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## The Relationship Between Quality of Parks and Playgrounds and Park-Based Physical Activity in Children

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Graduate Program in Health and Rehabilitation Sciences  
A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy  
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THE RELATIONSHIP BETWEEN QUALITY OF PARKS AND PLAYGROUNDS  
AND PARK-BASED PHYSICAL ACTIVITY IN CHILDREN

(Thesis format: Integrated Article)

by

Hammad Ali Qazi

Graduate Program in Health and Rehabilitation Sciences

A thesis submitted in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy

The School of Graduate and Postdoctoral Studies  
The University of Western Ontario  
London, Ontario, Canada  
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## Abstract

Research on the quality of parks and playgrounds has been limited, particularly regarding how conditions and cleanliness of parks and playgrounds influence park-based physical activity in children. This thesis explored the relationship between the quality of parks and playgrounds and physical activity in children, through a scoping review and a mixed-methods study.

The scoping review used a systematic search to identify gaps in the literature and to disseminate research findings on the topic. A total of 10 articles were selected in accordance with the selection criteria. The review showed that the features, amenities, and safety of parks and playgrounds were associated with physical activity in children to a limited extent; however, few studies have explored other aspects of quality of parks and playgrounds, such as cleanliness and conditions. Future original studies should explore the quality attributes of parks and playgrounds that can affect physical activity in children.

A mixed-methods study was conducted to explore the relationship between the quality of parks and playgrounds and park-based physical activity in children. A total of 18 neighbourhood parks with playgrounds were selected in the city of London, Ontario, through multistage sampling, and these parks were visited on different days and at different times. The quality of parks and playgrounds was measured with the Physical Activity Resource Assessment (PARA), and physical activity was measured with the System for Observing Play and Recreation in Communities (SOPARC). Multiple linear

regression was used to analyze the quantitative data, and thematic analysis was used to analyze the qualitative data (field notes).

The results showed that parks and playgrounds access  $\beta = .17$ ,  $t(1282) = 5.41$ ,  $p < .001$ ; features  $\beta = .07$ ,  $t(1282) = 2.48$ ,  $p = .01$ ; and fewer incidents of incivilities  $\beta = .14$ ,  $t(1282) = 4.77$ ,  $p < .001$  were positively associated with physical activity, while amenities were negatively associated  $\beta = -.10$ ,  $t(1282) = -3.19$ ,  $p < .001$ ; and child's observed age and gender were not associated with park-based physical activity; however, the type of physical activity (organized or free play) varied with child's observed age and gender. The results also indicated effects of the temperature, weather, day of the week, and time of day on park-based physical activity. These findings could help researchers conduct intervention studies evaluating how changes to parks influence physical activity in children. The findings could also help recreation planners to develop strategies that could improve the quality of parks that promote park use and park-based physical activity in children.

## Keywords

Physical activity, built environment, quality, parks and playgrounds, park use, park-based physical activity, children.

## Co-Authorship Statement<sup>1</sup>

The material presented in this dissertation is the result of my original work; however, I would like to acknowledge the important contributions of Dr. Janice Miller Polgar, my supervisor who contributed to all chapters included in this dissertation. The three chapters that are in the form of manuscripts will be sent for publication in different journals with Dr. Janice Miller Polgar as co-author in all of those studies.

<sup>1</sup>Note: There is some repetition due to the integrated nature of the thesis. The methods are described in detail in Chapter 3. A condensed version of the relevant methods is included in chapters 4 and 5, which will be sent for publication in different journals.

## Acknowledgments

I would like to take this opportunity to thank those individuals who supported me to successfully complete this PhD program. First, I would like to thank Dr. Janice Miller Polgar. She has been an excellent supervisor who guided me throughout the four years of my PhD program. Her help in my thesis writing is commendable in terms of frequent meetings, suggestions, advice, feedback, and extensive readings. Her help was not restricted to my research and thesis, but she helped me in every aspect of my course work, funding, and other personal issues including vacations that an international student may face in early years of settlement and even, thereafter. I would also like to thank my advisory committee, Dr. Chris Lee and Dr. Trish Tucker for their guidance, suggestions and feedback throughout my research project, analysis, and in thesis writing. I would like to thank the staff in Health and Rehabilitation Sciences department, particularly Nancy Inchley, Cathy Collins, and Amber Trent. I appreciate Nancy and Cathy for their timely replies and the information they provided to deal with my administrative queries.

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# Chapter 1

## 1 Introduction

### 1.1 Physical Activity

Physical activity is critical to maintain health and well-being in children (Ward, 2010). Physical inactivity in children is a growing concern, particularly in developed countries (World Health Organization [WHO], 2002), making it a global public health priority (Cochrane et al., 2009). Physical inactivity during childhood may be associated with acute and chronic conditions, such as myocardial infarction, coronary artery disease, hypertension, dyslipidemia, osteoarthritis, stroke, diabetes mellitus, and chronic respiratory diseases in adulthood (WHO, 2002).

Regular physical activity in childhood and adolescence not only aids in building strong bones and improving muscle strength but also provides the psychological advantages of reducing anxiety and stress levels and helps to prevent several disabling adulthood conditions (Centers for Disease Control & Prevention [CDC], 2013). Sixty minutes of daily physical activity in children can help them to grow stronger, to improve their self-confidence, to learn new skills, and to feel happier (Canadian Society for Exercise Physiology [CSEP], 2013). Several authors have shown that physical activity helps not only to decrease obesity but also to prevent weight regain (Berger & Peerson, 2009; Hemmingsson & Ekelund, 2007; Keeton & Kennedy, 2009; Maksimovic et al., 2009; Matheson et al., 2004; Wittmeier, Mollard, & Kriellaars, 2008).

The most recent Canadian Physical Activity Guidelines by the Canadian Society for Exercise Physiology (2013), supported by the Public Health Agency of Canada, stated that infants should be physically active several times daily, particularly in interactive floor-based play. Children between the ages of 1 and 4 years should be physically active for at least 3 hours in a day, and children 5 years of age should perform at least 60 minutes of energetic play. Furthermore, children between the ages of 5 and 17 years should perform at least 60 minutes of moderate-to-vigorous physical activity daily, with both muscle- and bone-strengthening activities and vigorous activities for at least 3 days a week (CSEP, 2013).

Despite the importance of physical activity, a large proportion of children do not meet the recommended guidelines of physical activity in the western world (Hills, Anderson, & Byrne, 2011). Based on accelerometer measurements, only 7% of Canadian children and youth between the ages of 6 and 19 years ( $N = 1,608$ ) performed 60 minutes of moderate-to-vigorous physical activity at least 6 days a week (Colley et al., 2011). Similarly, Lemstra, Nielsen, Rogers, Thompson, and Moraros (2012) conducted a school-based survey in Saskatoon and found that only 7% of youth ( $N = 4,197$ ) met the Health Canada standard of daily physical activity, which recommends 1 hour or longer of exercise at somewhat hard or higher intensity. The percentage of Canadian children aged 10-16 years who are performing at least 60 minutes of moderate-to-vigorous physical activity is very low (18%) (Active Healthy Kids Canada Report Card, 2012). A survey of health behaviour showed that only 34% of children aged 11-15 years in Europe performed regular moderate physical activity on 5 days a week (Currie et al., 2012). This low proportion of physical activity in children warrants exploration and an understanding of

the factors that are associated with the lack of physical activity, so that community-targeted interventions against factors inhibiting physical activity levels in children can be planned.

### 1.1.1 Factors Associated with the Lack of Physical Activity

Research has indicated that several variables are associated with physical activity in children, such as, age, gender, ethnicity, history of preterm birth, father's body mass index (BMI), parental weight status, and healthy diet (Finn, Johannsen, & Specker, 2002; Sallis, Prochaska, & Taylor, 2000). Authors have reported a decrease in physical activity levels from school age to adolescence (Konharn, Dantos, & Ribeiro, 2012; Riddoch et al., 2004; Swaminathan, Selvam, Thomas, Kurpad, & Vaz, 2011). On average, more boys are physically active than girls (Konharn et al., 2012; Swaminathan et al., 2011; Troiano et al., 2008).

Social factors, such as parental and family preferences, lifestyles, working hours, and motivational support from parents and friends, are associated with physical activity levels in children (Flodmark, Lissau, Moreno, Pietrobelli, & Widhalm, 2004; French, Story, & Jeffry, 2001; Kipke et al., 2007; Krishnamoorthy, Hart, & Jelalian, 2006; Ochoa, Moreno-Aliaga, Martinez-Gonzalez, Martinez, & Marti, 2007). Studies have shown that built environment factors, such as walkability, land use mix, transport, neighbourhood safety, and presence of parks and playgrounds, may be the primary predictors of physical activity (Ferdinand, Sen, Raturkar, Engler, & Menachemi, 2012; Galvez, Pearl, & Yen, 2010).

Factors associated with lack of physical activity can be broadly categorized into modifiable and non-modifiable risk factors. Non-modifiable risk factors include age, gender, family history, genetically determined traits, and ethnicity. Modifiable factors include lifestyle factors, built environmental aspects, diseases such as obesity, and motivational support from parents (Garko, 2011). Studies have shown that changing aspects of the built environment, one of the modifiable factors associated with physical activity, can promote physical activity levels and decrease physical inactivity levels in children (Garko, 2011; Kahn et al., 2002; Trasande et al., 2009). Thus, the following paragraphs will provide an overview of the aspects of the built environment that are associated with physical activity in children. The following section will conclude by highlighting the importance of characteristics of parks and playgrounds as one of the aspects of the built environment that are related to promoting physical activity in children.

## 1.2 The Built Environment

The built environment consists of spaces that are either deliberately constructed or modified (altered) by human activity, such as roads, schools, and parks and playgrounds (Sallis & Glanz, 2006; The American pediatric committee on environmental health, 2009). Understanding aspects of the built environment that are associated with the lack of physical activity may help in the development of strategies for modifying the built environment that could increase physical activity levels in children (Kahn et al., 2002; Trasande et al., 2009). The built environment may be broadly categorized into domains of land use patterns, safety and transportation issues, and urban design (Frank, Engelke,



& Schmid, 2003). Several built environment factors within each of these domains are related to physical inactivity, particularly in children. Several built environment factors will be discussed in the following paragraphs.

Authors have shown that built environment factors, such as residential density (dwelling units or population per acres of residential land), a diverse mix of land use, and high road or street connectivity, are associated with walking and physical activity in children (Berke, Koepsell, Moudon, Hoskins, & Larson, 2006; Kahn et al., 2002; Larsen et al., 2009; Norman et al., 2006; Saelens, Sallis, & Frank, 2003; Spence, Cutumisu, Edwards, & Evans, 2008). A well-maintained walking surface is the main infrastructure associated with walking and physical activity (Pikora, Giles-Corti, Knuiiman, Bull, & Jamrozik, 2006). Frank, Kerr, Chapman, and Sallis (2007) conducted a cross-sectional study in the US and found that walking, measured using a travel diary, was associated with residential density, intersection density, land use mix, and commercial and recreation space, only in children 12-15 years of age ( $N = 3,161$ ). Similarly, a cross-sectional study in Australia explored the relationship between objective physical environment, using a Geographic Information Systems (GIS) software package, and physical activity in children (Timperio et al., 2006). The authors found that in younger children ( $n = 235$ ) aged 5-6 years, steep inclines and school routes along busy roads were negatively associated with walking or cycling.

The built environment factors related to safety and crime rates within a neighbourhood are also associated with walking and physical activity in children (Carver et al., 2005; Gomez, Johnson, Selva, & Sallis, 2004; Molnar, Gortmaker, Bull, & Buka, 2004). Burdette and Whitaker (2005) conducted a study with preschool-aged children ( $N =$

3,141) in the US and found that mothers' perceptions of their neighbourhood as unsafe were associated with an increased likelihood of indoor sedentary pursuits, such as TV watching. Timperio et al. (2004, 2006), using self-administered questionnaires completed by older children (10-12 years) and by parents of younger children (5-6 years), found that no street lights or increased numbers of crossings and transportation issues, such as heavy traffic, busy road barriers en route to school, and limited transportation, were negatively associated with active commuting to school in both young and older children. However, perceived neighbourhood safety was not associated with physical activity as measured using activity monitors in 8- to 10-year-old African-American girls ( $N = 52$ ) in the US (Adkins, Sherwood, Story, & Davis, 2004). This difference in findings may be related to geographical setting (Australia or the US), community (white or African-American), demographic characteristics (boys and girls vs. girls only), and type of measurement (self-administered questionnaire vs. activity monitor).

