkvist, Ivarsson, & Eurenius, 2012). For example, research in Sweden found that adolescent boys reported healthier sleep patterns and more PA compared to girls (Vaezghasemi, et al., 2012). It is possible that regular sleep on all days of the week helps to maintain energy levels to be physically active on a daily basis. Future research should examine associations between sleep and PA on weekdays and weekends.

Results of this study showed that only one-fifth of all physically demanding activities on weekend days were at a vigorous intensity level, compared to nearly half of the physically
demanding activities that were reported on weekdays. Lower intensity weekend days also helps to explain why participants fell short of the daily sweating aspect of the Canadian PA guidelines. Moreover, even when participants were permitted to include low, moderate and vigorous intensity activities in their total daily PA duration, on average they were further from meeting the 60-minute per day recommendation on weekend days compared to weekdays. This tells us that participants did not simply shift from MVPA to low-intensity activities; they also reduced their total time being physically active on the weekend. Some studies support current findings that children and youth engage in less MVPA on weekend days (Brusseau, Kulinna, Tudor-Locke, van der Mars, & Darst, 2011; Treuth et al., 2007). At the same time, all three Canadian surveillance studies for youth PA (i.e., the Canadian Community Health Survey, the Physical Activity Monitor, and Kids CANPLAY) do not distinguish between PA participation on weekdays and weekend days. As well, the majority of youth PA interventions are school-based and only focus on weekdays (Camacho-Minano, LaVoi, & Barr-Anderson, 2011; Naylor & McKay, 2009; van Sluijs, McMinn, & Griffin, 2007). Given the considerable differences in the intensity and duration of weekday and weekend PA participation, future Canadian population studies should consider assessing these days separately, and interventions are needed to increase PA on weekend days.

5.4.1.2 Physical Activity Trends by Grade and Enrolment in Physical Education

Findings related to quantity of PA participation by grade and enrolment in physical education were mixed. It was expected that girls in senior grades would report lower PA participation than younger girls. However, junior and senior girls reported similar levels of PA duration. At the same time, data showed significantly higher perceptions of sweat frequency in a typical week and also trends of more vigorous bouts and daily sweating among junior girls compared to senior girls. Furthermore, girls in senior grades were less likely to be taking physical education classes. It may be the case that senior girls accumulated their daily minutes of PA by engaging in low to moderate intensity activities after they stopped taking physical education classes. However, if participation in vigorous intensity activities is lacking, senior girls may be missing out on the most important fitness and cardiovascular health benefits. Closer examination of MVPA patterns once girls are no longer enrolled in physical education is required, with a focus on why girls in senior grades may participate in fewer vigorous intensity physical activities. At the same time,
findings showed that girls who were enrolled in physical education were more physically active than girls not enrolled on weekdays only. Importantly, all girls reported a similar number of days with sedentary activities, vigorous activities and sweating on the weekend. This suggests that enrolment in physical education did not generalize to a preference for moderate to vigorous intensity activities on the weekend, and that girls taking physical education are not different (e.g., enjoy PA more) than those not taking physical education. As previously discussed, creating a “lifestyle” PA practicum within physical education where girls document activities beyond school hours might help to address the deficit of PA on weekends. As well, introducing activities into the curriculum where girls identify outdoor community sites for PA (e.g., picturesque streets, trails, and parks) may provide them with more options, and raise their awareness of neighbourhood structures conducive to PA. In turn, these practical enhancements to physical education may boost girls’ self-efficacy in physical activities, motivate them to enrol beyond the mandatory grade 9 year, and also help girls to continue to be active when they are no longer enrolled. Overall, when findings related to grade and physical education are considered together, they suggest that previously reported trends of decreasing PA participation with age (Cameron, Craig, & Paolin, 2006; Canadian Fitness and Lifestyle Research Institute, 2010a) may be driven or confounded by enrolment in physical education. Therefore, distinguishing between school-age youth who are enrolled and not enrolled in physical education may yield a more accurate snapshot of youth PA. As well, examining longitudinal, rather than cross-sectional differences will help to understand changes in PA duration or intensity as girls progress through high school.

5.4.2 Lower Physical Activity Reports in the Diary compared to the Questionnaire

The design of this study made it possible to compare the results of two different self-report PA instruments and to examine independent variables in relation to four PA outcomes. A diary approach has seldom been used because it is labour intensive for research (Sirard & Pate, 2001). However, study findings suggest that the modified Day Reconstruction Method (DRM) diary approach helped participants to gain additional insights into their PA levels compared to the questionnaire. Many participants reported less sweating and vigorous physical activities when tracking their daily physically demanding activities using the modified DRM compared to estimating their typical weekly participation in the Leisure Time Exercise Questionnaire (LTEQ)
(Godin & Shephard, 1985). Subsequently, participants were less likely to meet aspects of the PA guidelines based on their diary entries versus questionnaire data.

It is possible that diary and questionnaire reports of sweating and vigorous PA were not consistent because the diaries did not reflect a typical week. However, previous research often finds that the structure of the DRM diary facilitates recall (Kahneman, et al., 2004b; Stone, et al., 2006). Although the LTEQ has been validated and shown to be reliable, the seven-day period of recall might have posed a greater challenge for participants compared to the single-day PA recall in the diary. The diary might also yield more accurate reports of PA compared to a questionnaire because it was structured to minimize bias from social desirability. Self-reported PA has been shown to be an easy target for over reporting due to social desirability bias because participation in PA is popularly conceptualized as a positive behaviour with strong links to health and wellness (Adams et al., 2005; Klesges et al., 2004; Sirard & Pate, 2001). However, when completing diary information, participants were told that the researcher was interested in all their daily pastimes (i.e., extra-curricular activities, activities related to South Asian heritage, activities at school) without undue emphasis on physically demanding activities. At the same time, there may have been issues of reactivity in the diary where the process of tracking daily information and identifying the most physically demanding activity each day altered daily behaviours.

Further research on self-report PA assessment tools that use short recall periods, encourage reflection, and minimize social desirability is needed.

Overestimations of typical PA patterns in questionnaires may be problematic if adolescent girls perceive that they are sufficiently active for optimal health benefits even when they are not. Although these findings were based on a small sample and need further replication, researchers and those wishing to promote PA need to be aware about the potential for overestimation of activity levels, and to devise strategies to address this issue. One possible strategy for researchers is to include instructions similar to a diary when administering the LTEQ, where participants are guided to reflect on each day in a typical week, and estimate their PA participation on a “typical” Monday, Tuesday, etc., before tallying their typical weekly bouts of low, moderate and vigorous physical activities. Furthermore, it may be beneficial for health promoting individuals like physical educators and public health professionals to use a modified DRM diary to help adolescents learn more about their weekly PA patterns, and identify time-periods where they can incorporate longer or more intense physical activities into their day. Finally, when interpreting
findings, public health researchers must be aware that PA levels may be even lower than reported, and continue to devise school and community-based interventions that makes it easier for adolescents and family members to be physically active.

5.5 Factors Related to Physical Activity Participation

5.5.1 Enjoyment, Control and Fewer Barriers are Linked with Higher Levels of Physical Activity

In support of Social Cognitive Theory, bivariate findings showed that participants who enjoyed their physically demanding activities (i.e., positive outcome expectations), perceived greater control, and experienced fewer barriers (i.e., higher levels of self-efficacy) engaged in either higher duration or more intense physical activities. Conversely, participants who perceived their most physically demanding activity to be the least enjoyable part of their day spent less time being active. As explained by Bandura (2001), individuals who anticipate and experience negative emotions during a given behaviour, like PA, have less incentive to participate. Not surprisingly, activities deemed least enjoyable were often chores that were likely assigned by parents. Similar findings related to enjoyment, control and barriers have been reported in previous research (Dunton, Schneider, et al., 2007; Hohepa, et al., 2006), and point to the importance of giving adolescents opportunities to discover the kinds of activities they enjoy and identify those that they can easily engaging in. At the same time, the finding that parental permission was not related to PA participation was unexpected in this study, as previous research had suggested that South Asian parents restricted youth leisure time (Talbani & Hasanali, 2000; Tirone & Pedlar, 2000). This may be related to the small sample size of girls recruited for this study. However, it may also be that parental permission was rarely needed in this study because many of the physical activities cited were incidental (e.g., walking in a mall, chores), the majority took place within the home, or were done during school hours (e.g., physical education classes). Also important to note is that parents were perceived to be very supportive of PA participation, and measures of mother and father PA support showed ceiling effects.

Interestingly, the questionnaire showed that the two key barriers to PA participation were a lack of time and lack of energy. A lack of time for PA because of homework demands, part-time jobs or family responsibilities has been reported elsewhere (Dwyer, et al., 2006; Sherar et al., 2009).
However, the diaries showed that even though more discretionary time was available on weekends, participants often did not use this time for engaging in PA. There is some suggestion that on weekdays, adolescents are involved in a number of activities and get inadequate sleep (Active Healthy Kids Canada, 2012). Therefore, it could be the case that the weekend is perceived as an opportunity to “catch up” on rest. It is also important to note that the top-rated barriers were generally individual-level factors, including a lack of self-discipline. Seldom did participants perceive that external factors and other people prevented their PA participation (i.e., discouragement from others). Taken together, findings on enjoyment, control, and barriers further support the need to foster self-efficacy, encourage adolescent girls to prioritize PA, and raise awareness that participating in physical activities can boost energy levels.

5.5.2 Relationships between Social and Structural Factors and Physical Activity

Univariate findings showed that many participants had supportive social environments for PA. In fact, nearly all participants reported that they were strongly connected to their friends, siblings, parents and peers from other cultures, and had favourable perceptions of their mother and father’s parenting practices. Participants perceived such strong connections towards friends, siblings and peers from other cultures that these perceptions reached a ceiling effect and could not be examined in relation to the PA outcomes in the diary or questionnaire. Yet, it was noted that activity levels were relatively low across the sample. Perceptions of parenting practices varied somewhat within the sample, and were examined at the bivariate level. However, parenting practices (i.e., supportive dimensions of mothers and fathers, and controlling (protective) dimension of parents) were not related to either duration or intensity of PA participation. Although Social Cognitive Theory would suggest that having social environments that are supportive of PA, and having positive attitudes toward PA should be linked to higher levels of activity, it could be that the missing link is involvement in PA with those whom girls spend the most time with. As previously mentioned, key companions for physically demanding activities on the weekend were family members, and girls were least active on weekends. It may simply be that longer and more intense physical activities are not a priority or expectation for family time. Also important to note is that particularly high levels of social support in this sample pose a potential limitation to this research, and may have resulted from participant recruitment through extra-curricular activities. For instance, it is likely that those participants
who volunteered at a library or were enrolled in violin classes were supported by their parents in these activities, and had more opportunities to spend time with peers and build positive relationships with them. Also important to note is that more than a third of the sample was recruited through participant referrals and friends, which may have meant that there was less diversity in the sample given that girls may be more likely to have friends with similar social environments. Future research samples need greater diversity and should include those with less supportive social networks. This may be achieved by recruiting participants through schools.

Bivariate findings also showed that participants with more social provisions (e.g., attachment to those who value PA) spent more time being physically active and also engaged in higher intensity activities (i.e., vigorous bouts, MVPA, and sweating more often). These findings are in line with previous findings with youth showing that a network of those who support and engage in PA is critical (Motl, Dishman, Saunders, Dowda, & Pate, 2007; Prochaska, Rodgers, & Sallis, 2002). However, it was unexpected that a prominent aspect of social provisions was providing support to others. Specifically, many participants reported that they felt they were responsible for helping other people to be physically active, and that other people depended upon them in order to engage in physical activities. In the framework of Social Cognitive Theory, this aspect of social provisions may actually be tapping into self-evaluative outcome expectations (Luszczynska & Schwarzer, 2005). That is, participants may feel proud of themselves and satisfied with their actions if they help others to engage in health-positive behaviours like PA, and these positive evaluations may promote higher levels of PA. Previous research has emphasized the role that others play in fostering the activity of adolescents. This finding suggests that it may be possible to promote PA by appealing to an adolescent girl’s identity and perception of herself as being supportive and caring of others. This health promotion approach is relatively unique and may be particularly useful to increase PA levels in girls of this age group as well as their families.

