Development and Pilot of a Survey to Build Capacity for Examining Interactions of Constraints to Sport Participation among Adolescent Girls

by

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An oral defense of this thesis took place on November 27th, 2019 in front of the following examining committee:

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The above committee determined that the thesis is acceptable in form and content and that a satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate during an oral examination. A signed copy of the Certificate of Approval is available from the School of Graduate and Postdoctoral Studies.

ABSTRACT

Sport participation (SP) declines among girls during adolescence, and though many constraints to SP have been identified, it is not known whether or how they interact. The purpose of this thesis was to develop a survey which collects data on constraints to SP, and pilot it on adolescent girls residing in Durham Region, Ontario. A comprehensive list of constraints was generated from the literature. The research was guided by Newell's model of constraints (individual, environmental and task), and the Developmental Assets Profile (DAP). An online survey was developed and validated via an expert panel. The survey was piloted on a sample of adolescent girls (*n*=97, mean age= 15.5 years). Survey data revealed good reliability (Cronbach's α=0.897). Recommendations for larger scale implementations are discussed in terms of refining a sampling strategy, resolving issues with survey administration, and refining analytical techniques.

Words: 141

Keywords: sport, interactions, survey development, Newell's model

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AUTHOR'S DECLARATION

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I hereby certify that I am the sole author of this thesis and that no part of this thesis has been published or submitted for publication. I have used standard referencing practices to acknowledge ideas, research techniques, or other materials that belong to others. Furthermore, I hereby certify that I am the sole source of the creative works and/or inventive knowledge described in this thesis.

DEDICATION

To the girls - Thank you for sharing your experiences with me.

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LIST OF ABBREVIATIONS AND SYMBOLS

BMI	Body mass index
CSEP	Canadian Society for Exercise Physiology
DAP	Developmental Assets Profile
DCDSB	Durham Catholic District School Board
FSA	Forward sortation area
GSS	General Social Survey
PA	Physical activity
PYD	Positive Youth Development
SES	Socioeconomic status
SFAF	Sport Funding and Accountability Framework
SP	Sport participation

CHAPTER 1: Introduction

In Canada, females participate in sport less frequently than males at every age, with the sharpest disparity beginning in adolescence (Heritage Canada, 2013). Since sport participation (SP) has the potential to confer many benefits to people of all ages, it is imperative that we examine reasons behind this decreasing trend. Much research has been done into learning what the constraints to participation are, but the constraints are commonly examined and addressed in isolation. To address this, it is necessary to look at both the reasons why females participate less frequently in sport, and how these reasons relate to each other. It is important to note that this work uses a *gender* lens, that is, biological (sex) differences are not explicitly examined. Though gender is commonly conceptualized as binary (girls/women, boys/men) there are diverse ways in which gender is expressed and understood (Canadian Institute of Health Research, 2018). In the study of sport, the difference between sex and gender, as well as the relationship of these factors are often integrated. As such, some research on sport participation uses the terms "male/female" when sex differences are not measured, and "girls/boys" inconsistently. I will endeavor to use the gender terms (girls/women, boys/men) when discussing the objectives of this work but will use sex terms (female/male) when citing studies that have done so.

Sport is a unique component of physical activity (PA), though the benefits of participating in sport and PA are similar. SP can contribute to positive health outcomes such as reduced rates of depression, (Pluhar et al., 2019) obesity, heart disease and diabetes (Ifedi, 2008), as well as substantial social benefits. Aside from the similarities, sport also offers advantages that PA does not. For example, sport is competitive, and allows

participants an opportunity to cope with losing (Torres & Hager, 2007). In addition, there is the development of positive intergenerational relationships with adults outside of the family unit which has been found to be an asset in positive youth development (PYD) (Fraser-Thomas et al., 2005). SP also offers youth structured opportunities for leadership (Taylor, 2016), which do not necessarily arise from play or PA such as a fitness class. These additional benefits highlight the uniqueness of sport, and explain why sport is considered as separate from PA. Negative outcomes of SP have also been recognized, such as physical injury and psychological side effects of hazing (Bahr, 2014; Crow & Macintosh, 2009; Pépin-Gagné & Parent, 2016; Moseid et al., 2018), but in general it is evident that advantages outweigh the disadvantages Loprinzi, 2015). In addition, the benefits are recognized as occurring across all age groups (Eime 2015; Fuller et al., 2011).

Based on this premise, it is troubling that girls participate in sport less frequently than boys and much research has been undertake that examines these differences. Many *barriers* or *constraints* have been documented in the literature to explain this discrepancy. Though *barrier* is a more commonly cited term in the literature, it may not be the most appropriate term because it implies that its removal will result in increased participation. A constraint can limit, attenuate, or exacerbate an outcome. Therefore the term *constraint* lends itself well to this research because it sets the stage for potential negotiation and has therefore been chosen for the purpose of this work. The following chapter is a review of constraint literature for SP of adolescent girls. Adolescence is a critical period for SP among girls because it is when the gap in participation begins to widen (Heritage Canada, 2013). A preliminary review of the literature found that most research on constraints to SP seeks to determine single causality and has not used a theoretical framework to classify

constraints. This signifies a gap in the literature, because interactions of constraints have not been considered. Indeed, examining interactions has the potential to yield new insights into how to address the problem of low SP.

To examine interactions of constraints to SP, a comprehensive framework is needed to classify them. This work incorporates Newell's (1986) model of constraints and the 40 Developmental Assets (DAP) framework (Scales 1999). Newell's (1986) model sorts constraints into *individual*, *environmental* or *task*, and recognizes that a change in one constraint type effects change in another. As a PYD tool, the DAP adds more detail to the broader constraints in Newell's (1986) model by using a viewpoint that was developed for improving outcomes for adolescents. Combined, these models can also facilitate future examination of constraints to SP.

Research Question and Objectives

The goal of this thesis is to develop a survey instrument, and pilot test it in order to build capacity for research that examines how individual, environmental, and task constraints interact to affect SP among adolescent girls. The first objective was to use a compiled list of constraints to SP to develop a survey instrument that collects data on constraints to SP. The second objective was to pilot the survey to a sample of adolescent girls and refine the analytical technique with which to analyze interactions of constraints to SP. The following chapter is a consolidation and literature review of constraints to SP for adolescent girls in the literature. Chapter 3 describes the development of a survey that collects data related to constraints to SP. Constraints are organized according to Newell's (1986) model, with a note on task constraints which do not appear in constraint literature. Chapter 4 describes a pilot study that administered the survey on a sample of adolescents

and examined interactions of constraints to SP. Chapter 5 outlines the reliability analysis of the survey. The final chapter is a general discussion of how this work has contributes to a larger scale Ontario-wide project. Figure 1.1 outlines the process of completing chapters 3 and 4 (study 1 and study 2).

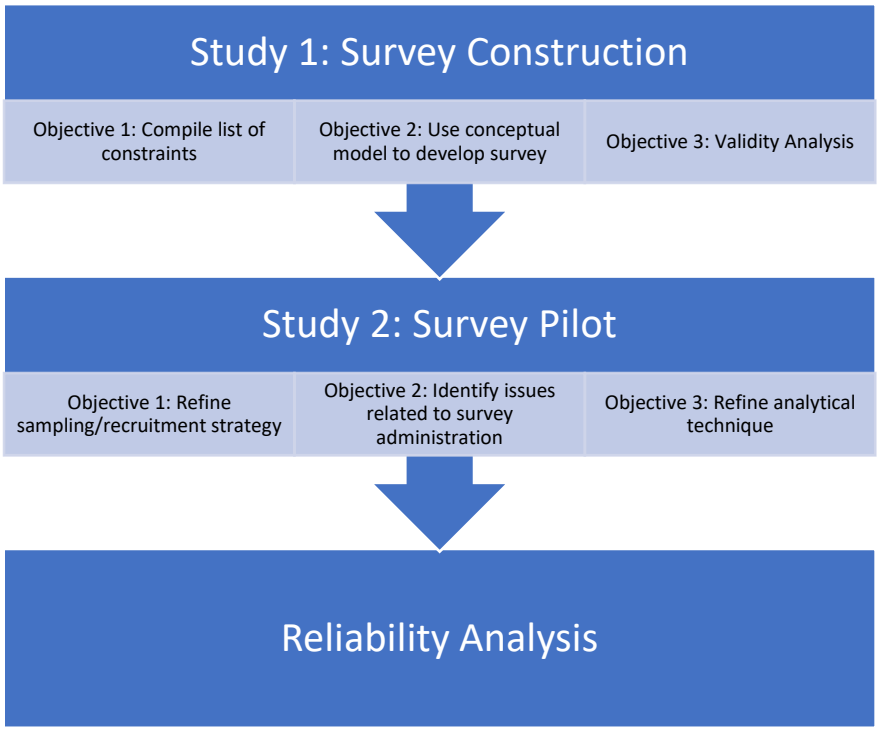

Figure 1.3 Concept map for thesis completion.

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CHAPTER 2: Literature Review

In preparation for the development of a survey which collects data on constraints to sport participation (SP), this chapter aims to situate the problem of low SP among girls in the context of physical activity (PA) and constraint research. Though most research uses the term *barrier*, the term *constraint* will be used in this work as it is consistent with the goals of this research.

Physical Activity and Sport

Physical activity (PA) is a broad concept, which includes exercise, active play, active transportation, and sport. *Exercise* is defined as non-competitive PA (Deaner et al., 2012), and includes the objective of increasing overall fitness (Khan et al., 2012). For children and adolescents, however, it is more suitable to refer to non-competitive PA as *active play* as the primary goal is not increased fitness but rather enjoyment, and this is how it is commonly operationalized in the academic literature in this population (Janssen, 2014). *Active transportation* refers to walking or cycling as a mode of transportation and is often examined with children and adolescents in the context of traveling to and from school (Larouche et al., 2014). Compared to their male cohorts, older adolescent girls participate in non-sport PA more frequently (Eime, 2016; Guevremont, 2016).

The definition of *sport* has been long disputed, but it is important to define sport to clarify its unique role in the context of PA. Most definitions of sport include components which differentiate it from PA in general and are based in Guttman's formative definition which included secularism, equality of opportunity, specialization, rationalization, bureaucratic organization, quantification, and quest for records (Guttman, 2004).

According to Holt (2017), the gold standard definition of sport developed by Guttman in 1978 and modernized by Darbon in 2014 has been both venerated and avoided by scholars. In a broad sense, the definition of sport cannot be finalized because sport is ever evolving. However, a working definition should have a historical context as well as practical underpinnings, to facilitate the study of sport. The Sport Canada definition states that sport is "an activity that involves two or more participants engaged for the purpose of competition… involves formal rules and procedures, requires tactics and strategies, specialized neuromuscular skills, and a high degree of difficulty and effort." (Heritage Canada 2013). Meanwhile, the Oxford English Dictionary (n.d.) defines sport as "An activity involving physical exertion and skill in which an individual or team competes against another or others for entertainment". Recently, a boom in the area of eSports – competitive video gaming – has challenged the standard definitions, because aside from a high degree of physical exertion, eSports meet all other criteria of most definitions (Jenny et al., 2017). Still, meeting the criteria is not always enough. For example, competitive dance meets every condition outlined by Guttman and Sport Canada, yet it is not considered a sport (Markula, 2018).

SP, specifically in team sport, also comes with some disadvantages, including the negative impacts of hazing (humiliating or abusive activity expected of younger athletes which is required to be accepted as part of a team) (Crow & Macintosh, 2009), sexual abuse and harassment (Pépin-Gagné & Parent, 2016), and physical injury (Bahr, 2014; Moseid et al., 2018) . In contrast to the positive effect of social interaction mentioned above, one study found that high social cohesion within a sport team can have a negative effect in the formation of cliques and putting social interaction above other matters (Hardy

& Carron, 2005). The issue of body image is also widespread (Abbott & Barber, 2011), with children as young as 5 years old reporting weight concerns, specifically when involved in aesthetic sport (Davison et al., 2002), though positive physical self perception has been reported among children and adolescents who engage in non-aesthetic sports and general PA (Davison et al., 2002; Okely et al., 2011).

Advantages have been found to outweigh the disadvantages across all forms of PA if participation falls in the moderate range (Loprinzi, 2015; Mills et al., in press). It is a very ambitious task to seek to increase overall PA among adolescents, but it is made possible by breaking PA down into its component parts and seeking an understanding of how to increase each. Examining SP is one way to contribute to the increase in overall PA.

Though research which focuses solely on SP is abundant, it fails to keep pace with the quantity of research on PA and this is reflected in Canadian policy. PA promotion is a much more prevalent concept for the adolescent cohort than SP when it comes to government funding initiatives (Ramanathan et al., 2018, Van Acker et al., 2012). PA comes with countless salutary benefits with respect to health (Paterson et al., 2007, The Government of Canada, 2011). Therefore, it is in the government's best interest to ensure all people have access. However, the Canadian government's approach has been mostly exhortation (Lau et al., 2007). For example, a new trend in PA promotion for adolescents in Canada are micro-grants; small budgets of grant money designed to alleviate environmental constraints to participation (Ramanathan et al., 2018). Ramanathan et al. (2018) examined the feasibility of micro-grants to support PA in adolescents on a national scale and suggested that sustainability of funding continued to be a problem. Micro-grant funding can contribute to more programs being available, but that may not be the solution

to increasing PA among girls. As it pertains to SP, increased funding on a larger scale also fails to improve gender equity in sport. For example, the Sport Funding and Accountability Framework (SFAF) supported almost 320 000 athletes and sport participants in 2000, and only 6% of them were female (Havaris & Danylchuk, 2007). Environmental and policy factors have not been considered sufficiently in the literature (Eyler et al., 2002), but have been alluded to considering a lack of desirable participation outcomes after increased government funding (Havaris & Danylchuk, 2007).

SP Among Girls

Though SP comes with many benefits, accessing SP opportunities can be a challenge especially for girls. Furthermore, the change in SP among boys and girls at adolescence is not the same; girls' participation decreases while boys' increases during this time period. Girls and boys experience vast developmental changes in a relatively short period of time during adolescence, and the experience of early maturation comes with more friction in social contexts for girls than it does for boys (Perry & Pauletti, 2011). For example, adolescent girls experience bullying differently than adolescent boys, with a higher likelihood of internalizing behavior (Ledwell & King, 2015) which may be due to the way girls are socialized to value interpersonal relationships more highly (Perry & Pauletti, 2011). In addition, some studies suggest that among girls in older adolescence SP is replaced by non-sport PA as they reach adulthood (Eime, 2016) and that although adolescent girls participate in sport less than their male counterparts, they participate in more non-sport PA than males (Eime, 2016; Guevremont, 2016). The disparity suggests that girls may be subject to different constraints to SP than boys.

Constraint Research

A *constraint* is anything that limits, restricts, or facilitates an outcome, in this case SP. Constraints have commonly been referred to as barriers in the literature and can be considered interchangeable because both seek to explain why individuals do not participate in sport. Semantically, however, the term constraint is more applicable to the study of SP because it implies that one can negotiate or overcome it (Jackson et al., 1993). Research has shown that even in instances where there is equal opportunity for both sexes to participate, females perceive more constraints than males (Casper et al., 2011; Dias et al., 2015).

The study of constraints to SP seeks to determine a main constraint which can be the target of interventions such as funding or policy. The two main theoretical frameworks used in the study of constraints to SP are the hierarchical (Crawford et al., 1991) and ecological (Gyurcsic et al., 2006) models. The hierarchical model categorizes constraints as intrapersonal (psychological states and attributes), interpersonal (based on interactions with others) or structural (externally imposed constraints). The ecological model goes a step further by breaking down the structural component into institutional, community, public policy, and physical environment constraints. Figure 1.1 depicts the similarities between the hierarchical and ecological models. The nested nature of these models suggests that each layer is part of a whole. It assumes that constraints in each category are separate, which has led to the understanding that in the presence of a single main constraint, the result is non-participation. It follows that by removing the main constraint, the outcome will change to participation, but this approach is too simplistic because it does not account for the complexity of constraints, i.e. constraints can be eliminated, attenuated,

or exacerbated by the presence of another constraint. Still, the hierarchical model of constraints remains as the most commonly used because to date it has been prolific of research, but its creators have called for suggestions about how constraints may otherwise be related (Godbey et al., 2010).

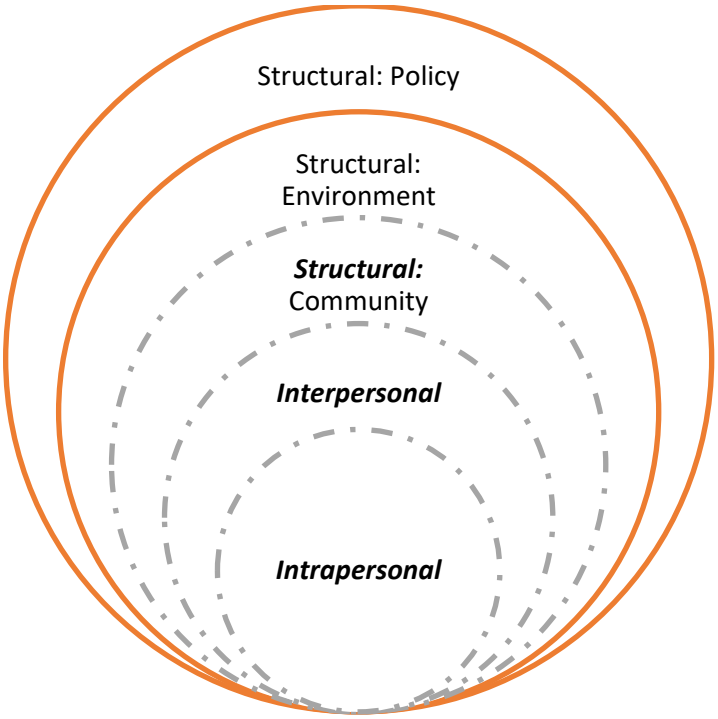

Figure 2.1. The hierarchical model (italics) and the ecological model propose that constraints are layered and exist in isolation.

Examining Interactions

A model which illustrates s the interconnectedness of constraints and their influence on one another is Newell's model of constraints (1986). It was initially designed to examine motor development in children rather than leisure constraints. Figure 1.2 depicts a modified version of Newell's model which encompasses the components of the

hierarchical and ecological models. Newell conceptualized optimal behavior and performance as a product of the interaction between three types of constraints: individual, environmental, and task. Individual constraints include structural factors (e.g. height, weight, and the timing/tempo of maturation) and functional factors (e.g. psychological qualities of resilience, motivation, and personality). Environmental constraints refer to the broader social constructs that affect development, including geographical area, the physical environment, sociocultural environment, policies, and the influence of important actors in persons' lives, such as coaches, family, and friends. Finally, task constraints include the demands of the activity, such as strength, speed, agility, flexibility, or technical ability, as well as the goals, rules, and structure of an activity (e.g. individual vs. team sport). Both the hierarchical and ecological models align with Newell's, and it lends itself well to the study of constraints to SP in adolescents, because constraints in this stage of development are experienced sporadically and fluctuate over time (Robbins et al., 2004). The nature of human motivation and behavior is very difficult to predict, so interventions to attain a desired outcome should be multifaceted. To this end, a theoretical model which examines interactions is necessary because it allows for the consideration of multiple constraints at a time. Also, the degree or the direction of an interaction can provide insight into whether a 'constraint' is truly a barrier, or a promoter of SP.