Access to parks and playgrounds is associated with physical activity in children (McKenzie et al., 2006). The lack of access to recreational facilities and increased access to shopping malls and fast food restaurants all contribute to inhibiting or preventing active living behaviours (De-Bourdeaudhuij, Sallis, & Saelens, 2003; Khan, 2009; McCormack, Giles-Corti, & Bulsara, 2008). The presence of recreational facilities and nearby parks is also associated with physical activity (Norman et al., 2006). Several studies have identified the features and amenities of parks and playgrounds that are associated with park use and physical activity (Dyment & Bell, 2008; Maroko, Maantay, Sohler, Grady, & Arno, 2009; Potwarka, Kaczynski, & Flack, 2008; Ries et al., 2009; Singh, Siahpush, & Kogan, 2010; Tucker, Gilliland, & Irwin, 2007). One study indicated

that recreational opportunities, measured both subjectively (by parental perception of recreational opportunities) and objectively (by GIS software), were associated with physical activity in youth ( $N = 811$ ) aged 11-13 years in London, Ontario (Tucker et al., 2009). Park features such as walking and cycling paths are associated with physical activity in children (Crawford et al., 2008).

### 1.2.1 Importance of Parks and Playgrounds

Physical activity occurs in different forms, including structured (organized sports, e.g., baseball and soccer) and unstructured or unorganized activities (free play, e.g., climbing equipment, running on the grass and around splash pads, and playing with a ball).

Organized sports and free play make meaningful contributions to the daily moderate-to-vigorous physical activities in children and youth (Active Healthy Kids Canada Report Card, 2012). Exploring factors related to both organized and unorganized activities that can promote both organized sports and free play activities in children is essential for increasing the physical activity levels in children (WHO, 2007).

Parks and playgrounds are important settings where children can engage in both free play activities, such as playing in a sand box, climbing equipment, playing with a ball, running around splash pads, cycling, and swimming, and organized sports, such as baseball, basketball, soccer, ice hockey, tennis, and volleyball (Kipke et al., 2007; Prellwitz & Skär, 2007; Proshanski & Fabian, 1987). The features and amenities of parks include playgrounds, sport courts, paths, and playing equipment, such as climbing structures, slides, and basketball nets (Farley, Meriwether, Baker, Rice, & Webber, 2008; Shores & West, 2008).

Moreover, parks and playgrounds are not only areas where children remain active and improve their motor skills, they also provide opportunities for children to interact with each other (Loukaitou-Sideris & Stieglitz, 2002). Parks and playgrounds are sources of pleasure and happiness, which have a positive role in reducing stress and anxiety, provide psychosocial health benefits, and encourage other health-enhancing behaviours in individuals (Godbey & Blazey, 1983; Hull & Michael, 1995). Additionally, regular physical activities performed within parks and playgrounds have a strong influence on reducing the prevalence of obesity (Blanck et al., 2012). For these reasons, city and local governments should create and maintain parks and playgrounds to promote physical activity, thereby leading to health-enhancing benefits from childhood to adolescence through adulthood (The American Pediatric Committee on Environmental Health, 2009).

In summary, the above discussion has highlighted that parks and playgrounds are important aspects of the built environment that influence both structured and unstructured physical activity in children and offer additional physical health and psychological advantages, as supported by the literature (Blanck et al., 2012; Godbey & Mowen, 2010).

### 1.3 Relationship Between Park and Playground Quality, Use of Parks and Playgrounds, and Related Physical Activity

The characteristics of parks and playgrounds, such as the presence of features, amenities, aesthetics, condition, and cleanliness, have been defined as quality components of parks and playgrounds in several studies (Coen & Ross, 2006; Hillsdon, Panter, Foster, &

Jones, 2006; Kaczynski & Henderson, 2007; Lee, Booth, Reese-Smith, Regan, & Howard, 2005; Prellwitz & Skär, 2007). The characteristics of parks and playgrounds can be sorted into three categories: (a) features, including basketball, tennis and volleyball courts, soccer fields, play equipment, and swimming pools; (b) amenities, including benches, tables, structures providing shade, lighting, fountains, and garbage cans; and (c) incivilities, including auditory annoyances, evidence of alcohol and substance abuse, broken glass, graffiti, and litter (Adamus, Mama, Sahnoune, & Lee, 2011; DeBate et al., 2011; Henrich et al., 2007; Lee et al., 2005; McAlexander K, Banda, McAlexander J, & Lee, 2009; Parmenter et al., 2008; Witten, Hiscock, Pearce, & Blakely, 2008). Authors in previous studies have shown that the features, amenities, and incivilities of parks and playgrounds are associated with their use and the physical activity of park visitors of all ages (Giles-Corti et al., 2005; Kaczynski, Potwarka, & Saelens, 2008; Maroko et al., 2009; Singh et al., 2010; Timperio et al., 2008; Tucker et al., 2009).

Parks and playgrounds with multiple features can increase the number of visitors and the frequency of visits, their use, and related physical activity in children (Cohen et al., 2006; Gordan & Larsan, 2006; Kaczynski et al., 2008; Kaczynski & Havitz, 2009; Moody et al., 2004; Romero, 2005). The presence of facilities and amenities such as water features and shaded areas, play equipment such as swings, and cleanliness are among the primary reasons for parents to visit parks and playgrounds (Tucker et al., 2007). Parks with high-quality features, such as field courts and basketball courts are associated with increased park use (Perry, Saelens, & Thompson, 2011; Rung et al., 2011). However, park use and number of visits cannot be employed as indicators of physical activity because several

authors have shown that large numbers of children within parks and playgrounds might engage in mild-to-moderate rather than vigorous physical activity (Kaczynski et al., 2011; Perry et al., 2011).

Hamilton (2011) concluded that not only is the presence of features and amenities of parks and playgrounds associated with physical activity among park visitors, but also the parks' condition and cleanliness. However, the study did not conduct a separate analysis on children. Poor condition and poor cleanliness of parks and playgrounds, such as litter and debris outside trash cans, high crime rates, fields with thick overlying grass or no grass, and play equipment that are rough, uneven, rusted, poorly installed, or unsafe, may hamper park use among park visitors of all ages; however, again no separate analysis on children (McCormac, Rock, Toohey, & Hignell, 2010; Powell et al., 2004; Shores & West, 2008).

## 1.4 Rationale of Research Based on the Literature Review

Previous authors have explored the relationship between the presence and the availability of features and amenities of parks and playgrounds and park use and visits; however, there is limited research on the quality aspects of park and playground condition and cleanliness and physical activity in children (Cohen et al., 2006; Ries, Yan, & Voorhess, 2011; Timperio et al., 2008). Moreover, authors have explored the association between the characteristics of parks and playgrounds and the overall daily or weekly physical activity patterns of the children (Cohen et al., 2006; Ries et al., 2011; Timperio et al., 2008). The daily or weekly physical activity measurements may not indicate whether the

physical activity was performed in parks and playgrounds or at other places within the neighbourhood. Further, these authors did not measure the park-based physical activity patterns in relation to quality characteristics of parks and playgrounds. To determine the influence of parks and playgrounds on physical activity in children, studies should evaluate the physical activity within parks and not the daily activities or activities performed within different neighbourhood settings.

To investigate the role of parks and playgrounds on physical activity, the current study was conducted to explore quality characteristics, including the condition and cleanliness of parks and playgrounds and how they influence and are related to park-based physical activity in children up to 12 years of age. The findings may help future researchers and public health consultants to conduct intervention studies aimed at improving park and playground quality and to evaluate how these changes can influence their use and the related physical activity in children (Floyd, Spengler, Maddock, Gobster, & Suau, 2008; Floyd et al., 2011; Perry et al., 2011). Identifying the quality components in parks that have stronger roles in promoting park-based physical activities in children may also direct urban and recreation planners to develop strategies for improving the quality of existing parks and playgrounds (park renovation) and for creating parks with those quality components that can promote their use and park-based physical activity in children.

## 1.5 Aims and Objectives

The aim of the research was to explore the relationship between park and playground quality and park-based physical activity in children (observed to be up to 12 years of age). The following studies were designed to achieve the above aim:

1. A scoping review was conducted to explore the nature of the literature on the relationship between park and playground quality (the presence of features and amenities, their condition and cleanliness, and park safety) and the related physical activity in children.
2. A mixed-methods study was conducted using the quantitative method as the primary design and the qualitative method as the secondary design. The primary objective of the quantitative method was to determine whether overall park and playground quality and the quality of features, amenities, and incivilities were associated with park-based physical activity in children. The primary objective of the qualitative method was to provide a greater context and description to the quantitative results by exploring the quantitative relationship between overall park and playground quality and the quality of features, amenities, and incivilities and park-based physical activity in children.

## 1.6 Theoretical Framework of the Research

The theoretical framework of this thesis is based on Ecological Systems Theory (EST) or Bronfenbrenner's ecological theory (Bronfenbrenner, 1979). Physical activity behaviour



in children is complex and multifactorial (Davison & Birch, 2001; Victorian Curriculum and Assessment Authority [VCAA], 2011-2014). Several social, physical, and policy-level factors influence physical activity participation in children (Davison & Birch, 2001; Kipke et al., 2007).

Socioecological models acknowledge that initiation, adoption, and maintenance of physically active lifestyles are dependent upon environmental factors (VCAA, 2011-2014). Environmental settings have multiple physical, cultural, and social constructs that influence health behaviour (Humphrey, 2000). Socioecological models also help identify opportunities that promote participation in physical activity by targeting either individual or combined interventions against social, physical, and policy factors that inhibit physical activity.

### 1.6.1 Ecological Systems Theory (EST)

Urie Bronfenbrenner's EST (1979) focuses on the relationship between the individual and the environment. EST has been used to explore and understand the relationship between the built environment factors and physical activity in individuals, including children, in several studies (Bocarro et al., 2009; Davison & Birch, 2001).

The theory states that childhood development is a process of progressive, complex, and reciprocal interactions between a child and his or her immediate environment. These interactions are termed proximal processes when they occur frequently and for prolonged periods of time (Bronfenbrenner, 1994). Physical activities usually performed by each child within his or her immediate environment (process) on a frequent and prolonged basis are examples of proximal processes (Bronfenbrenner, 1994; Bronfenbrenner &

Evans, 2000; Tudge et al., 2009). Physical activities performed by a child within a local neighbourhood park with which he or she is in direct contact were selected as processes in this study (Crosby et al., 2010; Parsons, 2011). Authors have shown that these interactions between children and parks and playgrounds are frequent and occur for a prolonged duration of time (Dowda, Ainsworth, Addy, Saunders, & Riner, 2001; Perry et al., 2010; Ries et al., 2009), justifying the use of proximal processes in this study. Furthermore, authors have also used studies with data collection at one point in time to evaluate proximal processes (Adamson, O'Brien, & Pasley, 2007; Tudge et al., 2009).

In addition to proximal processes, Bronfenbrenner included components of person (individual) and context (Bronfenbrenner, 1994; Bronfenbrenner & Evans, 2000). The personal characteristics may be of demand type, such as age, gender, skin colour, and physical appearance (Tudge et al., 2009). The individual characteristics may also include force characteristics, such as effectance, motivation, temperament, persistence, and preferences (Hickey, Harrison, & Sumsion, 2012; Tudge et al., 2009).

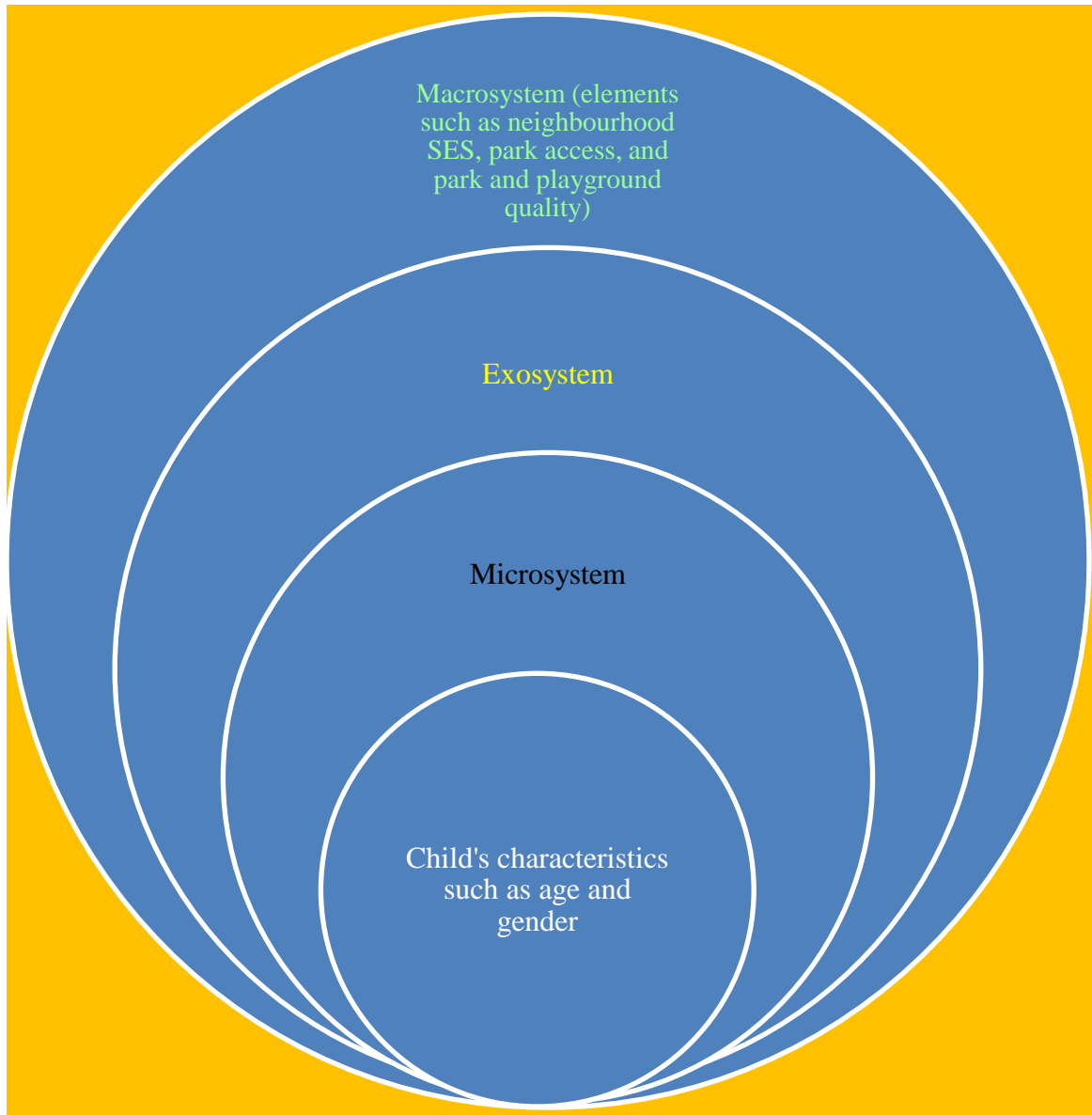
The context includes five subsystems (micro, meso, exo, macro, and chron systems), nested together in which each subsystem has several elements that are related to each other, both within and between the subsystems of EST. These subsystems are hierarchically arranged as concentric circles. The outermost subsystem has the weakest influence on the individual (child), and the innermost circle has the strongest influence on the individual. Microsystem refers to the setting in which the individual lives, for example, a family and a school (Davison & Birch, 2001). Mesosystem incorporates the connections and dimensions with the constituents of microsystems in one's life. For example, a healthy eating habit at home will influence a child's eating habit at school,