Across the measures examining support, culture played a smaller role than anticipated compared to previous findings with South Asian adults (Kalavar, et al., 2004; Kalra, Srinivasan, Ivey, & Greenlund, 2004; Lawton, et al., 2006; Mohan, et al., 2008) and youth (Ramanathan & Crocker, 2009; Talbani & Hasanali, 2000; Tirone & Pedlar, 2000). This may be, in part, because the PA outcomes were measured differently than in other research, and a lot of physical activities were included that parents and cultural communities wouldn’t necessarily object to. However, it may
also be that this sample of participants was more “Canadianized” compared to those in previous studies. Results of the new 13-item scale developed for this study and examining cultural and gender-specific attitudes towards PA generally found that participants were supported in physical activities as much as their male counterparts and non-South Asian peers. However, the scale was not significantly related to duration or intensity of physical activities. Because the scale was exploratory, additional work on cultural and gender-specific attitudes is needed, particularly with a larger and more diverse sample where age, gender, religious backgrounds and socioeconomic statuses could be examined in more detail.

Lastly, bivariate findings related to the cultural composition of the friend network shed light on the relationships between participants’ cultural and social environments and PA levels. Results of the new item created for this study showed that there was a mix of friend networks among participants. Of note, these findings were based on participants’ friend network in general and did not specifically refer to the cultural composition of friends with whom participants were physically active. At the same time, participants who reported having mostly South Asian friends engaged in lower levels of MVPA, and showed a trend of reporting sweating less frequently in a typical week compared to participants with few South Asian friends ($p = .08$). This may indicate that, although adolescent girls did not perceive cultural barriers, there may be subtle influences on PA that come from the composition of one’s network of friends, particularly supportive aspects from a network that includes a range of cultures. For example, there may be more normative beliefs and higher expectations about engaging in PA when one has a diverse group of friends. Alternately, the presence diverse friendship groups may be reflective of the neighbourhoods where girls resided, and schools that they attended. For example, there are large enclaves of South Asian families in suburban areas of Toronto, specifically in Brampton, Mississauga and Scarborough (Qadeer & Kumar, 2006). Similar concentrations of South Asian families are not present in urban Toronto areas (Qadeer & Kumar, 2006). Thus, findings on cultural composition and PA may be considered a structural factor, and tied in with neighbourhood characteristics like walkability and proximity to high school. On the other hand, cultural composition may reflect that more active South Asian girls sought friendships with similar others and this was not related to culture per se, but to similar interests. To date, there has been little research in Canada or elsewhere on the cultural composition of the friend network and companions for PA. More research is needed on the perceptions of culture, cultural composition
of friends and PA companions, cultural composition of neighbourhoods and schools, and their collective influence on PA duration and intensity. Furthermore, examining the cultural composition of a particular social network would be useful in other studies because this variable did not appear to pull for social desirability as other questions that assessed the role of culture and support. Findings also point to the need for longitudinal studies to examine potential changes in the cultural composition of friendship groups over time and its effects on PA patterns.

5.5.3 Multivariate Findings Related to Physical Activity Intensity and Duration

The final multivariate analyses included six variables: enrolment in physical education, cultural composition of the friend network, proportion of most enjoyable physically demanding activities, control over physically demanding activities, barriers to PA, and social provisions for PA. Results showed that different subsets of factors were related to each of the four PA outcomes. However, when all explanatory variables were accounted for, enrolment in physical education remained consistently related to all four PA outcomes. Those enrolled had longer duration and more intense physical activities according to both the diary and questionnaire (i.e., vigorous bouts, MVPA score, and sweat frequency). This emphasizes the earlier discussion that the number of mandatory physical education credits needs to be revisited. Another significant explanatory variable that was related to both the diary and questionnaire outcomes was perceived control over physical demanding activities. As control over PA is an aspect of self-efficacy and central to theories of motivated behaviour across cultures (Bandura, 2002), it was expected that control would emerge at the multivariate level. Control was related to PA intensity, with those who reported more control engaging in more MVPA. A trend also emerged with respect to PA duration, with participants with greater control tending to spend more time doing physical activities \( (p = .09) \). However, the final duration analyses were underpowered, particularly with respect to detecting differences in control. Future research with a larger sample is needed to give more power to these analyses, and longitudinal studies are needed to disentangle whether greater control leads to greater PA, or whether greater PA participation enhances perceptions of control in physical activities. As noted earlier, findings related to control over physically demanding activities point to the importance of teaching adolescent girls a range of skills, and exposing them to a variety of physical activities so that they have high self-efficacy to choose moderate and vigorous activities that appeal to them. Coupled with multivariate findings related to
physical education, this supports efforts over the last decade to enhance Ontario secondary
physical education curricula to include diverse team, dual and individual non-competitive
activities, and also lessons on creating and monitoring personal PA goals (Government of
Ontario, 2000a, 2000b).

When it came to understanding sweat frequency, enrolment in physical education as well as the
cultural composition of the friend network and perceived barriers were significant. Specifically,
girls with a network of mostly South Asian friends reported a lower sweat frequency compared
to participants with friendship groups that included few South Asian friends. However,
differences based on cultural composition did not emerge at the multivariate level for the two
other PA outcomes related to intensity-levels (i.e., vigorous bouts and MVPA). This could mean
that there are differences in cultural perceptions of sweating, where sweating is more acceptable
among girls who are connected to non-South Asian cultures through their friendship groups. If
this were the case, then sweating may not be the best indicator of intensity level for South Asian
girls with a homogenous friend network. Girls who reported more barriers to PA also reported a
lower sweat frequency. Although it is understandable that girls who experienced greater
obstacles to engaging in PA would sweat less often, many of the key barriers were at an
individual level, and there is some indication from the diaries that the two primary barriers cited
(i.e., time and energy) might be used as an excuse. Given the nature of key perceived barriers,
results suggest that there is a need to help adolescent girls enhance their self-efficacy to
overcome personal barriers by identifying opportunities for PA that can be integrated into their
daily lifestyle that are long enough and hard enough to sweat. Earlier suggestions to promote
physically demanding chores, walking to nearby locations (i.e., school) may help in this regard.
It may also help to infuse more opportunities for PA into time spent at shopping malls on
weekends by offering free classes for teens in open spaces, and posting signs that encourage
teens to take the stairs instead of the elevators or escalators. A strong body of evidence supports
the effectiveness of prompts to increase stair use in public spaces, which includes shopping malls
(Soler et al., 2010). Finally, it is important to note is that although there were a number of
significant findings, the multivariate analyses explained only a small amount of the variance in
PA participation for any of the PA outcomes (i.e., between 17% and 26%). Other studies have
similarly explained up to one-third of the variance in PA participation (Duncan, Duncan, &
Strycker, 2005; Kimiecik, Horn, & Shurin, 1996; Neumark-Sztainer, et al., 2003; Reynolds, et
al., 1990; Welk, et al., 2003). This highlights the complexity of the area in terms of samples, and the need for more research into independent and outcome measures that will help us to understand regular participation in physical activities among adolescent girls. It also suggests that factors other than those examined in this study need to be explored. Potential variables framed by Social Cognitive Theory that might further explain levels of PA among adolescent girls include the perceived priority given to physical activities over other activities, intentions to be physically active on a daily basis, as well as perceived self-efficacy to meet one’s PA intentions.

Of the four PA outcomes measured, findings suggest that vigorous bouts and MVPA may be the two best measures for future research. As previously noted, there was less variation in PA duration versus the three outcomes related to PA intensity (i.e., vigorous bouts, MVPA and sweat frequency). This may have been, in part, because low to moderate and vigorous intensity activities were permitted in the total estimation of time spent being physically active each day, and no minimum duration for each activity was specified. Furthermore, activities at the highest intensity were lacking, suggesting that vigorous activities should be a focus of future research. Findings also suggested that reports of sweat frequency might be related to cultural perceptions and not necessarily intensity of physical activities. Considered together, moderate and vigorous bouts of PA are recommended as metrics of PA in future research.

### 5.6 Study Limitations and Future Directions

This research contributes to our understanding of PA among South Asian adolescent girls. However, there were a number of limitations that need to be addressed in future research. Although girls were recruited through a variety of sources with the aim of trying to include a range of activity levels (e.g., recruitment at active and passive extra-curricular activities, and through a website entitled “The Everyday Activities Study”), the final sample was small. As a result, a number of trends were seen that might have been significant with a larger sample (i.e., relationship between control and PA duration), and the multivariate regression analyses were not adequately powered (e.g., the final model examining PA duration was not significant). The sample was also more homogenous than was desired. For example, the majority of participants were born in Canada, reported supportive family networks and had little religious diversity. There were also only a few participants who reported high levels of PA participation. A growing
area of research suggests that recruiting young people for survey-based health research through online social networks is cost-effective and may help to target specific population groups (Fenner et al., 2012; Ramo & Prochaska, 2012). Future research with South Asian girls needs a larger and more diverse sample for greater statistical power, which may be achieved by recruiting through schools in classrooms or through online social networks.

In terms of the study design, a cross-sectional sample of high school girls meant that causal relationships and changes over time could not be inferred. For example, although there was a good balance of girls in junior and senior grades, it was not possible to determine whether differences in typical sweat frequency between younger and older girls were due to the changing nature of PA participation with age. Similarly, it was not possible to disentangle cause and effect relationships between the cultural composition of friendship groups or control and participation in MVPA. At the same time, the study enabled comparisons between a diary and a questionnaire, and across four different PA outcomes, furthering our understanding of daily and typical PA using metrics for duration as well as intensity. Future research using longitudinal designs will help to examine potential changes over time and cause and effect relationships.

With respect to PA measurement, self-report data in this study may have been limited by bias from social desirability. However, a previously validated instrument was used to assess typical PA participation in the questionnaire, strengthening confidence in the results, and allowing comparisons to other studies. The modified day reconstruction diary method gathered all daily pastimes, guided participants through a reflective process, and used an inclusive measure of PA (i.e., most physically demanding activity). This inclusive measure addressed a major limitation in previous research of narrowly defining PA, and resulted in rich information on PA types, companions and locations that may be incorporated into future questionnaire prompts or items. Furthermore, there was a strong association between participants’ ratings of perceived exertion for their most physically demanding activity and the activity intensity codes that were validated by two independent coders. This provided additional support for the reliability of the self-report diary data. Nevertheless, future research should validate the electronic diary using the objective method of accelerometers for South Asian girls and teenaged youth. Once validated, adapted versions of the diary may be developed for smart phones and other mobile devices to ease diary administration and capitalize on teenagers’ desire to use technology. Finally, the diaries and questionnaire used an electronic format, and participants completed study materials from the
privacy of their homes whenever it was most convenient for them to do so. These electronic elements of the study have been shown to be appealing for the targeted age group (i.e., adolescents) (Storey & McCargar, 2012), and likely helped to minimize missing data. At the same time, available research has not examined the validity the Leisure Time Exercise Questionnaire when administered electronically. While there is some evidence to support that validated paper-based PA surveys have strong concordance with electronic versions among Canadian youth (Storey & McCargar, 2012), future research should validate the electronic LTEQ with adolescent girls.

5.7 Summary

To summarize, this study was framed by Social Cognitive Theory and addressed two major research gaps using diaries and a questionnaire. First of all, the modified diary method gathered a depth of information on PA participation in a sample of South Asian high school girls, with new items that inclusively assessed all types of physical activities and everyday activities across a variety of domains. Secondly, this study was one of the first that examined a range of psychosocial and cultural factors in relation to PA participation. Overall, this study found four key findings: 1) Physical education classes and a variety of incidental walking activities were prevalent types of PA, 2) A preference for sedentary activities on the weekend may have limited regular moderate to vigorous PA (MVPA), with vigorous intensity activities especially lacking, 3) Major factors related to PA participation were enrolment in physical education, perceptions of control and individual barriers, like not having enough time or energy for PA, and 4) Findings did not replicate previous studies showing that South Asian girls are particularly vulnerable to very low levels of PA (i.e., inactivity).