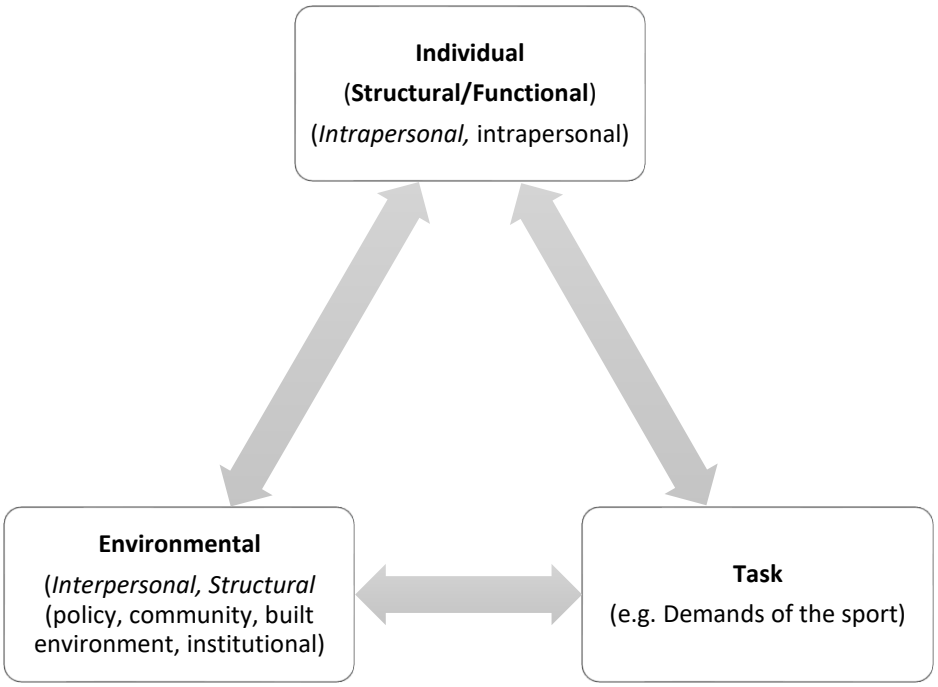

Figure 2.2. Newell's (1986) model of constraints (bolded), modified to include hierarchical and ecological models superimposed. Bidirectional arrows indicate interactions between constraint types. Constraints in *italics* are derived from the hierarchical model, and those in plain text incorporate the ecological model.

Another related framework with potential to be used in the study of constraints for adolescents is the 40 Developmental Assets Profile (DAP) (Scales, 1999). In recognizing that problems faced by adolescents are usually related to each other, the DAP framework proposes that by increasing the power of 40 internal and external "assets", adolescents will experience better outcomes in physical health and school success, as well as engage in fewer risky behaviors such as drinking and violence (Scales 1999). The framework comprises of 20 *internal* and 20 *external* assets which are based on adolescents' positive experiences with their environment and social network and listed in Appendix A. The DAP provides more detail about the types of constraints that occur within the broader constraint categories in Newell's model. This allows for a comprehensive understanding of

constraints to SP which is necessary for policymakers to create effective interventions to target this problem.

Previous studies have resulted in an extensive body of work about single constraints to SP. However, though researchers have called for more comprehensive strategies at examining constraints to SP, interactions among constraints have not yet been examined.

Though not all studies which examine constraints to SP use a theoretical framework, constraints are usually grouped into *internal* and *external* constraints based on either the hierarchical (Crawford et al., 1991) or ecological (Gyurcsic et al., 2006) model of constraints. Most of the studies consulted (69%) in the review did not use a theoretical framework, but those that did sorted constraints into interpersonal (related to the individual) and intrapersonal (external to the individual) constraints. Constraints to SP among adolescent girls are discussed by constraint type.

Environmental Constraints

Based on the integrative review of qualitative and quantitative literature, the most commonly cited constraints to SP for adolescent girls were intrapersonal, which corresponds to environmental constraints in Newell's (1986) model. This literature review yielded 23 environmental constraints to SP for adolescent girls, though some studies included boys in analysis as well. Environmental constraints are related to factors external to an individual, including the physical and built environments, and social support. Constraints obtained from literature that did not use a framework were categorized conceptually into Newell's (1986) model.

Studies which found a *lack of facilities* to be a constraint to SP included both rural and urban areas (Karjalainen et al., 2016; Kubayi et al., 2015), suggesting that the constraint may be subjective to individuals' experience. Deelen and colleagues (2017) noted that the *presence of facilities* may increase SP, but that it is also possible that people who engage in more SP gravitate toward more developed areas in the first place. Few studies exist regarding *accessibility issues* as constraints to SP (Bedell et al., 2013), and persons with disabilities were included in only one study consulted for this literature review which suggests that the voices of adolescent girls with disabilities who require accessibility features to access SP have not been heard in constraint literature. *Residential location* (urban vs. rural) in relation to sport facilities (Harrington et al., 2017; Nichol, 2009) also influences *neighborhood perception* (Nichol, 2009; Harrington et al., 2017), and access to *public transportation* (Loptson et al., 2012) which is relied upon by adolescents who are unable to drive. Aspects of the built environment, including *neighborhood features* such as greenspace (Karjalainen, 2016) and school recreational opportunities (Nichol et al., 2009), also influence participation because adolescents rarely choose where they live or which school they attend. Constraints to SP related to the physical environment including *weather* (Muhajarine et al., 2015) and *air quality* (Loptson et al., 2012) vary between geographical regions, and are of interest for the study of interacting constraints for comparison between areas.

A *lack of family support* was noted to include parents who do not encourage adolescent girls to participate in sport (Eime et al., 2015) as well *as parents who do not engage in SP themselves* (Faulkner et al., 2016; Kubayi et al., 2015; Sukys, 2014). In addition, Eime and colleagues (2015) disclosed that constraints related to family support may be

underrepresented in their longitudinal study because the difficult process of accessing the target population meant an increased likelihood that participants came from families where PA and sport are more highly valued. An increased *number of children in the family* has been found to be associated with lower level of SP for girls (Downward & Rasciute, 2015), likely due to the *social norms* around girls taking on a caregiver role within the household particularly in adolescence (Amusa et al., 2008). *Parental education level* (Heritage Canada, 2013) and *socioeconomic status* (SES) (Heritage Canada, 2013; Harrington et al., 2017) are inversely related to SP among adolescents. SES was considered in general, but this review did not find any work which broke SES down to specific components such as parental employment status or education level, or household income. Though SES may be considered an individual constraint in some literature, it is considered as environmental in this work because adolescents SES is based on that of their parents' or guardians'.

In a similar vein, *social support* (Eime et al., 2015) and *peer influence* (Eime et al., 2016) and a *lack of peer support* (Yungblut et al., 2012) are important environmental constraints for adolescents because of the changing role and influence of family and peers during this time of development. A *lack of friends* with whom to participate in sport (Yungblut et al., 2012) becomes especially salient when social interactions are no longer being orchestrated by parents as they are for younger children, but rather by adolescents themselves. The social climate may also dictate *cultural* constraints to SP, such as the belief that *sport is not important* in society (Kubayi, 2015).

Individual Constraints

Individual constraints were referred to as intrapersonal or internal in literature which used a hierarchical or ecological model, respectively. If no framework was used,

constraints were categorized conceptually into Newell's (1986) model. This literature review yielded 21 individual constraints.

Individual constraints which influence SP among adolescents in general included *perceived wellness* (Heritage Canada, 2013), *presence of chronic illness* or *developmental disability* (Bedell et al., 2013), and *body type* (Tremblay et al., 2005). Though perceived wellness is subjective, it has been shown to be correlated to self-reported measures of overall health (Brewer & Olson, 2015).

There were several constraints in the literature review which related specifically to girls. These were based on deep-seated *gender norms* and *roles* that females typically take on (Robbins et al., 2009). For example, concrete constraints such as feeling comfortable with the *dress code* required to participate in sport (Kubayi, 2015); *self perception* and *body image* (Amusa et al., 2008) and *perceived appearance* (Robbins et al., 2004), which can be associated with being seen as boyish or masculine, or otherwise misaligned with the 'feminine ideal' (Robbins et al., 2009). These gender-based factors could be argued to influence girls' *interest* in sport (Heritage Canada, 2013; Faulkner et al., 2016), their belief that sport is not *fun* (Yungblut et al., 2012) and their lack of *self efficacy* in sport (Robbins et al., 2004). On a positive note, self efficacy in health promoting behaviors among adolescent girls has been shown to be teachable (Chilton et al., 2014), but ultimately, these constraints may play a role in influencing adolescent girls' *perceived competence* in sport (Yungblut et al., 2012; Eime et al., 2015) and *self esteem* in general (Raymore et al., 1994).

Additional constraints cited in the literature review were *motivation* (Robbins et al., 2004), in relation to beliefs about the role of sport in becoming a successful adult or a

strong woman, as well *having time* for SP after *individual responsibilities* (Heritage Canada, 2013; Faulkner et al., 2016). *Lack of energy* (Kubayi, 2015), *'feeling gross'* while engaging in sport (Yungblut et al., 2012) and age (Heritage Canada, 2013) were also found to be constraints to SP.

Task Constraints

The literature review yielded no task constraints, which was expected because task constraints are not considered in either the hierarchical or ecological models. However, one study suggested that *competition* in sport is a constraint which opposes expected feminine ideals (Yungblut et al., 2012) so it was included in this literature review because it aligns with the definition of task constraints proposed by Newell.

The literature review yielded 45 constraints to SP for adolescent girls. The number of environmental and individual constraints were nearly equal (23 and 21, respectively), and there was one task constraint. Constraints were sorted into Newell's (1986) model of constraints. Next steps to mobilize the information generated from this literature review include the creation of an item bank for survey development. To operationalize the constraints, it is necessary to expand some to include their component parts, as discussed previously with respect to SES.

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CHAPTER 3: SURVEY CONSTRUCTION. Development and Validation of a Survey Instrument to Build Capacity for Examining Constraints to Sport Participation

Abstract

Research has shown that girls experience different constraints to sport participation (SP) from those experienced by boys, and that even when constraints are equal, they are perceived differently by girls. Much is known about specific constraints to SP, yet SP among females is lower in every stage of life. Constraints to SP have also been shown to vary across geographical regions due to variability in provision of resources and geographical variations in socioeconomic status (SES). To increase SP in adolescent girls, it is necessary to determine how these constraints to SP interact in varying geographical regions, yet no tool exists for the measurement of this occurrence. The purpose of this study was to develop an empirically informed survey instrument to facilitate the examination of interactions of constraints to SP among adolescent girls, and to verify the survey's validity.

To meet this objective, two theoretical frameworks were combined to facilitate the examination of interactions of constraints to SP. Newell's (1986) model of constraints was used to categorize constraints obtained through a critical review of literature into *environmental*, *individual* and *task* constraints. Then the 40 Developmental Assets Profile (DAP) (Scales 1999) was used as a guide to index the constraints into broader categories within each constraint type.

Forty-five constraints were generated from the literature review, and six additional constraints were added through expert panel review. In total, 51 constraints were sorted

into the combined frameworks. Questions were created to either directly evaluate or triangulate a constraint, and thus an 81-question survey was developed. An expert panel was consulted to review the survey for construct and content validity, and after research ethics board amendments, the survey was approved for dissemination. Minimal changes were made to the survey with the input from the expert panel and community members.

When used in different geographical locations, the survey instrument has the potential to reveal the most salient constraints for that sample, as well as build capacity for research that examines which constraints interact with the location to better inform interventions.

Background

Starting in adolescence, girls participate in sport less than boys (Eime, 2015). There has been substantial interest in uncovering the reasons, known as constraints, for non-participation in sport among girls. This is mainly due to the multitude of benefits accrued though participation in sport, including the positive linear relationship with physical activity level at adulthood (Bélanger et al., 2015; Howie et al., 2016) and the subsequent health benefits. Recent findings also suggest that analysis of constraints to SP at the community level is needed to inform long term planning initiatives to increase SP (Eime et al., 2017). This is because constraints to SP have been shown to vary across geographical regions due to variability in provision of resources (facilities) (Karjalainen et al., 2016; Kubayi, 2015; Deelen et al. 2017), and geographical variations in SES (Eime et al., 2017; Harrington et al., 2017).

Due to the wide-ranging nature of human behavior, quantitative measures of constraints to SP have yielded mixed results, so a qualitative (Tannehill et al., 2015, Yungblut et al., 2012, Allender et al., 2006) or mixed method (Visek et al., 2015) approach has been the preferred method of examining constraints to sport participation (SP). In studies where quantitative methodologies were used, survey instruments are either modified versions of an established measure (Amusa et al., 2008; Vasudevan et al., 2015), or an altogether novel measure (e.g. Alexandris & Carrol, 1997; Raymore et al., 1994; Rodrigues et al., 2017; Siesmaa et al., 2011). In both cases, the measures being used are tailored to a specific population or sport, and lacks generalizability in different settings (Siesmaa et al., 2011). Differences also exist in the types of constraints elicited in quantitative versus qualitative studies. According to Charlton and colleagues (2010),

quantitative methodologies are preferred to ascertain the role of personal circumstances and external factors, while qualitative methods more accurately describe the underlying psychological (individual) constraints. This highlights the importance of incorporating both methodologies to capture the multi dimensional nature of SP.

In addition to the inconsistencies related to the methods and measures used to examine constraints to SP, studies have failed to examine potential interactions between constraints and how these impact SP. To our knowledge, no tool exists for the measurement of this occurrence. Much of the research into constraints uses a hierarchical or ecological framework for classifying constraints (Crawford et al., 1991; Gyurcsik et al., 2006). Specifically, the hierarchical model of leisure constraints developed by Crawford and colleagues (1991) and ecological frameworks based on Bronfenbrenner's (1977) ecology of human development model which have been applied to the study of health behaviors such as SP (Gyurcsik et al., 2006). Though the use of these conceptual frameworks has generated more knowledge about the types of constraints to SP that adolescent girls face, the frameworks do not lend themselves well to the examination of interactions. This is acknowledged in the limitations of many studies, which endorse further investigation into the way constraints affect each other (Alexandris et al., 2002; McArthur, 2014). The acknowledgement that the components of both the hierarchical and ecological models do affect each other is the key step in moving toward a more comprehensive understanding of the tenuous relationship between girls and sport. This study has three main objectives. The first is to review constraints to SP identified in literature for adolescent girls and create a comprehensive list of constraints, thus ensuring construct validity. The second objective is to use a conceptual model derived from

Newell's (1986) model of constraints and the DAP (Scales 1999) to organize the constraints and develop a survey that collects data on constraints to SP. The third objective is to assess the survey's content validity through consensus building.

Conceptual Framework

In previous literature, the hierarchical model of leisure constraints developed by Crawford and colleagues (1991) was used to categorize constraints as intrapersonal (psychological states and attributes), interpersonal (based on interactions with others) or structural (externally imposed constraints). The ecological model elaborated on the structural component by adding institutional, community, public policy, and physical environment constraints. The original ecological development theory suggested that factors affecting development are nested (Bronfenbrenner, 1977), but it did not explicitly take on the position that they interact. Both models imply that although constraints are related, they are separate; thus, interactions are not considered per se. However, due to the complex nature of human motivation and behavior, a nested model is not sufficient in capturing fluctuating constraints. As it pertains to positive youth development (PYD), the creation of interventions to improve outcomes for adolescents often uses a Developmental Systems Theory (DST) approach. The DST is based on the understanding that development happens as a result of interaction between an individual and the context in which they develop (Lerner & Overton, 2008). A tool for measuring interactions of constraints to SP requires a conceptual framework which can facilitate this type of exploration. Though it was developed for the study of motor development in children, Newell's (1986) model of constraints lends itself well to the incorporation of both the hierarchical and ecological models used in the past for categorizing constraints (Figure 3.1). Based on Newell's

definition, a constraint can be reduced or intensified in the presence of other constraints. According to Newell, optimal behavior is the product of the interaction between individual, environmental, and task constraints. Specifically, individual constraints refer to structural or functional factors such as height or motivation. These are factors internal to an individual, usually acquired through genetics and not easily manipulated. Environmental constraints refer to the broader social context which affects development, including geographical area, the physical environment, sociocultural environment, policies, and the influence of important actors in persons' lives, such as coaches, family, and friends. Task constraints refer to the demands of the activity or sport, and include strength, speed, agility, flexibility, or technical ability, as well as the goals, rules, and structure of an activity (e.g. individual vs. team sport). Task constraints are not considered in hierarchical or ecological models, which signifies a gap in the research on constraints to SP. However, both task and environmental constraints constitute the context of an individual's experience and are therefore necessary to include in examination. In this dynamic model, constraints interact to restrict or facilitate an outcome, in this case SP.

In addition to Newell's (1986) model of constraints, the 40 Developmental Assets Profile (DAP) (Scales, 1999) is another useful framework with the potential to aid in classifying constraints to SP. The DAP is an empirically based framework which recognizes that there are many interacting parts to a whole person which cannot be addressed individually to stimulate changed behavior. In recognizing that problems faced by adolescents are usually related to each other, the DAP framework proposes that by increasing the power of 40 internal and external "assets", adolescents will experience better outcomes in physical health and school success, as well as engage in fewer risky

behaviors such as drinking and violence (Scales 1999). The DAP is a holistic framework used in youth development research and interventions (Scales et al., 2017), and as such, is an appropriate complement to Newell's (1986) model in this study. The framework comprises 20 *internal* and 20 *external* assets which are based on adolescents' positive experiences with their environment and social network, as shown in Appendix A.

This study reports the creation and validation of a survey instrument that collects data related to constraints to SP for adolescent girls.

Method

Survey Construction

The first objective was to synthesize evidence by completing a literature review of constraints to SP for adolescent girls. International literature (excluding languages other than English) from 1990 to 2017 which focused on constraints to SP was included. Older studies were included to capture constraints related to social norms which develop over long periods of time and change incrementally. Initial search terms from PubMed and CINAHL databases used to compile a list of constraints for our sample were *sport, sport participation, barrier* or *constraint, Canada* or *Canadian, adolescents* or *teenagers* or *young adults, female* or *girls,* and *trends*. Exclusion criteria consisted of articles which were not peer-reviewed, or those which contained any of *injury, trauma, disorder, illness, mental illness, spine, spinal, vertebral, athlete and male* or *boys* in the title.

The second objective was to categorize the list of constraints. Since Newell's (1986) model has not previously been used to analyze constraints to SP, parallels were drawn between the model and the more commonly used ecological and hierarchical models

as seen in Figure 3.1. For example, constraints defined as 'structural' in the hierarchical model (e.g. accessibility issues, neighborhood features) were paralleled as Environmental in Newell's model, and those defined as 'interpersonal' (e.g. chronic illness, self esteem) were defined as Individual. The remaining constraints generated from the review were sorted conceptually into one of the three categories from Newell's (1986) model. This iterative process began with evaluating each constraint separately to determine if it logically satisfies the requirements of individual or environmental constraints. After sorting the constraint conceptually, the list was reviewed by the expert panel for consensus. The constraints are discussed by type.