and physical activity encouragement by parents at home will influence a child's participation in physical activity at school. Exosystem refers to a setting based on interconnections between two or more settings with at least one, where an individual does not have a direct role. For example, a child may be affected by parents who work extra hours (overtime because of promotion, fewer staff, job requirement, etc.) because these parents have less time for their child and may not be able to take them to recreational areas due to their busy schedules. Macrosystem refers to the broad social or cultural context in which a person lives and includes belief systems, material resources and opportunity structures (Bronfenbrenner, 1994). Chronosystem refers to those important events, circumstances, and transitions that an individual faces during the course of their life (Bronfenbrenner, 1979; Woodside, Caldwell, & Spurr, 2006). These subsystems (and their characteristics) encircle the individual (and its characteristics) within the EST.

The focus of this thesis is on the macrosystem of EST. Understanding the elements of the macrosystem, such as park and playground quality and access, may help in the development of strategies and interventions that can modify these elements (Kahn et al., 2002; Trasande et al., 2009). Exploring macrosystem elements may help public health researchers to develop interventions (e.g., improving quality by the renovation of parks) targeting the macro and community levels. Interventions targeting the macrosystem elements (related to physical activity) are cost-effective because they impact the health-enhancing behaviour of the community by influencing the subsystems of exo, meso and ultimately microsystems of an individual. Thus, macrosystem elements are more important because any change in the macrosystem ultimately influences all of the other

subsystems and their elements that are related to the developmental outcomes (such as physical activity) of an individual.

Neighbourhood socioeconomic status (SES) and park and playground quality and access were selected as macrosystem elements. Day and time were selected as chronosystem elements in this study. Accessibility and quality maintenance of neighbourhood parks and playgrounds are primarily responsibilities of city and local governments, guided by policies at the macro level. Furthermore, neighbourhood SES, weather, and temperature influence the physical activity at the macro levels of society, community, and culture. Select factors, such as lack of organized activities, recreational facilities, resources, access to recreational facilities, and SES have been assessed as macro elements in studies (Brown, n.d.; Crosby et al., 2010; Davison & Birch, 2001). The children's ages and genders were selected as individual characteristics in this study. The arrangement of elements (included in the study) within different subsystems, encircling the children and their characteristics, is shown in Figure 1.



*Figure 1:* Arrangement of study elements within the different subsystems of EST

### 1.6.1.1 Application of EST to Predict the Relationship Between Park and Playground Quality and Park-Based Physical Activity in Children

The decreased physical activity levels in Canadian children and the relationship between built environment factors and physical activity, as reported in the literature, suggest the need for improvement and changes on the broader level of the community and the macrosystem. One of these community and macro-level changes may include changes in park and playground quality. The quality of parks and playgrounds (macrosystem element) and their characteristics, such as features, amenities and incivilities, including their presence, condition, and cleanliness, may afford opportunities for children to visit these areas and engage in play, sports, and physical activities, as reported in the literature.

The process by which any subsystem influences a child's park-based physical activity is established on the hierarchical position of a subsystem within the EST, environmental (contextual elements) interactions both immediate and remote, characteristics of individuals, and the direction of these interactions (Bronfenbrenner, 1979, 1994; Bronfenbrenner & Evans, 2000). This study will use these foundational ideas to support future predictions about which changes in park and playground quality characteristics are most effective to make and how they will affect park-based physical activity in children.

## 1.7 Structure of This Thesis

This thesis consists of the present chapter and five subsequent chapters. The present chapter provides an overview of physical activity and the built environment, the relationship between park and playground quality with physical activity of children and a discussion of EST as the theoretical framework. The next chapter, in the form of a manuscript, explores the nature of the literature on the relationship between park and playground quality and physical activity in children using a scoping review. The identified gaps and findings of the scoping review provide a rationale to conduct original research on the relationship between park and playground quality and park-based physical activity in children. Chapter 3 includes a detailed description of the methods. Chapter 4, which is presented in the form of a manuscript, explores the quantitative relationship between park and playground quality (i.e., features, amenities, and incivilities) and park-based physical activity in children. Chapter 5 provides a greater context for the quantitative results to better understand the quantitative findings and to provide a rich description of two parks (high- versus low-quality) in relation to park-based physical activity behaviours in children. The last chapter of this thesis synthesizes the findings of the chapters and manuscripts, discusses the cumulative results, and concludes the thesis with practical implications, study limitations, and final remarks.

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## Chapter 2

### 2 Scoping Review

#### 2.1 Introduction

Physical activity has several benefits in children, such as building strong bones and improving muscle strength (Centers for Disease Control and Prevention [CDC], 2013). It also helps to prevent several disabling adulthood conditions, such as myocardial infarction, coronary artery disease, hypertension, diabetes mellitus, chronic respiratory diseases, and obesity (Berger & Peerson, 2009; CDC, 2013; Keeton & Kennedy, 2009; Maksimovic et al., 2009; Matheson et al., 2004; Wareham, 2007). Despite the importance of physical activity, only a small proportion of children in the Western world are physically active (Hills, Anderson, & Byrne, 2011). Only 7% of Canadian children and adolescents performed at least 60 minutes of moderate-to-vigorous physical activity at least 6 days per week, based on accelerometer measurement and a school-based survey (Colley et al., 2011; Lemstra, Nielsen, Rogers, Thompson, & Moraros, 2012). Studies have shown that only 29% of high school students in the US and 34% of children 11-15 years of age in Europe are physically active (Currie et al., 2012).

Factors associated with decreased physical activity levels in children include aspects of the built environment (French, Story, & Jeffry, 2001; Kipke et al., 2007; Krishnamoorthy, Hart, & Jelalian, 2006; Sallis, Prochaska, & Taylor, 2000). The built environment is defined as man-made structures and surroundings, recreational facilities, such as parks and playgrounds, food sources, buildings and houses, road and streets, and outdoor

spaces, that are either deliberately constructed or modified (altered) by human activity (Sallis & Glans, 2006; The American Pediatric Committee on Environmental Health, 2009). Several authors have found that built environment factors, including walkability, land-use mix, transportation, safety, and characteristics of parks and playgrounds, are associated with physical activity in children in different communities (Berke et al., 2006; Carver et al., 2005; Cochrane et al., 2009; Gilliland et al., 2012; Kahn et al., 2002; Larsen et al., 2009; Saelens, Sallis, & Frank, 2003).

To increase physical activity in children, both structured and unstructured activities should be promoted (WHO, 2007). Parks and playgrounds are among the primary factors of built environments that influence both organized and unorganized physical activity levels in children (Floyd et al., 2011; Kipke et al., 2007; Prellwitz & Skär, 2007).

Moreover, the characteristics of parks and playgrounds, such as features, amenities, and aesthetics, provide opportunities for children to engage in physical activities that can improve their motor skills, provide opportunities for social interaction, and have several psychological benefits (Godbey & Blazey, 1983; Hull & Michael, 1995; Loukaitou-Sideris & Stieglitz, 2002). This review will focus on the characteristics of parks and playgrounds (Koplan, Liverman, & Kraak, 2005; Singh, Kogan, & van Dyck, 2008) that are associated with physical activity in children (Floyd et al., 2011).

Characteristics such as the presence and availability of features, amenities and incivilities, and safety have been used in several studies as the primary components in the quality of parks and playgrounds (Coen & Ross, 2006; Hillsdon, Panter, Foster, & Jones, 2006; Kaczynski & Henderson, 2007; Lee, Booth, Reese-Smith, Regan, & Howard, 2005; Prellwitz & Skär, 2007). Studies have also shown that the features and amenities

of parks and playgrounds, such as walking and cycling paths, drinking fountains, picnic tables, and water features, are associated with increased park use and physical activity among park visitors, including children (Cohen et al., 2006; Crawford et al., 2008; Dymont & Bell, 2006; Moody et al., 2004; Perry, Saelens, & Thompson, 2011; Rung, Mowen, Broyles, & Gustat, 2011; Tucker, Gilliland, & Irwin, 2007; Tucker et al., 2009). Separate analyses of children, inclusion of other quality characteristics, such as conditions, cleanliness, and safety, or a focus on park-based physical activity in children are evident in a limited number of studies.

The features, amenities, aesthetics, and incivilities of parks and playgrounds are myriad. Listing and repetition of individual items would create redundancy that could distract the reader from the focus of the argument. Therefore, Table 1 lists the items categorized by features, amenities, and incivilities, as classified in previous studies (Adamus, Mama, Sahnoune, & Lee, 2011; DeBate et al., 2011; Henrich et al., 2007; Lee et al., 2005; McAlexander K, Banda, McAlexander J, & Lee, 2009; Parmenter et al., 2008; Witten, Hiscock, Pearce, & Blakely, 2008).

Table 1

*Classification of Characteristics of Parks and Playgrounds Into Features, Amenities and Incivilities, Based on the Literature Review*

Features	Amenities	Incivilities
Baseball diamonds	Bathrooms	Auditory annoyance
Soccer fields	Benches and tables	Vandalism
Squash, tennis, basketball, and volleyball courts	Fountains	Evidence of substance Abuse and Alcohol abuse
Rugby grounds	Landscapes, trees, shrubs, and flowers	Graffiti and litter
Play equipment (such as swings, climbing structures, see-saw, slides, etc.)	Lighting	Overgrown or no grass
Walking and biking trails	Trash containers	
Water features (such as splash pads, wading pool and swimming pools)	Structures providing shade	
Sandboxes		

In summary, authors have explored the characteristics and attributes of parks and playgrounds that might influence their use and the physical activity of children; however, literature on how the conditions and cleanliness of parks and playgrounds relate to their use and to physical activity in children is scarce (Floyd et al., 2011; Moody et al., 2004; Timperio et al., 2008). Individual studies have advocated for further research on the role of park and playground characteristics in the use of parks and playgrounds and park-based physical activity in children (Cohen et al., 2006; Colabianchi et al., 2011; Floyd et al., 2008; Ries, Yan, & Voorhess, 2011).

A scoping review was performed with the aim of exploring the literature on the relationship between quality characteristics of parks and playgrounds, including their conditions and cleanliness, and physical activity in children (the articulation of the specific research question formed a part of the scoping review and hence will be included in the methodology section of the review). The review identified those quality characteristics of parks and playgrounds that might influence their use and physical activity in children and also identified gaps in the literature (with regard to the relationship between the quality of parks and playgrounds and physical activity in children), in which original research is needed. Based on the results, future researchers can conduct intervention studies in different settings and communities, exploring how changes in these characteristics can promote park use and related physical activities in children. In addition to identifying gaps in the literature, the current review also helped to collate, summarize, and report the research findings by drawing conclusions from the existing literature (Arksay & O'Malley, 2005).

### 2.1.1 The Conceptual Framework of the Review: Ecological Systems Theory (EST)

Ecological Systems Theory (EST) was introduced by Urie Bronfenbrenner (1979), a leading developmental psychologist. The theory states that child development occurs based on the interactions between the context and the child. These interactions are termed “proximal processes” when they occur regularly and over a prolonged period of time (Bronfenbrenner, 1994). Physical activity in children within the immediate environment (e.g., a neighbourhood park, a school, etc.) is an example of a proximal process (Bronfenbrenner, 1994).