Study findings point to several recommendations for researchers. In terms of youth PA assessments, results suggest that researchers should include a broader range of PA types, especially walking activities, play, and activities related to domains other than leisure, including chores, transportation and volunteer or part-time work. Findings also suggest that it may be useful to infuse elements of the day reconstruction diary (e.g., guided reflection and short periods of recall) into validated PA questionnaires to enhance data quality and facilitate recall. In addition, findings highlight specific areas in need of further research, particularly structural factors that may enhance PA. Information is needed on physically demanding youth activities
beyond school settings or designated PA areas, including those that take place in outdoor spaces like streets and parks. Involvement of family members in PA deserves greater attention, as does the quality and quantity of engagement in MVPA once youth are no longer enrolled in physical education. With respect to cultural factors, future research should examine the cultural composition of friendship networks, companions for PA, and neighbourhoods, and whether particular cultures should be targeted for PA interventions.

5.8 Conclusions

In conclusion, study findings have a number of implications for schools, communities and governments. At the level of schools, we could revisit the number of mandatory physical education credits, and also enhance control and address barriers like time through the curriculum. For example, Ontario’s curriculum could be expanded to encourage students to document a certain number of hours of PA beyond school hours and facilities. This could include walking to and from school. Adolescent girls could also focus on identifying physical activities that they enjoy, especially higher intensity activities, and activities outdoors in streets and parks, and integrate them into their daily lifestyle. In addition, adolescent girls may be charged with helping friends and family members to be more physically active by brainstorming ways to incorporate physical activities into the time that they spend together. Secondary schools could also consider requiring high school youth to devote a portion of their mandatory 40 hours of voluntary service to physically demanding activities. This could include volunteering in community gardens, community cleanup events, or assisting with children’s physical activity classes, like dance.

At the level of communities, point-of-decision signage could be installed in shopping malls to encourage youth to take the stairs rather than elevators or escalators. In addition, PA events like dance or aerobic classes specifically for teens could also be offered in the open spaces at the mall.

At the level of governments, we could adopt a “healthy families” physical activity promotion approach. Public health professionals can develop messages that promote physical activities that can be done as a family (e.g., chores, walking to a park), and also messages that raise awareness about sedentary activities beyond screen time that youth may be engaging in. Furthermore, educators and public health professionals may wish to highlight walking to and from high school as a valuable source of regular PA. Active school travel could be formalized into Municipal
transportation plans. Municipalities could prioritize PA when planning new neighbourhoods or retrofitting existing ones. For example, municipalities could strive to situate destinations of interest (like shopping areas) and necessity (like schools and grocery stores) at a reasonable walking distance of homes, and include an extensive network of sidewalks and trails. In addition, suburban neighbourhoods with a high concentration of South Asian families could be among the first to be selected for retrofitting. The government could also offer grants to South Asian organizations for planning physical activity events and programs, possibly ones that are integrated with cultural festivals. Lastly, at the Federal level, an added tax incentive could be applied to the Children’s Fitness Tax Credit if teenagers and parents participate in activities together.

5.8.1 Significance and Innovations

- This study provided a depth of information on PA levels among South Asian high school girls, filling an important research gap with this population group.

- This study tested a new diary method that shifted the emphasis away from narrow definitions of physical activity by examining the “most physically demanding” activity.

- This study confirms low levels of physical activity found in other adolescent studies, but also shows that South Asian high school girls engage in a variety physical activities beyond structured sport and physical activities, including walking activities and household chores.

- Physical education plays a critical role in overall levels of physical activity participation, but on weekends, most adolescent girls engage in lower levels of physical activity.

- High school girls are more physically active when they enjoy and are in control of their physical activities and feel that they have the time, energy and few barriers to being active.

- Homes, outdoor spaces like streets and parks, and schools are key locations for physical activities, and used more often than designated sport and fitness areas.
• Family members are important companions for physical activities among South Asian high school girls, and play a more prominent role than friends do on the weekend.

• A diary method with structured reflections may be a useful technique to minimize socially desirable responses and learn about daily responsibilities, priorities for leisure time, and perceptions of activity intensity levels among adolescent girls.

• Future research should give greater attention to relationships between physical activity participation and the cultural composition of social networks, and include culturally diverse samples of adolescent males and females.
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10.2196/jmir.1978


Appendix A – Research Ethics Board Approval

University of Toronto
Office of the Vice-President, Research
Office of Research Ethics

PROTOCOL REFERENCE # 24615

December 4, 2009

Dr. Monique A.M. Gignac
Arthritis Community Research & Evaluation Unit
Toronto Western Research Institute
398 Bathurst St, MP10-316
Toronto, ON M5T 2S8

Ms. Subha Ramanathan
Dalhousie School of Public Health
University of Toronto
155 College St., 7th Floor
Toronto, ON M5T 3M7

Dear Dr. Gignac and Ms. Ramanathan

Re: Your research protocol entitled “The Everyday Activities of South Asian Girls: Relationships between Social Networks and Cultural Influences”

ETHICS APPROVAL

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<tr>
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<td>December 3, 2010</td>
</tr>
<tr>
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</table>

We are writing to advise you that a member of the Health Science Research Ethics Board has granted approval to the above-named research study, for a period of one year, under the REB’s delegated review process. Please ensure that you submit an Annual Renewal Form or a Study Completion Report 15 to 30 days prior to the expiry date of your study. Note that annual renewals for studies cannot be accepted more than 30 days prior to the date of expiry, as per federal and international policies.

All your most recently submitted documents have been approved for use in this study.

Any changes to the approved protocol or consent materials must be reviewed and approved through the amendment process prior to its implementation. Any adverse or unanticipated events should be reported to the Office of Research Ethics as soon as possible.

If your research has funding attached, please contact the relevant Research Funding Officer in Research Services to ensure that your funds are released.

Best wishes for the successful completion of your project.

Yours sincerely,

Daniel Gyewu
Research Ethics Board Manager - Health Sciences
Appendix B – Telephone Script and Consent

[If leaving a voicemail for a respondent who has contacted us after seeing a flyer/handout about the study]

Hi, my name is Subha and I’m calling about your response to the flyer about our study looking at the everyday activities of adolescent girls in high school. I’m sorry I missed you, but please try us again at 416-603-5800 x 2645 and ask for Subha. Thank you!

If I don’t hear from you after a couple of days I will try to call you again. Hope to hear from you soon!

[If speaking to a live respondent]

Hello! Thank you for calling to learn more about our research study that will look at the everyday activities of South Asian girls in high school. My name is Subha, and I’m the main researcher for this study. Are you free for about 10 minutes so I can tell you a bit about the research and what it involves, if you choose to participate?

[Yes, continue with the script; No, arrange for another time to call].

Before I begin, may I ask where you heard about the study? ________________.

Background Information

Ok, great. This study is being done as a part of my Ph.D. research at the School of Public Health at the University of Toronto. In this study, we are interested in learning more about the types of activities you participate in, where you spend your time, and with whom you spend time. We want to know more about what you like and don’t like so that we can better design programs to suit your interests and needs. We are especially interested in physical activities, family responsibilities and cultural activities. As well, we would like to learn more about what girls in high school with South Asian heritage think about their friends and family, religion and culture, and physical activities. In total, about 150 girls will be recruited to participate in this research.
Publication of Results

Findings from this research will help people who design programs and activities for teenagers, especially teenage girls with South Asian heritage. We will also share the findings with researchers and community organizations and write reports for health journals. I just wanted to let you know that doing this kind of research takes a bit of time. This study will take about a year to complete, and when it is done, we will send you a summary of the findings so you’ll have a chance to see how other South Asian girls answered the questions.

Methods

If you choose to participate, there will be two parts to your involvement: keeping a brief diary of your everyday activities for two separate weeks, which will take you less than 10 minutes a day to complete, and a survey which will take you about 45 minutes to fill out. In total, the time commitment for you to participate in the study is about 2 hours and 45 minutes over the course of about a month.

Both the diary and survey have been set up electronically so that you can complete them in the comfort, convenience, and privacy of your home.

Do you have access to the Internet at home? □ 1 Yes □ 2 No

[Yes, continue with script; No: Not a problem, we can send you paper copies of the diary and survey in the mail and provide you with stamps and an envelope to send it back to us.]

Would you mind telling me what grade are you in? _______ (grade).

[If in grades 9-12, continue with the script; If not: Thank you for calling in, but unfortunately we are specifically looking for participants who are currently enrolled in high school. Thanks again for your time.]

Great! For the diary portion of the study, we will email you daily reminders and a Word attachment to complete and email back to us before you go to bed each night. At the end of the Day 1 diary entry, you’ll have a chance to ask any questions that crossed your mind while filling it out. We’ll answer all of your questions and email you some tips when we send you the diary for Day 2. This way, we’ll be on track for the rest of your diary entries. A few weeks later, you
will start the second week of diaries. After both of the seven-day diaries are done, we’ll email you a link to a secure website so that you can complete the survey online.

If you choose to complete the study using the paper copies, we’ll send you a seven-day diary that you can fill out and mail back at the end of the week. If you have any questions after Day 1, you can call me anytime for help. A few weeks later, we’ll send you the second seven-day diary along with the survey to fill out and mail back to us.

Whether you choose to complete the diaries and survey online or on paper, we recommend that you let your family members know that you are participating in this research and that you would like some privacy while filling the survey out. If you choose to complete the diaries and survey using pen and paper, we recommend that you put it in the self-addressed stamped envelope and stick them in the mail as soon as possible.

**Compensation**

We know how valuable your time is, so as a token of our thanks, we will give you $20 for participating: $10 for the diary portion of the research (that is, $5 x two weeks) and $10 for the survey portion. This money will be in the form of a Cadillac Fairview gift card that can be used to shop at any store in 9 major malls including Sherway Gardens, Erin Mills Town Centre, Eaton Centre, and Fairview Mall. As well, at the end of the study, all participants will be entered into a draw for an additional $50 Cadillac Fairview gift card. Funding for the gift cards has been provided by the Centre for Urban Health Initiatives at the University of Toronto.

Do you have any questions about what I’ve told you so far?

[Yes, answer questions; No, continue with script]

**Participant Rights, Contact Information and Research Risks**

I just have a few more things to tell you about. This research has been approved by the Research Ethics Board at the University of Toronto. If you volunteer to participate, you can skip any questions you wish in the diary or survey, and withdraw from the study at any time without negative consequences. If you have any questions about your rights as a research participant you may contact the Office of Research Ethics at the University of Toronto at
ethics.review@utoronto.ca or 416-946-3273. You’ll get a copy of all of this information by email or mail if you choose to participate, and it will be available at the study’s website: www.myeverydayactivities.com.

Overall, there are no known risks to being a part of this study, although sometimes answering personal questions can be upsetting to some people. So when you’re completing the diary or survey, if any questions do upset you, you are free to skip them. Skipping questions will not affect the amount of your gift card.

Confidentiality

I also want to mention to you all information that we collect from you will be identified by a code number only and kept in a locked filing cabinet. Electronic files will be stored in a password protected hard drive in a locked office space. Your name will not be anywhere on the diaries or survey. When we look at all of the information we’ve collected and write about the findings, we will combine your information with everyone else’s so that no one can ever be singled out. I also want to let you know that no one other than me and my research supervisor will have access to your diary or survey, and this information will be stored safely at the University of Toronto for a minimum of five years as recommended by the School of Public Health.