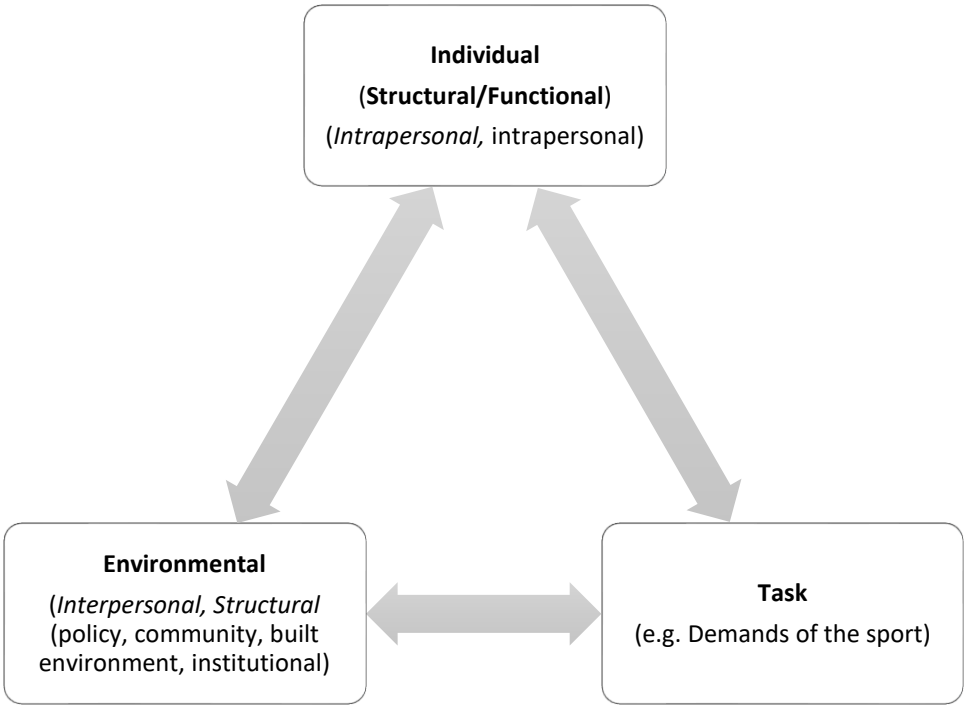

Figure 3.1. Newell's (1986) model of constraints (bolded), modified to include hierarchical and ecological models superimposed. Bidirectional arrows indicate interactions between constraint types. Constraints in *italics* are derived from the hierarchical model, and those in plain text incorporate the ecological model.

Individual Constraints

As outlined in the modified version of Newell's model above, individual constraints included any constraints from the literature which related to a person's structure (e.g. anthropometrics) and function (e.g. personal characteristics related to one's development, one's values, identity). Certain aspects of demographics were also considered as individual constraints, if they pertained directly to the individual, rather than their environment.

Environmental Constraints

Environmental constraints included any constraints from the literature related to factors external to an individual. Based on the modified Newell's model in Figure 3.1, these were categorized in the literature as interpersonal or structural for Hierarchical and Ecological models, respectively. If no framework was used in the studies consulted in the literature review, any constraints external to an individual but not related to the demands of a sport were included in the Environmental category.

Task Constraints

Task constraints which originally appeared in literature that used an ecological framework were recategorized in consultation with experts in Newell's (1986) model as well as sport literature. Additional task constraints were generated using the definition of sport which guided this study (Heritage Canada, 2013).

After constraints were sorted, an item bank was generated in preparation for survey construction. The target population were adolescent girls aged 13-19, therefore readability of the questions and survey was intended to be at Grade 9 or lower reading level.

The third objective was to assess the validity of the survey instrument. The survey was expected to have construct validity because the constraints were generated from peer-reviewed literature, and subsequently content validity was generated through consensus building among a panel of experts. An expert panel was chosen as the method to establish the validity of the survey instrument. A minimum of 5 people is recommended to review an instrument to rule out the possibility of chance agreement (Zamanzadeh, 2015), thus the panel consisted of a convenience sample of 7 individuals. The constraint list and item bank were circulated among three experts in the field of adolescent sport or with experience in the application of Newell's (1986) model of constraints, 2 Ontario Tech University (formerly *University of Ontario Institute of Technology* (UOIT)) Master's students, and 2 community members (youth counselors at GIRLS Inc) prior to seeking school board ethics approval. After the survey was drafted, input was also sought from the Durham Catholic District School Board (DCDSB) throughout their Research Ethics application process. The completed survey was again sent out to the panel, who were asked to respond if they felt that any questions were irrelevant or inessential.

Results

Review and Classification of Constraints

Though a systematic review is outside the scope of this work, a similar approach was used in searching the literature for articles that would be included in the integrative review. Figure 3.2 is a flowchart based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to illustrate the search process (Moher et al., 2009). An integrative review of qualitative and quantitative constraints literature was completed in winter 2017 and included Canadian and international literature from 1990 to

2017. Older studies were included so that constraints related to social norms which develop over long periods of time and change incrementally could be included. Initial search terms from PubMed and CINAHL used to compile a list of constraints for our samples databases were *sport, sport participation, barrier* or *constraint, Canada* or *Canadian, adolescents* or *teenagers* or *young adults, female* or *girls,* and *trends*. The preliminary EBSCOhost search included *sport, adolescent* or *youth* or *teen* or *young adult and women* or *girls* or *female* yielded 4085 articles. However, after excluding the terms *injury, trauma, disorder, illness, mental illness, spine, spinal, vertebral, athlete and male* or *boys,* this was reduced to 165, and with the addition of barriers or constraints 8 articles remained. Due to the limited volume of articles, a search of grey literature included reviewing the reference lists of these articles to capture constraints which may not have been significant in the research article but were considered during their respective literature reviews. Twenty studies were consulted to generate a list of 51 constraints to SP among adolescent girls (Table 3.1). Of these, 6 (30%) had used either an ecological or hierarchical model to categorize constraints. The prominence of individual and environmental constraints is consistent with current literature which often uses an ecological framework for examining constraints

(Gyurcsik et al., 2006).

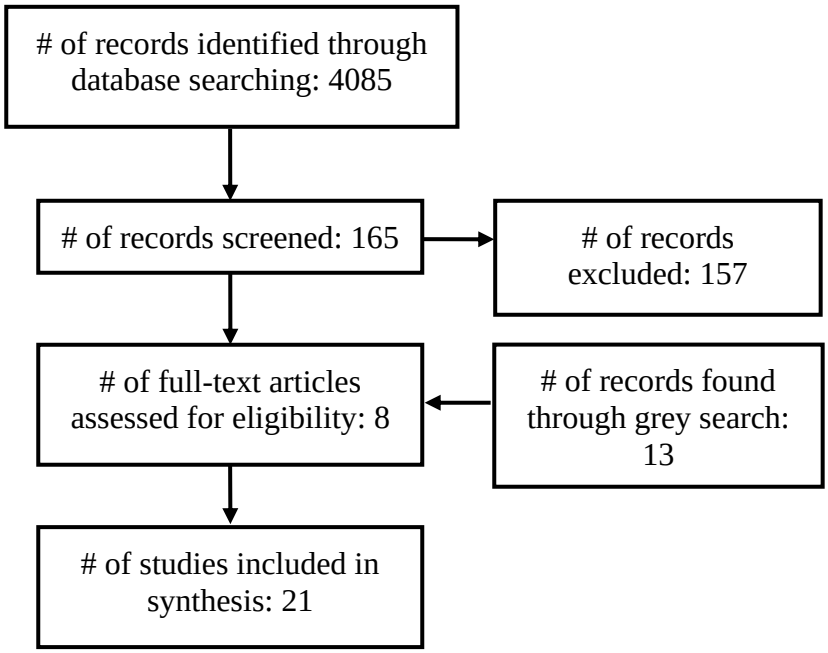

Figure 3.2. Flowchart of selection process for articles on constraints to SP among adolescent girls.

To meet the second objective, the constraint list was sorted into 25 individual constraints, 22 environmental and 4 task constraints. Table 3.1 shows the final breakdown of constraints. Of the 51 constraints, 12 (24%) had been reported in two or more studies. The concept of task constraints was not considered in any literature which used a hierarchical or ecological model of constraints. Only one task constraint appeared in the literature review (*competitiveness*), and it was contrasted with the opposite (*recreational*), though this was not a focus of that study (Yungblut et al., 2012). Additional task constraints were added in consultation with the expert panel. Specifically, 'goals of the sport' was further broken down to include *recreational sport*, *strict rules*, and *contact sport*, and physical strength was included as both an individual constraint, as well as a task

constraint worded as *physically intense sport.* Finally, *games of long duration* was added for a total of 7 task constraints. Due to a shortage of previous examination, the task constraints were not validated previously. Thus, construct validity was established with input from the experts.

Table 3.1.
Constraints from literature review and expert panel sorted by type.

Constraint	Model	Defined as	Newell's (1986)
Accessibility issues[1]	E	Structural	Environmental
Poor air quality[2]	None	-	Environmental
Lack of facilities[3,4,5]	E/ None	Struct: Phys Env	Environmental
Lack of family support[2,4,6]	E/ None	Interpersonal	Environmental
Lack of friends[7]	None	-	Environmental
Lack of opportunity[4]	None	-	Environmental
Lack of peer support[7]	None	-	Environmental
Neighborhood features[3,8]	E/None	Struct: Phys Env	Environmental
Low Parental education level[9]	None	-	Environmental
Peer influence[10]	E	Intrapersonal	Environmental
Small population size[11]	H	Structural	Environmental
Presence of children in the family[12]	None	-	Environmental
Presence of facilities/opportunity[2,3,13]	E/None	Struct: Phys Env	Environmental
Residential location[2,8,11]	None/H	Structural	Environmental
Lower socioeconomic status[9,11]	None/H	Structural	Environmental
Social norms[14]	None	-	Environmental
Social support[6]	E	Interpersonal	Environmental
Lack of transportation[2]	None	-	Environmental
Weather[15]	None	-	Environmental
Sport is not important[4]	None	-	Environmental
High family commitment[4,16,17]	None	-	Environmental
Neighborhood perceptions[8,11]	None	-	Environmental
Not in my culture[4]	None	-	Environmental
Poor body image[14]	None	-	Individual
Body type[18]	None	-	Individual
Presence of chronic illness/physical impairment[1]	E	Interpersonal	Individual
Date of birth[9]	None	-	Individual
Presence of developmental disability[1]	E	Interpersonal	Individual

Gender norms[19]	None	-	Individual
Gender role[19]	None	-	Individual
I feel "gross" when I engage in sport[7]	None	-	Individual
Having many individual responsibilities[17,20]	None	-	Individual
No interest in sport[9,17]	None	-	Individual
Lack of energy[4]	None	-	Individual
Lack of motivation[20]	None	-	Individual
Lack of time[9,20]	None	-	Individual
No interest[9]	None	-	Individual
Not fun[7]	None	-	Individual
Low perceived competence[6,7]	None/E	Intrapersonal	Individual
Low perceived wellness[9]	None	-	Individual
Perceived appearance[20]	None	-	Individual
Low self esteem[21]	H	Interpersonal	Individual
Low self-efficacy[20]	None	-	Individual
Self-perception[14]	None	-	Individual
Competitiveness[7]	None	-	Task
Dress code[4]	None	-	Individual
Strength[22]			Individual
Type of sport[22]			Individual
Goals of Sport[22]			Task
Agility[22]			Task
Perseverance[22]			Task

E = Environmental; H= Hierarchical; [1]Bedell et al., 2013; [2]Loptson et al., 2012; [3]Karjalainen, 2016; [4]Kubayi, 2015; [5]Deelen et al., 2017; [6]Eime et al., 2015; [7]Yungblut et al., 2012; [8]Nichol, 2009; [9]Heritage Canada, 2013; [10]Eime et al, 2016; [11]Harrington et al., 2017; [12]Downward & Rasciute, 2015; [13]Fuller; [14]Amusa; [15]Muhajarine; [16]Sukys; [17]Faulkner; [18]Tremblay; [19]Robbins, 2009; [20]Robbins, 2004; [21]Raymore et al., ;[22]Expert Panel

Survey Instrument

Survey questions were written to capture each constraint listed in Table 2.1. Some constraints required multiple questions to accurately reflect broader concepts. For example, to capture the individual constraint of *socioeconomic status*, there were five questions related to parental income and education level as well as postal code. The survey was comprised of 81 items, each corresponding wholly or in part to one constraint identified in the literature review. The survey was created using Google Forms, which has secure data storage capabilities. The survey was made up of three sections which contained the

dependant variables. Table 3.2 shows the list of questions with corresponding constraint and type. The first section of survey items gathered demographic information including postal codes, age, family income, ethnicity, health status (perceived as well as objective). The second section was a combination of multiple choice or Likert-type items asking about specific individual and task constraints. Options for non-response were also given for most questions, as research has shown that this can reduce the ambiguity of a neutral response (Chyung et al., 2017; Kulas & Stachowski, 2008). Due to the length of the survey, and to facilitate reliability analysis, Likert scale was used to enhance the flow of completion. This included beliefs about SP with respect to gender norms, peer values as well as likelihood of participation in sports based on conditions inherent to sports (e.g. competitive, contact sports, co-ed). The third section was comprised of environmental constraint questions, phrased to allow respondents to report their likelihood of participation in sport in certain conditions, and their perceptions of their own neighborhoods. For example, "There are safe places close to my home where I can participate in or practice sport". The outcome variable of *regular SP* was set on a 5-point Likert scale from Strongly Agree to Strongly Disagree. The final section allowed respondents the opportunity to enter their name and contact information in for potential recruitment in follow-up qualitative research.

Table 3.2
Survey questions with corresponding constraint and constraint type.

Survey Question	Constraint	Constraint Type
1. Consent		
2. How did you hear about this study?		
3. Please enter the first three letters of your postal code (example: A1A)	SES, Population size	Environmental
4. What most accurately describes your ethnic background?	Ethnicity	Individual
5. In what year were you born?	Date of birth	Individual
6. In what country were you born?	Immigrant status	Individual

7. If you were NOT born in Canada, in which year did you immigrate to Canada? (Leave blank if you were born in Canada)	Immigrant status	Individual
8. If one or both of your parents were not born in Canada, in which year did they immigrate to Canada?	Immigrant status of Parents	Environmental
9. Including yourself, how many children under the age of 18 live at your home?	Presence of children in the family	Environmental
10. Of those, how many children are under the age of 5?	Presence of children in the family	Environmental
11. What is your birth order?		Individual
12. Have you been diagnosed with any of the following chronic conditions?	Perceived Wellness: presence of illness/impairment/developmental disability	Individual
13. Has anybody in your immediate family been diagnosed with any of the following chronic conditions?	Perceived Wellness: family history of illness/impairment/developmental disability	Environmental
14. I use an assistive device/mobility aid regularly	Perceived Wellness	Individual
15. If you answered "yes", does the assistive device/mobility aid prevent you from accessing sport facilities or participating in sport?	Perceived Wellness	Individual
16. What is your approximate weight? (in pounds)	Body Type	Individual
17. What is your approximate height? (in feet/inches e.g. 5'7")	Body Type	Individual
18. How would you describe your body type?	Body Type, Body Image	Individual
19. How satisfied are you with your body type?	Body Type, Perceived appearance	Individual
20. How would you describe your overall health?	Perceived Wellness	Individual
21. What is your family's annual household income?	SES	Environmental
22. What is your mother's/primary guardian's highest level of education?	Parental education level	Environmental
23. What is your father's/guardian's highest level of education?	Parental education level	Environmental
24. Are you currently employed? If so, how many hours per week do you work?	Individual responsibilities	Individual
25. Do you have daily responsibilities apart from school work? Select all that apply.	Individual responsibilities	Individual
26. On average, how many hours per week do you spend on these responsibilities?	Individual responsibilities	Individual
27. I enjoy sports.	Interest	Individual
28. I participate in sport regularly (three times a week or more)	OUTCOME VARIABLE	
29. I have friends who I can participate in sports with.	Lack of friends	Environmental
30. My friends encourage me to participate in sports.	Lack of peer support	Environmental
31. Having friends to participate with makes me more willing to participate.	Peer influence	Environmental
32. I am good at the sports I enjoy.	Perceived competence	Environmental
33. I have had the opportunity to try different sports at school.	Lack of opportunity, presence of facility/opportunity	Environmental
34. I have had the opportunity to try different sports on my own time, outside of school.	Lack of opportunity, presence of facility/opportunity	Environmental
35. Members of my family participate in sport regularly.	Family commitment	Environmental

36. My family supports my participation in sports.	Lack of family support	Environmental
*37. If you answered 1 or 2, please state the most common reason for why your family does not support you participating in sport. *used for qualitative analysis.*	Lack of family support	Environmental
38. In my culture, it is expected that girls participate in sports.	Not in my culture	Environmental
39. I feel confident when I participate in sports.	Self esteem, self efficacy	Individual
40. I believe that participating in sports will make me a healthy adult.	Social norms, social support	Individual
41. I believe that participating in sport is fun.	Not fun	Individual
42. I believe that participating in sport is important.	Sport is not important	Individual
43. I have energy to participate in sports.	Lack of energy	Individual
44. I have time to participate in sports.	Lack of time	Individual
45. I feel comfortable with the dress code of my preferred sport.	Dress code	Individual
46. My family/I can afford to participate in the sports of my choosing.	SES (Financial)	Environmental
47. Girls should participate in sports.	Social norms	Environmental
48. There are certain sports in which girls should NOT participate.	Social norms	Environmental
*49. If you answered 4 or 5 in the previous question, please list the sports in which girls should NOT participate. *used for qualitative analysis.*		Individual
50. Sport makes me feel positive.	Self esteem	Individual
51. I feel gross when I participate in sports.	Feel gross	Individual
52. I strive to excel in the sports that I play.	Perseverance, Motivation	Individual
53. Sport helps girls develop into strong women.	Social norms	Environmental
54. Participating in sport is viewed as important in society.	Social norms, sport is important	Environmental
55. Most people I know agree that SP is important.	Sport is important	Environmental
56. Participating in sports will help me be successful in other avenues of life.	Personal goals	Individual
57. When something slows down or prevents my participation in sport, I always try my best to resolve the issue.	Perseverance	Individual
58. Which sports do you participate in?	Type of sport	Individual
59. Which sports would you participate in if you could?	Type of sport	Individual
60. Which sports (if any) would you have NO INTEREST in participating in?	Interest in sport, Type of sport	Individual
62. Have you ever had a negative experience while practicing sport which caused you to stop practicing that sport?	Interest in sport	Individual
63. Please rate the degree to which these characteristics describe you.		Individual
Assertive		Individual
Physically Strong	Strength	Individual
Shy		Individual
Flexible / Agile	Agility	Individual
Energetic	Have energy/endurance	Individual
Studious		Individual
Creative		Individual
Careful		Individual
High Speed	Physical speed	Individual
64. Please rate how likely you are to participate in a sport which is/has/requires:		

Highly competitive	Competition/Recreational	Task
Recreational	Competition/Recreational	Task
Physically intense	Intensity of sport	Task
Strict Rules	Rules, Type of sport	Task
Boys and Girls On Same Team	Co-ed	Task
Contact With Other Players	Contact sport, Type of sport	Task
Games of long duration	Long games, Type of sport	Task
65. My neighborhood is safe.	Neighborhood perception	Environmental
66. The outdoor air quality in my neighborhood prevents me from participating in outdoor sport.	Air quality	Environmental
67. I am proud of where I live.	Neighborhood perception (pride)	Environmental
68. There is a lot of green space (eg. parks, paths, fields) in my neighborhood.	Neighborhood features	Environmental
69. The sidewalks and walking paths in my neighborhood are safe.	Neighborhood features	Environmental
70. The weather in my geographical area allows me to participate in my chosen sport when I want to.	Weather	Environmental
71. The weather in my geographical area prevents me from participating in my chosen sport when I want to.	Weather	Environmental
72. Please rate how the following weather conditions negatively affect your participation in your preferred sports.		Environmental
Cold temperature	Weather	Environmental
Hot temperature	Weather	Environmental
Humidity	Weather	Environmental
Rain	Weather	Environmental
Snow	Weather	Environmental
73. I have options for where to participate when weather conditions change (eg. indoor running track/soccer pitch)	Lack of facilities	Environmental
74. There is safe public transportation available for me to access sport opportunities.	Transportation	Environmental
75. There are safe places close to my home where I can participate in or practice sport.	Lack of facilities	Environmental
76. The sport facilities close to my home offer sports and activities that I want to participate in.	Lack of opportunity	Environmental
77. What mode of transportation do you most often use to access the sport of your choice?	Transportation	Environmental
78. Please enter the amount of time in minutes that it takes you to get to your sport/activity of choice.	Transportation	Environmental
79. The sport facilities close to my home are clean.	Lack of facility	Environmental
80. The sport facilities close to my home are accessible.	Lack of facility, Accessibility issues	Environmental
81. The sport facilities close to my home are not over-crowded	Lack of facility	Environmental

Operationalizing SP as an outcome was based on available data from Statistics Canada which indicates actual total SP. SP is often included as part of PA in Canadian literature and as such, the target of the Canadian Physical Activity Guidelines is total PA,

which includes sport and recreation that is of moderate to vigorous intensity (Sharratt & Hearst, 2007). Therefore, the outcome variable of SP was based on Clark (2008), which used General Social Survey (GSS) data to show that Canadian adolescent girls participate in sport approximately 2.7 times per week. It was worded as "I participate in sport regularly (3 times a week or more)".