The context in EST is divided into five subsystems (micro, meso, exo, macro, and chrono systems) that are nested within each other, hierarchically arranged in concentric circles surrounding the individual (Bronfenbrenner, 1979). Each subsystem of EST has several elements that are interrelated, both within and among the subsystems. These interactions within the environment (context) relate to individual characteristics, such as age and gender, to influence processes such as physical activity.

The review mainly focused on how one of the contextual elements (the quality of parks and playgrounds) influences physical activity in children. The quality of parks and playgrounds is primarily the responsibility of city and local governments, guided by policies at the macro level, so it was included as a macrosystem element in this review.

The foundational concepts of EST mentioned above were used in this review to explore the literature regarding how the characteristics of parks and playgrounds influence their use and related physical activity in children.



## 2.2 Methods

Scoping reviews are conducted to identify gaps and to explore areas in which research has been limited (Arksay & O'Malley, 2005; Sawka et al., 2010). Scoping reviews also help to create a rich database of literature that can serve as a foundation for more detailed reviews. Scoping reviews follow systematic reviews by using rigorous and transparent methods for data collection (a systematic search of the relevant literature, based on pre-defined selection criteria). The charting of data and the collating and summarizing of the results in scoping reviews also enhance reliability and the potential for replication (Weeks & Strudsholm, 2008). Assessment of the quality of the literature is generally not a part of scoping reviews, unlike systematic reviews (Brien, Lorenzetti, Lewis, Kennedy, & Ghali, 2010). In scoping reviews, the primary focus is on the research findings of the studies and not on how these findings were obtained (Lambert, 2006).

The scoping review typically is structured as follows (Arksay & O'Malley, 2005):

1. Identifying the research question;
2. Searching for relevant studies;
3. Selecting the studies, based on pre-defined selection criteria;
4. Charting the data, and;
5. Collating, summarizing, and reporting the results.

### 2.2.1 Identifying the Research Question

The research question of this review was as follows: does the quality of parks and playground, as defined by the presence of features and amenities, their condition and

cleanliness, and park safety influence park and playground use and related physical activity in children?

### 2.2.2 Searching for Relevant Studies

The initial search strategy focused on four subjects: (a) parks and playgrounds; (b) quality; (c) physical activity; and (d) childhood. Each component was later classified into relevant synonyms, key words, and MeSH terms, and a systematic search strategy was developed and applied using Medline, OVID, PubMed, Web of Science, Web of Knowledge, Scopus, EMBASE, and Google. “Parks and playgrounds” included key words such as “park or playground or open space or public facilities.” “Quality” included key words such as “quality or feature or characteristic or attribute or property or trait or condition.” “Physical activity” included key words such as “physical activity or motor activity or obesity or overweight or excessive weight or body mass index (BMI) or weight gain or body weight or body fat or adipose tissue.” “Childhood” included “child\* or children or young\* or youth or childhood or adolescent or kid or teen\* or teenager or toddler.” The combination of all four components on Medline Ovid found only 12 articles. Thus, a three-component search strategy, combining “park and playground”, “quality”, and “physical activity” (excluding “childhood”), was used in the review according to the advice of an experienced librarian in Health Sciences at Western University. The reference lists of the selected studies in the review were also reviewed to avoid missing any relevant articles. The details of the search strategy are provided in Appendix A.

### 2.2.3 Selection of Studies Based on Pre-Defined Selection Criteria

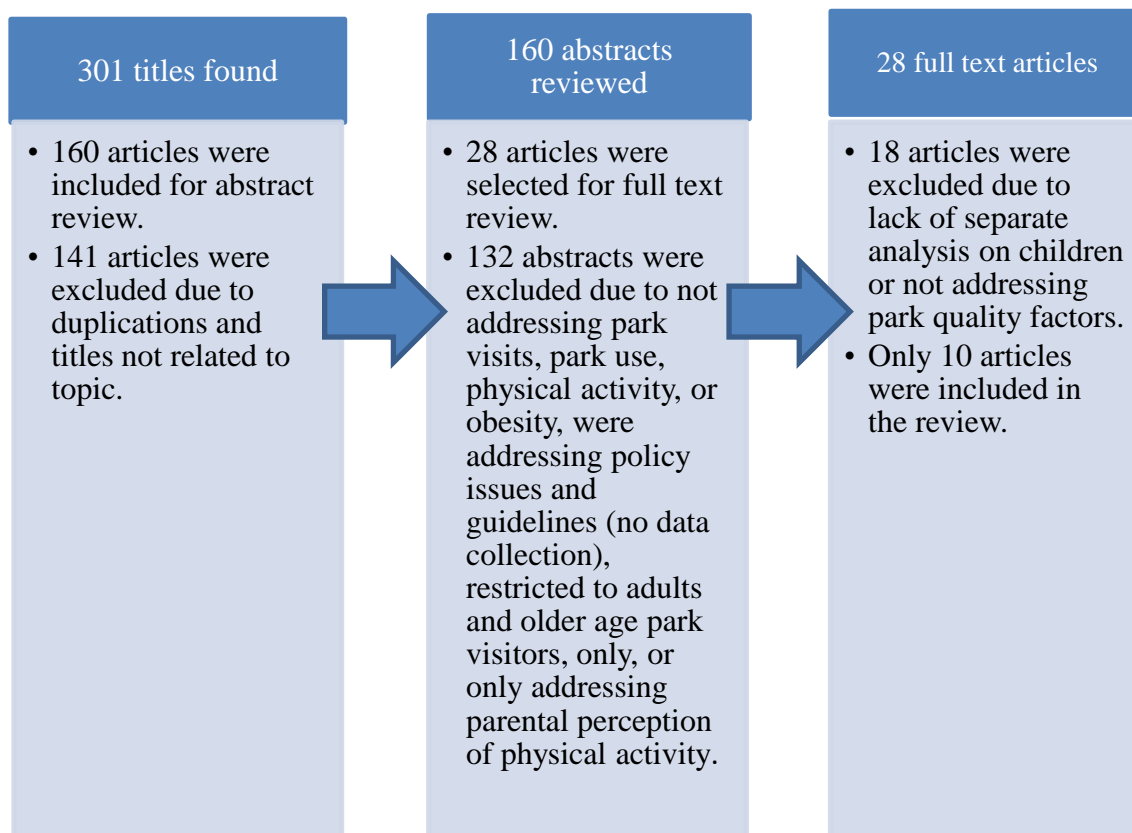
To be included in this review, a study had to meet all of the following criteria:

1. Measure one or more quality characteristics, such as the features, amenities, incivilities, crime, or safety of parks and playgrounds. Parks and playgrounds were included irrespective of whether they were parts of schools or were intended for particular groups or communities.
2. Measure child physical activity or obesity or park and/or playground use (use of parks and playgrounds was defined as children within the parks and playgrounds).
3. Report separate results for children (aged 0-18 years old).
4. Written in English.
5. Available or found before May 2012.

### 2.2.4 Data Collection

The selected studies were assessed by a single researcher; however, the research strategy, selection criteria, and assessment of the studies were discussed with at least two experts in the field. The titles and abstracts of the relevant articles identified by the systematic search strategies were used to categorize the articles as “include”, “exclude”, or “unsure”, based on the selection criteria. The full text of the “uncertain articles” was read to determine whether they should be included in the current review based on the selection criteria. The findings were recorded from the full text of the articles included in this review. Of the 301 articles identified by the search strategy, only 10 met the selection

criteria, as described in Figure 2. The summaries of the included full-text articles are provided in Table 2.



*Figure 2:* Systematic selection of relevant articles for data collection.

Table 2:

*Summary of Full Text Articles Selected Articles Included in the Review*

Authors	Objective	Methods	Results and Conclusion
Cohen et al. (2006)	This study examined the association between park proximity, park type, and park features and physical activity in adolescent girls.	A cross-sectional study was conducted including 1556 Grade 6 girls from middle schools in different US states. Physical activity was measured as moderate-to-vigorous activity using accelerometers. A checklist was used to record the presence of facilities and amenities at each park.	The study showed that the type, number, and specific parks features were associated with daily moderate/vigorous physical activity in adolescent girls. Park features and amenities such as walking paths, running tracks, playgrounds, basketball courts, streetlights, and floodlights were associated with increased moderate/ vigorous physical activity. However, skateboard areas were negatively associated with moderate/vigorous physical activity.
Colabianchi et al.	The study examined attributes of 20 school	Portions of the Environmental Assessment of Public Recreation	The parks and playgrounds included in the study had good to excellent scores for overall condition,

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(2011)	playgrounds and their association with school playground use and physical activity outside of school hours.	Spaces (EAPRS) measurement tool that focused on the playground features and amenities, such as type, number, condition, cleanliness and quality of play equipment, benches, trashcans, and shades, were recorded with respect to renovated and unrenovated parks. The physical activity was measured by System for Observing Play and Leisure Activities (SOPLAY).	cleanliness, quality, and safety. Overall, 60% of the boys and 49% girls were moderate to vigorously active. The total number of play features were positively associated, whereas the overall cleanliness was negatively associated, with use in renovated school playgrounds in both boys and girls. Overall quality and presence of benches were negatively associated (girls only), overall safety and presence of trash cans were positively associated (boys only), and overall cleanliness was negatively associated (boys only) with use in school playgrounds that were not renovated. After controlling for confounders and effect modifiers, only the total number of play features was positively associated with use at the renovated school grounds in both boys and girls, whereas overall safety of the grounds that were not
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			renovated was positively associated with use in boys.
Floyd et al. (2008)	The study explored park-based physical activity in diverse communities in two US cities	Direct observation was used to assess physical activity in public parks in Tampa FL ( <i>n</i> = 10) and Chicago IL ( <i>n</i> = 18). Physical activity was measured by System for Observing Play and Leisure Activity in Youth (SOPLAY). Activity codes from SOPLAY were transformed to energy expenditure per person.	The park features and amenities associated with vigorous physical activity in Tampa parks were tennis/racquetball courts and basketball courts, open-space areas, playgrounds, baseball/softball fields, fishing areas, and picnic shelters. In Chicago parks, the most prominent activities were reported in target areas of tennis/racquetball courts and basketball courts, followed by open-space areas, playgrounds, and baseball/softball fields.
Floyd et al. (2011)	The study explored associations between individual features of parks and park-based physical activity.	A total of 2712 children and adolescents were observed in 20 randomly selected parks in Durham, NC. It was a cross sectional study that used SOPARC for measuring physical activity.	The results showed that picnic areas and shelters were associated with a lower level of physical activity, whereas courts were associated with higher levels of physical activity. Girls had lower physical activity levels compared to boys. Furthermore, the study also showed that physical activity was

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			associated with the number of recreation facilities.
Loukaito- Sideris and Stieglitz (2002).	The study explored the factors associated with children's visits to parks and to understand park visitation patterns between boys and girls and between inner-city and suburban children.	The study surveyed children and their parents in 12 middle schools. The researchers also observed children at 50 inner city and 50 suburban parks, and used multiple regression models to explore the study objectives.	Park characteristics such as cleanliness, perceived safety, and superiority of facilities were the main reasons for visits by participants. The results also showed that girls frequently used playground equipment, while boys reported using playing fields. Soccer fields were the most frequently used sport facilities for both boys and girls, followed by basketball courts, and baseball or softball diamonds. Fewer children used facilities, including indoor gyms, bike paths, ramps and rails for skateboarding, swimming pools, tennis, volleyball, and picnic areas. The observational data revealed that the existence of active recreation facilities and the park's landscape were the most attractive feature.
Perry et	The study explored	The study examined the quality of	The most frequent activities were watching sports

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al. (2011)	behaviours that attract youth to visit parks, park use and park-based physical activity in a rural, predominantly Latino community	amenities in 13 parks and recreation spaces using the Environmental Assessment of Parks and Recreation Spaces (EAPRS) tool. Middle school students completed surveys in the school classroom ( $N = 1,102$ ) regarding park use and physical activity.	events/games and swimming. The fields and courts at most of the parks were of poor quality. For example, none of the basketball courts were full sized, most had cracks on the surface, and most did not have nets. However, the majority of the parks were rated as safe and in safe neighbourhoods.
Reis et al. (2009)	The purpose was to assess the relationship between perception about the environment of urban parks and physical activity in adolescents.	A questionnaire was used to evaluate both the perceived environment as well as Physical Activity in the Parks (PAP), Habitual physical activity (HPA) and demographics. Multivariate logistic regression was used to achieve the study objectives.	Among boys, parks' features were associated with park-based physical activity; however, safety issues (safety, dangerous traffic, lighting, and crowded parks) were not associated. Among girls, park features such as "lack of space to be active", "no activities to choose from", "lack of equipment", and safety perception, such as "having people of the same age", "poor lighting", and "people tease me" were

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			associated with park-based physical activity.
Ries et al. (2009)	The study explored the associations between objective and perceived measures of environmental characteristics and use of parks for physical activity.	A total of 329 adolescents from two high schools in Baltimore, Maryland were recruited. Objectively measured physical activity was calculated using accelerometers. A Web-based survey, GIS data and perceived Park Quality Scale included nine items was used for evaluation of park quality.	The results showed that perceptions of greater park availability and quality were associated with more park use. However, perceived crime and park quality were not significant and park availability was marginally associated with physical activity. Objective measures of park availability and objective and subjective measures of crime were not associated with either park use or physical activity.
Ries et al. (2011)	To explore perceptions and use of public and private recreational facilities and to examine environmental	A total of 329 adolescents from two high schools in Baltimore, Maryland were recruited. Physical activity and facility availability was objectively measured using accelerometers and	The results showed that perceived facility quality was highly associated with facility use. However, perceived recreational facility availability, quality, and objective recreational facility availability were insignificantly related to physical activity.