If you choose to participate in the study, I may be leaving messages for you on your home phone, and at the end of the study, I will be sending you a gift card to your home address. Because of this, it may be a good idea to let your parents know about your participation in this research study. To help with this, I have put together an information letter for your parents that I will either email you to pass along to them, or send you in the mail as a part of the study package. If your parents have any questions about the study, they can call me directly. I am happy to share blank copies of the diary or survey with your parents, but I want you to know that I will not be giving your parents any of your answers. Your parents can also visit the study website at www.myeverydayactivities.com to learn more about this research.

Do you have any questions for me? Is there anything you’d like me to go over again?

[Yes, answer questions; No, continue with script]
I just have one more thing to ask you. How long have you lived in Canada? □ 1 >2 years □ 2 <2 years

[If > 2 years, continue with script; If < 2 years: Thank you for calling in, but unfortunately we are specifically looking for participants who have lived in Canada for at least 2 years. Thanks again for your time.]

Ok, so now that I’ve told you all about the study, would you like to take part in it? □ 1 Yes □ 2 No

[Yes, continue with script; No: Thank you for calling in. I’m sorry you are unable to help out. Thanks again for your time.]

Great! Thanks for volunteering for this study! Now all I need to do is ask you some questions on how to contact you for the study.

**Participant Contact Information**

Since the study can be done in two different ways, which would you prefer?

□ 1 Using the Internet □ 2 Pen and Paper

[“Using the Internet”, continue to question 1; “Pen and Paper”, continue to question 2.]

**1. What’s your email address?** ____________________________

2. What is your phone number?
   (        ) _______ ________ (cell) OR (        ) _______ ________ (home)

3. What are the best days and times to call you if I need to talk to you?

<table>
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<th>TIME</th>
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</table>
4. What is your full mailing address with postal code?

Name ___________________________________________________________

Street __________________________________________________________

City ____________________________________________________________, Ontario

Postal Code ______________________________________________________

Great! Now that I have your address, I can mail you a gift card when you’ve finished the diaries and survey.

Thanks again [insert participant name] for volunteering to be a part of this study! I’m going to [email or mail] you a copy of all of the study information that I just told you about, including my contact information and an information sheet for your parents. Please have a look over the information and get in touch with me anytime if you need to.

You should start your first diary entry on the Monday night after you receive the diary by [email or mail]. Let me know if you have any questions along the way. Thanks so much for your time! Bye, bye!
Appendix C – Consent Information

THE EVERYDAY ACTIVITIES OF SOUTH ASIAN GIRLS

Background information about the study

We are conducting a study to understand the everyday activities of South Asian girls in high school. This study is being done as a part of a Ph.D. research thesis at the School of Public Health at the University of Toronto. We are interested in learning more about the types of activities you participate in, where you spend your time, and with whom you spend time. We want to know more about what you like and don’t like so that we can better design programs to suit your interests and needs. We are especially interested in physical activities, family responsibilities and cultural activities. As well, we would like to learn more about what girls in high school with South Asian heritage feel about their friends and family, religion and culture, and physical activities. In total, about 150 girls will be asked to participate in this research.

Importance of this research

Findings from this research will help people who design programs and activities for teenagers, especially teenage girls with South Asian heritage. We will also share the findings with researchers and community organizations and write reports for health journals. Doing this kind of research takes a bit of time. This study will take about a year to complete, and when it is done, we will send you a summary of the findings and post it on the study website: www.myeverydayactivities.com so you’ll have a chance to see how other South Asian girls answered the questions.

What you will be doing as a research participant

If you choose to participate, there will be two parts to your involvement: keeping a brief diary of your everyday activities for two separate weeks, which will take you less than 10 minutes a day to complete, and doing a survey which will take you about 45 minutes to fill out. In total, the
time commitment for you to participate in the study is about 2 hours and 45 minutes over the course of about a month. Both the diary and survey have been set up electronically so that you can complete them in the comfort, convenience, and privacy of your home. Or, if you prefer, we can send you paper copies of the diary and survey in the mail and give you stamps and an envelope to send it back to us.

If you choose to complete the study using the Internet, we will email you daily reminders and a Word attachment to complete and email back to us before you go to bed each night. At the end of the Day 1 diary entry, you’ll have a chance to ask any questions that crossed your mind while filling it out. We’ll answer all of your questions and send you some tips by email when we send you the diary for Day 2. This way, we’ll be on track for the rest of your diary entries. A few weeks later, you will start the second week of diaries. After both of the seven-day diaries have been filled out and returned to us, we’ll email you a link to a secure website so that you can complete the survey online.

If you choose to complete the study using the paper copies, we’ll send you a seven-day diary that you can fill out and mail back at the end of the week. If you have any questions after Day 1, you can call Subha at 416-603-5800 x 2645 for help. A few weeks later, we’ll send you the second seven-day diary and the survey that you can fill out and mail back to us.

**Your gift for participating**

We know how valuable your time is, so as a token of our thanks, we will give you $20 for participating: $10 for the diary portion of the research ($5 for each week) and $10 for the survey portion. This money will be in the form of a Cadillac Fairview gift card that can be used to shop at any store in 9 major malls including Sherway Gardens, Erin Mills Town Centre, Eaton Centre, and Fairview Mall. As well, at the end of the study, all participants will be entered into a draw for an additional $50 Cadillac Fairview gift card. Funding for the gift cards has been provided by the Centre for Urban Health Initiatives at the University of Toronto.

**Your rights as a research participant**

This research has been approved by the Research Ethics Board at the University of Toronto. If you volunteer to participate, you can skip any questions you wish in the diary or survey, and
withdraw from the study at any time without negative consequences. If you have any questions about your rights as a research participant you may contact the Office of Research Ethics at the University of Toronto at ethics.review@utoronto.ca or 416-946-3273.

There are no known risks to being a part of this study, although sometimes answering personal questions can be upsetting to some people. So when you’re completing the diary or survey, if any questions do upset you, you are free to skip them. Skipping some questions will not affect the amount of your gift card.

**Keeping your information safe and private**

All of the information that we collect from you will be identified by a code number only and kept in a locked filing cabinet. Electronic files will be stored in a password protected hard drive in a locked office space. Your name will not be anywhere on the diaries or survey. When we look at all of the information we’ve collected and write about the findings, we will combine your information with everyone else’s so that no one can ever be singled out. Only the researcher, Subha, and research supervisor, Monique, will have access to your contact information, diary and survey, and this information will be stored safely at the University of Toronto for a minimum of five years as recommended by the School of Public Health.

Over the course of the study, we may be leaving messages for you on your home phone and we will be sending you a gift card to your home address. Because of this, it may be a good idea to let your family know about your participation in this research study. To help with this, we have put together an information letter that you may share with your parents. That way, if your parents have any questions about the study, they can call Subha directly. We are happy to share blank copies of the diary or survey with your parents, but we will not give them any of your answers. Whether you choose to complete the diaries and survey online or on paper, we recommend that you let your family members know that you would like some privacy while filling them out. If you are completing the diaries and survey using pen and paper, we recommend that you place completed materials in the self-addressed stamped envelope and put them in the mail as soon as possible.
Who to contact for more information about the study

If you have any questions or want further information about this study, please contact Subha Ramanathan at 416-603-5800 x 2645 or subha.ramanathan@utoronto.ca and visit the study website at www.myeverydayactivities.co
Appendix D - Daily Diary

What do I need to do?

Just before you go to sleep, take a few minutes to reflect. What happened today? When did you wake up and when will you go to sleep? Where did you go, what were you doing, and who were you with? Each day may be different, and that’s just fine! Write whatever actually happened on that day. Did you eat lunch with different people or meet a club member? Remember, you can write about more than one activity in one episode. For example, in a single episode between 5 and 6 pm you could be listening to your iPod, doing your homework, and eating dinner at the same time.

We are also interested in how your daily routines change. Did you eat lunch with different people or meet a club member? Remember, you can write about more than one activity in one episode. For example, in a single episode between 5 and 6 pm you could be listening to your iPod, doing your homework, and eating dinner at the same time.

What I need to do each day: writing the “episodes” of your daily story

Think of your day as a story, with a series of episodes. In episode 1 you might get up and eat your breakfast. In episode 2, you might attend your morning classes. In episode 3, you might go to your gym class… you get the picture! Give each episode a brief name (for example, “traveling to school”) and make sure that you tell us what you did during the episodes started and ended. If you run out of time, you can finish it off the entry sometime the next morning.

Fill out an entry for any 3 weekdays and both weekend days for a total of 5 entries. Try and choose weekdays where you are involved in extra-curricular activities. Each entry will begin with a “waking up” episode and end with a “filling out diary” episode. If you run out of time, you can finish it off the entry sometime the next morning.

For all multiple choice questions, click to select a box. If you want to change your answer, just deselect your previous answer and choose the one you want. If you want to change your answer, just deselect your previous answer and choose the one you want.

How long will this take?

Less than 10 minutes for each entry!

Summary: writing what is most important

At the end of the entry, there are a few summary questions to answer. We are really interested in anything unusual that may have happened – especially if it has to do with being South Asian or doing any physically strenuous activity. For all multiple choice questions, click to select a box. If you want to change your answer, just deselect your previous answer and choose the one you want.

fill out an entry for any 3 weekdays and both weekend days for a total of 5 entries. Try and choose weekdays where you are involved in extra-curricular activities. Each entry will begin with a “waking up” episode and end with a “filling out diary” episode. If you run out of time, you can finish it off the entry sometime the next morning.

We are also interested in how your daily routines change. Did you eat lunch with different people or meet a club member? Remember, you can write about more than one activity in one episode. For example, in a single episode between 5 and 6 pm you could be listening to your iPod, doing your homework, and eating dinner at the same time!
<table>
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<th>Time it ended</th>
<th>What were you doing?</th>
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<td><strong>7:15am</strong></td>
<td><strong>7:45am</strong></td>
<td>Brushing teeth; showering; getting dressed</td>
<td><strong>Home</strong></td>
<td><strong>Alone</strong></td>
</tr>
<tr>
<td><strong>2M</strong></td>
<td><strong>8:30am</strong></td>
<td><strong>9:00am</strong></td>
<td>Walking to bus stop; riding the bus to school</td>
<td><strong>Street; Bus</strong></td>
<td>2 female friends; 1 male friend</td>
</tr>
<tr>
<td><strong>3M</strong></td>
<td><strong>9:00am</strong></td>
<td><strong>11:30am</strong></td>
<td>Watching a documentary and doing group work for a project;</td>
<td><strong>Classroom</strong></td>
<td>Classmates, teacher</td>
</tr>
<tr>
<td><strong>4M</strong></td>
<td><strong>9:00am</strong></td>
<td><strong>11:30am</strong></td>
<td>Watching a documentary and doing group work for a project;</td>
<td><strong>Classroom</strong></td>
<td>Classmates, teacher</td>
</tr>
<tr>
<td><strong>1M</strong></td>
<td><strong>7:45am</strong></td>
<td><strong>7:15am</strong></td>
<td>Walking up</td>
<td><strong>Walking up</strong></td>
<td><strong>Walking up</strong></td>
</tr>
</tbody>
</table>

**DAY 0: SAMPLE MORNING (from waking up until just before noon)**
<table>
<thead>
<tr>
<th>DAY</th>
<th>Episode Name</th>
<th>Time it began</th>
<th>Time it ended</th>
<th>What were you doing?</th>
<th>Where were you?</th>
<th>Who were you with?</th>
</tr>
</thead>
<tbody>
<tr>
<td>5M</td>
<td>Waking up</td>
<td>7:00am</td>
<td>7:25am</td>
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<td>4M</td>
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<td>1M</td>
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<tr>
<td>Episode Name</td>
<td>Time it began</td>
<td>Time it ended</td>
<td>What were you doing?</td>
<td>Where were you?</td>
<td>Who were you with?</td>
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<td>(e.g. travelling to school, in class, eating lunch, blogging, etc.)</td>
<td>(e.g. 12:10pm)</td>
<td>(e.g. 1:25pm)</td>
<td>(e.g. classes, shopping and exchanging</td>
<td>(e.g. school, home, work</td>
<td>(e.g. alone, best friend only, friends, brother, sister, mother, father, cousins, boyfriend, etc.)</td>
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<td>(e.g. community centre, pool, friend's house, park, place of worship, volunteering placement, etc.)</td>
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<td>(e.g. school, home, work</td>
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<td>(e.g. alone, best friend only, friends, brother, sister, mother, father, cousins, boyfriend, etc.)</td>
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</table>

**DAY:** Afternoon (from noon until 6pm)
### Day __: Evening
(from 6pm until when you went to sleep; try and fill out your diary as your last episode)

<table>
<thead>
<tr>
<th>Episode Name</th>
<th>Time it began</th>
<th>Time it ended</th>
<th>What were you doing?</th>
<th>Where were you?</th>
<th>Who were you with?</th>
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**PLEASE SCROLL DOWN AND ANSWER THE SUMMARY QUESTIONS**
Have a look over your diary pages. Is there anything you’d like to change or add to? Is there an episode that you want to break up into two parts? Take a few moments to make these changes. When you’re done, please answer the summary questions below.