Upon completion of the item bank, readability levels were calculated electronically (www.readabilityformulas.com/free-readability-formula-tests.php). The readability of the items and survey instructions was found to be at the Grade 6 level (readers aged 10-11 years) which was appropriate for the intended population and would not exclude potential participants who were below the reading level for their age.

Validity Measures

Having been generated from peer-reviewed literature, the constraints used for the construction of this survey were found to have *construct validity*. In addition, *content validity* was determined by the expert panel through consensus building. This qualitative method of validating content validity has been used previously in similar scenarios where time and resources are limited (Presser et al., 2004). Also, it has been shown that engaging stakeholders in contributing to the development of research materials can increase validity (Jacquez et al., 2013). The expert panel and contributors made minor revisions within each category of constraints but agreed that the questions were sufficiently clear and relevant. Changes were made to two questions to reflect the needs of our sample with respect to verbiage and confidentiality, and one change was made for clarity. The wording of the response categories to the question "How would you describe your body type" included *overweight, slightly overweight, just right, slightly underweight, underweight,* and *I don't*

know. The 'neutral' category was changed to "*average"* with input from one of the leaders at GIRLS Inc, who indicated that the organization does not endorse a "correct" body type and that the phrase "*just right*" was incongruent with their values. The second change related to limiting the postal code to the first three letters (Forward Sortation Area (FSA)). This change still allows objective measures related to proximity to facilities and access to transportation and walking paths. This is relevant because research has shown that the availability of facilities to practice sport is a constraint to participation for some adolescents (Karjalainen et al., 2016; Fuller et al., 2011; Loptson et al., 2012). Finally, one question pertaining to the task constraint of *perseverance* was reworded for clarity and to reflect the purpose of the study at the suggestion of two experts. The original statement of *I always do my best in sport* was changed to *When something slows down or prevents my participation in sport, I do my best to resolve the issue* to the satisfaction of the entire panel. In addition to these three specific changes, the DCDSB requested that questions that require a response have a non-response option made available, thus *I don't know,* and *Not Applicable* options were added to all questions as appropriate. Universal agreement with the final survey among the panelists resulted in the decision that the survey instrument had sufficient content validity to be used for the study. The final iteration of the survey, as delivered to the participants via Google Forms is shown in Appendix B.

Discussion

This work sought to create a new survey instrument to facilitate the examination of interactions of constraints to SP, and to verify the survey's validity. A critical review of the literature about constraints to SP for adolescent girls yielded 51 constraints, which were categorized using Newell's (1986) model of constraints, and further indexed using the

DAP framework (Scales 1999) as a guide. Questions were created to either directly evaluate or triangulate a constraint, and thus 81 questions were developed. Due to the large quantity of variables, and because many were related to personal beliefs rather than concrete information most questions were given in a Likert scale format. After an expert panel review and research ethics board amendments, the survey was approved for dissemination. Minimal changes were made with the input from the expert panel and community members. This study demonstrated the construct and content validity of the survey.

This work has contributed a new survey instrument to the literature on constraints to SP. The instrument is the first to facilitate the evaluation of the multifaceted relationship between constraints, which is a major strength of this study. Individual and environmental constraints which appear most commonly in the literature on constraints to SP were given equal weight which was reflected in the quantity of items of each type. Task constraints, which do not typically appear in literature on constraints to SP were also included. When used in different geographical locations, the survey instrument may reveal the most salient constraints for that sample and elucidate which constraints interact with it. In addition, it has the potential to inform future interventions to increase SP at the community level. In addition, trends may emerge on a larger scale if these community level findings are compared.

A key recommendation for future implementation, based on insights gained from the development stage, is a larger sample size. The findings from this work advocate for larger sample size to allow for factor analysis and eventually effect sizes. It was not possible to carry out test-retest reliability measures due to a lack of access to the sample

and confidentiality issues around working with participants below the age of majority. The response rate was approximately 39% which may indicate a biased sample (Alexandris & Carroll, 1997), but the recruitment strategy was judged to be the most efficient way to access the sample. Robbins et al. (2004) suggest that older adolescents may lack interest in participating in this type of research because of an already declining interest in PA. This has been substantiated in more recent work as well, as *lack of interest* is a common theme in adolescent girls' approach to SP (Charlton et al., 2010; Faulkner et al., 2016; Heritage Canada, 2013).

To increase response rate, the survey may be shortened from its original 20-25minute completion time to a slightly shorter 10-20 minutes as suggested in previous literature (Revilla & Ochoa, 2017). Also, the survey could be delivered cyclically, at different semesters and with more advanced preparation. This may increase compliance among educators who are the gatekeepers to the participant pool, and who often have curriculum material to deliver which is planned well in advance. Adding questions to clarify frequency, intensity and times of year that SP is taking place can also aid in delineating between sport and physical activity, as has been suggested in recent work by Allison and colleagues (2017) as a way of increasing the quality of SP data to better inform future interventions.

Future Directions

Though much knowledge exists on the topic of specific constraints to SP for this population, there is a need for this knowledge to be mobilized into practice so that adolescent girls can reap the benefits of SP. The development of a measurement tool to

assess interactions between constraints to SP among adolescent girls is a key step in addressing these constraints. It is necessary to administer this tool again using a larger sample to establish test-retest reliability, reduce the possibility of Type I error, and to refine some of the items to elicit more responses. A larger sample size can also facilitate factor analysis. Overall this tool demonstrated good construct and content validity based on expert panel review. With some changes as outlined above, it can be successfully administered to a larger sample of adolescent girls between the ages of 13-19 to assess interactions among constraints to SP.

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CHAPTER 4: SURVEY PILOT.

Abstract

Across all age groups, girls participate in sport less frequently than boys. This difference becomes most pronounced during adolescence. A thorough understanding of constraints to SP and how these interact to facilitate or restrict participation is a key step in addressing the problem of low SP among adolescent girls. This study is an exploratory pilot of a previously developed survey which collected information on constraints to SP for adolescent girls. The main outcome measures were refining recruitment, identifying issues with administration, and exploring analytical techniques to examine interactions of constraints to SP. Participants were recruited using convenience sampling from three high schools and one community organization. An 81-item survey developed previously by this research team was piloted online using Google Forms. Participants (n=97) were generally healthy adolescent girls living in and attending high school in Durham Region. The response rate was 39%, which suggests a need for a more direct recruitment strategy. Overall the online format was preferred as none of the participants chose hard copy, but the length of the survey may have contributed to lower levels of interest from teachers who delivered it in class. Pilot results suggest that weather and the physical environment are main constraints to SP for girl adolescents, though no interactions were found among this sample. Recommendations for larger scale implementation include increasing sample size, and sampling from a wider range of geographical regions (e.g. rural, more densely populated).

Introduction

Evidence suggests that beginning in adolescence, sport participation (SP) decreases for both boys and girls (Fuller et al., 2011; Karjalainen, 2016; Spurr 2016). However, participation in sports among girls decreases markedly in comparison to their male cohorts (Eime, 2015). Some studies suggest that among adolescent girls, SP is replaced by non-sport physical activities (PA) as they reach adulthood (Eime, 2016) and that although adolescent girls participate in sport less than their male counterparts, they participate in more non-sport PA than boys (Eime, 2016; Guevremont, 2016). However, even in instances where there is equal opportunity for both sexes to participate, females perceive more constraints to SP than males (Casper et al., 2011; Dias et al., 2015) which contributes to lower levels of SP.

The definition of sport can vary within the academic and sport communities, and the definition used in this work is the definition established by Sport Canada (Heritage Canada, 2013) which states that sport is "an activity that involves two or more participants engaged for the purpose of competition… involves formal rules and procedures, requires tactics and strategies, specialized neuromuscular skills, and a high degree of difficulty and effort."

The conventional method of examining factors affecting SP is barrier or constraint analysis. The terms "barrier" or "constraint" as pertaining to PA participation and SP are used interchangeably in the literature. The nature of constraints is that they can be negotiated (Jackson et al. 1993), thus we have used the term "constraints" to develop the objectives for this work. Previous research on barriers to SP suggests that in the face of a barrier, the result is non-participation (Jackson et al., 1993). This oversimplifies constraint

negotiation, as it implies that removing a discrete barrier will result in resumption of participation. We know this is not necessarily true, due primarily to the complexity and interaction of constraint factors.

Although focusing on constraints to participation has been the standard method of determining why adolescent girls do not participate in sport, it comes with two main limitations. First; the outcome of most research seeks single causality for non-participation. For example, Liu et al. (2014) suggest that a lack of interest is one of the main constraints to SP, which is different from previous findings in which access to opportunities was the main constraint (Bailey et al., 2005). Studies vary greatly with respect to which constraints appear to have the greatest impact on SP. For example, research examining environmental constraints such as school intramural sport availability (Fuller et al., 2011, Nichol et al., 2009), the built environment (Karjalainen, 2016) and weather patterns (Muhajarine, 2015) all demonstrate how certain aspects of the environment can prevent or facilitate participation among adolescents. Similarly, research which emphasizes the importance of family support (Spurr, 2016; Sukys, 2014) and individual factors such as lack of friends to participate with, the belief that sport is not fun (Yungblut et al., 2012), and dress code required for the sport (Kubayi, 2015) have provided a wealth of information on discrete constraints. Constraints to SP are abundant and vary greatly, and most research alludes to the complex nature of constraint negotiation as a topic for further investigation (Smith et al., 2012). To our knowledge, there are no studies which examine how the presence of one constraint to SP interacts with the presence of another.

The second gap in literature on constraints to SP is the inconsistency of frameworks being used to classify constraints. It is important to consider the type of frameworks used

in the literature to gain a deeper understanding of how non-participation has been studied, in order to inform the current work. Chapter 3 of this thesis outlines the two commonly used models in examining constraints to SP; which are the hierarchical (Crawford et al., 1991) and ecological (Gyurcsic et al., 2006) models. The nested nature of these models suggests that each layer is part of a whole. It assumes that constraints in each category are separate, which has led to the understanding that in the presence of a single 'main' constraint, the result is non-participation. It follows that by removing the 'main' constraint, the outcome will change to participation. The use of both models has promoted the channeling of funds into specific interventions based on the most salient constraint by way of government grants (Ramanathan et al., 2018). However, much of the research on barriers to SP does not use a framework at all, which makes it difficult to conceptualize the findings in a practical setting or broader context. For example, in generating a comprehensive list of constraints to SP among adolescent girls in the literature Klicnik and colleagues (under review) found that approximately 31% of studies examining constraints to SP used a framework to classify them.

Though these models successfully aid in classification, they do not account for how constraints in one category interact with constraints in another category. For example, a lack of interest (individual constraint) could interact with a lack of attractive facilities in one's neighborhood (environmental constraint), or a lack of family support due to parental non-participation (environmental constraint) to influence SP. However, to our knowledge, no studies to date have examined interactions of constraints, and a gap in the knowledge exists because intuitively the different layers do affect one another. According to McArthur et al. (2014), relationships exist between factors that ultimately result in an increase,

maintenance, or decline in levels of participation. It is these relationships which we are calling “interactions between constraints”. In addition, even in instances of equal access to SP opportunities, girls continue to participate less than boys (Liu et al., 2014). An interaction could be occurring which is affecting participation in two different samples even though access to opportunity is constant. In the case of participation level differences between boys and girls, a potential interaction could be due to gender norms with which children are socialized toward SP. This is a common theme in qualitative exploration of SP among adolescent girls, with the finding that girls who participate in sport will be seen as ‘boyish’ or not feminine (Robbins et al., 2009). When constraints are viewed as occurring in isolation, the effect of initiatives which seek to ameliorate constraints will be diminished because of potential interactions which differ between samples.

Examining interactions between constraints to participation can address the gap in knowledge about the complex nature of SP. A dynamic model of constraints is needed to account for the interactions between constraints, rather than simply classifying them as has been done in previous work. This study uses a combined model consisting of Newell’s (1986) model of constraints and the 40 Developmental Assets Profile (DAP) (Scales 1999) to examine constraints to SP among adolescent girls. Newell conceptualized optimal behavior and performance as a product of the interaction between three types of constraints: individual, environmental, and task. Individual constraints include structural factors (e.g. height, weight, and the timing/tempo of maturation) and functional factors (e.g. psychological qualities of resilience, motivation, and personality). Environmental constraints refer to the broader social constructs that affect development, including geographical area, the physical environment, sociocultural environment, policies, and the

influence of important actors in persons' lives, such as coaches, family, and friends. Finally, task constraints include the demands of the activity, such as strength, speed, agility, flexibility, or technical ability, as well as the goals, rules, and structure of an activity (e.g. individual vs. team sport). Both the hierarchical and ecological models align with Newell's model as shown in Figure 4.1. The definition of sport being used in this study lends itself especially well to the analysis of task constraints, as it emphasizes competition, formal rules and strategy. Importantly, these three constraints can influence outcomes, namely SP. Though it was originally developed to examine motor development in children, Newell's model has been used in previous research to examine relative age effects (RAEs) in sport talent identification and development (Wattie et al., 2015) and has been found to be a useful framework for organizing knowledge in the area of visual performance with respect to sport (Rienhoff et al., 2016).

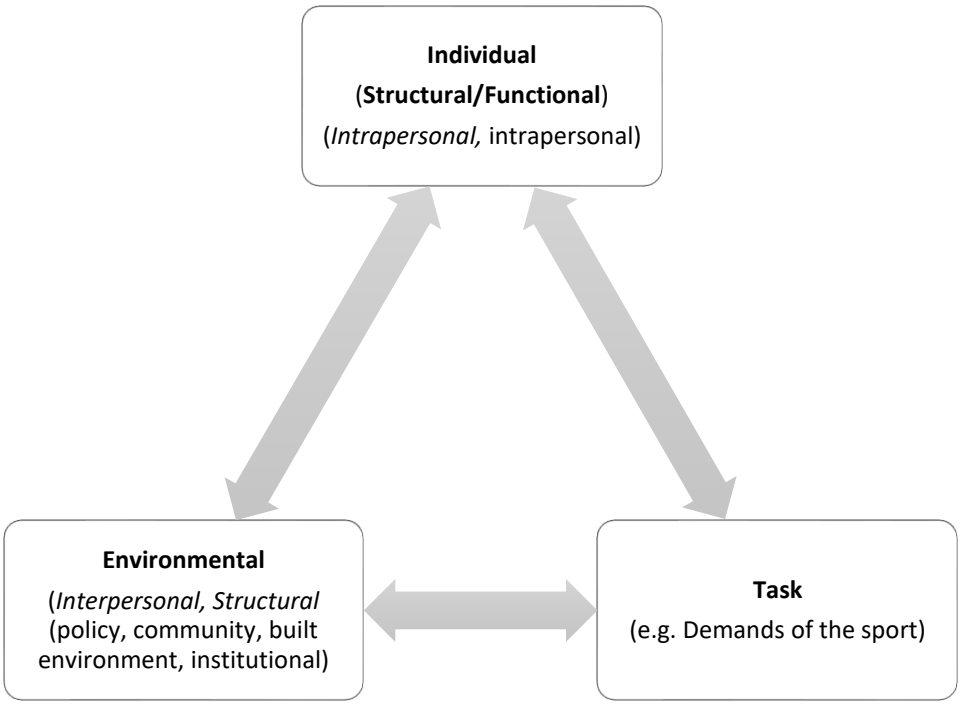

Figure 4.1: Newell's model (bolded) with the hierarchical (italics) and ecological models superimposed. Bidirectional arrows indicate interactions between constraint types

The DAP framework was developed as an empirically based complement to the risk and protective factor ideology. Though both approaches are rooted in the same empirical evidence, the DAP framework emphasizes the applied implications of increasing assets rather than strictly on the theory. Much like Newell's model, this framework is based on the idea that there are many interacting parts to a whole person which cannot be addressed individually to stimulate changed behavior. Furthermore, the DAP has been shown to be adaptable across cultural settings (Scales, 2011), which is an important factor in implementing this pilot study on a larger scale. The DAP is made up of *Internal* and *External* assets. *Internal* assets are individual qualities which guide decision making and affect adolescents' confidence and self efficacy. There are 20 *internal* assets in four categories which include *commitment to learning*, *positive values*, *social competencies* and

positive identity. External assets are based on relationships and interactions with the society and environment in which one lives. There are likewise 20 *External* assets in four categories which include *support*, *empowerment*, *boundaries and expectations*, and *constructive use of time*. The combined model is shown in Figure 4.2. Variables included in each index are listed in Table 4.1.

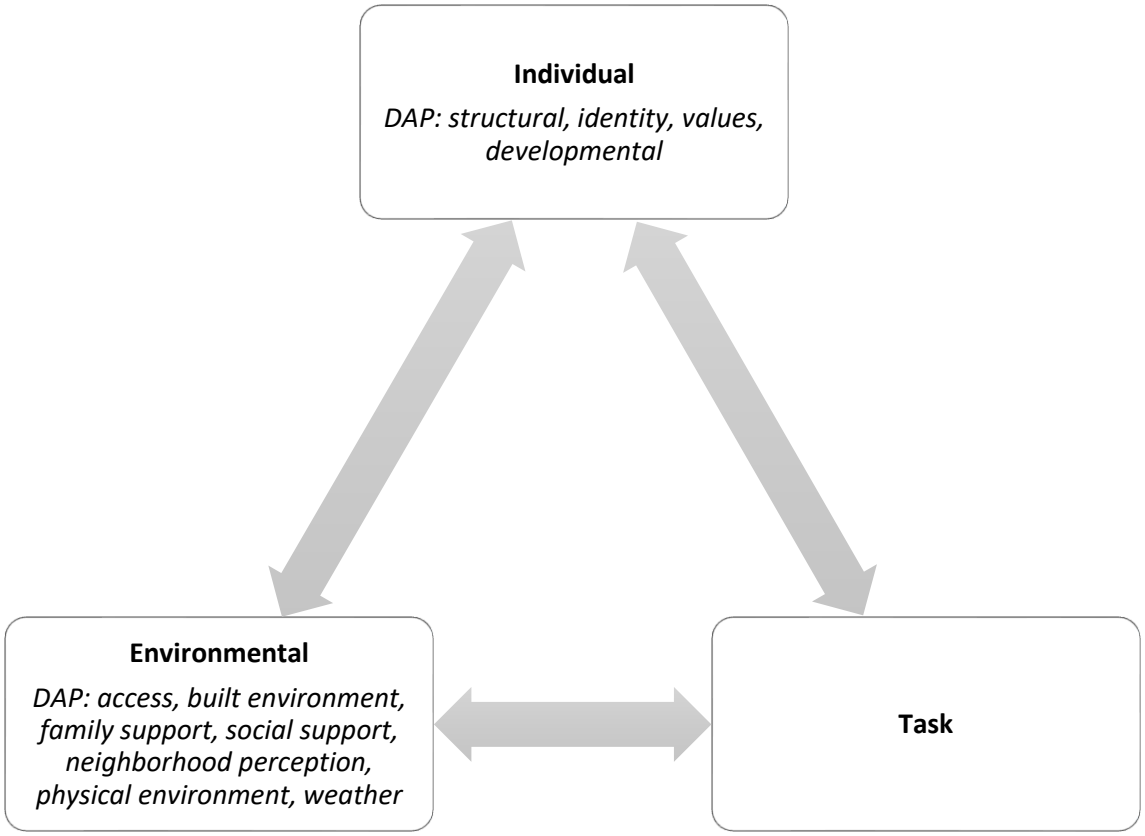

Figure 4.2. Newell's (1986) model of constraints (bolded) with indices based on the DAP (Scales, 1999) (italics).