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	correlates that are associated with facility use and physical activity in adolescents.	Geographical Information Systems data respectively. The facility use and perceptions were measured with a survey.	
Timperio et al. (2008)	This study examined associations between features of public open spaces, and children's physical activity	A total of 163 children aged 8–9 years and 334 adolescents aged 13–15 years from Melbourne, Australia were recruited. A Geographic Information System was used to identify all public open spaces (POS). Accelerometers were used to measure moderate-to-vigorous physical activity (MVPA) after school and on weekends.	Among younger girls, the number of recreational facilities was inversely associated with after school moderate-vigorous physical activity. However, physical activity in adolescent girls increases if their closest POS had trees that provided shade. The younger boys performed more moderate-vigorous physical activity with each additional playground in their closest POS, but presence of lightings along the paths was related to decreased physical activity levels. There were no significant associations between POS features and moderate to vigorous physical activity in adolescent boys.

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### 2.2.5 Data Charting

A charting approach, based on a descriptive-analytical method (Arksey & O'Malley, 2005), was used to synthesize and interpret the quantitative and qualitative data collected from the selected studies. Following this approach, the authors' names, year of publication, study setting, objectives of the study, study design, methods, and study results of the selected studies were recorded, if available within a study (Arksey & O'Malley, 2005). To extract the study results from the reviewed studies, the full text of the articles was read several times to extract statements related to the features, amenities, incivilities, conditions, cleanliness, and safety of parks and playgrounds and to their use and related physical activity from the results section of each article. References to the results of other studies in the discussion sections of the reviewed articles were excluded (Sandelowski & Barroso, 2003). These statements, along with information related to the above variables, were entered on a separate form for each study.

### 2.2.6 Collating, Summarizing, and Reporting the Results

The collated information is presented first, as a description of the selected studies. It includes a description of the numerical data and other collected information obtained from each of the quantitative and qualitative studies, such as the authors' names, study design, setting, publication year, and sample characteristics (Arksey & O'Malley, 2005). Thematic analysis was performed on the extracted statements identified from the results section of each of the full-text articles. These statements were read several times to identify common themes related to quality characteristics of parks and playgrounds

influencing their use and physical activity or obesity in children. The identified themes were discussed with the supervisor to minimize researcher bias.

## 2.3 Results

### 2.3.1 Description of the Studies

Of the 10 full-text articles reviewed, three studies were cross-sectional, two were surveys, one was observational, one used mixed methods, and three studies had no study designs mentioned. Of the 10 full-text articles reviewed, two studies were authored by Ries and colleagues, two studies were authored by Floyd and colleagues, and the remaining six studies were authored by other researchers. Seven studies were conducted in the US, and one each was conducted in Brazil, Australia, and Canada. The publication years ranged from 2002 to 2011. The number of parks visited in each study ranged from four to 100. The number of children included in the selected studies ranged from 163 to 2712. One study was restricted to girls in the sixth grade. The remaining studies included both boys and girls in their samples. Four studies included children of all ages, three studies included middle-age children/adolescents only, and three studies included park visitors of all ages but with separate analyses of children.

### 2.3.2 Thematic Analysis

The thematic analysis identified the following four themes:

- Overall quality of parks and playgrounds and their use and physical activity in children ( $n = 5$ );

- Features and amenities of parks and playgrounds and their use and physical activity in children ( $n = 4$ );
- The conditions and cleanliness of features and amenities of parks and playgrounds and their use and physical activity in children ( $n = 2$ ); and
- The safety and crime rates of parks and playgrounds and their use and physical activity in children ( $n = 4$ ).

### 2.3.2.1 Overall Quality of Parks and Playgrounds and Their Use and Physical Activity in Children

The overall quality of parks and playgrounds is a combination of features and amenities, aesthetics, cleanliness, condition, and safety. Ries et al. (2009, 2011) found that the perceived quality of parks, as measured by a Web-based survey, was associated with increased park use; however, there was no association between the objective quality of parks, as measured by Geographical Information Systems (GIS) data, and physical activity. The GIS measurement used by Ries et al. (2009, 2011) assessed quality in terms of availability and facilities and did not measure the conditions or cleanliness of the facilities. The perceived park-quality survey included conditions and cleanliness, in addition to the facilities. Thus, perceived park quality had more influence on park use and physical activity than the GIS measurement. Perry et al. (2011), using an observational quality-assessment instrument (measuring presence, condition, and cleanliness), showed that higher-quality parks were associated with greater park use, particularly in youth.

### 2.3.2.2 Presence of Features and Amenities of Parks and Playgrounds and Their Use and Physical Activity in Children

The features and amenities of parks and playgrounds are important enablers of park use and physical activity in children. Cohen et al. (2006) found that park features, such as basketball courts, walking paths, swimming areas, and tracks, were associated with higher levels of physical activity in adolescent girls. Similarly, Colabianchi et al. (2011) found that shaded areas in renovated school playgrounds were associated with park use and physical activity in boys. Floyd et al. (2008, 2011) found that playgrounds, sports fields, and courts were associated with higher levels of physical activity in children compared to other park features and amenities. Timperio et al. (2008) found that public open-space (POS) areas with trees and shade were more appealing to female adolescents than to young girls and boys.

### 2.3.2.3 Conditions and Cleanliness of Features and Amenities of Parks and Playgrounds and Their Use and Physical Activity in Children

Only two studies explored the conditions and cleanliness of the features and amenities of parks and playgrounds, along with park use and physical activity. Colabianchi et al. (2011), using the Environmental Assessment of Public Parks Recreational Spaces (EAPRS) tool, reported that overall cleanliness was negatively associated with use of renovated school playgrounds in girls and boys, but the overall condition of the school

playgrounds had no influence on park use in children. Loukaitou-Sideris and Stieglitz (2002) found that the use of picnic areas was dependent on the condition and cleanliness of benches and tables, as determined through direct observation. The authors also identified a list of complaints, later supported by field observations that hampered facility use by park visitors. These issues included the quality of equipment, broken play equipment, such as climbing objects, slides, and swings, and problems due to a lack of maintenance, such as refuse in the pools and sand, broken glass bottles in the mud, dead trees and grass, and dirty toilets.

#### 2.3.2.4 Safety and Crime Rates of Parks and Playgrounds and Their Use and Physical Activity in Children

Colabianchi et al. (2011) found that safe school playgrounds were more frequently used than school playgrounds that scored the lowest on safety. Loukaitou-Sideris and Stieglitz (2002) explored children's perceptions of park safety and found that most children reported feeling safe within most of the parks. Further, the authors also found that the safety issues identified by the children that hampered park use and physical activity were gangs, shootings, unruly behaviour, strangers talking to children, and criminal activity. Reis et al. (2009) found that safety issues, such as poor lighting and bullying, were associated with lower physical activity in girls but not in boys; however, objective measurements of crime rates were not associated with either park use or physical activity in children (Ries et al., 2009).



## 2.4 Discussion

This review showed that the features of parks and playgrounds are associated with park use and physical activity. Factors such as overall quality and safety and the crime rates of parks and playgrounds are associated with increased park use, but the evidence as to whether these factors can increase physical activity in children has been conflicting. The review identified a scarcity of literature on the relationship between the conditions and cleanliness of parks and playgrounds and their use and physical activity in children. In addition to the studies ( $N = 10$ ) included in the review, conclusions drawn from studies that did not provide a separate analysis for children will be used to provide greater understanding of the relationship of interest to this study.

### 2.4.1 Overall Quality of Parks and Playgrounds and Their Use and Physical Activity in Children

The authors showed that higher-quality parks and playgrounds with good-quality courts and fields were positively associated with increased use of parks and playgrounds in children, compared to lower-quality parks and playgrounds (Loukaitou-Sideris & Stieglitz, 2002; Perry et al., 2011). However, the authors also found conflicting results regarding the quality of parks and playgrounds and physical activity (Hamilton, 2011; Ries et al., 2009, 2011). This difference in findings among the studies might be related to different methods of measuring park quality, for example, direct observation by the researcher (Hamilton, 2011) and quality of parks measured by GIS (Ries et al., 2009).

Another reason might be the overall quality of parks and playgrounds being a broad category encompassing many characteristics and components of parks and playgrounds. The authors used different characteristics of parks and playgrounds while assessing the overall quality of parks and playgrounds, leading to differences in findings (Floyd et al., 2011; Hamilton, 2011; Ries et al., 2011; Rung et al., 2011).

#### 2.4.2 Presence of Features and Amenities of Parks and Playgrounds and Their Use and Physical Activity in Children

The review showed that the features of parks and playgrounds were associated with increased park use and physical activity levels in children. Children are mostly found in and around park features and amenities, such as fields, open space areas, coverage/shade, and picnic areas (Colabianchi et al., 2011; Floyd et al., 2011). Several authors have found that park features, such as soccer fields, basketball courts, and skateboarding facilities, are associated with increased park use and physical activity (Cohen et al., 2006; Floyd et al., 2008; Loukaitou-Sideris & Stieglitz, 2002; Perry et al., 2011). However, Timperio et al. (2008) found that the number of recreational facilities was not related to physical activity in boys. The differences among studies might be related to the types of park features explored, as soccer and baseball fields can increase the number of visits and level of physical activity, compared to other park features (Perry et al., 2011). The differences among studies might also be related to the demographics (e.g., age and gender) of the samples. Swimming pools and trails were associated with physical activity in girls (Cohen et al., 2006) compared to boys, who were more often involved with courts

and fields (Floyd et al., 2008). Younger children were more commonly observed in open spaces and on trails and playgrounds, compared to older children (Floyd et al., 2008).

Park amenities were associated with increased park use but not with physical activity (Cohen et al., 2006; Rung et al., 2011). Authors have shown that both features and amenities of parks and playgrounds can attract visitors to visit these places but that features are more influential than amenities in increasing physical activity (Chomitz, Aske, McDonald, Canral, & Hackar, 2011; Rung et al., 2011). The amenities and aesthetics of parks and playgrounds are a greater source of attraction and might be associated with increased visits and greater park use, but they tend to promote sedentary activities. Park amenities such as water features, benches and tables, and shelters are frequently used for mildly active or sedentary activities, such as family picnics, playing with dogs, standing, sitting, or lying on the grass (Cohen et al., 2009; Loukaitou-Sideris & Stieglitz, 2002).

### 2.4.3 Condition and Cleanliness of Features and Amenities of Parks and Playgrounds and Their Use and Physical Activity in Children

The review identified a scarcity of literature regarding the relationship between the conditions and cleanliness of parks and playgrounds and their use and physical activity in children. Loukaitou-Sideris and Stieglitz (2002) found that good condition and clean benches and tables were associated with increased usage of picnic areas in the parks. Colabianchi et al. (2011) found that overall cleanliness was negatively associated with the use of renovated school playgrounds in girls and boys. This seeming contradiction

might have arisen because playgrounds in heavy use will be less clean than those that are used very little (Colabianchi et al., 2011; Rung et al., 2011). Authors have found that good conditions and cleanliness of parks and playgrounds could be associated with increased park use (Hamilton, 2011), whereas poor conditions might hamper park use (McCormack, Rock, Toohey, & Hignell, 2010). However, the above studies by Hamilton (2011) and McCormack et al. (2010), included park visitors of all ages with no separate analyses of children. Overall, there has been a scarcity of literature regarding the role of conditions and cleanliness of parks and playgrounds and their use and physical activity in children. Future studies should explore this gap to facilitate effective interventions.

#### 2.4.4 Safety and Crime Rates of Parks and Playgrounds and Their Use and Physical Activity in Children

The review showed that safety issues could hamper park use; however, evidence remains lacking as to safety's relationship with physical activity. Authors have shown that unsafe or poorly maintained parks, with complaints such as gangs and persons under the influence of alcohol, can be associated with decreased park use among park visitors, including children (Loukaitou-Sideris & Stieglitz, 2002; Reis, et al., 2009). However, crime rates are not associated with physical activity (Ries et al., 2009). This difference among studies might be related to how the safety of parks and playgrounds was measured. For example, the perception of the safety of parks and playgrounds was associated with increased park use (Reis et al., 2009), but crime rates were not associated with park use or physical activity (Ries et al., 2009). This contradiction might also be gender related, as safety issues (safety, dangerous traffic, lighting, and crowded parks)

are associated with physical activity among girls but not among boys (Reis et al., 2009). These findings highlight the roles of park safety and gender in terms of park use and physical activity, which are considerations that future studies should explore.