Summary Questions

What is today’s date? Monday (day of the week), January (month), (date)

1a. Looking back over your day, what was your MOST fun and enjoyable episode? Episode name: ____________________________

2a. What was your LEAST fun and enjoyable episode? Episode name: ____________________________

1b. Did you need permission from your parents to do this activity? ____________________________

2b. Did you need permission from your parents to do this activity? ____________________________

1c. How much control did you have in choosing to do this activity? ____________________________

2c. How much control did you have in choosing to do this activity? ____________________________

As a part of this study, we are interested in hearing more about your most fun and enjoyable activity, your least enjoyable activity, the activity you needed permission to do, and your level of control over your choice of activity. Have a look over your diary pages. Is there anything you’d like to change or add to? Is there an episode that you want to break up into two parts?
178 1c. How much control did you have in choosing to do this activity?

1. None
2. A little
3. Some
4. Quite a bit
5. A great deal

3a. What was of your most physically demanding episode? Episode name:

3b. How hard or strenuous did it feel? How tired were your muscles? Were you out of breath?

Read all of the descriptions below and rate your feeling of effort and exertion. Read all of the descriptions before choosing ONE answer:

1. No exertion at all
2. Extremely light
3. Very light (e.g. easy walking slowly at a comfortable pace)
4. Light
5. Somewhat hard (it was a bit tiring, but you could keep going)
6. Hard
7. Very hard (very strenuous, and you were tired afterwards)
8. Extremely hard (you could not do it for very long, it was one of the most strenuous activities you've ever done)
9. Maximal exertion

3c. Did you work up a sweat?

1. Yes
2. No

3d. Did you need permission from your parents to do this activity?

1. Yes
2. No
1. How much control did you have in choosing to do this activity?
   - None
   - A little
   - Some
   - Quite a bit
   - A great deal

2a. Sometimes things aren’t physically demanding but can be mentally draining. What was your most mentally draining activity?
   - Episode name: Nothing stands out (skip to #5)

2b. Did you need permission from your parents to do this activity?
   - Yes
   - No

2c. How much control did you have in choosing to do this activity?
   - None
   - A little
   - Some
   - Quite a bit
   - A great deal

3. Did you have gym class today?
   - Yes
   - No

4a. How did you get to school today?
   - Walked or cycled for less than 10 minutes
   - Walked or cycled for more than 10 minutes
   - By bus
   - By car
   - Subway
   - Other (specify)

4b. How did you get back home from school today?
   - Subway
   - Walked or cycled for less than 10 minutes

4c. How much control did you have in choosing to do this activity?
   - None
   - A little
   - Some
   - Quite a bit
   - A great deal

5. Did you have gym class today?
   - Yes
   - No

6a. How did you get to school today?
   - Subway
   - Walked or cycled for less than 10 minutes
   - Walked or cycled for more than 10 minutes
   - By bus
   - By car
   - Other (specify)

6b. How did you get back home from school today?
   - Subway
   - Walked or cycled for less than 10 minutes
7. Think about all of your sources of physical activity today: the physically demanding activity you listed above, chores that made you move around, plus any walking or cycling that you did for at least 10 minutes (e.g. walking at the mall, cycling with friends, etc.). Add it all up and tell us how much physical activity you did in total today.

6. Did not go to school today

5. Other (specify)

4. By bus

3. By car

2. Walked or cycled for more than 10 minutes

1. Not all day

8a. There are a number of activities and events in people's lives. We are interested in any South Asian activities you may be involved in, like traditional music or dance classes, language classes, cultural or religious events, prayer sessions, etc. Did you do anything related to your South Asian heritage today?

1. Yes

2. No

Try the question based on the longest episode? Episode name:

8b. If you answered “yes”, what was the episode number of this activity? If you were involved in more than one today, answer “yes” if you answered “yes”, what was the episode number of this activity? If you were involved in more than one today, answer

1. Yes

2. No

Skip to #9.

8c. How much did you enjoy this South Asian activity or event?

1. Not at all

2. A little

3. Somewhat

4. Quite a bit

5. A great deal

8d. Is this something that you do regularly (weekly, monthly, yearly)?

1. Yes

2. No
Congratulations! You’ve just completed Day ___.

Questions? Do you have any feedback for us? Sometimes it can be confusing to fill out a diary. Do you have any questions about filling out the diary or the summary?

1. How much control did you have in choosing to participate in or attend this cultural activity?
   - None
   - A little
   - Some
   - Quite a bit
   - A great deal

2. Overall, how much control did you have over your free time today?
   - None
   - A little
   - Some
   - Quite a bit
   - A great deal

3. Overall, how much control did your parents have over your free time today?
   - None
   - A little
   - Some
   - Quite a bit
   - A great deal

4. Overall, how much control did others (e.g. teachers, other adults, friends, etc.) have over your free time today?
   - None
   - A little
   - Some
   - Quite a bit
   - A great deal

5. How much control did you have in choosing to participate in or attend this cultural activity?
Appendix E – Final Questionnaire

THE EVERYDAY ACTIVITIES OF SOUTH ASIAN GIRLS

The purpose of this survey is to learn more about what girls in high school of South Asian ancestry do with their time, and what they think about physical activities, their friends and family, and religion and culture. Your opinions are valuable and will be helpful for people who design programs and activities for teenagers, especially teenage girls of South Asian ancestry.

It will take you about 30-45 minutes to complete this survey. Please carefully read the instructions at the top of each section because they will change throughout the survey. Most of the questions are multiple-choice. Near the end of the survey there are a few open-ended questions, where you’ll have the chance to write as much as you’d like!

As a reminder, your participation in the study is voluntary and you may skip any questions that make you uncomfortable. Please review your survey at the end to make sure that you have filled out everything that you wanted to. All of your responses will remain confidential. When we look at all of the information we’ve collected and write about the findings, we will combine your information with everyone else’s so that no one can ever be singled out.

Thanks for filling this out!

Please do not use your name or anyone else’s when answering the questions.
**SECTION A. RELATIONSHIPS**

We are interested in learning about your relationships with your parents or guardians, friends, siblings (brothers and sisters) and peers from other cultures. Please read each statement and all of the answers before choosing one.

**Mother or female guardian**

Skip these questions if a) you have not spent any time with your mother or female guardian in the last 6 months or b) you do not have a female guardian.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Never</th>
<th>Only once in a while</th>
<th>Sometimes</th>
<th>Often</th>
<th>Very Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. She comforts and helps me when I have troubles</td>
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<tr>
<td>2. She makes me feel I can talk with her about everything</td>
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<tr>
<td>3. She makes me feel she is there if I need her</td>
<td></td>
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<tr>
<td>4. When she punishes me, she explains why</td>
<td></td>
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<tr>
<td>5. When she wants me to do something, she explains why</td>
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<tr>
<td>6. She helps me with homework or lessons, if there is something I don’t understand</td>
<td>Never</td>
<td>Only once or twice a year</td>
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<tr>
<td>7. She teaches me things I want to learn</td>
<td>Never</td>
<td>Only once or twice a year</td>
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<tr>
<td>8. I know what she expects of me and how she wants me to behave</td>
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<tr>
<td>9. When I do something she doesn’t like, I know exactly what to expect of her</td>
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<td>10. She encourages me to try new things on my own</td>
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<tr>
<td>11. She lets me make my own plans about things I want to do</td>
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<td>12. She lets me off lightly when I do something wrong.</td>
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<tr>
<td>13. She cannot bring herself to punish me.</td>
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<tr>
<td>14. She expects me to keep my things in good order.</td>
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</table>
15. She expects me to help around the house or yard.  

<table>
<thead>
<tr>
<th>Frequency</th>
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<tbody>
<tr>
<td>Never</td>
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<tr>
<td>Only once or twice a year</td>
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<tr>
<td>About once a month</td>
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<td>About once a week</td>
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<tr>
<td>Almost every day</td>
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</table>

16. She keeps after me to do well in school.  

17. She keeps after me to do better than other children.  

18. She wants to know exactly where I am going when I go out.  

19. She expects me to tell her exactly how I spend my pocket money.  

20. She worries that I cannot take care of myself.  

21. She won’t let me go places because something might happen to me.  

Father or male guardian
The following questions follow the same pattern as above, but ask you about your father or male guardian. Skip these questions if a) you have not spent any time with your father or male guardian in the last 6 months or b) you do not have a male guardian.

<table>
<thead>
<tr>
<th>Frequency</th>
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<tbody>
<tr>
<td>Never</td>
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<tr>
<td>Only once a while</td>
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<tr>
<td>Sometimes</td>
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<tr>
<td>Often</td>
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<tr>
<td>Very often</td>
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</table>

22. He comforts and helps me when I have troubles  

23. He makes me feel I can talk with him about everything  

24. He makes me feel he is there if I need him  

25. When he punishes me, he explains why  

26. When he wants me to do something, he explains why  

27. He helps me with homework or lessons, if there is something I don’t understand  

28. He teaches me things I want to learn
29. I know what he expects of me and how he wants me to behave.

30. When I do something he doesn’t like, I know exactly what to expect of him.

31. He encourages me to try new things on my own.

32. He lets me make my own plans about things I want to do.

33. He lets me off lightly when I do something wrong.

34. He cannot bring himself to punish me.

35. He expects me to keep my things in good order.

36. He expects me to help around the house or yard.

37. He keeps after me to do well in school.

38. He keeps after me to do better than other children.

39. He wants to know exactly where I am going when I go out.

40. He expects me to tell him exactly how I spend my pocket money.

41. He worries that I cannot take care of myself.

42. He won’t let me go places because something might happen to me.

Read each sentence and decide how TRUE about you is each sentence?

Mother or female guardian

43. I enjoy spending time with my mother.

44. My mother and I are pretty close.

45. My mother cares a lot about me.

46. My mother and I argue a lot.

47. I talk with my mother about very personal things and my problems.
### Father or male guardian

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<tbody>
<tr>
<td>48. I enjoy spending time with my father.</td>
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<tr>
<td>49. My father and I are pretty close.</td>
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<td>50. My father cares a lot about me.</td>
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<td>51. My father and I argue a lot.</td>
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<td>52. I talk with my father about very personal things and my problems.</td>
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### Friends

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<tr>
<td>53. Spending time with friends is not so important to me.</td>
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<td>54. I have friends I'm really close to and trust completely.</td>
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<td>55. Spending time with my friends is a big part of my life.</td>
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<td>56. My friends and I talk openly with each other about personal things.</td>
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<td>57. I spend as much time as I can with my friends.</td>
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<td>58. My friends and I spend a lot of time talking about things.</td>
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### Siblings (skip if you are an only child)

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<tr>
<td>59. I have a lot of fun with my brother(s) or sister(s).</td>
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<td>60. I feel close to my brother(s) or sister(s).</td>
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<tr>
<td>61. I enjoy spending time with my brothers/sisters.</td>
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<tr>
<td>62. I try to spend time with my brothers/sisters when I can.</td>
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<td>63. I try to avoid being around my brother/sister(s).</td>
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### Kids from other cultures

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<tbody>
<tr>
<td>64. I like getting to know kids from other cultural groups.</td>
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<tr>
<td>65. I would like to know more people from different cultural groups.</td>
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<tr>
<td>66. I like getting to know people who are culturally different from me.</td>
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### SECTION B. RELIGIOUS BELIEFS

In this section, we would like to know your thoughts about religion and religious practices (if any).