Recruitment is an important consideration when examining the experiences and preferences of adolescents. Research has shown that accessing this subpopulation can be challenging when seeking participants for studies of a sensitive nature (e.g. sexuality, tobacco/drug use). Recently, recruitment via social media has gained attention as a

potentially effective strategy to access an adolescent sample (Jones et al., 2012; Whitaker et al., 2017). However, over-representation of young white women has been noted in a systematic review of this strategy by Whitaker and colleagues (2017). Recruitment of adolescents is regulated by the Tri-Council Policy Statement 2 (TCPS2) (Canadian Tri-Council, 2018). Per the TCPS2, involvement of individuals below the age of 18 in research studied requires informed consent from a parent or guardian. Special accommodations can be made to this proviso if a research study is deemed to be 'low risk' in which case participants as young as 16 years are able to provide informed consent independently.

Web-based surveys have been shown to be an economical option which may result in higher completeness of data and reduced response time (Schleyer et al., 2000; Sebo et al., 2017) and encourage participants to respond more honestly than in the presence of a researcher (Timon et al., 2017), paper surveys (mail or in person) often result in higher response rates (Schleyer et al., 2000; Link & Burks, 2013). Therefore, it is necessary to include both options to optimize response rate.

The current research is an exploratory pilot study that aims to administer a data collection tool developed previously by this research team on a sample of adolescent girls from Durham Region, Ontario. The survey is designed to gather information on individual, environmental and task constraints to SP for the purpose of examining interactions of constraints. The first objective is to refine a sampling and recruitment strategy to best access the sample. The second objective is to identify any issues related to the administration of this online survey. The third objective is to explore and refine the analytical techniques to analyze interactions between constraints that emerge as most

relevant to lay the groundwork for a larger scale project on adolescent girls in other regions of Ontario, Canada.

Design and Method

Study Design

This exploratory pilot study used an online survey instrument developed previously by this research team to collect data on constraints to SP among adolescent girls and analyze the data for interactions among constraints using Statistical Package for Social Sciences (SPSS) 25. The survey and all methods were approved by the University of Ontario Institute of Technology Research Ethics Board (UOIT REB) in January 2017.

Participants

Adolescent girls aged 13-19 who attend high school in the Durham Region were included in recruitment. Though 19 is considered age of majority in Ontario, it was included because it is possible that some students in upper years would have turned 19 before the survey was administered.

Survey

We used the survey developed in the previous chapter to assess constraints to SP for this sample. The survey was comprised of 81 questions, in three sections. Initially, participants were given a description of the study's purpose with the research team's contact information, followed by a statement of assent. Responding in the affirmative to the assent statement allowed respondents to carry on to the survey, while responding in the negative terminated access to the survey. The first section of the survey sought demographic information which was also used to ascertain the socioeconomic status

(SES)of respondents, and other general questions that would later be recategorized into either individual or environmental constraints. In the final section participants were given the opportunity to enter a prize draw, and to be considered for focus group participation later.

To manage the large quantity of variables, constraints were indexed based on the 40 Developmental Assets framework (Scales, 1999) with additions to further classify constraints that did not fit the framework. Higher order categories were used to create the indices as described below.

The iterative process of establishing each index required that variables of the same type (e.g. Likert scale) were grouped together to be added. Categorical variables were not included in indices unless the constraint fit in with the DAP framework. For example, *Presence of Chronic Conditions* was a multiple-response option, where participants could indicate up to 10 chronic conditions. It was collapsed into three options; no chronic conditions, one chronic condition, or two or more chronic conditions. This was also the case for demographic variables. For example, date of birth (age) and ethnicity type (white, non-white, multi-ethnic) did not fit in any of the indices, but also could not logically be combined in their own index. Because demographic variables are not easily modifiable as is the case with SES, chronic conditions, age, and ethnicity type, they were not included as part of Individual, Environmental and Task variables but rather entered in as their own block.

After data cleaning, 73 constraint variables remained, including 29 individual constraints, 36 environmental constraints and 8 task constraints. After indexing, these

variables were reduced to 7 environmental indices and 4 environmental variables, 4 individual indices, 8 task variables and 8 demographic variables. Table 4.1 shows the breakdown of each index after data cleaning.

Table 4.1.
Variables sorted into 40 Developmental Assets framework.

	Constraint
Environmental Constraints (Indexed)	
Access[2] (5)	Accessible facility
	Opportunity in school
	Opportunity outside school
	Safe public transportation
	Availability of facilities
Built Environment[2] (5)	Greenspace
	Safe walking
	Options (for indoor/outdoor)
	Safe places close to home
	Clean facility
Support Family[1] (4)	Cultural
	Family participates in sport
	Family supports
	Financial
Support Social[1] (5)	Have friends (with whom to participate)
	Friends encourage
	Having friends makes me willing to participate
	Belief – Sport is important in society
	Peer Influence
Neighborhood Perception[2] (2)	Safe Neighborhood
	Pride in neighborhood
Physical Environment[2] (3)	Air Quality[3]
	Weather Allow
	Weather Prevent[3]
Weather[2] (5)	Cold[3]
	Hot[3]
	Humidity[3]
	Rain[3]
	Snow[3]
Environmental Constraints (Variables)	
Transportation	Mode of Transportation
Transportation	Duration of Transportation
Demographic	Immigrant status
Demographic	Immigrant status - parent
Demographic	Immigrant type - parent

Demographic	Presence of chronic condition[3] - family
Demographic	Postal Code
Use of TIME[1]	Hours Employed
Use of TIME[1]	Responsibilities
Individual Constraints (Indexed)	
Structural[2] (5)	Chronic condition
	Presence of Chronic Condition[3]
	BMI
	Body Type
	Overall Health
Identity[1] (3)	Body Type Satisfaction
	Have Energy
	Strive to excel
Values[1] (6)	Belief – Should participate
	Belief – Healthy Adult
	Belief - Important
	Have time
	Belief – Strong Women
Developmental[1] (13)	Enjoy Sport
	Perceived Competence
	Negative Experience
	Physical Strength
	Flexibility/Agility
	Energetic
	High Speed
	Confidence
	Belief – sport is fun
	Comfortable with dress code
	Sports not for girls
	Feel Positive
	Feel Gross[3]
Individual Constraints (Variables)	
Demographic	Ethnicity Type
Demographic	Age
Demographic	Immigrant type
Task Constraints (Variables)	
	Perseverance
	Competitive
	Recreational
	Physically intense
	Strict rules
	Coed
	Contact
	Long Game

[1] Taken from DAP framework
[2] Developed by research team to complement DAP framework

[3] **Reverse scored**

Objective 1: Refining recruitment strategy

To meet the first objective of refining a sampling and recruitment strategy, participants were recruited from three schools at one local area schoolboard, and one community organization. Inclusion criteria to participate in the survey included girls between the ages of 13-19 who were attending high school in the Durham Region. Ethical approval was obtained from the research ethics board at the Durham Catholic District School Board (DCDSB), and GIRLS Inc (GI) did not have a research ethics framework in place at the time this research was conducted. Convenience sampling was used to recruit participants, as parental consent and educator support was required to gain access to the participants. Consent forms were distributed by teachers in the physical education department of 3 Durham Region high schools, as well as the program coordinator of GI (Appendix C). Upon receipt of parental consent participant were given a link to complete an online survey about constraints to SP (Appendix B). Participant assent was collected in the first page of the online survey. Potential participants who were age of majority were given the individual consent portion within the survey only. Participants who were given parental consent but did not assent to participating in the study were redirected to a page which thanked them for their time and did not have access to the survey. Respondents completed the survey on school computers or common area computers at GI, and data were stored without identifiers by the UOIT Information Technology (IT) department.

Objective 2: Identifying issues with survey administration

The survey was delivered online via Google Forms. Web based delivery was selected due to the timeline and resources allotted for this project. For a participant to complete the survey, she must have submitted a completed parental consent form which she received from a physical education teacher who expressed interest in the study.

Objective 3: Refining analytical technique

To investigate the interactions between Task, Individual and Environmental constraints, univariate analyses were conducted first. Each variable (constraint) was assessed independently to evaluate the frequency of missing data. Items with fewer than 60% responses were not included. Little's MCAR test was run in SPSS on the remaining variables to investigate whether data were missing at random. Some responses which were entered as "I don't know/Prefer not to say" or those which were left blank were initially coded as '0' along with the Likert Scale of 1-5. Variables which were not going to be included as part of an index were collapsed into either a dichotomous response (e.g. high/low, yes/no), and in the instance of *Ethnicity Type*, three categories which were white, non-white and multi-ethnic, based on classifications from STATSCAN Visible Minority categories (Statistics Canada, 2015).

Variables used as part of an index were required to have no missing data because they would be added together. If non-responses and missing data were left as empty, the indexed value term would not exist. Univariate analyses were used to determine the percentage of missing data, and Little's test was used to determine whether data were missing completely at random (MCAR). The acceptable limit for missing data varies

within the literature from 5-10% (Tabachnick & Fidell, 2007; Peng et al., 2006). For variables with less than 10% missing data, the values were replaced with the mean for that variable, so that they could be added together to create an index. For variables not included in an index, categories were collapsed into binary responses (High/Low, Yes/No). Due to the large quantity of variables, the range of constraints included in the analysis was limited to constraints with a $p<0.10$ to ensure that interactions could be captured. Bivariate analysis of the indexed variables was used determine which variables would be used in interaction analysis.

Multivariate analysis was carried out to examine interactions between significant constraints. Specifically, because the outcome variable (SP) was dichotomous and there were a variety of independent variables (constraints), binary logistic regression was used. Constraints were entered in blocks based on constraint type using the enter method. Constraints which came out as significant ($p<0.10$) were entered into a second binary logistic regression against the outcome and were used for interaction analysis.

Interaction analysis

New variables were computed by multiplying the existing significant variables together to carry out interaction analysis. Two constraints from different categories (e.g. Environmental and Individual) along with an interaction term (e.g. Environmental X Individual) entered the binary logistic regression to examine if the interaction was significant.

Results

Demographic data for our sample is shown in Table 4.2. Mean age of participants was 15.5 years, participants were primarily white (54.2%), with 86.6% reporting good, very good or excellent overall health. The mean body mass index (BMI) was 21.5 (*SD*=4.16; Z-score 0.46, based on https://zscore.research.chop.edu/) which is within the normal range for this age group. The majority (87.6%) were born in Canada, and 65.9% had parents who were born in Canada.

Table 4.2
Demographic information and characteristics of our sample.

	Participate in sport regularly				
	NO (%) (*n*=49)	**YES(%) (*n*=48)**	**Total (%) (*n*=97)**	***X²***	***p***
Mean Age	15.52 +/- .98	15.47+/- 1.03	15.49 years +/- 1.00		
Mean BMI	21.89	21.08	21.49 *SD* 4.16		
Immigrant Status				0.67	0.72
Non-Immigrant	85.73	89.59	87.6		
Established Immigrant (>10years)	6.12	6.24	6.2		
Recent Immigrant (<10 years)	8.16	4.16	6.2		
Immigrant Status of Parents				1.37	0.50
Non-Immigrant	67.35	62.51	64.9		
Established Immigrant (>10years)	24.49	33.33	28.9		
Recent Immigrant (<10 years)	8.16	4.16	6.2		
Ethnicity				2.60	0.27
White	48.98	58.35	54.2		
Non White	40.82	25.00	33.0		
Multi Ethnic	10.20	14.59	12.5		
Presence of Chronic Conditions				0.95	0.81
None	69.39	60.43	64.9		
1 Chronic Condition	22.45	29.16	25.8		

2+ Chronic Conditions	4.08	4.16	4.1		
Overall Health				4.19	*0.04**
Good+	79.61	93.76	86.6		
Fair-	20.41	6.24	13.4		
Employment				4.62	*0.03**
Not Employed	67.31	81.24	74.2		
Employed	30.69	20.82	25.8		

***$\alpha<0.05$.**

Objective 1: Refining recruitment strategy

The survey was completed by adolescent girls (*n*=97) who attend three high schools in Durham Region in 2017. The convenience sampling strategy resulted in a response rate of approximately 39%. This was based on 97 eligible completions across three schools with approximately 35-40 students per class (teacher) in two sections, with an additional 20 potential respondents at GIRLS Inc and 5 deletions due to insufficient data. Figure 4.3 illustrates the process of obtaining 97 eligible completions. Specifically, entries were considered for deletion if greater than 30% of the responses were either missing or “I don’t know”. This result indicates that a more direct and purposeful sampling is needed to reach a larger proportion of this sample.

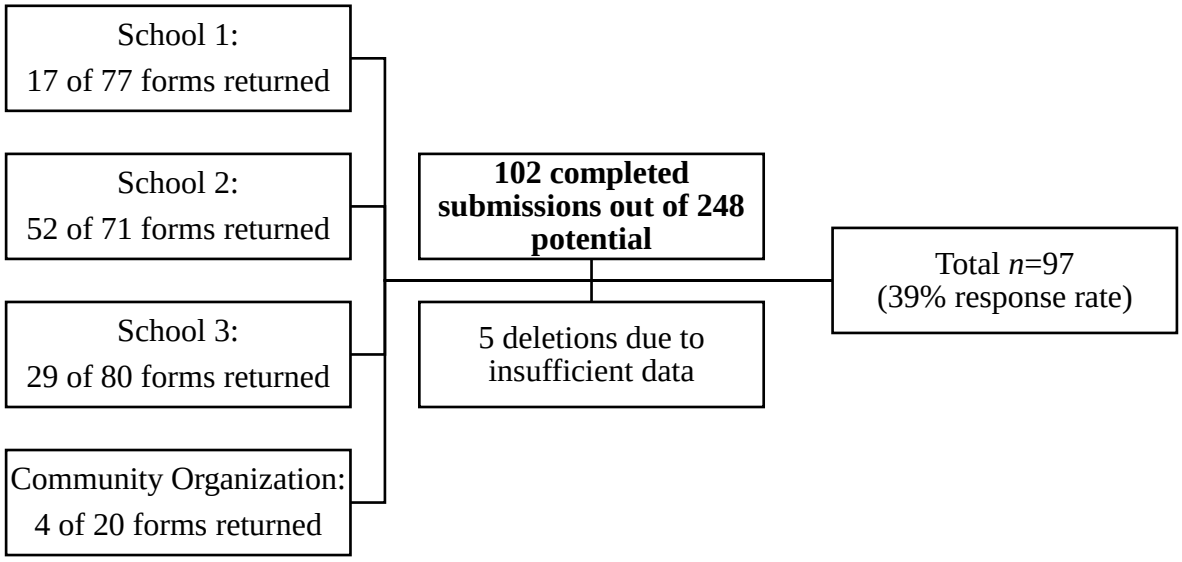

Figure 4.3 Recruitment process.

Objective 2: Identifying issues with survey administration

The multi-step process of administering the survey (approval of School board REB, approval of principal, assistance of physical education teachers, parental consent) may have contributed to the low response rate. Also, out of 99 completed surveys, two were found to be exact duplicates (equivalent time stamp and verbatim free-text responses) which is an unexpected error attributable to either Google Forms or the computer or network being used.

Objective 3: Refining analytical technique

Univariate analysis

Eight Task Constraints remained unindexed as they did not logically fit together and could in some cases be considered mutually exclusive (e.g. competitive and recreational). There were 7 indices and 4 singular variables in the Environmental

Constraints category, and 4 indices in the Individual Constraints category. Finally, there were 8 demographic variables.

Little's MCAR test was not significant ($X^2(1135) = 1127.12$, $p=0.56$) indicating that any missing data were missing completely at random. Each singular constraint and 9 out of 11 indices contained fewer than 5% missing data. The *Weather* and *Developmental* indices, the percentage of missing data was 5.2% and 6%, respectively, which is within the 10% outlined in the literature (Peng et al., 2006), so the mean for each variable and was imputed. Table 4.3 shows descriptive statistics for indexed variables, and single variables not included in demographic analysis. Lower mean values indicate the presence of a constraint. For example, a response of "Strongly disagree" to the questions "My neighborhood is safe" and "I am proud of where I live" would result in a score of 2 in the *Neighborhood Perceptions* index. In cases of missing data, the imputed mean sometimes contained decimal places, which resulted in decimal places in the index means, ranges and standard deviations. Most questions were on a 5-point Likert scale, and the number in brackets indicates how many questions were included in each index. For example, *Access*, made up of 5 variables had a max response of 25. Deviations from this pattern occur when responses are continuous, but not on a Likert Scale. For example, though the *Individual Structural* index included only 5 variables, the max response was 49.8 because this index included BMI, which was not on a 5-point scale. Among the task variables, the constraint identified as the most likely to facilitate participation was *recreational* with the fewest participants who considered it a constraint (16.5%). The constraint identifies as most likely to reduce participation was *perseverance* with 36.5% of participants reporting it as a constraint.

Table 4.3
Results of univariate analysis of variables and indices.

Index	Mean (SD)	Median	Range	Min-Max
Environmental Indices (variables contained in index)				
Access (5)	18.62(4.07)	19	19	6.0-25.0
Built Environment (5)	19.19(4.28)	19	17	8.0-25.0
Support Family (4)	14.41(3.24)	15	16	4.0-20.0
Support Social (5)	19.09(4.09)	19	19	6.0-25.0
Neighborhood Perception (2)	8.17(1.84)	8	7	3.0-10.0
Physical Environment (3)	11.38(2.00)	11	8	7.0-15.0
Weather (5)	16.25(4.05)	15	20	5.0-25.0
Environmental Variables				
Duration Transportation(mins)	15.62(17.95)	10	90	0.0-90.0
How many Responsibilities		1	4	0.0-4.0
Individual Indices (variables contained in index)				
Structural (5)	28.22(5.00)	27.69	32.91	16.9-49.8
Identity (3)	10.62(2.00)	11	12	3.0-15.0
Values (6)	25.03(4.35)	26	18	13.0-30.0
Developmental (13)	43.03(7.38)	43	31.94	24.0-55.9
Task Variables (% of respondents who considered it a constraint)				
Competitive			24.7	
Recreational			16.5	
Physically Intense			24.7	
Strict Rules			27.8	
Co-Ed			27.8	
Contact between players			25.8	
Games of Long Duration			24.7	
Perseverance			36.5	

Bivariate

Independent samples t-tests were computed for each of the 11 indices to determine if a difference existed between those who participate in sports regularly, and those who do not. Table 4.4 shows the means and standard deviations for regular participants and non-participants within each index, as well as the t-test p-values. Only the *weather* index

demonstrated a significant difference between participants and non-participants (*p=0.014)*. *Physical environment* and *developmental* indices approached significance, with *p* values of 0.18 and 0.16, respectively. Among non-indexed variables, *contact between players* and *duration of transportation* were the only variables which demonstrated a significant difference between participants and non-participants, with *p* values of 0.03 and 0.05, respectively.