#### 2.4.5 Implications of the Review

The review revealed a scarcity of research on the relationship between the quality of parks and playgrounds and physical activity in children. The reviewed studies mostly addressed these issues with regard to the features and amenities of parks and playgrounds. The few studies ( $n = 2$ ) that explored the cleanliness and condition of parks and playgrounds had conflicting results. This gap in the literature warrants future studies on the conditions and cleanliness of features and amenities, in addition to the relationship between the quality of parks and playgrounds and physical activity in children.

The review also showed that the measurement of park quality differed among studies, which used objective (GIS data) and subjective (perception of participants via survey) means of measurement, thus creating conflicting findings. Measurements, such as GIS, can be used to assess the presence of features but do not assess all aspects of park quality, while perceived park quality evaluates the condition and cleanliness of features and amenities, in addition to their presence. Future studies should include both objective and subjective measurements to explore the possible reasons for these differences.

Moreover, studies have used different characteristics of parks and playgrounds while evaluating their quality. To evaluate the role of the quality of parks and playgrounds, a study should include all of the quality characteristics of parks and playgrounds that can influence their use and physical activity in children. The discussion of the results

identified all of those quality attributes of parks and playgrounds, such as features and amenities that were associated in the literature with park use and physical activity. It also identified those quality attributes of parks and playgrounds, such as park conditions, cleanliness, and safety, in which research has been lacking. The identification of these quality characteristics would provide future researchers with a list of all of the essential quality components of parks and playgrounds that they could include when conducting original and interventional research on the topic.

The review also provided limited information regarding the influences of age and gender on the relationship between the quality of parks and playgrounds and physical activity patterns in children. Future studies should identify the quality characteristics of parks and playgrounds that influence their use and physical activity in particular age groups and genders, so intervention studies improving the quality characteristics of parks and playgrounds can be planned for children of all ages and both genders.

#### 2.4.6 Discussion of EST Relative to Study Findings

EST was the selected framework for this review. The quality of parks and playgrounds and the quality of features, amenities, and incivilities (contextual elements) can influence physical activity in children, as proximal processes are dependent on contextual elements (Bronfenbrenner, 1994). The review of the study findings fit consistently with EST, as far as the use of parks and playgrounds was concerned. Overall quality and the quality of features and amenities (presence, condition, and cleanliness of features and amenities) were associated with increased park use; however, the results were inconclusive

regarding the relationship between the quality of parks and playgrounds and park-based physical activity in children, as there was a scarcity of available literature on the topic.

Proximal processes are also dependent on individual characteristics (Bronfenbrenner, 1994). This review also identified the influences of age and gender as individual characteristics on the relationship. Future studies should conduct empirical research, particularly in relation to EST, to examine whether proximal processes are dependent on contextual characteristics of the quality of parks and playgrounds that were identified in the review.

## 2.5 Conclusion

The quality of parks and playgrounds is a broad concept, and it includes a combination of features and amenities, condition, cleanliness, and safety. The features, amenities, and safety of parks and playgrounds are associated with their use and, to a limited extent, with park-based physical activity in children in the case of features only. However, few studies were found exploring other aspects of quality, such as the cleanliness and conditions of parks and playgrounds, leading to inconclusive findings on this aspect of the relationship. The review also identified the influences of age and gender on park-based physical activity in children, although to a limited extent. It is recommended that future original studies focus particularly on the conditions and cleanliness of the features, facilities, and amenities of parks and playgrounds while exploring the above relationship, so intervention strategies on the quality components of parks and playgrounds can be planned.

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## Chapter 3

### 3 Materials and Methods

#### 3.1 Background

The scoping review in the previous chapter identified a need for further research on the relationship between the quality of parks and playgrounds and park-based physical activity in children. To this end, a study of park-based activity was conducted as a part of this thesis. This chapter describes the study's methods. The next chapter presents its quantitative findings. The fifth chapter presents its qualitative findings.

#### 3.2 Study Objectives

1. The primary objective of the quantitative analysis was to determine whether the assessment of the overall quality of parks and playgrounds and the quality of the features, amenities, and incivilities were associated with park-based physical activity in children (observed to be up to 12 years of age).
2. The secondary objective was to determine whether variables such as child's observed age and gender, neighbourhood SES, weather, temperature, time of day, and day of week are associated with park-based physical activity in children.
3. The objective of the qualitative analysis was to provide greater context and description to the quantitative findings by exploring the relationship between observed quality of park and quality of features, amenities, and incivilities and

park-based physical activity in children. Another objective was to explore the influence of child's observed age and gender, weather, temperature, neighbourhood SES, day, and time on the relationship between park quality and park-based physical activity in children.

### 3.3 Study Design

A mixed-methods design was used to achieve the study objectives, as a single research method was considered to be insufficient to provide an in depth understanding of the research problem. A mixed-methods study design (here, an embedded design) allows the researcher to use both quantitative and qualitative methods (Creswell, Plano Clark, Gutmann, & Hanson, 2003; Creswell, 2008; Morse, 1991). The embedded design includes a primary method, complemented and supported by a secondary method (Creswell, et al., 2003). The relationship between the quality of parks and playgrounds and park-based physical activity in children was explored by concurrently applying quantitative methods in the primary analysis and qualitative methods in the secondary analysis. The qualitative field notes and data were used to extend, explore, and understand the quantitative study findings. The quantitative and qualitative methods and data will be described below.

### 3.4 Study Setting

An observational cross-sectional study was conducted in the city of London in Middlesex County, southwestern Ontario. The city has a population of 366,151, according to the 2011 Canadian census. Multistage sampling was used to select the parks within the city.

A park is an area of open space that is provided for recreational use (Park, 2013a; Park, 2013b; Park, 2013c). The current study focused only on neighbourhood parks, which are usually maintained by local or municipal governments. Neighbourhood parks can vary from mere areas of grass to a number of features, including fields, courts, swimming pools, play equipment, sandboxes, water features, etc. A playground is a playing area specifically designed for children to play (Playground, 2013a; Playground, 2013b). Playgrounds include structures that promote free play, such as monkey bars, slides, swings, seesaws, sandboxes, and water features (Playground, 2013c).

### 3.5 Selection Criteria

The selection criteria for parks were as follows:

- Parks were included with signage posted, identifying them as city staff-maintained, parks that incorporated a playground in order to observe a wide range of features, and containing at least three or more features mentioned in the instrument used to evaluate park quality.

Parks with fewer than three features, that were parts of school yards, that required membership or fees for use, or that were intended for a particular group or community were excluded, as these spaces are not accessible to all members of the community.

Parks were required to have at least three features for the following reasons:

- The primary objective of interest was the relationship between the quality of parks and playgrounds and park-based physical activity. Including parks with at least

three features provided the opportunity to observe children engaged in a wide variety of physical activities in different parts of the park and to explore their park-based physical activity levels relative to different quality characteristics.

- There are 13 features listed in the Physical Activity Resource Assessment (PARA) instrument, which was the quality-evaluation instrument used. A range of three to 13 features within a park provided sufficient variability in the sample to explore the relationship between the quality of parks and physical activity in children.
- Not only the presence of features but also their conditions and cleanliness are important elements of quality. The inclusion of parks with at least three features ensured that the relationship between the conditions and cleanliness of features could also be explored relative to park-based physical activity in children.

The selection criteria for children included any child up to 12 years of age (based on direct observation by the researcher) who was observed within the selected parks during study visits. Authors have used direct observation measurements to categorize park visitors as children, teenagers, adults, and older adults (Floyd et al., 2011; McKenzie et al., 2006).

### 3.6 Sampling Procedure

Multistage sampling was used to select parks within the city. The city of London is divided into 41 neighbourhoods. The city of London Website provides related information and maps for each neighbourhood (The City of London, 2013). Each

neighbourhood map has marked resources, including sports and recreational facilities.

There are a total of 60 (45+15) sports and recreational facilities and community resource centers in 41 neighbourhoods.

Sports and recreational facilities in this study refer to outdoor features within parks, such as fields, playground, water features, swimming pools, and basketball courts. The sports and recreational facilities were included in the initial sample because most of them were attached to or were within parks, based on preliminary visits to a small number of parks within the city. These facilities provided the opportunity to explore park-based physical activity in children relative to the quality aspects within the parks and playgrounds that were the primary focus of the study.

Of the 41 neighbourhoods found on the Webpage, two parks were mapped to the same area. A total of three neighbourhoods had no maps or related information available on the Website, and 16 neighbourhoods' maps did not show any sports or recreational facilities, leaving a total of 21 neighbourhoods. In the next stage, one sports and recreational facility was selected from each of 21 remaining neighbourhoods by random sampling. The randomization for each neighbourhood was performed by drawing pieces of paper, representing parks within that neighbourhood, from a bag. Table 3 shows the Webpages on the City of London Website from which information on each neighbourhood was obtained. The Central London neighbourhood is considered as an example.

Table 3

*The City of London Webpages: The Related Information*

Webpage	Related Information
<a href="http://www.london.ca/d.aspx?s=/About_London/infoabout_neighbourhood.htm">http://www.london.ca/d.aspx?s=/About_London/infoabout_neighbourhood.htm</a>	Neighbourhood profiles of each neighbourhood
<a href="http://www.london.ca/d.aspx?s=/About_London/infocentral_london_nopics.htm">http://www.london.ca/d.aspx?s=/About_London/infocentral_london_nopics.htm</a>	Information about the Central London neighbourhood
<a href="http://www.london.ca/About_London/PDFs/neigh_central_london.pdf">http://www.london.ca/About_London/PDFs/neigh_central_london.pdf</a>	Map of Central London neighbourhood
<a href="http://www.london.ca/About_London/PDFs/8_CentralLondon.pdf">http://www.london.ca/About_London/PDFs/8_CentralLondon.pdf</a>	Profile of Central London neighbourhood

The selected sports and recreational facilities were visited, and only those facilities that met the inclusion criteria were selected. For each excluded sports and recreational facility, another facility was selected from the same neighbourhood and was subsequently visited. Of the 21 sports and recreational facilities visited, one neighbourhood facility was not attached to any park and was excluded. This neighbourhood's second park was under construction and was closed, leading to exclusion of that neighbourhood from the study. One neighbourhood had a park that was within a schoolyard, and another neighbourhood park had fewer than three features, yielding a total of 18 parks (within 18 neighbourhoods) that were included. Each of the visited parks had a playground within them.

### 3.6.1 Justification of Exclusion of Neighbourhoods

A total of 18 neighbourhood parks were selected through multistage sampling within the city. Multistage sampling was used when visiting all of the elements within the sample is not necessary (Whitemoore, 1997). Visiting all of the parks within the city was not required based on the sample size needed for the power calculations, selection criteria and measurements, and study objectives. The estimated sample size, based on number of predictors and on effect size (sample-size calculations are provided below), provided information on the number of child observations required within the parks and provided justification that visiting all of the neighbourhood parks was not required for this study. The study included all children observed within the parks and included direct observation. Informed consent was not needed in this study, and because of direct observations within each target area, there was a very low probability of missing



observations, supporting the assessment that visiting all of the parks was not necessary. In addition, the sampling units of the study were children within parks, and the objective of the study, which was to explore park-based physical activity (in children) relative to the quality of parks and playgrounds, not require data collection in all of the neighbourhood parks in the city. Furthermore, not all of the parks in the city were accessible due to a lack of public transportation. For example, the London Transit Commission (LTC) bus service serves only a small portion of the Lambeth neighbourhood, and it offers no service on weekends and holidays. Including parks that lacked LTC bus service on particular days and times might have influenced park visits or use on a particular day or at a particular time, which might in turn have influenced park-based physical activity levels.

Several studies (Floyd, Spengler, Maddock, Gobster, & Suau, 2008; Floyd et al., 2011; Hino et al., 2010; Parra et al., 2010) exploring the relationship between the quality of parks and park-based physical activity have used purposeful, convenience, and random sampling procedures to select similar numbers of parks. For example, Hino et al. (2010) conducted a study to explore the influence of public open space (POS) characteristics on physical activity in Brazil. The authors used multistage sampling to include neighbourhoods and neighbourhood POS, initially clustering the neighbourhoods and selecting only those neighbourhoods that had facilities (thus excluding a large number of neighbourhoods), as in this study.

## 3.7 Sample size

The statistical procedures (VanVoorhis & Morgan, 2007) recommended 10-30 cases per predictor, based on the type of regression and number of predictors. The study had six predictors and four covariates, for a total of 10 predictors. Thus, the sample size required in this study was 300 child observations. Studies have also used “effect size” to determine the sample size needed to detect differences among or within groups (VanVoorhis & Morgan, 2007). Using an online *a priori* sample-size calculator for multiple regression (Soper, 2013) and assuming a minimum  $f^2 = .02$  (effect size, small),  $P = .80$  (power); number of predictors = 10; and  $p = .05$  (probability level), the required sample size was 818 child observations ( $N = 818$ ).