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<tr>
<td>1. My religion is very important to me.</td>
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<td>2. I attend a religious service (at a temple, mosque or spiritual centre) regularly.</td>
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<td>3. I am a religious or faithful person.</td>
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<td>4. My whole approach to life is based on my religion.</td>
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<td>5. Although I believe in my religion, many other things are more important in life.</td>
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<td>6. My faith helps me know right from wrong.</td>
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<td>7. My faith shapes how I think and act each and every day</td>
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<td>8. I talk with other people about my faith.</td>
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<td>9. How often do you pray privately in places like a temple, mosque, or spiritual centre?</td>
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<td></td>
<td>1 - Several times a day</td>
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<td>2 - Once a day</td>
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<td></td>
<td>3 - A few times a week</td>
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<td></td>
<td>4 - Once a week</td>
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<td></td>
<td>5 - A few times a month</td>
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<td>6 - Once a month</td>
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<td></td>
<td>7 - Less than once a month</td>
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<tr>
<td>10. How often do you pray privately in places OTHER THAN a temple, mosque, or spiritual centre?</td>
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<td>1 - Several times a day</td>
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<td></td>
<td>2 - Once a day</td>
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<td></td>
<td>3 - A few times a week</td>
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<td></td>
<td>4 - Once a week</td>
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<td></td>
<td>5 - A few times a month</td>
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<td>6 - Once a month</td>
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<td></td>
<td>7 - Less than once a month</td>
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<tr>
<td>11. How often do you attend religious services?</td>
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<tr>
<td></td>
<td>1 - Never</td>
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<td></td>
<td>2 - Less than once a year</td>
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<td></td>
<td>3 - About once or twice a year</td>
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<td></td>
<td>4 - Several times a year</td>
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<td>5 - About once a month</td>
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<td>6 - 2-3 times a month</td>
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<td></td>
<td>7 - Nearly every week</td>
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<td></td>
<td>8 - Every week</td>
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<td></td>
<td>9 - Several times a week</td>
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<tr>
<td>12. Besides religious services, how often do you take part in other activities at a place of worship?</td>
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<tr>
<td></td>
<td>1 - Never</td>
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<td></td>
<td>2 - Less than once a year</td>
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<td>3 - About once or twice a year</td>
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<td></td>
<td>4 - Several times a year</td>
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<td>5 - About once a month</td>
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<td>6 - 2-3 times a month</td>
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<td>7 - Nearly every week</td>
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<td></td>
<td>8 - Every week</td>
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<tr>
<td></td>
<td>9 - Several times a week</td>
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</tbody>
</table>
**SECTION C. PHYSICAL ACTIVITY**

We are interested in what you and the people around you think about physical activity and what influences your choices about being physically active.

Read each statement and decide how much you agree or disagree with it.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. There are people I can count on to be physically active with me.</td>
<td></td>
<td></td>
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<tr>
<td>2. I do not have any friends or relatives who are physically active.</td>
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<tr>
<td>3. There is no one I can turn to for advice about physical activity.</td>
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<tr>
<td>4. There are people who depend on me to help them be physically active.</td>
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<td>5. I know people who enjoy the same physical activities that I do.</td>
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<tr>
<td>6. Other people think of me as being physically active.</td>
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<tr>
<td>7. I feel personally responsible for helping another person be physically active.</td>
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<tr>
<td>8. I am part of a group of people who have the same attitudes about physical activity.</td>
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<tr>
<td>9. Other people do not respect my physical skills and abilities.</td>
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<tr>
<td>10. There is no one to take over chores for me so I have time to be physically active.</td>
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<tr>
<td>11. I am good friends with at least one person who values physical activity.</td>
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<tr>
<td>12. There is someone I can talk to about physical activity.</td>
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<tr>
<td>13. There are people who recognize my skills and abilities at physical activity.</td>
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<tr>
<td>14. There is no one who shares my interests about physical activity.</td>
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<tr>
<td>15. No one relies on me for help with their physical activity.</td>
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<tr>
<td>16. There is a person I can turn to for advice if I have problems with physical activity.</td>
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<td>17. I have close relationships with people who make me feel good about myself.</td>
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<td>18. There is no one who rewards me for being physically active.</td>
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<td>19. There is no one who I feel comfortable talking about physical activity.</td>
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<td>20. There are people who admire my talents and abilities regarding physical activity.</td>
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<tr>
<td>21. I am not close to anyone who values physical activity.</td>
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<tr>
<td>22. There is no one who likes the same physical activities I do.</td>
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<td>23. There are people who will change their schedule to be physically active with me.</td>
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<tr>
<td>24. No one counts on me to be physically active with them.</td>
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<tr>
<td>Question</td>
<td>Strongly agree</td>
<td>Agree</td>
<td>Not sure</td>
<td>Disagree</td>
<td>Strongly disagree</td>
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<tr>
<td>25. My mom encourages me to be physically active.</td>
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<td>26. My mom supports me being physically active</td>
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<tr>
<td>27. My mom approves of me being physically active.</td>
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<tr>
<td>28. My dad encourages me to be physically active.</td>
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<tr>
<td>29. My dad supports me being physically active</td>
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<tr>
<td>30. My dad approves of me being physically active.</td>
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</tbody>
</table>

For questions 31-37, read each statement and all of the possible answers before choosing one.

31. For me, being physically active is...
   - Extremely difficult  - Extremely easy
   - 1  2  3  4  5  6  7

32. How much control do you feel you have over being physically active regularly?
   - Very little control  - Complete control
   - 1  2  3  4  5  6  7

33. How much I am regularly physically active is completely up to me.
   - Strongly disagree  - Strongly agree
   - 1  2  3  4  5  6  7

34. Most people in my cultural community want me to be physically active.
   - Strongly disagree  - Strongly agree
   - 1  2  3  4  5  6  7

35. I feel pressure to be physically active from most people in my cultural community
   - Strongly disagree  - Strongly agree
   - 1  2  3  4  5  6  7

36. Most people in my cultural community think I should be physically active.
   - Strongly disagree  - Strongly agree
   - 1  2  3  4  5  6  7

37. I feel pressure from my cultural community to refrain from participating in sports or activities that are considered “masculine”
   - Strongly disagree  - Strongly agree
   - 1  2  3  4  5  6  7
38. Considering a typical 7-day period (a week) how many times on average do you do the following kinds of physical activities for more than 15 minutes during your free time? For example, if you typically do 45-minute sessions of easy walking 6 days a week, write 6 on the line beside “MILD PHYSICAL ACTIVITY”.

a) STRENUOUS PHYSICAL ACTIVITY  
(fairly exhausting or tiring)  
Examples: running, jogging, soccer, fast swimming, fast bicycling

TIMES PER WEEK

________________

b) MODERATE PHYSICAL ACTIVITY  
(not exhausting)  
Examples: fast walking, easy bicycling, easy swimming

________________

c) MILD PHYSICAL ACTIVITY  
(minimal effort)  
Examples: yoga, easy walking

________________

39. Considering a typical 7-day period (a week), during your leisure time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

1 - Often
2 - Sometimes
3 – Never/Rarely

We are also interested in the things that may prevent you from being physically active.

How often has each of the following prevented you from being physically active?

<table>
<thead>
<tr>
<th>40. Self conscious about my looks when I exercise</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Very often</th>
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<tbody>
<tr>
<td>41. Lack of interest in exercise</td>
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<td>42. Lack of self-discipline</td>
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<td>43. Lack of time</td>
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<td>44. Lack of energy</td>
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<td>45. Lack of company</td>
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<tr>
<td>46. Lack of enjoyment from exercise</td>
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<td>47. Discouragement</td>
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<td>48. Lack of equipment</td>
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<td>49. Lack of good weather</td>
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<td>50. Lack of skills</td>
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<td>51. Lack of facilities or space</td>
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<tr>
<td>52. Lack of knowledge on how to exercise</td>
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<tr>
<td>53. Lack of good health</td>
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<tr>
<td>54. Fear of injury</td>
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<tr>
<td>55. Other (please specify)</td>
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</table>
SECTION D. PHYSICAL ACTIVITY and SOUTH ASIAN GIRLS IN CANADA

People have told us that there are different ways of participating in physical activities and different reasons for participating in physical activities. We are interested to learn more about your thoughts and feelings in physical activities as a South Asian girl in Canada. Read each statement and decide how much you agree or disagree with it.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My parents have similar attitudes towards physical activities as non-South Asian parents in Canada.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. My South Asian cultural and religious community is generally supportive of physical activities for girls.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
</tr>
<tr>
<td>3. South Asian parents hold similar attitudes towards physical activities as non-South Asian parents in Canada.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. Being physically active is a priority for many people of South Asian descent.</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
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<tr>
<td>5. Most South Asian fathers do not participate in physical activities.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
</tr>
<tr>
<td>6. Most South Asian mothers do not participate in physical activities.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. My friends who are not South Asian are more physically active than my friends who are South Asian.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>8. Girls who are not from South Asian families usually spend more time being physically active than girls from South Asian families.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>9. South Asian parents are more likely to discourage their daughters from being physically active compared to their sons.</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>10. Girls and boys in my cultural community spend about the same time being physically active.</td>
<td>☐</td>
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<td>☐</td>
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</tr>
<tr>
<td>11. South Asian girls are not expected to be as physically active as South Asian boys.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>12. Non-South Asian parents are more encouraging of their daughter’s physical activities than South Asian parents.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>13. It is easier for Canadian girls that are not from South Asian backgrounds to be physically active.</td>
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<tr>
<td>14. South Asian parents treat boys and girls the same when it comes to physical activity.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>15. Based on my experience, South Asian girls are usually less physically active than other girls.</td>
<td>☐</td>
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</table>
SECTION E. OPEN-ENDED QUESTIONS

We are interested in learning more about your life as a teenage girl of South Asian ancestry in Canada. Please think about this aspect of your identity when answering the four questions below. When talking about the people in your life, use words like “friend”, “sister”, “uncle”, etc. but do not include their names.

1a) How are you similar to non-South Asian girls when it comes to the physical activities you participate in? Please use as much space as you need.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

1b) How are you different from non-South Asian girls when it comes to the physical activities you participate in? Please use as much space as you need.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2a) How are you similar to South Asian boys when it comes to the physical activities you participate in? Please use as much space as you need.

________________________________________________________________________
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________________________________________________________________________

2b) How are you different from South Asian boys when it comes to the physical activities you participate in? Please use as much space as you need.

________________________________________________________________________
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________________________________________________________________________

3a) How are you similar to South Asian girls when it comes to the physical activities you participate in? Please use as much space as you need.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

3b) How are you different from South Asian girls when it comes to the physical activities you participate in? Please use as much space as you need.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
SECTION F. SUMMARY INFORMATION

In this last section of the survey, there are some questions about you and your family. As a reminder, any information you tell us will be kept safe and private. When we look at all of the information we’ve collected and write about the findings, we will combine your information with everyone else’s so that no one can ever be singled out.