Table 4.4.
Results of bivariate analysis (independent t-test) of indices

Index	**Mean (SD)**		***t*-test**	***p***
	Participant (*n*=49)	**Non-Participant (*n*=48)**		
Environmental Indices				
Weather	15.26(3.97)	17.27(3.92)	-2.51	0.01**
Physical Environment	11.65(1.97)	11.10(2.02)	1.35	0.18
Family Support	14.05(3.57)	14.78(2.87)	-1.11	0.27
Neighborhood Perception	8.32(1.83)	8.02(1.86)	0.82	0.42
Access	18.54(4.45)	18.71(3.69)	-0.21	0.84
Built Environment	19.16(4.63)	19.20(3.94)	-0.05	0.96
Social Support	19.10(4.16)	19.08(4.05)	0.02	0.98
Individual Indices				
Developmental	41.99(7.17)	44.10(7.51)	-1.42	0.16
Identity	10.57(1.98)	10.67(2.06)	-0.23	0.82
Structural	28.13(5.02)	28.32(5.03)	-0.19	0.85
Values	25.06(4.53)	25.00(4.22)	0.07	0.95
Remaining Variables				
Contact between players	0.16(0.37)	0.35(0.48)	-2.18	0.03*
Duration of Transportation	12.04 12.4)	19.27(21.73)	-2.01	0.05*
Games of Long Duration	0.18(0.39)	0.31(0.46)	-1.47	0.14
Ethnicity Type	0.67(0.71)	0.49(0.69)	1.28	0.20
Hours Employed	0.20(0.40)	0.31(0.46)	-1.22	0.23
Strict Rules	0.22(0.42)	0.33(0.47)	-1.19	0.24
Competitive	0.20(0.40)	0.29(0.46)	-0.99	0.32
Immigrant type	0.14(0.45)	0.23(0.59)	-0.81	0.42
Co-Ed	0.24(0.43)	0.31(0.46)	-0.74	0.46
Presence of Chronic Conditions	1.30(0.71)	1.27(0.53)	0.28	0.78
Age	15.4(0.98)	15.52(1.03)	-0.25	0.80
Responsibilities	0.96(0.86)	0.98(0.91)	-0.11	0.92

Immigrant type – Parent	0.41(0.57)	0.42(0.65)	-0.07	0.94
Physically Intense	0.24(0.43)	0.25(0.43)	-0.06	0.95
Perseverance	0.63(0.49)	0.64(0.48)	-0.06	0.95
Recreational	0.16(0.37)	0.17(0.38)	-0.04	0.96
Presence of Chronic Conditions - Family	1.69(1.06)	1.69(1.01)	0.03	0.98

**$p<0.05$

Multivariate

Four binary logistic regression (BLR) analyses were computed with SP as the outcome. Specifically, each constraint type was entered in a block, with a fourth block of demographic variables. Odds ratios and 95% confidence intervals are shown in Table 4.5. There were no significant task constraints. There were three significant Environmental Constraints (*weather* $p<0.05$, *OR* = 0.83, 95% CI (0.72, 0.96), *physical environment* $p<0.05$, *OR* =1.3, 95%CI (1.03, 1.77) and *duration of transportation* $p<0.1$, *OR* 0.97, 95%CI (0.94, 1.00)). There was one significant Individual Constraint (*developmental* $p<0.05$, *OR* = 0.90, 95%CI (0.82, 0.99)) and one significant Demographic variable, which was classified as an Environmental constraint (*presence of chronic condition in the family* $p<0.1$, *OR*=0.66, 95%CI (0.43, 1.03)). These were used for interaction analysis which were entered into a second BLR as shown in Table 4.6. There were no significant constraints or interactions.

Table 4.5.
Results of multivariate analysis: Binary logistic regression

	Reference Category	OR (95% CI)	*p*
Demographic Variables			
Presence of Chronic Cond(Family)	No Chronic Condition	0.66(0.43,1.03)	0.07*
Ethnicity Type	White	1.58 (0.84, 2.99)	0.15
Immigrant Type	Non immigrant	0.53 (0.18, 1.53)	0.24
Presence of Chronic Condition	No Chronic Condition	1.19 (0.58, 2.43)	0.63
Parental Immigrant type	Non immigrant	1.21 (0.48, 3.08)	0.68
Birthdate		0.95 (0.62, 1.47)	0.82
Environmental Constraints			

Weather (i)	Low (Strongly Disagree)	0.83(0.72, 0.96)	0.01**
Physical Environment (i)	Low (Strongly Disagree)	1.35(1.03, 1.77)	0.03**
Duration of Transportation	Short (<10min)	0.97(0.94, 1.00)	0.07*
Hours Employed	Not Employed (0 hours)	0.50(0.16, 1.52)	0.22
Built Environment (i)	Low (Strongly Disagree)	0.89(0.73, 1.10)	0.29
Support: Social (i)	Low (Strongly Disagree)	1.07(0.93, 1.23)	0.36
Neighborhood Perception (i)	Low (Strongly Disagree)	1.16(0.81 1.67)	0.41
Support: Family (i)	Low (Strongly Disagree)	0.94(0.78, 1.13)	0.52
Access (i)	Low (Strongly Disagree)	1.03(0.85, 1.26)	0.74
Individual Constraints			
Developmental (i)	Low (Strongly Disagree)	0.90(0.82, 0.99)	0.03**
Values (i)	Low (Strongly Disagree)	1.11(0.96, 1.30)	0.17
Identity (i)	Low (Strongly Disagree)	1.11 (0.84, 1.48)	0.45
Structural (i)	Low (Strongly Disagree)	0.97(0.89, 1.06)	0.55
Task Constraints			
Contact	Not present	0.38(0.12, 1.25)	0.11
Physically Intense	Not present	1.78 (0.51, 6.26)	0.37
Long Games	Not present	0.66(0.24, 1.84)	0.43
Strict Rules	Not present	0.67(0.22, 2.04)	0.48
Competitive	Not present	0.68(0.19, 2.44)	0.55
Perseverance	Low (Strongly Disagree)	0.78 (0.31, 1.96)	0.59
Recreational	Not present	1.41(0.39, 5.08)	0.60
Co-Ed	Not present	1.08(0.37, 3.20)	0.88

(i)– index, *p<0.1, **p<0.05

Table 4.6
Binary Logistic Regression 2

	Reference Category	OR (95% CI)	*p*
Significant Constraints			
Developmental (i)	Low (Strongly Disagree)	1.42(0.91,2.21)	0.12
Weather (i)	Low (Strongly Disagree)	1.64(0.73,3.67)	0.23
Physical Environment (i)	No Chronic Condition	2.22(0.41,12.08)	0.36
Presence of Chronic Condition (Family) (PCCF)	Low (Strongly Disagree)	0.61(0.02, 16.68)	0.77
Duration of Transportation	Short (<10min)	0.98(0.77, 1.26)	0.90
Interaction terms			
Developmental x Weather		0.99(0.95,1.03)	0.09
Developmental x Physical Environment		1.00(0.99,1.01)	0.56
Developmental x PCCF		1.01(0.94,1.09)	0.80
Developmental x Duration of Transportation		0.985(0.97,1.01)	0.90

Note. (i)– index

Discussion

Increasing SP is a targeted way of increasing overall PA, which research has shown to improve optimal well-being (Brewer & Olson, 2015). A thorough understanding of constraints to SP and how these interact to facilitate or restrict participation is a key step in the development of interventions to address the problem of low SP among adolescent girls. The goal of this work was to pilot a self-developed survey which collected information on constraints to SP for adolescent girls. The objectives were to refine the recruitment strategy, identify potential issues with survey administration, and to explore and refine analytical techniques to examine interactions.

This exploratory pilot study found that the initial recruitment strategy needs a more direct approach to accessing the sample, and that the online format was effective. Binary logistic regression did not reveal any significant interactions of constraints, but identified *weather* ($p<0.01$, OR 0.82, 95% CI (0.72, 0.94)), the *physical environment* ($p<0.05$, OR 1.32 95% CI (1.03, 1.70)), *duration of transportation* ($p<0.10$, OR 0.970 95% CI (0.939, 1.001)), *presence of chronic condition in the family* ($p<0.10$, OR 0.662 95% CI (0.426,1.027)) and *development (*$p<0.05$, OR 0.90 95% CI (0.82, 0.99) as constraints to SP for this sample. Some constraints, such as *contact* (in sport) were significant in bivariate but were not significant in multivariate. Weather was the only significant environmental index in the bivariate analysis, but five additional constraints became significant in multivariate analysis.

No significant interactions were found among the constraints examined in this study, and thus it is not possible to draw conclusions from this work about constraints to SP in the

general population. However, there were two interesting themes in the data which highlight the importance of gender and environment. First, though many participants responded favorably to questions regarding beliefs about and attitudes toward SP, half of them (50.5%) still indicated that they do not participate in sport regularly, and 41.2% indicated that they had had a negative experience which caused them to stop participating in a certain sport. Further probing into these types of negative experiences is necessary to understand drop-out from sport in addition to non-participation. As there were no boys in the study, there is no reference point to which to compare the quantity of constraints listed for adolescent girls in Durham Region. Yet, it is consistent with previous findings which suggest that girls consider certain constraints as having more salience (Liu et al., 2014; Alexandris & Carroll, 1997) which may explain their lower rate of participation when opportunities for boys and girls are otherwise equal (Casper et al., 2011).

Second, it was clear that environmental constraints were the most frequently reported among our sample. This is consistent with previous research which shows that constraints external to the individual are more commonly generated through quantitative study than are individual or psychological factors (Charlton et al., 2010). The information collected from the survey was but a snapshot of the participants' stage of development but speaks to the importance of acknowledging the multifaceted nature of constraints with respect to their stability over time. It also challenges the recent dialogue about changing the rules of sports (a task constraint) to facilitate girls' participation as task constraints were not found to be significant in our sample. This applies to sports like hockey, where checking is not permitted in girls' leagues but is in boys' and thus the tasks inherent to the sport are being modified. However, in volleyball, where nets are lowered to accommodate girls who are

generally shorter in stature than boys, the task constraint (e.g. height of the net) is interacting with the individual (structural) constraint of shorter stature. In this case, it is not known whether short stature is the only constraint interacting with the height of the net to result in non-participation, but clearly an interaction of previously uninvestigated magnitude is occurring. This highlights the utility of considering interactions between constraints in modifying the rules of sport by recognizing that it is probable that a task constraint would be moderated by an individual constraint. Some environmental constraints are modifiable. Though weather itself cannot be changed; safe, clean, and accessible indoor options in the neighborhood can reduce or eliminate this constraint altogether. However, for these options to be effective in increasing SP, it is equally important to address individual developmental constraints such as a lack of confidence or a belief that sports are not for girls. It is an appreciation of these interactions which can help create more comprehensive interventions to increase SP.

This pilot study comes with several strengths which arise from meeting the three objectives. First, the pilot study highlighted the importance of a more comprehensive sampling strategy to access a representative sample of adolescent girls. The response rate was low (39%) likely due to the population being “hard-to-reach”. A convenience sample of adolescents was recruited from three high schools in Durham Region. Most of the respondents came from relatively higher socioeconomic areas of the Durham Region, based on postal code information provided in the survey and Durham Region demographic and socio-economic data (The Region of Durham, 2015). A potential bias is that most participants were in grade 10 at the time of participating in the survey. Physical education classes are only mandatory in grade 9. It is not known whether the participants were

enrolled in an elective physical education course because they are more likely to participate in sport or because they were not successful in completing the mandatory course. Expanding recruitment to classrooms outside of physical education may help to reduce this bias. An ideal sample would consist of a stratified random sample of participants, to capture participants who reside in different areas of Durham Region which reflect socioeconomic differences within the area. Alternatively, respondent-driven sampling (RDS) which is a chain-based recruitment method used to access hard-to-reach populations such as homeless youth or drug users (Decker et al., 2014) may be of use. Though it can be more efficient in terms of duration of data collection and access to a representative sample, RDS requires intensive resources for monitoring recruitment logs (Decker et al., 2014). In addition, informed consent from parents or guardians may continue to be a barrier (Wagner et al., 2017).

The second objective was to resolve any issues related to survey administration. Feedback regarding the survey resulted in strengthening the instrument for future use. For example, the outcome variable was strengthened to removing any possibility of incorrect interpretation. The initial survey question read "*I participate in sport regularly (3x/week or more)*". The adjective '*regularly'* was defined in parentheses based on General Social Survey (GSS) data (Clark, 2008), but it was not clear if the sports being practiced were organized, in physical education class or a combination of both. Also, the intensity at which the sport was pursued was not accounted for. Separating the question to account for both frequency and intensity, as well as differentiating between organized sport and physical education classes allows for a more accurate method of extracting the true level of SP for this population in larger scale implementation. The length of the survey may have

also been a factor in survey administration. Hoover and colleagues (2017) suggest that reducing the time required to complete a survey may increase participation in adolescent samples where teachers or coaches are gate keepers to the sample. The present survey required approximately 20-25 minutes to complete thus future iterations may consider streamlining the question types or reducing the number of questions. Our survey was made available in hard-copy format, yet no participant in this study opted for the hard-copy version. The finding that paper format is preferred has been shown in studies with adult samples, thus our contradictory occurrence may be attributable to the age of our sample.

Finally, this work demonstrated the feasibility of examining interactions between constraints to SP using binary logistic regression analysis which has not been done previously. Many studies focus on isolating constraints (McArthur et al., 2014; Allison et al., 2017), but this approach fails to consider the complex nature of participation because it does not recognize that modifying a constraint in one category can interact with a constraint in another category. In this study, constraints which approached significance in bivariate analysis, such as the *developmental* and *physical environment* indices became significant in multivariate (logistic regression) analysis. This finding suggests that an interaction may exist between constraints which are non-significant when examined individually. More in-depth statistical analysis of indices which did not come out as significant, but which contained some significant components is warranted. However, in a larger scale application of this study, sample size will no longer be a limiting factor so single constraints will have enough statistical power to be meaningful without being part of an index.

This work also comes with limitations and recommendations for next steps. The first key limitation was the low response rate (39%) which can be increased with a more comprehensive sampling strategy. A second limitation was the potential for Type I error due to the large number of examined associations , specifically in the case of a large quantity of variables. As this was an exploratory pilot study with a small sample size, it is expected that this will be resolved in a larger scale study. Another potential limitation lies in how findings from this work could be interpreted. If an interaction is found between two constraints, it may not necessarily translate into an easily implemented intervention. There is no 'one size fits all' solution to the problem of non-participation, but it is also not reasonable to create an abundance of new possible interventions to increase SP. This is why larger scale implementation is necessary, so that patterns of interactions can begin to emerge.

The Ontario-wide extension of this pilot study will add richness to this research design because there will be greater variability in the physical and built environments of this subpopulation. Most of the participants in the Durham Region pilot lived in Pickering or Whitby (Appendix D) which have higher than average household income than Durham Region overall (The Region of Durham, 2015 p.46) and higher average household income than the Greater Toronto Area overall (The Region of Durham, 2015 p.46). This is important because variation in household income may affect the interaction between constraints, so sampling from a heterogeneous population is necessary to strengthen this methodology. Also, Ontario is more ethnically diverse than Durham Region (The Region of Durham, 2015), so the effect of certain individual constraints may be heightened in other areas of the province. In addition, the residential context is only part of the picture of

geographical location. Studies have shown that one's residential neighborhood is not the only factor affecting PA participation but that the workplace (or in this case, school) neighborhood should also be considered (Troped et al., 2010). Sharkey and Faber (2014) go a step further to suggest that isolating neighborhood effects on important contexts in children's lives is detrimental because it overlooks the ways in which these contexts interact. Using Newell's conceptual framework in combination with the DAP framework to organize constraints as well as to examine their interactions can encourage a perspective shift in addressing constraints to SP at the policy level by allowing policy makers to appreciate the intricate nature of non-participation. In addition, exploring three-way interactions may yield a deeper understanding of the most significant predictors of non-participation.

It may also prove useful to include a sample of boys from the same schools to compare with the girls. In this way environmental constraints are essentially controlled for, and the true differences between boys and girls can be examined to bring attention to the gap in participation.

Conclusion

This study has two main implications for the study of constraints to SP among this sample; including recruitment, and survey administration. Recruitment of adolescent girls must consider the many levels of consent required when accessing the sample through educational institutions, and more geographical locations should be considered to allow for comparison between rural and urban areas. Though interactions were not found to be significant in this study, further examination with larger sample sizes in different areas is

warranted. The piloting of this online survey has also improved the instrument to decrease length of completion, clarify questions, and simplify future implementation.

Acknowledging the dynamic nature of constraints during adolescence and using a framework which allows for the conceptualization of constraints as connected rather than separate is an important step in understanding the unique combinations of constraints on adolescent girls. It has been shown that adolescent girls experience different socialization with respect to SP and are exposed to different barriers because of gender norms (Amusa et al., 2008; Robbins et al., 2009). Future policies and programs to address the low levels of SP among girls should consider the female-specific individual factors related to SP, as well as environmental constraints.

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CHAPTER 5: Reliability Analysis

Chapters 3 and 4 reported on the creation and piloting of a survey which collects data on constraints to SP among adolescent girls. The survey was created to facilitate the examination of interactions of constraints (Chapter 4 of this thesis). This chapter presents the reliability analysis which was completed after the survey was administered.

The present study had three hypotheses.

1. The survey will possess adequate internal consistency (Cronbach's $\alpha<0.70$)
2. Each constraint type subscale (individual, environmental, and task) will possess adequate internal consistency (Cronbach's $\alpha<0.70$)
3. Each index type subscale (individual, environmental) will possess adequate internal consistency (Cronbach's $\alpha<0.70$)

Method

The methods for data collection have been described in chapters 3 and 4 of this thesis. Briefly, participants were adolescent girls (n=97 mean age=15.5 years) attending high school in Durham Region, Ontario. Convenience sampling was used to recruit participants from one of 3 high schools, and one community organization.

Procedure

After data collection, constraints were indexed using the DAP (Scales, 1999) as a guide. This process was completed after data cleaning and is outlined in Chapter 4 of this thesis. Appendix E outlines the composition of each index. Environmental variables were categorized into one of 7 indices; *access, built environment, family support, social support, neighborhood perception, physical environment* and *weather*. Individual constraints were

categorized into one of 4 indices; *structural, identity, values,* and *developmental.* Indexing prepared the survey data for reliability analysis, as each index could be considered a subscale of the overall survey. Questions were removed from reliability analysis because of insufficient responses, and lack of variability. The threshold for insufficient response was 40% or fewer responses.

Analysis

Pilot data were used to evaluate internal consistency using Cronbach's alpha (α) with SPSS 25.0. The acceptable level for α was deemed to be 0.70 which is the standard in similar work (Vasudevan et al., 2015). If the value of α was less than 0.70, individual items were examined to assess if a change occurred after their removal.

Results

The response rate was 39%. Questions removed for insufficient responses (>40% non-response/ 'I don't know') were parental education level (45% mother, 42% father), and annual family income (65%). Of the two participants (2.1%) who responded that they used an assistive device, neither responded that the assistive device interferes with their SP in the follow up question, therefore both questions were removed for a lack of variability. Two questions related to birth order and presence of children under 18 were removed because the wording did not account for siblings over the age of 18. Questions designed for follow up in the qualitative portion of the analysis were also not included. Finally, questions about personal characteristics that have not been found to be predictors of SP (shyness, creativity, studiousness, and carefulness) and were included in the survey as

‘throw-away’ questions for the purpose of reducing partiality to a specific ‘type’ of respondent were also not included in reliability analysis.