## 3.8 Study Variables

The predictors included park quality and its components (features, amenities, and incivilities), the child’s observed age and gender, and access to parks. The outcome variable was park-based physical activity. Further variables, such as the day and time of visits, weather, temperature, and neighbourhood SES, were selected as confounders.

### 3.8.1 Operational Definitions of Study Variables

#### 3.8.1.1 Quality Assessment of Parks

The quality of the parks was defined as the park features, amenities, and incivilities and by the conditions and cleanliness, based on direct observation. Quality was measured

using the Physical Activity Resource Assessment (PARA) instrument (Lee, Booth, Reese-Smith, Regan, & Howard, 2005).

### 3.8.1.2 Physical Activity Resource Assessment (PARA)

The Physical Activity Resource Assessment (PARA; Lee et al., 2005) is a short questionnaire that is used to evaluate different resources, such as parks, playgrounds, communities, schools, clubs, and sports facilities, or combinations of resources. It consists of 49 items, including 13 features (e.g., basketball courts, soccer fields, and play equipment), 12 amenities (e.g., benches, lighting, and fountains), and 11 incivilities (e.g., auditory annoyances, broken glass, graffiti, and litter), all of which are elements specific to the assessment of physical-activity resources, such as parks and playgrounds. All of the items are scored using a 4-point scale that ranges from 0 to 3. Features and amenities were rated as 0 “not present”, 1 “poor”, 2 “mediocre”, and 3 “good”; incivilities were rated as 0 “a lot”, 1 “a medium amount”, 2 “a little”, and 3 “not present”. A higher score in all categories indicates higher quality, although in the case of incivilities, the higher score means fewer incidents of incivilities. The overall quality score is the combined scores of each of the features, amenities, and incivilities observed within a resource.

The instrument includes a well-defined protocol that is supported by operational definitions and pictures to minimize researcher and observer bias. The instrument showed good inter-observer reliability (Pearson’s correlation coefficient  $> 0.77$ ; Lee et al., 2005); however, other information, such as validity, was not found in the literature. The authors were contacted, but they did not reply. The instrument is provided in a supplementary file to this thesis as an Appendix B.

### 3.8.1.2.1.1 Justification of Selection of PARA

A systematic search was performed to identify instruments and questionnaires that evaluate the quality of recreational spaces, such as parks and playgrounds. The search strategy revealed a number of these instruments, such as the Path Environment Audit Tool (PEAT; Troped et al., 2006), Bedimo-Rung Assessment Tool (BRAT; Bedimo-Rung, Gustat, Tompkins, Rice, & Thomson, 2006), Environmental Assessment of Public Recreation Space (EAPRS; Saelens et al., 2006), System for Observing Play and Recreation in Communities (SOPARC; McKenzie, Cohen, Sehgal, Williamson, & Golinelli, 2006), Physical Activity in the Park Setting (PA-PS; Walker et al., 2009), and Physical Activity Resource Assessment (PARA; Lee et al., 2005).

Each of these instruments was evaluated in terms of the study objectives and scope, relevance of the factors studied, items and domains relevant to the research, data analysis, feasibility, and psychometric properties of the instrument, including validity and reliability (Brownson et al., 2009). The selection of PARA was justified, as it assessed all of the relevant quality features, amenities, and incivilities of parks and playgrounds on the basis of presence, conditions, and cleanliness. It takes only 10-30 minutes to complete, has a good inter-rater reliability, and has been used in several studies (Adamus, Mama, Sahnoune, & Lee, 2011; DeBate et al., 2011; Henrich et al., 2007; Lee et al., 2005; McAlexander K, Banda, McAlexander J, & Lee, 2009; Parmenter, McMillan, Cubbin, & Lee, 2008; Witten, Hiscock, Pearce, & Blakely, 2008), compared to other park-assessment tools and instruments.

### 3.8.1.3 Child's Observed Age

Each child was categorized as either preschool ( $\leq 5$  years) or school age ( $> 5-12$  years), based on observation. Children of all ages, including 1-year-old infants, were included in this study. As part of the qualitative data collection, very young children were included to obtain information on the following: (a) What are the activities of these young children within these settings? (b) Are toddlers confined to their strollers or do parents involve them in play by throwing a ball, walking, or performing floor-based activities? The researcher was unable to monitor and observe children who were very young, who were in strollers, and who were very close to the parents accompanying them. These cases were excluded from the quantitative analysis. However, the frequency of these cases was extremely low compared to the large sample size in the study.

### 3.8.1.4 Child's Observed Gender

Each child's gender was determined based on direct observation.

### 3.8.1.5 Weather

Weather was recorded as the average, minimum, and maximum daily temperatures in degrees Celsius obtained from the Website "The Weather Network". Field notes regarding weather conditions, such as rain, overcast, cloudy, and sunny, were also recorded.

### 3.8.1.6 Park Access

Access to the park was measured as the duration of a walk (normal walking speed) in minutes from the closest London Transit Commission bus stop to the nearest park entrance. Children use parks that have large numbers of features and facilities (McCormack, Giles-Corti, & Bulsara, 2008). These parks might be located some distance from their residences, as Tucker, Gilliland, and Irwin (2007) found that a majority of families travelled more than 4 km to visit the parks they preferred. Some families might rely on public transportation to travel to parks; however, not all neighbourhood parks are accessible by public transportation. For example, a small number of parks within the Lambeth neighbourhood are not within walking distance from the LTC bus stops. Thus, park access was defined in terms of travel time in minutes from the closest London Transit commission bus stop to the nearest park entrance. Other measurements of access to parks, such as distance from home to the park, number of parks close to home, and travelling time to the park, were not possible, as the park visitors were not interviewed in this study. Authors have measured numbers of parks or their distribution within neighbourhoods via mapping and GIS software to determine the accessibility of parks within neighbourhoods, but this study had a different focus. Mapping the parks within a neighbourhood or the number or distribution of parks within a neighbourhood does not provide any relevant information about the relationship between access to a particular park and the physical activity of a child within that park (the focus of this study).

### 3.8.1.7 Neighbourhood SES

SES was recorded as the annual family income of the neighbourhood, obtained from the city of London Website. There was a difference in average family income and median family income between neighbourhoods excluded (CAD\$104,431 and CAD\$88,138) versus neighbourhoods included (CAD\$88,454 and CAD\$71,630) in the study. The city of London average and median family incomes are CAD\$84,593 and CAD\$68,648 respectively. The neighbourhoods included in the study had on an average lower family income compared to neighbourhoods excluded from the study. However, the average and median family incomes of the neighbourhoods included in the study were closer to the city average and median family incomes.

### 3.8.1.8 Day

The day of the week was categorized as a weekday or weekend (including public holidays).

### 3.8.1.9 Time

The time of the day was categorized as morning, afternoon, or evening, (9.00 a.m.-1.00 p.m., 1.00 p.m.-4.00 p.m. and 4.00 p.m.-8.00 p.m., respectively).

### 3.8.1.10 Physical Activity

Physical activity of a child was classified as any type of activity performed by the child during the observation period during park visits. The type of activity (sedentary or mild, moderate, or vigorous) was measured according to the operational definitions in the

System for Observing Play and Recreation in Communities (SOPRAC; McKenzie, et al., 2006) protocol.

### 3.8.1.10.1 System for Observing Play and Recreation in Communities (SOPARC)

The System for Observing Play and Recreation in Communities (SOPARC) was developed by McKenzie, Cohen, Sehgal, Williamson, and Golinelli (2006). It gathers and assesses the physical activity levels of the participants observed. The physical activity levels include sedentary (lying down and sitting), moderate (walking), and vigorous (swimming and running). The physical-activity modes include fitness-related codes (aerobic and jogging), sports-related codes (baseball and basketball), active game-related codes (climbing and jumping), and sedentary activity-related codes (artwork, picnicking, and reading). The age groups include children, teenagers, adults, and seniors. The inter-rater reliability of the instrument was measured in a small number of parks from December 2005 to July 2006. The overall inter-observer agreement scores for the instrument were excellent, ranging from 88% to 99% (McKenzie et al., 2006).

The SOPARC component of physical activity modes and types, such as sedentary, walking, jogging, vigorous etc., has been validated (concurrent validity) in previous observation systems: BEACHES (Behaviours of Eating and Activity for Children's Health: Evaluation System) and the System for Observing Fitness Instruction Time (McKenzie, Sallis, Nader, & Patterson, 1991; Pope et al., 2000). The construct validity related to the interpretation of the SOPARC activity codes has also been established in different studies through heart rate monitoring (McKenzie et al., 2006). McKenzie et al.



(2006) acknowledges the limitation that there have been no studies of validity assessments related to the age and ethnicity components of the instrument. The instrument is provided in a supplementary file to this thesis as an Appendix C.

### 3.8.1.10.1.1 Justification for Using Direct Observational Measurements

Direct observation measurements and participant-based interviews or survey questionnaires have been used commonly to measure park-based physical activity levels, rather than objective measurements, such as accelerometers. For example, Ries et al. (2009) conducted a study to explore the associations between measures of environmental characteristics and park-based physical activity and the total weekly minutes of moderate to vigorous physical activity (MVPA) in adolescents. Total weekly physical activity was measured by accelerometers; however, physical activity within parks was measured with the question “Do you ever use parks for physical activity?”. Similarly, Loukaitou-Sideris and Stieglitz (2002) used observation and interview methods to determine park use and physical activity in children based on the quality of parks in Los-Angeles, California, in the US.

Several authors have measured park-based physical activity levels using SOPARC (Colabianchi, Maslow, & Swayampakala, 2011; Floyd et al., 2011; Hamilton, 2011; Hino et al., 2011; Kaczynski, Wilhelm-Stanis, Hatsmann, & Besenyi, 2011; Reed, Price, & Grost, 2012). For example, Floyd et al. (2011) conducted a study of 2,712 children in the US, examining associations among individual, park, and neighbourhood environmental characteristics and park-based physical activity (measured by SOPARC). Similarly,

Hamilton (2011) explored the features, amenities, conditions, and cleanliness of parks and neighbourhood types in Kingston, Ontario, in association with park usage and physical activity, using the SOPARC.

Before commencement of the study, a small number of parks were visited on different days and at different times; PARA and SOPARC questionnaires were completed, and the park features, amenities, and incivilities were photographed. The pictures are provided as an appendix (Appendix E) in the form of a supplementary file to this thesis. The pictures are provided as examples of how the condition and cleanliness of park and playground characteristics were measured in this study. The collected data and pictures were discussed with experienced researchers for ensuring reliability in data collection.

### 3.9 Data Collection

Each of the selected parks was visited between May and August 2011, in the morning, afternoon, and evening on weekdays and weekends (six visits per park). The PARA was completed only on the first park visit, as there was little change observed in the quality of the features, amenities, and incivilities during other park visits. At the first visit to each park, each of the features, amenities, and incivilities observed in the specific park was rated based on the operational definitions of PARA.

The SOPARC was completed at each park visit, and the target areas for the observation of physical activity were selected based on the number of features and amenities. Each feature or amenity served as a separate target area. Activities performed by children in and around the target area were recorded as vigorous, moderate, or sedentary, according

to the operational definitions in SOPARC. Each target area was scanned from left to right, observing the participants (children) present within the target areas and recording each child's age, gender, and type of physical activity (sedentary, moderate, and vigorous) in the SOPARC questionnaire. If a large number of children were observed within the target area, that target area was sub-divided into smaller sub-target areas. Time, day, and average, minimum, and maximum daily temperatures were recorded for each park visit.

In addition to the PARA and SOPARC questionnaires, field notes were also recorded at each park visit (six visits in each park, for a total of 108 visits to 18 different parks). The field notes captured information related to quality of each park feature, amenity, and incivility and observation of each child's age, gender, and activity within each target area, based on operational definitions from PARA and SOPARC. For example, field notes on the quality of a park feature, such as a baseball field, included the coverage of grass, surface of the ground, fences, seating arrangements, and shade for the reserve players or spectators. For soccer fields, the field notes recorded grass coverage, whether the field was mowed, and whether there were goal posts with nets.

Similarly, field notes recorded the activity of the child within each target area of a park, along with the child's observed age and gender. Each baseball field, soccer field, and piece of play equipment served as a separate target area. For example, play equipment field notes include a male child from the preschool age group climbing monkey bars or swinging. Within target areas such as soccer or baseball fields, field notes included the number of children performing physical activities, such as standing, running, or sitting, and whether they were playing the game, waiting as reserve players in the dugout, or

watching the game. In addition to a brief scan of the children playing these games, 1-minute observations of the physical activity levels (walking, running, standing, or sitting) were also recorded.

The field notes also included information relevant to the objective of interest but not mentioned in either PARA or SOPARC. For example, the field notes recorded the quality characteristics of park features not mentioned in PARA, such as skate boarding areas and splash pads, and recorded information on their usability, overall quality, safety, conditions, and cleanliness. Other safety issues and incidents, such as loud traffic noise, were also recorded during park visits, as they might have been related to park use and physical activity. Similarly, the mean, maximum, and daily average temperature at the time of the visit, date, day, and time were also recorded as field notes to explore how each of these variables influenced the relationship of interest. In addition, qualitative weather conditions at the time of the visit were also recorded. To provide a better understanding of what information was recorded in field notes, two scanned images of field notes recorded during a visit to two different parks are provided as Appendix D.