Do you have any siblings?  □ 1 Yes  □ 2 No → skip to #2
If you checked “Yes”, please fill out the chart below from your oldest to youngest sibling.

a)  □ 1 Brother  □ 2 Sister  Age: ___
b)  □ 1 Brother  □ 2 Sister  Age: ___
c)  □ 1 Brother  □ 2 Sister  Age: ___
d)  □ 1 Brother  □ 2 Sister  Age: ___
e)  □ 1 Brother  □ 2 Sister  Age: ___

How old are you? ______

What grade are you in?
□ 1 Nine  □ 2 Ten  □ 3 Eleven  □ 4 Twelve

4. How tall are you? ______ feet ______ inches OR ______ cm

5. How much do you weigh? ______ pounds OR ______ kg

6. Which religious grouping(s) reflect(s) your family’s beliefs? (Check all that apply).
□ 1 Sikh
□ 2 Hindu
□ 3 Muslim
□ 4 Christian
□ 5 Other (Jain, Buddhist, etc.)
□ 6 None

7. Was your mother/female guardian born in Canada? □ 1 Yes  □ 2 No
b) If you answered “no”, please write her birth country below:

8. Was your father/male guardian born in Canada? □ 1 Yes  □ 2 No
b) If you answered “no”, please write his birth country below:

9. Were you born in Canada? □ 1 Yes  □ 2 No
b) If you answered “no”, please write your birth country below:
10. How many years have you lived in a Westernized country (e.g. Canada, U.S., U.K)?
   - 1. 0-2 years
   - 2. 3-5 years
   - 3. 6-8 years
   - 4. 9-11 years
   - 5. 12+ years or since birth

11. Which of the following statements best describes your friends?
   - 1. Most of my friends are South Asian.
   - 2. I have about the same number of South Asian and non-South Asian friends.
   - 3. Most of my friends are not South Asian.

12. What are the first three digits of your postal code? __ __ __

13. Do you have any comments or questions about this study?
   _____________________________________________________________
   _____________________________________________________________
   _____________________________________________________________

14. Would you be interested in participating in a research study with us in the future?
   - 1. Yes  
   - 2. No

   Congratulations! You’ve reached the end of the survey.
   Thanks again for your help with this research!
Are you a teenage girl with South Asian heritage?

The University of Toronto wants YOU to participate in a study looking at the everyday activities of girls with South Asian heritage and time spent with friends and family. We want to learn more about what you like and don’t like so that we can better design programs to meet your interests and needs!

To participate, you must be:
- a teenaged girl with South Asian heritage
- in high school
- enrolled in a Canadian school for at least the last two years

You will be asked to complete brief diary entries and a survey, and everything can be done online and using email in the comfort and convenience of your home!

All participants will receive a $20 shopping gift card valid in several major malls and be entered into a draw for a $50 gift card.

If you’re interested, call or email Subha at 416-603-5800 x 2645 or subha.ramanathan@utoronto.ca and visit our website: www.myeverydayactivities.com

Enrollment is limited so contact us today!
Appendix G – Handout for the Everyday Activities Study

Calling all teenage girls with South Asian heritage:

The University of Toronto wants YOU to participate in a study looking at everyday activities of girls with South Asian heritage and time spent with friends and family.

To participate, you must be:
- a teenaged girl with South Asian heritage
- in high school
- enrolled in a Canadian school for at least the last two years

You will be asked to complete brief diary entries and a survey. If you’d like, everything can be done online and using email in the comfort and convenience of your home!

All girls will receive a $20 gift card valid in major shopping malls and be entered into a draw for a $50 gift card.

If you’re interested, call or email Subha at 416-603-5800 x 2645 or subha.ramanathan@utoronto.ca
Check out: www.myeverydayactivities.com

Enrollment is limited so contact us today!
Appendix H – Study Information for Parents

Background information about the study
Your daughter has been invited to participate in a study that looks at the everyday activities of South Asian girls in high school. This study is being done as a part of a Ph.D. research thesis at the School of Public Health at the University of Toronto. We are interested in learning more about the types of activities South Asian girls participate in, where they spend their time, and with whom they spend time. We are especially interested in physical activities, family responsibilities and cultural activities. As well, we would like to learn more about what girls in high school with South Asian heritage feel about their friends and family, religion and culture, and physical activities. In total, about 150 girls will be asked to participate in this research.

Importance of this research
Findings from this research will help people who design programs and activities for teenagers, especially teenage girls with South Asian heritage. We will also share the findings with researchers and community organizations, and write reports for health journals. Overall, this study will take about a year to complete, and when it is done, we will send your daughter a summary of the findings so that she will have a chance to see how other South Asian girls answered the questions. A summary will also be made available on the study website: www.myeverydayactivities.com

What your daughter will be doing as a research participant
Your daughter will be keeping a brief diary of her everyday activities for two separate weeks and filling out a survey. In total, the time commitment for your daughter to participate in the study is about 2 hours and 45 minutes over the course of about a month.

Your daughter’s rights as a research participant
This research has been approved by the Research Ethics Board at the University of Toronto. Your daughter may skip any questions she wishes in the diary or survey, and withdraw from the study at any time without negative consequences. If you have any questions about your daughter’s rights as a research participant, you may contact the Office of Research Ethics at the University of Toronto at ethics.review@utoronto.ca or 416-946-3273.
Keeping your daughter’s information safe and private

All of the information that we collect from your daughter will be identified by a code number only and kept in a locked filing cabinet. Electronic files will be stored in a password protected hard drive in a locked office space. Your daughter’s name will not be anywhere on the diaries or survey.

When we write about the findings of this research, we will combine responses from your daughter with all other study participants, so that no one can ever be singled out. Only the researcher, Subha, and research supervisor, Monique, will have access to your daughter’s contact information, diary and survey, and this information will be stored safely at the University of Toronto for a minimum of five years as recommended by the School of Public Health.

For this type of research, it is important that your daughter has privacy while filling out the study documents and feels comfortable sharing her thoughts openly and honestly. We request your help with providing your daughter the time and space to complete the diary and survey by herself, and keeping her responses confidential.

Your daughter’s gift for participating

We know how valuable your daughter’s time is, so as a token of our thanks, we will send her a $20 Cadillac Fairview gift card that can be used to shop at any store in 9 major malls including Sherway Gardens, Erin Mills Town Centre, Eaton Centre, and Fairview Mall. As well, at the end of the study, all participants will be entered into a draw for an additional $50 Cadillac Fairview gift card. Funding for the gift cards has been provided by the Centre for Urban Health Initiatives at the University of Toronto.

Who to contact for more information about the study

If you have any questions or want further information about this study, please contact Subha Ramanathan at 416-603-5800 x 2645 or subha.ramanathan@utoronto.ca and visit our website at www.myeverydayactivities.com
Appendix I – Screenshot of Online Sign-up Sheet
Appendix J – Screenshots of Study Website
PARTICIPANTS

South Asian Club

Everyday Activities of

Home

Everyday Activities of

South Asian Club

University of Toronto

Dalla Lana School of Public Health
Appendix K – Data Entry Rules for Diary Summary Questions

General Rules:

- Enter the date as day-month-year, e.g., 27-Jan-2010.
- Enter “66” for missing data and “99” for questions that are not applicable based on response to the previous question(s).
- Whenever participants are asked to identify a particular episode (i.e., questions 1a, 2a, 3a, 4a, and 8b), enter the episode number in the spreadsheet. For example, “1A” for the first episode of the afternoon or “3E” for the third episode of the evening. If no episode is identified, enter “66” for missing data in the spreadsheet. If the response option, “Nothing stands out” is chosen, enter “99” for “not applicable” in the spreadsheet.
- For questions with “yes” or “no” response options (i.e., questions 1b, 2b, 3c, 3d, 4b, 5, 8a, and 8d), enter “1” for “yes” and “2” for “no” in the spreadsheet.
- For questions with Likert-type responses (i.e., questions 1c, 2c, 3b, 3e, 4c, 6a, 6b, 7, 8c, 83, 9, 10, and 11), enter the corresponding response number as indicated by the question. For example, where participant has selected “none” and 1 = “none”, enter “1” in the spreadsheet.
- Summary Questions on mode of travel to and from school (i.e., questions 6a and 6b) are coded as “yes=1” or “no=2” for each mode because participants may have used multiple modes of travel for the school journey (i.e., walking for more than 10 minutes and also taking the bus).

Special Cases:

- On the initial version of the Summary Questions administered to the first 30 participants, question 4a was as follows: “Did you do another physically demanding activity today?” . This was later replaced with “What was your most mentally draining activity today?” . Enter “88” for questions 4a, 4b and 4c for the first 30 participants. Enter responses for the remaining 58 participants using the General Rules above.
- Question 6b, “How did you get home from school today” was not on the initial version of the Summary Questions administered to the first 30 participants. It was added later to capture mode of travel home from school, which may differ from mode of travel to school. Enter “88” for the first 10 participants.
Appendix L – Data Entry Rules and Coding Schemes for the Details of the Diary Episodes

General Rules for Coding the Details of the Diary Episodes

• Enter “66” for missing data and “99” for empty codes (i.e., if a particular episode only requires one intensity code, use code “99” for intensity codes 2 and 3).

• Participants often report activities with various intensity levels, types, locations and companions within the same episode. For example, in their diary entry table, participants may report that they were “playing on the swings and then eating a snack” in the episode details column; “at the park, at home” in the location column; and “with friends” in the companion column. To capture the richness of this information, each episode may receive up to three codes for intensity level, location and companion.
  o If activities of more than one intensity level are reported in a single episode, they must be coded from highest to lowest intensity level. The example above would be coded as “6, 2, 99”
  o If participants report engaging in activities at more than one location within a single episode, location codes must be assigned based on the duration of time spent in each location from most time to least time. The example above would be coded as “8, 1, 99”
  o Companion codes may be assigned in the order that they are reported. The example above would be coded as “2, 99, 99”
Intensity Level Codes (up to 3 codes)

Sedentary Intensity Level

1 **lying down**: napping, sleeping

2 **sitting**: writing, reading, prayer, watching television or a Bollywood movie, language lessons, music lessons, eating Indian food, sitting at a festival or concert, etc.

3 **standing**: showering, dressing, cooking, packing lunch, packing backpack, brushing teeth, washing up in the morning, changing clothes, painting a backdrop, making the bed

Low to Moderate Intensity Level

4 **walking inside**, walking in the mall, putting up posters, playing with siblings indoors, low intensity chores: putting clothes away, cleaning kitchen counters, washing dishes, putting up/removing decorations, tidying up a room, drama practice

5 **walking outside, moderate intensity chores**: vacuuming, cleaning room, laundry or folding clothes, mopping, sweeping, cleaning snow off of the car, shovelling snow, gardening, collecting recycling at school

6 recreational sport/leisure time activities at a **low to moderate intensity** level, playing with friends in a park/outside, exercises at home, dancing at a party, yoga

Vigorous Intensity Level

7 recreational sport and physical activities at a **vigorous intensity** level, e.g. dance classes or dance practice/rehearsal, gym class, treadmill, elliptical, badminton, shooting hoops, running outside, ski lesson, lifting weights, skating, abdominal exercise routine

8 recreational sport and physical activities at the **highest intensity or competitions**, i.e. sport practice/competition/tryout swimming laps, dance performance, intense aerobic/dance class at a gym

*Note*: commuting by public transport is coded as: 5, 3, 2
Types of Sedentary Activities (up to 3 codes)

1 Spending time with friends or family (e.g., “hanging out”)

2 Personal care activities (e.g., “mirror time”, personal grooming)

3 Hobbies and extra-curricular activities (e.g., singing, playing the violin, club activity, spending time at a temple or cultural centre, reading)

4 Homework or classes at school

5 Cooking or eating

6 Screen time (e.g., watching television, using a computer, texting on a cellphone)

7 Very low intensity chores (e.g., making bed, packing backpack or car, unpacking bag)

Types of Physical Activities at a Low to Moderate or Vigorous Intensity Level (1 code only, corresponds with the highest intensity activity in the most physically demanding episode)

1 Structured physical activity and dance or sport practices and competitions (e.g., badminton, rugby, physical education class, dance class or practice).