Table 5.1 shows the α values for individual, environmental and task constraints separately as well as the survey as a whole. The values for standardized items are also shown, as there were differences in how survey items were answered (e.g. 3-point vs. 5-point Likert scales). Overall, the survey instrument demonstrated good internal consistency for this sample with all subsections having α>0.70, thus confirming the first and second hypotheses. Reliability of the individual constraints’ subscale was improved negligibly with the removal of *BMI* (28 items; α=0.813) but was consistent in the environmental and task subsections.

Table 5.1.
Cronbach’s α values for the survey instrument

	Number of items included	Cronbach’s α	Cronbach’s α based on standardized items
Survey total	71	0.897	0.907
Individual	29	0.747	0.788
Environmental	34	0.866	0.864
Task	8	0.760	0.763

Reliability Measures of Indices

Table 5.2 which shows the α values for indexed variables. The third hypothesis is rejected because one of the indices was below the acceptable range. However, the reliability of the individual subsection improved with the removal of the *Structural* index (3 items; α=0.747) which is consistent with the previous finding that the inclusion of *BMI* resulted in a lower alpha level.

Table 5.2.
Cronbach's α values for indexed variables

	Number of items included	Cronbach's *α*	Cronbach's α based on standardized items
Individual	4	0.503	0.625
Environmental	7	0.740	0.751

Discussion

The aim of this study was to examine the reliability of the newly developed survey on constraints to SP for adolescent girls. Overall, this study showed that the survey possesses good internal consistency for this sample. Limitations and next steps are discussed.

The overall survey, as well as each constraint type (*individual*, *environmental*, and *task*) exceeded the minimum *α* value of 0.7 and were therefore considered to have good internal consistency for this sample. This survey has the potential to reveal interactions between constraints to SP for adolescent girls. It can also allow for future examination of constraints within a comprehensive framework, which can be compared between samples. When used on a representative sample, the results of this survey can be used to inform interventions to increase SP among adolescent girls.

A limitation of this work was that test-retest reliability was not possible due to limited access to this sample. The survey data were stored without identifiers to ensure confidentiality and anonymity of participants; thus, the study design did not allow for a retest. The majority (77%) of respondents were in grade 10 at the time of completing the survey, thus dividing the sample and comparing means between younger and older participants was also not possible. In addition, the sample size did not allow for robust factor analysis of indices. As a rule of thumb, a ratio of 30:1 responses to factors is needed to ensure factors are stable (Yong & Pearce, 2013). Therefore, statistical measures of

validity are needed. Also, though Cronbach's α has been the standard for contexts of predictive analysis such as this work (Revelle & Zinbarg, 2009; Sijtsma, 2009; Vasudevan et al., 2015), it has been shown to be a poor estimate of internal consistency if a survey has more than 15 items (Streiner & Kottner, 2014). This study contributed to the literature by assessing a new self-developed survey which can be used for adolescent girls. Revisions to the survey based on this analysis can strengthen the instrument for future implementation.

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CHAPTER 6: General Discussion

This thesis reported on the development of a new survey for gathering information on constraints to sport participation (SP). First, a literature review was done to generate a comprehensive list of constraints which would be used to create a survey. The survey instrument was validated through consultation of an expert panel. Second, the survey was piloted on a sample of adolescent girls in Durham Region, Ontario, and three objectives related to sampling and recruitment, survey administration, and refining analytical technique were met. Finally, reliability testing (Cronbach's α) was done. This chapter discusses the objectives of both studies, how they were met, additional findings, as well as implications for practice and research.

There were three objectives of the survey development phase. First, a comprehensive list of constraints generated from the literature was used to develop a survey. Studies on both females and males were used. The survey was guided by a conceptual model derived from Newell's (1986) model of constraints to organize constraints into individual, environmental and task constraints, and the DAP (Scales 1999) to index the constraints. This was a strength of the work, because it facilitates future implementation across different geographical areas. Using Newell's model enabled quantitative analysis in study 2, and the DAP- based indexing allowed for many constraint variables to be included even with a small sample size. The constraints were expected to have construct validity because they were generated from peer reviewed literature. Content validity was established by an expert panel through an iterative process of consensus building. This was another strength of the work, because academic experts as well as community members were included in revising the survey. At this stage, the survey was

piloted to a sample of adolescent girls (n=97). The completion of the first objective highlighted the multi-step process to accessing the adolescent girl population. The process involved school board research ethics approval, school principal approval, physical education teacher approval, parental consent, as well as participant assent. Issues with survey administration were identified to meet objective 2, and the survey data were analyzed to establish reliability, which was objective 3 of the first study. Binary logistic regression was used because the outcome variable was dichotomous, and there were many independent (constraint) variables.

The binary logistic regression analysis did not reveal any significant interactions between constraints to SP, though interactions may be seen if a larger sample size was used. Within the survey, the question of "The number 1 reason why I do not participate in sports is…" was posed to check for concordance between a participant's numerical responses and her 'knee jerk' top of mind response. The overall results pointed to a *lack of interest*, yet this was not the most salient constraint from the remainder of the survey. Rather, environmental constraints such as *weather* and *physical environment* were found to be significant predictors of non-participation. This is an encouraging result because though weather is not necessarily modifiable, having different options for SP in varying weather conditions may increase participation. For example, easily accessible, local, and safe indoor soccer fields may encourage players to continue in inclement weather. Likewise, increasing transport opportunities such as the frequency of public transportation may reduce the incumbrance of winter travel. *Lack of interes*t has not been examined extensively in the literature, though it has been mentioned as a constraint in some (Faulkner, 2016) and it is outside the scope of this study. It may be worthwhile to delve

into the reasons behind this using a feminist perspective in the context of social, gender and cultural norms for adolescent girls. Sport has the potential to increase academic performance (Trudeau & Shephard, 2008), so collecting data on constraints to SP may be of interest to schoolboards. As such, it may be worthwhile to collaborate with school boards to reach the most students.

Implications for future work

Three main recommendations for future research include incorporating qualitative methods, including boys in the sample, and balancing the uniqueness of SP within the context of PA. with the goal of increasing uptake of policies. Though surveys and quantitative methodology provide an abundance of data to measure a construct, it is difficult to quantify some aspects of human behavior. Previous qualitative studies of SP have shown that individual constraints are more salient than environmental (Charlton et al., 2010). In light of the results of study 2, a qualitative component may allow for deeper exploration into interactions among constraints. Incorporating qualitative methods in the study of constraints to SP in future research can also take the focus from why adolescents are not able to participate, to why they are not willing to do so in the absence of constraints. Mixed methodology can yield a more comprehensive understanding of phenomena surrounding factors which motivate behavior (Visek et al., 2015).

A second key area of future exploration is to include a sample of boys from the same schools or environments to compare with the girls. However, sport has historically been segregated by sex rather than gender. Changerooms and leagues are separated by biological sex, and this notion is rarely challenged (Love & Kelly, 2011). However, the effect of sex-segregation in sport on gender inequality has also garnered attention,

suggesting that the role of sex and gender in sport require further investigation. Within a setting such as a school or school district, environmental constraints like built environment, weather, and physical environment would be the same for both groups, regardless of sex or gender. Previous research has shown that even in instances where there is equal opportunity for both sexes to participate, females perceive more constraints than males (Casper et al., 2011; Dias et al., 2015), but a consistent framework has not been used to organize the data. Previous literature has also demonstrated that girls and boys experience vast developmental changes in a relatively short period of time during adolescence, and the experience of early maturation comes with more friction in social contexts for girls than it does for boys (Perry & Pauletti, 2011), which can ultimately influence SP. On the other hand, SP rates are plateauing in adolescence for both genders (Sharratt & Hearst, 2007) so it may be useful to include boys in the analysis to develop comprehensive strategies aimed at adolescents in general. By including boys in the sample, environmental constraints are essentially controlled for, and the true differences between boys and girls can be examined to bring attention to the gap in participation, and low rates of participation overall. A gender lens is needed for this exploration because the inequality extends into later life as well as into professional sports. Women hold fewer coaching and sport management positions (Moore et al., 2010), get paid less than male athletes (Hernandez-Arenaz & Iriberri, 2018), and receive less media coverage (Lumpkin, 2009; Sherry et al., 2016). When athletes who are women are covered in the media, the focus has historically been on their femininity rather than their skill (Lumpkin, 2009; Sherry et al., 2016; Yip, 2018). Increasing women's' representation in professional sport is a potential outcome for research on the reasons why girls don't participate in sport. Continued use of a framework

with which to categorize constraints in qualitative research can also increase the empirical theory base for examining constraints. In addition, further gender based and sex based analysis is needed.

As a final recommendation, increasing SP is a focused approach to addressing non-participation in PA. PA promotion is a much more prevalent concept for the adolescent cohort than SP when it comes to government funding initiatives (Ramanathan et al., 2018, Van Acker et al., 2012). Among school-aged children, initiatives to meet PA guidelines at school are built into the school curriculum (Allison et al., 2016,). For example, the Ontario Ministry of Education has instituted a Daily Physical Activity (DPA) guidelines based on the 24-hour movement guidelines outlined by CSEP (Ontario Ministry of Education, 2005). Unfortunately, a study evaluating the effectiveness of this program has shown that only 50% of teachers follow this guideline at the classroom level (Allison et al., 2016). However, this program does not extend into high school. Some studies suggest that among adolescent girls, SP is replaced by non-sport PA as they reach adulthood (Eime, 2016) and that although adolescent girls participate in sport less than their male counterparts, they participate in more non-sport PA than males (Eime, 2016; Guèvremont, 2016). Thus, the finding that 49% of the sample participate in just sport on a regular basis, was encouraging because it is possible that this sample could also be involved in other PA as well. The survey used for this study did not include physical activities such as dance and yoga, exercise and fitness activities, or active transportation. Nearly 11% of participants who indicated that they participate in sport regularly indicated that their sport of choice was other (which participants specified as cheerleading or dance), but these activities were not listed as sports in this study. This result sheds light on an area of physical activity in which

many girls participate, when or if they are not engaged in sport. It also underscores the idea that some sports may be viewed as “for girls” or “for boys”. From our sample, 3% of participants indicated “*strongly agree*” when asked if there are certain sports that girls should not participate in. In the follow up question, they identified hockey, football, basketball and soccer as “for boys”. Klomsten and colleagues (2005) acknowledged that though women have come a long way from the outdated view that sports are for men, gender differences still exist in the perceptions of SP. Therefore, it was also encouraging that only 12% indicated that “I don’t participate in any sports”. It is possible that some participants included SP that occurs in physical education classes, which may not be an accurate reflection of their actual participation. To reduce ambiguity, future iterations of the survey should clearly differentiate between curricular and extracurricular SP and allow for reporting of actual frequency of participation

Though the small sample size precludes generalizability, this estimate of regular SP is on the higher end of reports from General Social Survey trends from 2005 to 2010 which indicate approximately 40-50% (Heritage Canada, 2013). It may also be beneficial to also consider other aspects of PA such as active transportation, exercise, and play in research examining constraints to SP to establish whether the constraints are similar or different (Casper et al., 2011). This way, future policies to increase participation can incorporate specific measures which may be more easily attainable by the public. Many factors are at play, so future research should continue to incorporate a comprehensive approach.

PA comes with countless benefits with respect to health (Paterson et al., 2007, The Government of Canada, 2011). Therefore, it is in the government’s best interest to ensure all people have access. However, the Canadian government’s approach has been mostly

exhortation (Lau et al., 2007). For example, a new trend in PA promotion for adolescents in Canada are micro-grants; small budgets of grant money designed to alleviate environmental constraints to participation (Ramanathan et al., 2018). Ramanathan et al. (2018) examined the feasibility of micro-grants to support PA in adolescents on a national scale and suggested that sustainability of funding continued to be a problem. Micro-grant funding can contribute to more programs being available, but that may not be the solution to increasing PA among girls. As it pertains to SP, increased funding on a larger scale also fails to improve gender equity in sport. For example, the Sport Funding and Accountability Framework (SFAF) supported almost 320 000 athletes and sport participants in 2000, and only 6% of them were female (Havaris & Danylchuk, 2007). Environmental and policy factors have not been considered sufficiently in the literature (Eyler et al., 2002), but have been alluded to considering a lack of desirable participation outcomes after increased government funding (Havaris & Danylchuk, 2007).

Conclusion

This work can be used to guide future studies of constraints to SP as well as to inform interventions to increase SP among adolescent girls. Specifically, this work has demonstrated the challenges of recruiting adolescent girl participants and made a case for recruiting outside of the school setting. The survey pilot offers insight into the complex procedure of recruiting adolescent participants in Ontario, Canada, as well as potential gaps in collected information about SES (e.g. parental education level and household income) which emphasize the importance of using postal code data to estimate SES. The survey instrument included a comprehensive list of constraints to SP, was validated by an expert panel and was found to be reliable. Aspects of survey administration such as the

length of the survey, the clarity of some questions and availability of hard-copy format can inform future implementation of this survey on a larger scale to increase response rate. On a larger scale, this survey can be used to examine interactions of constraints to SP using the standard sample size calculation of 10 participants to each construct or question. To further the conceptual knowledge base about constraints to SP, it is necessary to consider boys and girls from similar environments, incorporate qualitative methodologies to complement the quantitative findings, and recognize the uniqueness of sport in its pivotal role in increasing PA in general. Due to the complex nature of human motivation and behavior, a variety of methods is required to engage the target population, as well as the policymakers charged with developing evidence-based interventions.

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APPENDICES

Appendix A

A1. Search Institute's 40 developmental assets, adapted from Scales et al., 2006.

	Category	Asset
External	Support*	1. Family support 2. Positive family communication 3. Other adult relationships 4. Caring neighbourhood 5. Caring school climate 6. Parent involvement in schooling
	Empowerment	7. Community values youth 8. Youth as resources 9. Service to others 10. Safety
	Boundaries and expectations	11. Family boundaries 12. School boundaries 13. Neighbourhood boundaries 14. Adult role models 15. Positive peer influence 16. High expectations
	Constructive use of time	17. Creative activities 18. Youth programs 19. Religious community 20. Time at home
Internal	Commitment to learning	21. Achievement motivation 22. School engagement 23. Homework 24. Bonding to school 25. Reading for pleasure
	Positive values*	26. Caring 27. Equality and social justice 28. Integrity 29. Honesty 30. Responsibility 31. Restraint
	Social competencies	32. Planning and decision making 33. Interpersonal competence 34. Cultural competence 35. Resistance skills 36. Peaceful conflict resolution
	Positive identity*	37. Personal power 38. Self-esteem 39. Sense of purpose

		40. Positive view of personal future

‘*’ denotes indices taken directly from DAP

Appendix B

B1. Google Forms Survey

Examining Constraints to Sport Participation among Ethnically-Diverse Female Adolescents from Durham Region, Ontario.

Thank you for participating in the survey! This survey is made up of THREE (3) Sections. The first section will ask about your demographics - who you are, where you live etc. The second section will ask about your sport participation and the third section will ask about the area in which you live. The survey may take 20-25 minutes to complete and must be completed in one session. If you wish to STOP the survey and withdraw your participation, you may do so at any time during the survey by closing this window. Your information will not be saved unless you click "Submit" at the end of the survey. Once you click "Submit", your responses will be processed by UOIT Information Technology and will not be traceable back to you, and we will not be able to remove your input from the study. Please try to be as accurate as possible. Questions marked with an asterisk (*) must not be left blank. If you have any questions concerning the research study or experience any discomfort related to the study, please contact Dr. Caroline Barakat-Haddad at caroline.barakat-haddad@uoit.ca Any questions regarding your rights as a participant, complaints, or adverse events may be addressed to Research Ethics Board through the Research Ethics Coordinator – researchethics@uoit.ca or 905.721.8668 x. 3693. This study has been approved by the UOIT Research Ethics Board (REB#14113) on January 14, 2017.

* Required

Consent

By completing this survey, you are agreeing to participate in this study

1. **I consent to participating in this study** *

Mark only one oval.

- ❍ Yes
- ❍ No *Stop filling out this form.*

2. **How did you hear about this study?**

Mark only one oval.

- ❍ School
- ❍ Community Center/Organization
- ❍ A parent/guardian
- ❍ A friend who is also participating
- ❍ Other:

3. **Please enter the first three letters of your**

postal code (example: A1A) *
If you do not know, please enter 000.

4. **What most accurately describes your ethnic background?** *
Select all that apply.
Check all that apply.

- White
- Hispanic/Latino
- Black/African Canadian
- Native Canadian/First Nation (i.e. Metis, Cree etc.)
- South Asian (i.e. Pakistani, Sri Lankan etc.)
- Middle Eastern (i.e. Syrian, Iraqi etc.)
- East Asian (i.e. Chinese, Korean etc.)
- Pacific Islander (i.e. Filipino, Vietnamese etc.),
- European (i.e. Ukrainian, Croatian)
- Other:

5. **In what year were you born?** *
Please enter in the format of YYYY, e.g. 2003.
6. **In what country were you born?** *
7. **If you were NOT born in Canada, in which year did you immigrate to Canada? (Leave blank if you were born in Canada)**
8. **If one or both of your parents were not born in Canada, in which year did they immigrate to Canada?** *
Please enter in the format of YYYY, e.g. "2003". If you do not know, enter "0000" If your parents were both born in Canada, enter "NA". If your parents immigrated to Canada at different times, please enter the date of the parent who immigrated FIRST.
9. **Including yourself, how many children under the age of 18 live at your home?** *
10. **Of those, how many children are under the age of 5?** *
11. **What is your birth order?** *
If you are the first born, enter "First".

12. **Have you been diagnosed with any of the following chronic conditions?** *
Check all that apply.

- Metabolic condition (eg. Diabetes, PKU, Crohn's Disease)
- Respiratory condition (eg. Asthma)
- Cardiopulmonary condition (eg. congenital heart disease, pacemaker)
- Neurological condition (eg. muscular dystrophy, Guillain-Barre Syndrome)
- Cancer - in treatment/not treating
- Cancer - in remission/tumor free
- Mental condition (eg. bipolar disorder, anxiety, depression, psychosis)
- Vision impairment
- Hearing impairment

- ❍ Developmental condition (eg. Down's Syndrome, Cerebral Palsy, Intellectual Disability)
- ❍ I have not been diagnosed with any of these
- ❍ Other:

13. **Has anybody in your immediate family been diagnosed with any of the following chronic conditions?** *

Check all that apply. Your "immediate family" includes your birth parents, brothers, sisters and natural grandparents.

Check all that apply.

- ❍ Metabolic condition (eg. Diabetes, PKU, Crohn's Disease)
- ❍ Respiratory condition (eg. Asthma)
- ❍ Cardiopulmonary condition (eg. Congenital Heart Disease, Pacemaker)
- ❍ Neurological condition (eg. muscular dystrophy, Guillain-Barre Syndrome, Parkinson's Disease,
- ❍ Dementia)
- ❍ Cancer - in treatment/not treating
- ❍ Cancer - in remission/tumor free
- ❍ Mental condition (eg. bipolar disorder, anxiety, depression, psychosis)
- ❍ Developmental condition (eg. Down's Syndrome, Cerebral Palsy, Intellectual Disability)
- ❍ I am not aware that anybody in my family has been diagnosed with or passed away as a result
- ❍ of any of these
- ❍ Other:

14. **I use an assistive device/mobility aid regularly** *

This can include a wheelchair, walker, crutches, cane, guide dog which you are using for a term of
longer than 3 months. This does NOT refer to eye glasses, hearing aids, ostomies or orthoses.

Mark only one oval.

- ❍ Yes
- ❍ No

15. **If you answered "yes", does the assistive device/mobility aid prevent you from accessing sport facilities or participating in sport?** *

Mark only one oval.