2 Walking activities (e.g., walking indoors at a mall or walking outdoors to school).

3 Low to moderate intensity chores (e.g., household tasks like sweeping, cleaning the counters, cleaning the bedroom, and putting away the groceries; outdoor tasks like planting trees, pulling out weeds and washing the car; and chores at school or volunteer placements like wiping tables, and collecting or taking out the recycling).

4 Unstructured physical activity and play (e.g., activities at a park or backyard like playing on the swings, playing with cousins or siblings outside; casual dancing at a party; playing indoors like “dark tag”).

Note: Code 1 corresponds with physical activities with intensity levels 7 to 8. Codes 2 to 4 corresponds with physical activities with intensity levels 4 to 6.
Location (up to 3 codes)

1 Home (e.g., bedroom, kitchen, living room, etc.)

2 School/school grounds (e.g., classroom, cafeteria, piano class, hallways, tutor’s house)

3 Friend, relative or family friend’s house

4 Shopping mall, grocery store, plaza

5 Work or volunteer location (e.g., hospital, community centre)

6 Spiritual centre

7 Designated physical activity area (e.g., school gymnasium, dance studio, paintball place, ski resort, soccer field, indoor beach volleyball courts)

8 Streets or park and any other open outdoor spaces

9 Other – restaurant, movie theatre, airport, hair salon, coffee shop, pizza shop, library, doctor/dentist’s office, banquet hall, university campus

Note: Physical education class is coded as: 7, 2

Companion (up to 3 codes)

1 Alone

2 Friend(s)

3 Parent(s) (e.g., mother or father or guardian)

4 Sibling(s)

5 Relative(s) (e.g., cousins, uncles, aunts)

6 Boyfriend

7 Grandparent(s)

8 Classmates, teammates, or clubmates

9 Teacher or coach (or other adult figures like principal, librarian, music or dance teacher)

10 Family friends (e.g., friend’s parent(s), neighbour, sibling’s friends)
11 Other (e.g., fellow students being tutored, people at volunteer placements, people on the bus, hairstylist, special event delegates, dentist, doctor, nanny)

**Duration** (1 code)

1 About 15 minutes
2 About 30 minutes
3 About 45 minutes
4 About an hour
5 About an hour and 15 minutes
6 An hour and a half or more

**Special Episode Codes**

1 Most fun
2 Least fun
3 Most physically demanding
4 Most mentally draining
5 Related to South Asian heritage
6 Extra-curricular activities (e.g., volunteering, part-time job, club, sport team, music or dance lessons or practice, tutoring, etc.)

*Note:* Codes 1 to 5 correspond with episodes identified by participants in their diary summary questions. Code 6 is assigned when the “most physically demanding activity” is also an extra-curricular activity.
Appendix M – Double Data Entry Coding Agreement

Table 19: Results of the Double Data Entry of the Physically Demanding Intensity Codes

<table>
<thead>
<tr>
<th>Diary Entry</th>
<th>Intensity codes in agreement</th>
<th>Intensity codes that differ</th>
<th>Percentage agreement (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>44</td>
<td>2</td>
<td>95.7</td>
</tr>
<tr>
<td>Day 2</td>
<td>40</td>
<td>3</td>
<td>93.0</td>
</tr>
<tr>
<td>Day 3</td>
<td>42</td>
<td>1</td>
<td>97.7</td>
</tr>
<tr>
<td>Day 4</td>
<td>42</td>
<td>2</td>
<td>95.5</td>
</tr>
<tr>
<td>Day 5</td>
<td>39</td>
<td>3</td>
<td>92.9</td>
</tr>
<tr>
<td>TOTAL</td>
<td>207</td>
<td>11</td>
<td>95.0%</td>
</tr>
</tbody>
</table>
Appendix N – Types of Activities Identified as Physically Demanding and Coded at a Sedentary Intensity Level

Table 20: Sedentary Intensity Level Episodes Coded by Activity Type

<table>
<thead>
<tr>
<th>Sedentary Type Codes</th>
<th>Episode Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIARY ONE – TEN EPISODES</strong></td>
<td></td>
</tr>
<tr>
<td>5 6 99</td>
<td>Ate dinner at Aunt's house with [my] Cousin and Grandfather, watched TV for a bit, waited for parents to come, texting friends [on cell phone]</td>
</tr>
<tr>
<td>5 1 6</td>
<td>Bought ticket for winter formal, ate lunch with friends, chatted with friends, texting [on cell phone]</td>
</tr>
<tr>
<td>2 99 99</td>
<td>Brushed my teeth, washed my face, did my night time prayers</td>
</tr>
<tr>
<td>2 5 99</td>
<td>Brushing teeth; showering; getting dressed; eating breakfast; packing lunch for school</td>
</tr>
<tr>
<td>6 2 99</td>
<td>Checking email, changing, brushing teeth,</td>
</tr>
<tr>
<td>3 99 99</td>
<td>Discussed my volunteer coordination for the fundraising efforts</td>
</tr>
<tr>
<td>5 1 99</td>
<td>Eating lunch, socializing, hanging out with friends,</td>
</tr>
<tr>
<td>4 99 99</td>
<td>French: writing a French composition; Biology: experiment about the nervous system</td>
</tr>
<tr>
<td>5 6 99</td>
<td>Help out with dinner; talk; watch TV</td>
</tr>
<tr>
<td>3 1 99</td>
<td>Youth activities, hanging out with friends, prayers (Aarti),</td>
</tr>
<tr>
<td><strong>DIARY TWO – FOURTEEN EPISODES</strong></td>
<td></td>
</tr>
<tr>
<td>2 5 99</td>
<td>Brushed teeth, washed face, ate breakfast</td>
</tr>
<tr>
<td>2 99 99</td>
<td>Brushed teeth; got ready to study.</td>
</tr>
<tr>
<td>2 5 4</td>
<td>Brushing [teeth], eating breakfast, taking a shower, doing homework</td>
</tr>
<tr>
<td>2 6 99</td>
<td>Changed, makeup, straightened hair, texting</td>
</tr>
<tr>
<td>5 1 99</td>
<td>Eating lunch, hanging out with friends, talking</td>
</tr>
<tr>
<td>2 99 99</td>
<td>Freshening up</td>
</tr>
<tr>
<td>2 99 99</td>
<td>Getting out of bed</td>
</tr>
<tr>
<td>2 99 99</td>
<td>Got out of bed brushed teeth</td>
</tr>
<tr>
<td>1 99 99</td>
<td>Hanging out with friends.</td>
</tr>
<tr>
<td>4 6 99</td>
<td>Homework, talking, watching YouTube videos [on the computer], looking at possible Prom dresses</td>
</tr>
<tr>
<td>3 99 99</td>
<td>Practicing violin</td>
</tr>
<tr>
<td>3 99 99</td>
<td>Rehearsal: playing violin, learning new pieces</td>
</tr>
<tr>
<td>Date</td>
<td>Time</td>
</tr>
<tr>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>4</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

**DIARY THREE – SIXTEEN EPISODES**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>99</td>
</tr>
<tr>
<td>4</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>3</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>4</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>5</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>5</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>7</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

**DIARY FOUR – FOURTEEN EPISODES**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>99</td>
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<td>5</td>
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<td>99</td>
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<td>2</td>
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<td>99</td>
<td>99</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>99</td>
</tr>
<tr>
<td>Date</td>
<td>Time</td>
<td>Activity</td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>----------</td>
</tr>
<tr>
<td>7</td>
<td>99</td>
<td>Loading items into car, Dad driving my brother, mom, aunt, and myself to hall</td>
</tr>
<tr>
<td>3</td>
<td>99</td>
<td>Playing the violin</td>
</tr>
<tr>
<td>3</td>
<td>99</td>
<td>Playing violin in class</td>
</tr>
<tr>
<td>3</td>
<td>99</td>
<td>Practicing music: singing</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>Shower, getting dressed, praying, eating lunch/breakfast</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>Showering; brushing teeth; going to sleep</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>Waking up; refreshing; breakfast; school</td>
</tr>
</tbody>
</table>

**DIARY FIVE – EIGHTEEN EPISODES**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2</td>
<td>At home, took a bath, ate relaxed, watched TV</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>Brushed teeth, went through a few magazines</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>Brushed teeth; got ready for school</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>Brushing teeth; getting ready</td>
</tr>
<tr>
<td>3</td>
<td>99</td>
<td>Driving to heritage Class, teaching at the class, driving home</td>
</tr>
<tr>
<td>5</td>
<td>99</td>
<td>Eating lunch</td>
</tr>
<tr>
<td>1</td>
<td>99</td>
<td>Go dropped off; Went to locker got my books; Went to hang with friends before class</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>Helping in the kitchen, making pizza, watching TV</td>
</tr>
<tr>
<td>4</td>
<td>99</td>
<td>I practiced keyboarding for our daily practical quizzes/tests</td>
</tr>
<tr>
<td>4</td>
<td>99</td>
<td>I was starting my homework. I started my history culminating [homework] and I was working on my drama culminating [homework]</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
<td>I woke up, brushed my teeth and went for breakfast</td>
</tr>
<tr>
<td>5</td>
<td>99</td>
<td>Prepared and ate lunch</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Talking with friends; going home; had a shower; after school snack; watched TV</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>Took a shower, watched part of a movie, went online.</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>Took shower, unpacked books, watched TV, ate lunch again</td>
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<td>3</td>
<td>99</td>
<td>Visited Hindu temples in the vicinity</td>
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<td>6</td>
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<td>Watching hockey game, jumping up and down watching Canada win GOLD in men's [Olympic] hockey against USA :)</td>
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<td>Ya. I wax my legs. Sugar wax so it is healthy. My mom just sat there watching me and laughing, because she was born with no hair on her legs, so she got off lucky. VERY lucky.</td>
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Notes: 1 = Spending time with friends or family
2 = Personal care activities
3 = Hobbies and extra-curricular activities
4 = Homework or classes at school
5 = Cooking or eating
6 = Screen time
7 = Very low intensity chores
99 = not applicable, no additional code needed for this episode

Table 20 lists all of the episodes identified by participants as “most physically demanding,” where only sedentary intensity activities were reported. The episodes were split up based on the diary entry in which participants listed them. Each episode received up to three codes for the type of sedentary activities. When tallied, the frequency of each type of activity within the 72 episodes that had only sedentary intensity activities is listed below. Note that the categories were not mutually exclusive, therefore the frequencies do not add up to 100%.

- Spending time with friends or family: 11 (15.3%) episodes
- Personal care activities: “mirror time”, personal grooming: 33 (45.8%) episodes
- Hobbies and extra-curricular activities: singing, playing the violin, club activity, spending time at a temple or cultural centre, reading: 14 (19.4%) episodes
- Homework or classes at school: 10 (13.9%) episodes
- Cooking or eating: 22 (30.6%)
- Screen time: watching television, using a computer, texting on a cellphone: 16 (22.2%)
- Very light chores: making bed, packing backpack or car, unpacking bag: 4 (5.6%)
Appendix O – Inter-item Correlation Matrix for the Cultural and Gender-specific attitudes towards Physical Activity Scale

Table 21: Inter-item Correlations for the New Items Examining South Asian Cultural and Gender-specific Attitudes towards Physical Activity (N = 76)

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Notes: **p<.05, *p<.01
Table 22: Bivariate Correlation Matrix for Psychosocial Variables

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Appendix Q – Bivariate Correlation Matrix for the Final Independent Variables and the PA Outcomes

Table 23: Bivariate Correlations for the Six Independent Variables and Four PA Outcomes Eligible for the Multivariate Analyses (N = 65)

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Notes:  **p<.05,  *p<.01

1 – Enrolment in physical education
2 – Most friends are South Asian
3 – Equal South Asian and not
4 – Most enjoyable
5 – Control over PA
6 – Barriers to PA
7 – Social provisions for PA
8 – PA duration
9 – Diary vigorous bouts
10 – Moderate to vigorous PA score
11 – Sweat frequency