- ❍ Yes, my device always prevents me from accessing facilities AND participating in sport.
- ❍ My device prevents me from accessing facilities, but I can still participate in sport.
- ❍ My device prevents me from participating in sport, but I can still access facilities
- ❍ My device does NOT prevent me from accessing facilities or participating in sport.
- ❍ My device never prevents me from accessing facilities or participating in sport.
- ❍ I do not use an assistive device/mobility aid.
- ❍ I prefer not to say.

16. **What is your approximate weight? (in pounds)** *

Please enter numbers only (e.g. "180" instead of "180lbs")

17. **What is your approximate height ? (in feet/inches e.g. 5'7")** *

18. **How would you describe your body type?** *
Mark only one oval.
- ❍ Overweight
- ❍ Slightly Overweight
- ❍ Average
- ❍ Slightly Underweight
- ❍ Underweight

19. **How satisfied are you with your body type?** *
Mark only one oval.
- ❍ Very satisfied - I wouldn't change it.
- ❍ Somewhat satisfied
- ❍ I am neither satisfied nor dissatisfied with my body type
- ❍ Somewhat dissatisfied
- ❍ Very dissatisfied - I would make many changes if I could.

20. **How would you describe your overall health?** *
Mark only one oval.
- ❍ Excellent
- ❍ Very Good
- ❍ Good
- ❍ Fair
- ❍ Poor

21. **What is your family's annual household income?** *
Mark only one oval.
- ❍ Less than $25,000
- ❍ $26,000-$50,000
- ❍ $51,000-$75,000
- ❍ $76,000-$100,000
- ❍ More than $100,000
- ❍ I don't know/prefer not to say.

22. **What is your mother's/primary guardian's highest level of education?** *
Mark only one oval.
- ❍ Doctorate Degree (eg. PhD, MD)
- ❍ Master's Degree/Graduate Training
- ❍ Bachelor's Degree/Undergraduate
- ❍ Vocational/Trade Training (eg. electrician, plumber, baker)
- ❍ College Diploma
- ❍ Completed High School
- ❍ Elementary school

- ❍ I don't know

23. **What is your father's/guardian's highest level of education?** *
Mark only one oval.
- ❍ Doctorate Degree (eg. PhD, MD)
- ❍ Master's Degree/Graduate Training
- ❍ Bachelor's Degree/Undergraduate
- ❍ Vocational/Trade Training (eg. electrician, plumber, baker)
- ❍ College Diploma
- ❍ Completed High School
- ❍ Elementary school
- ❍ I don't know

24. **Are you currently employed? If so, how many hours per week do you work?** *
This refers to work for which you are paid.
Mark only one oval.
- ❍ I am NOT employed
- ❍ I am employed and work less than 4 hours per week
- ❍ I am employed and work between 5 and 10 hours per week
- ❍ I am employed and work between 11-15 hours per week
- ❍ I am employed and I work more than 16 hours per week

25. **Do you have daily responsibilities apart from school work? Select all that apply.** *
Check all that apply.
- ❍ Babysitting (eg. younger siblings or other children)
- ❍ Caregiver role (eg. grandparents, individuals older than yourself)
- ❍ Employment
- ❍ Housekeeping
- ❍ Other:

26. **On average, how many hours per week do you spend on these responsibilities?**
Mark only one oval.
- ❍ Less than 4 hours per week.
- ❍ 5-10 hours per week.
- ❍ 11-15 hours per week.
- ❍ 16-20 hours per week.
- ❍ 21-25 hours per week.
- ❍ More than 26 hours per week.

The questions in this section refer to your sport participation.

Please be as accurate as possible. Please rate your responses on how they apply to you. A "3" means that you neither agree nor disagree with the statement.

27. **I enjoy sports.** *
Mark only one oval.
- ❍ 1 Strongly Disagree
- ❍ 2 Disagree

- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

28. **I participate in sport regularly (three times a week or more)** *
Mark only one oval.
- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

29. **I have friends who I can participate in sports with.** *
Mark only one oval.
- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

30. **My friends encourage me to participate in sports.** *
Mark only one oval.
- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

31. **Having friends to participate with makes me more willing to participate.** *
Mark only one oval.
- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

32. **I am good at the sports I enjoy.** *
Mark only one oval.
- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

33. **I have had the opportunity to try different sports at school.** *
Mark only one oval.
- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

34. **I have had the opportunity to try different sports on my own time, outside of school.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

35. **Members of my family participate in sport regularly.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

36. **My family supports my participation in sports.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

37. **If you answered 1 or 2, please state the most common reason for why your family does not support you participating in sport.**

Leave blank if you answered 3, 4 or 5 in the previous question.

38. **In my culture, it is expected that girls participate in sports.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

39. **I feel confident when I participate in sports.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

40. **I believe that participating in sports will make me a healthy adult.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree

- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

41. **I believe that participating in sport is fun.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

42. **I believe that participating in sport is important.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

43. **I have energy to participate in sports.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

44. **I have time to participate in sports.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

45. **I feel comfortable with the dress code of my preferred sport.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

46. **My family/I can afford to participate in the sports of my choosing.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

47. **Girls should participate in sports.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

48. **There are certain sports in which girls should NOT participate.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

49. **If you answered 4 or 5 in the previous question, please list the sports in which girls should NOT participate.**

50. **Sport makes me feel positive.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

51. **I feel gross when I participate in sports.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

52. **I strive to excel in the sports that I play.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

53. **Sport helps girls develop into strong women.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree

- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

54. **Participating in sport is viewed as important in society.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

55. **Most people I know agree that sport participation is important.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

56. **Participating in sports will help me be successful in other avenues of life.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

57. **When something slows down or prevents my participation in sport, I always try my best to resolve the issue.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

58. **Which sports do you participate in?** *

Check all that apply.

- ❍ Baseball
- ❍ Basketball
- ❍ Soccer
- ❍ Ice Hockey
- ❍ Ball/Field Hockey
- ❍ Softball
- ❍ Volleyball
- ❍ Rugby
- ❍ Tennis/Badminton
- ❍ Football
- ❍ Swimming/Diving (Competitive)
- ❍ Martial Arts (Jujitsu, Karate, Taekwondo, Judo etc)
- ❍ Track & Field (short/long distance running, triathlon, etc)
- ❍ Gymnastics
- ❍ Water sports (rowing, polo, sailing, canoeing etc.)
- ❍ Cricket
- ❍ Lacrosse
- ❍ Equestrian
- ❍ Winter sport (ski, snowboard, etc.)
- ❍ Skating

- ❍ I don't participate in any sports
- ❍ Other:

59. **Which sports would you participate in if you could?** *

Check all that apply.

- ❍ Baseball
- ❍ Basketball
- ❍ Soccer
- ❍ Ice Hockey
- ❍ Ball/Field Hockey
- ❍ Softball
- ❍ Volleyball
- ❍ Rugby
- ❍ Tennis/Badminton
- ❍ Football
- ❍ Swimming/Diving (Competitive)
- ❍ Martial Arts (Jujitsu, Karate, Taekwondo, Judo etc)
- ❍ Track & Field (short/long distance running, triathlon, etc)
- ❍ Gymnastics
- ❍ Water sports (rowing, polo, sailing, canoeing etc.)
- ❍ Cricket
- ❍ Lacrosse
- ❍ Equestrian
- ❍ Winter Sport (ski, snowboard, etc.)
- ❍ Skating
- ❍ I don't want to participate in any sports.
- ❍ Other:

60. **Which sports (if any) would you have NO INTEREST in participating in?** *

Check all that apply.

- ❍ Baseball
- ❍ Basketball
- ❍ Soccer
- ❍ Ice Hockey
- ❍ Ball/Field Hockey
- ❍ Softball
- ❍ Volleyball
- ❍ Rugby
- ❍ Tennis/Badminton
- ❍ Football
- ❍ Swimming/Diving (Competitive)
- ❍ Martial Arts (Jujitsu, Karate, Taekwondo, Judo etc)
- ❍ Track & Field (short/long distance running, triathlon, etc)
- ❍ Gymnastics
- ❍ Water sports (rowing, polo, sailing, canoeing etc.)
- ❍ Cricket
- ❍ Lacrosse
- ❍ Equestrian
- ❍ Winter Sport (ski, snowboard, etc.)
- ❍ Skating
- ❍ Not applicable/Prefer not to answer
- ❍ Other:

61. **The number one reason why you do NOT participate in the sports you would like to participate in is:**

62. **Have you ever had a negative experience while practicing sport which caused you to stop practicing that sport?**
Mark only one oval.
- ❍ Yes
- ❍ No

63. **Please rate the degree to which these characteristics describe you.** *
Mark only one oval per row.

	Very High	Moderate	Average	Below Average	Low
Assertive	❍	❍	❍	❍	❍
Physically Strong	❍	❍	❍	❍	❍
Shy	❍	❍	❍	❍	❍
Flexible / Agile	❍	❍	❍	❍	❍
Energetic	❍	❍	❍	❍	❍
Studious	❍	❍	❍	❍	❍
Creative	❍	❍	❍	❍	❍
Careful	❍	❍	❍	❍	❍
High Speed	❍	❍	❍	❍	❍

64. **Please rate how likely you are to participate in a sport which is/has/requires:**
Mark only one per row.

	Not likely at all	Somewhat likely	Very likely
Highly competitive	❍	❍	❍
Recreational	❍	❍	❍
Physically intense	❍	❍	❍
Strict Rules	❍	❍	❍
Boys and Girls On Same Team	❍	❍	❍
Contact With Other Players	❍	❍	❍

Games of long duration	❍	❍	❍

The following questions pertain to the area in which you live.

Think about the community in which you live. This can include your neighborhood (within walking distance to your home or school) your city and town. Choosing "3" means that you neither agree nor disagree with the statement (i.e. you don't know)

65. **My neighborhood is safe.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

66. **The outdoor air quality in my neighborhood prevents me from participating in outdoor sport.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

67. **I am proud of where I live.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

68. **There is a lot of green space (eg. parks, paths, fields) in my neighborhood.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

69. **The sidewalks and walking paths in my neighborhood are safe.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

70. **The weather in my geographical area allows me to participate in my chosen sport when I want to.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

71. **The weather in my geographical area prevents me from participating in my chosen sport when**
I want to. *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

72. **Please rate how the following weather conditions negatively affect your participation in your preferred sports.** *

Mark only one oval per row.

	Never	*Rarely*	*Sometimes*	*Most Times*	*Always*	*n/a*
Cold temperature	❍	❍	❍	❍	❍	❍
Hot temperature	❍	❍	❍	❍	❍	❍
Humidity	❍	❍	❍	❍	❍	❍
Rain	❍	❍	❍	❍	❍	❍
Snow	❍	❍	❍	❍	❍	❍

73. **I have options for where to participate when weather conditions change (eg. indoor running**
track/soccer pitch). *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

74. **There is safe public transportation available for me to access sport opportunities.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

75. **There are safe places close to my home where I can participate in or practice sport.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

76. **The sport facilities close to my home offer sports and activities that I want to participate in.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

77. **What mode of transportation do you most often use to access the sport of your choice?** *

If you don't participate in sports in or outside of your neighborhood, select "Not applicable".

Mark only one oval.

- ❍ Walking/Cycling
- ❍ Someone drives me (parent, friend)
- ❍ I drive myself
- ❍ Public Transit (bus, taxi)
- ❍ Not applicable

78. **Please enter the amount of time in minutes that it takes you to get to your sport/activity of choice.** *

Based on the previous question. If you usually take the bus, how long does it take? If you answered "Not Applicable" enter "NA"

79. **The sport facilities close to my home are clean.** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree

- ❍ 5 Strongly Agree

80. **The sport facilities close to my home are accessible.** *

Accessibility features may include: wheelchair ramp, contrast flooring, multi-language signage,
elevator etc.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

81. **The sport facilities close to my home are not over-crowded** *

Mark only one oval.

- ❍ 1 Strongly Disagree
- ❍ 2 Disagree
- ❍ 3 Neither Agree nor Disagree
- ❍ 4 Agree
- ❍ 5 Strongly Agree

Focus Group and Prize Draw

If you would like to be considered for either the Focus Group or Prize Draw (or both), please copy and
paste this link into a new window / click on this link and fill out the required information:
https:/msBkn7ozFIlwp5FK2/goo.gl/forms/

END OF SURVEY.

Appendix C

C1. Consent form

March 1, 2017
Dear Parents/Guardians,
I am a graduate student in Health Sciences at the University of Ontario institute of Technology, currently collecting information for my research on constraints to sport participation among adolescent females. I am writing to request your permission for your daughter to be included in this study. Students will be asked to complete an online survey through Google Forms, in which they will be asked about their sport participation behaviors and attitudes, the facilities, and services available to them, as well as some demographic data (postal code, family health status (including family health history), students'/parents' employment status, etc.).

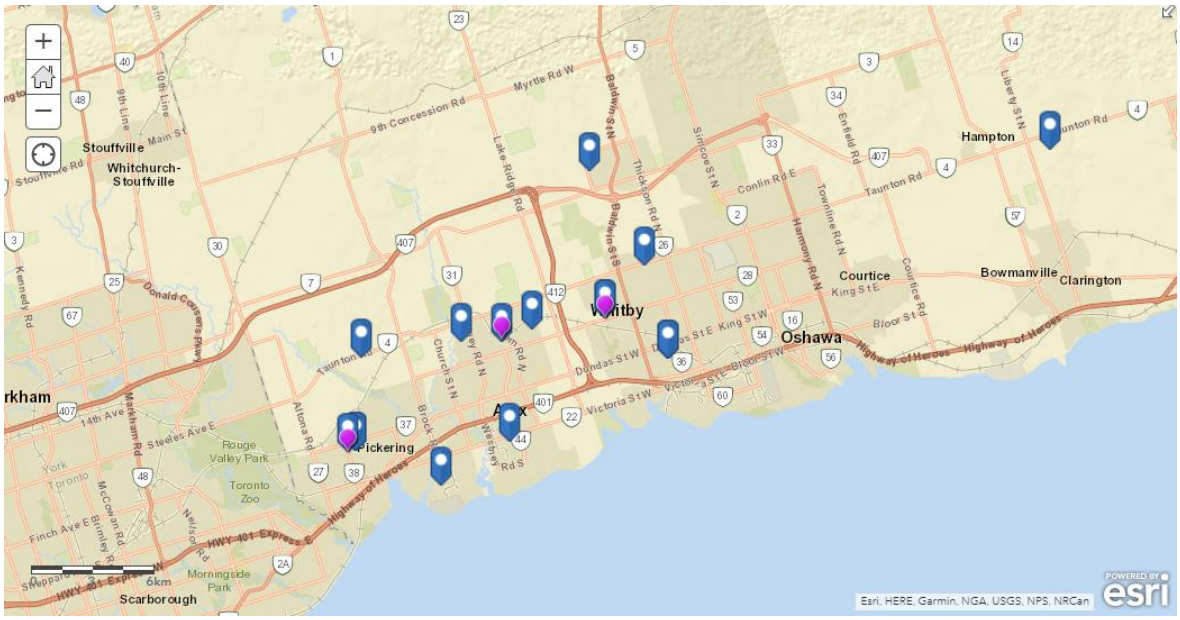
The surveys will be completed during Physical Education/Health class in the week following March Break. Students who indicate that they do not want to participate will not have to complete the survey, and will continue with their regular classroom activities. The information collected will be used as part of group data only. No individual students will be identified by name and all responses will be held in confidence by me. Results will be analyzed for common themes in constraints to sport participation and the interaction of various factors. The raw data will be destroyed upon completion of the entire study.
Please complete and return the bottom section of this letter to your child's teacher ***by Thursday, March 9, 2017.*** If you have any questions about this study or your child's participation in it, please call me at 905-922-3500. Should you change your mind about your child's involvement in this study, you may wish to call me or notify the school principal. Thank you for your assistance.

Any questions regarding your rights as a participant, complaints, or adverse events may be addressed to UOIT Research Ethics Board through the Research Ethics Coordinator researchethics@uoit.ca or 905.721.8668 x. 3693. This study has been approved by the UOIT Research Ethics Board REB (REB#14113) on January 14, 2017.
Sincerely,
Irmina Klicnik, MHSc Candidate

___I have read the above information and consent for my child_____, to participate in this study.
Parent's Signature: _____Date: _____
OR
___ I have read the above information and do not wish to have my child_____, participate in the study.
Parent's Signature: _____Date: _____

Appendix D

D1. Map of sampling area, Durham Region Ontario



Approximate location of participants' residence based on forward sortation area

Location of high schools from which sample was taken

Source:
https://www.arcgis.com/home/webmap/viewer.html?useExisting=1&layers=7d8f743a4fe94b17b2f762a38a42699e

Appendix E

E1. Composition of each index after data cleaning.

Indices (number of questions in index)	Corresponding survey question
Environmental Indices	
1. Access[2] (5)	33. I have had the opportunity to try different sports at school.
	34. I have had the opportunity to try different sports on my own time, outside of school.
	74. There is safe public transportation available for me to access sport opportunities.
	76. The sport facilities close to my home offer sports and activities that I want to participate in.
	80. The sport facilities close to my home are accessible.
2. Built Environment[2] (5)	68. There is a lot of green space (eg. parks, paths, fields) in my neighborhood.
	69. The sidewalks and walking paths in my neighborhood are safe.
	73. I have options for where to participate when weather conditions change (eg. indoor running track/soccer pitch)
	75. There are safe places close to my home where I can participate in or practice sport.
	79. The sport facilities close to my home are clean.
3. Support Family[1] (4)	35. Members of my family participate in sport regularly.
	36. My family supports my participation in sports.
	38. In my culture, it is expected that girls participate in sports.
	46. My family/I can afford to participate in the sports of my choosing.
4. Support Social[1] (5)	29. I have friends who I can participate in sports with.
	30. My friends encourage me to participate in sports.
	31. Having friends to participate with makes me more willing to participate.
	54. Participating in sport is viewed as important in society.
	55. Most people I know agree that sport participation is important.
5. Neighborhood Perception[2] (2)	65. My neighborhood is safe.
	67. I am proud of where I live.
6. Physical Environment[2] (3)	66. The outdoor air quality in my neighborhood prevents me from participating in outdoor sport. [3]
	70. The weather in my geographical area allows me to participate in my chosen sport when I want to.
	71. The weather in my geographical area prevents me from participating in my chosen sport when I want to.

7.Weather[2] (5)	72. Please rate how the following weather conditions negatively affect your participation in your preferred sports. [3]
	Cold temperature
	Hot temperature
	Humidity
	Snow
	Rain
Individual Indices	
1. Structural[2] (5)	12. Have you been diagnosed with any of the following chronic conditions?
	13. Has anybody in your immediate family been diagnosed with any of the following chronic conditions?
	16. What is your approximate weight? (in pounds) AND 17. What is your approximate height? (in feet/inches e.g. 5'7")
	18. How would you describe your body type?
	20. How would you describe your overall health?
2. Identity[1] (3)	19. How satisfied are you with your body type?
	43. I have energy to participate in sports.
	52. I strive to excel in the sports that I play.
3. Values[1] (6)	40. I believe that participating in sports will make me a healthy adult.
	42. I believe that participating in sport is important.
	44. I have time to participate in sports.
	47. Girls should participate in sports.
	53. Sport helps girls develop into strong women.
4. Developmental[1] (13)	27. I enjoy sports.
	32. I am good at the sports I enjoy.
	39. I feel confident when I participate in sports.
	62. Have you ever had a negative experience while practicing sport which caused you to stop practicing that sport?
	63. Please rate the degree to which these characteristics describe you. Physically Strong
	63. Flexible / Agile
	63. Energetic
	63. High Speed
	41. I believe that participating in sport is fun.
	45. I feel comfortable with the dress code of my preferred sport.
	48. There are certain sports in which girls should NOT participate.
	50. Sport makes me feel positive.

	51. I feel gross when I participate in sports.