### 3.9.1 Justification for Quantitative and Qualitative Data Collection in the Study

In short, quantitative data from PARA can show only whether the feature, amenity, and incivility is of poor, mediocre, or good quality and cannot determine whether the poor quality is due to poor conditions or cleanliness and/or the quality characteristics that yield a specific score for any feature, amenity, or incivility; however, the field notes record these characteristics for each of the park items and explore the quality characteristics that

categorize them into poor, mediocre, and good quality scores, as well as the overall condition and cleanliness. Similarly, analysis of the quantitative data collection using SOPARC can show only physical activity levels and not the type of activity (such as playing or watching soccer, sitting as reserve player, climbing equipment, or swinging), which can only be explored using qualitative data. The field notes also recorded the children's observed ages and genders to explore common activities and types with regard to observed age and gender in ways that the quantitative analysis cannot evaluate.

Furthermore, quantitative data analysis could identify which secondary variables, such as temperature, time, and day, were related to park-based physical activity but not how these variables influenced the above relationship. For example, quantitative analysis could determine whether time of the day was associated with park-based physical activity but not the types of activities that varied with the time of day or the reason for these differences. Qualitative analysis could determine the types of activities that varied with regard to these variables and the possible reasons for these associations. The possible reasons might be related to the characteristics of parks (a small number of features could be used more commonly at particular times of day) or to municipal rules and regulations, such as operational hours of water features, which could only be captured by qualitative data.

### **3.10 Data Analysis**

All of the quantitative data were entered into SPSS software, version 17. The entered data were checked twice by the principal researcher for data verification and validation. The data verification also included a review of the means, standard deviations,

frequencies, and interquartile ranges to help identify possible errors in the data entry. The objectives of the study were addressed using multiple linear-regression models. Multiple linear regression is suited to analyses in which the dependent variable is continuous, such as physical activity. In linear regression, the independent variables can be a mixture of categorical and continuous variables, as in this study. The first multiple linear-regression model included observed age and gender and park access and quality as independent variables and park-based physical activity as the dependent variable, with day, time, temperature, and neighbourhood SES as confounders. A second multiple linear regression was performed using features, amenities, and incivilities as the independent variables and the same predictors and confounders as in the first analysis.

The qualitative analysis included descriptions of overall park quality, the presence or absence of features, amenities, incivilities, conditions, and cleanliness of park and park-based physical activity levels, with examples from specific parks. The analysis also included descriptions of the roles of park access, age, gender, neighbourhood SES, weather, day, and time in determining park-based physical activity levels in children. The field notes, based on observations from 108 visits, were thematically analyzed with regard to the study variables and objectives. The recorded field notes were read several times to identify themes. The notes were then categorized using both the preset themes, based on quantitative findings, and emergent themes from the field notes. The themes and observational findings were later discussed with the thesis supervisor, to minimize researcher bias in the interpretation of the findings.

The qualitative analysis also provided descriptions of case studies of two parks (high-versus low-quality). A detailed description of the quality characteristics of the two parks,

with regard to different visits at different times and on different days, under different weather conditions and in different temperatures, served as case studies, providing a rich picture of the relationship between the quality of parks and playgrounds and park-based physical activity in children.

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## Chapter 4

# 4 The Relationship Between the Quality of Parks and Playgrounds and Park-Based Physical Activity in Children

## 4.1 Introduction

Physical activity is critical to maintaining the health and well-being of children (Ward, 2010). Physical inactivity is a growing concern, particularly in developed countries (World Health Organization [WHO], 2002), making it a public-health priority globally (Cochrane et al., 2009). Regular physical activity in children helps to build strong bones, improve muscle strength, and prevent adulthood obesity, cardiovascular, respiratory, and hormonal disorders and conditions (Berger & Peerson, 2009; Centers for Disease Control & Prevention [CDC], 2013; Maksimovic et al., 2009; WHO, 2002). Despite the importance of physical activity, only a small proportion of children perform at least 60 minutes of moderate-to-vigorous physical activity at least 6 days per week in Canada (7%), the US (29%), and Europe (34%; Colley et al., 2011; Currie et al., 2012; U.S. Department of Health and Human Services, 2008).

There are several factors associated with decreased physical activity levels in children. A number of socioenvironmental factors, such as parental and family preferences, interests, lifestyle, working hours, and built environment factors, have been associated with physical activity levels in children (Flodmark, Lissau, Moreno, Pietrobelli, & Widhalm,

2004; French, Story, & Jeffry, 2001; Kipke et al., 2007; Krishnamoorthy, Hart, & Jelalian, 2006). The built environment is defined as the man-made structures and surroundings that are either deliberately constructed or are modified by human activity, such as buildings, schools, and recreational areas (Committee on Environmental Health & Tester, 2009; Sallis & Glanz, 2006). Several authors have found that built environment factors, such as walkability, land-use mix, transportation, safety, and the characteristics of recreational areas, such as parks and playgrounds, are associated with physical activity in children (Committee on Environmental Health & Tester, 2009; Ferdinand, Sen, Raurkar, Engler, & Menachemi, 2012; Galvez, Pearl, & Yen, 2010). This manuscript will focus on the role of parks and playgrounds as important aspects of the built environment that influence physical activity in children (Kipke et al., 2007; Perry, Saelens, & Thompson, 2011).

Parks and playgrounds are among the most important elements of the built environment in which children can perform physical activity (Kipke et al., 2007; Prellwitz & Skär, 2007). Several authors have defined the quality of parks and playgrounds based on their features, amenities, aesthetics, conditions and cleanliness, and incivilities (Hillsdon, Panter, Foster, & Jones, 2006; Kaczynski & Henderson, 2007; Kipke et al., 2007; Lee, Booth, Reese-Smith, Regan, & Howard, 2005). These characteristics have been associated with increased use of parks and playgrounds and physical activity among park visitors (Reed, Price, & Grost, 2012; Rung et al., 2011); however, only a few of these studies have looked at children separately.

Authors have also found differences in the use of parks and playgrounds and physical activity levels between boys and girls and between younger and older children (Hino et



al., 2010; Loukaitou-Sideris & Sti-Eglitz, 2002; Perry et al., 2011). Researchers have also shown the influence of neighbourhood SES on both the quality of parks and playgrounds and physical activity levels (Crawford et al., 2008; Leslie, Cerin, & Kremer, 2010). Similarly, variables such as the day of the week (weekday or weekend), time of day (morning, afternoon, or evening), temperature, and weather conditions have also been associated with park use and physical activity levels (Brockman, Jago, & Fox, 2011; Cradock, Melly, Allen, Morris, & Gortmaker, 2009; Hino et al., 2010; McMurdo et al., 2012; Wolff & Fitzhugh, 2011).

Authors have shown that the quality characteristics of parks and playgrounds are associated with their use and physical activity; however, research on this relationship in children, particularly on conditions and cleanliness and park-based physical activity, has been scarce (Cohen et al., 2006; Perry et al., 2011; Ries, Yan, & Voorhess, 2011).

Authors have explored the relationship between the quality of parks and playgrounds and physical activity, but they have not undertaken separate analyses of children (Hamilton, 2011; Rung et al., 2011), have not explored conditions and cleanliness (Perry et al., 2011; Reed et al., 2012), or have measured the daily or weekly physical activity of the children within a neighbourhood and not park-based physical activity (Cohen et al., 2006; Ries et al., 2011; Timperio et al., 2008). Children's overall daily or weekly physical activity levels do not provide information regarding whether the physical activity is performed in parks and playgrounds or elsewhere in the neighbourhood.

A study was conducted to address the gaps in the literature through the examination of associations between the objective assessment of the quality of parks and playgrounds and quality components (features, amenities, and incivilities) relative to physical activity

in children. This information would help to promote physical activity and to reduce further the factors commonly linked to physical inactivity in parks (Frank & Kavage, 2009; McCreedy & Leslie, 2009; Renalds, Smith, & Hale, 2010). The primary research question was whether quality of park and its components (quality of features, amenities, and incivilities) were associated with park-based physical activity in children. The secondary research question was to determine the influence of park access, neighbourhood SES, temperature, time, and day on the park-based physical activity in children.

## 4.2 Methods

A cross-sectional, observational study was conducted from May to August 2011 in of London, Canada. London is an urban city located in southwestern Ontario. According to the 2011 Canadian census, the total population of the city was 366,151 (The City of London, 2013).

Physical activity was only observed within parks; there was no direct contact with any children or adults who were using the parks. Because the data were not collected directly from any person and because there was no audio or visual recording of children engaged in physical activity, ethics approval was not required, on the advice of the health-sciences ethical review board of Western University.

Multistage random sampling was performed to identify parks within the city. The selection criteria were as follows:

- Parks with signage posted with the word “park” that were maintained by the city staff, incorporated a playground, and contained at least three of the features included in the Physical Activity Resource Assessment (PARA; Lee et al., 2005) questionnaire (the instrument used to evaluate park quality) were selected. The inclusion of at least three features ensured the presence of a playground in each park.
- Parks within schoolyards, those with no free access to the public, and those requiring fees or membership in a particular group or community were excluded.

The selected parks were visited and any child up to 12 years of age (as determined by observation) of either gender, observed within the selected parks during study visits was included in the study.

The city is divided geographically into 41 neighbourhoods. The City of London Website provides demographic information, maps, and related information, such as the locations of sports and recreational facilities, for each neighbourhood. Sports and recreational facilities that include outdoor features, such as courts, fields, water features, and bike racks, are among the main elements of parks and playgrounds. Thus, in the first stage of the multistage sampling, one sports and recreational facility area was selected at random from each neighbourhood. Of the 41 neighbourhoods listed on the City of London Website, the Argyle and Airport neighbourhoods were mapped in the same geographical area; for three neighbourhoods, there were no maps available on the Website; and 16 neighbourhoods did not have any sports and recreational facility area shown on the map, leaving a total of 21 neighbourhoods. Each of these 21 sports and recreational facility

areas were visited, resulting in the identification of 18 sports and recreational facility areas that met the selection criteria.

#### 4.2.1 Study Variables

The independent variables were the quality of parks and playgrounds and quality components, such as quality of features, amenities, and incivilities; the child's observed age and gender, and access to parks. The dependent variable was park-based physical activity. Variables such as day and time of visits, temperature, and neighbourhood SES were selected as confounders.

The quality of parks and playgrounds was measured using the Physical Activity Resource Assessment (PARA; Lee et al., 2005), a short questionnaire used to evaluate resources such as parks, playgrounds, communities, school, clubs, and sport facilities or combinations of resources. The PARA questionnaire consists of 49 items, including 13 features, 12 amenities, and 11 incivilities. Features include basketball courts, soccer fields, baseball diamonds, etc. Amenities include access points, bathrooms, fountains, etc. Incivilities include auditory annoyances, broken glass, graffiti, etc. These features, amenities, and incivilities were assessed on a 4-point scale from 0 to 3. Features and amenities were rated as 0 "not present", 1 "poor", 2 "mediocre", and 3 "good"; incivilities were rated as 0 "a lot", 1 "a medium amount", 2 "a little", and 3 "not present". The quality of park features was defined as sum of scores of all the observed features, quality of park amenities was defined as sum of scores of all the observed amenities, and quality of park incivilities was defined as sum of scores of all the incivilities rated within a park using PARA. The overall park quality was a sum of the

total scores of quality for park features, amenities, and incivilities rated within a park using PARA.

The instrument includes a well-defined protocol, supported by operational definitions and pictures to minimize researcher and observer bias (Lee, Booth, Reese-Smith, Regan, & Howard, 2005). The psychometric properties, as evaluated in these prior studies, were determined to be sufficient for use in this study (Debate et al., 2011; Henrich et al., 2007). The ages of the children were categorized into preschool-aged ( $\leq 5$  years old) and school-aged ( $> 5$ -12 years), based on observation of child age. Gender was recorded based on observation.

Previous work has suggested that availability and access to parks have been problematic in low-SES neighbourhoods (Castelli, Hillman, Buck, & Erwin, 2007; Estabrooks, Lee, & Gyurcsik, 2003; Powell, Slater, & Chaloupka, 2004) due to transportation issues.

Therefore, in this study, access to the parks was measured as the duration of the walk (based on the normal walking speed of the researcher) in minutes from the closest London Transit Commission bus stop to the nearest park entrance. The researcher did not determine whether park visitors were using the parks closest to their homes.

Temperature was recorded as an average daily temperature in degrees Celsius. SES was based on the median family income of the neighbourhood in Canadian Dollars (CAD), obtained from the city Website.

Physical activity within parks was measured using the System for Observing Play and Recreation in Communities (SOPARC) Questionnaire (McKenzie, Cohen, Sehgal, Williamson, & Golinelli, 2006; Shores & West, 2010). The SOPARC questionnaire is

used to gather and assess the physical activity levels of the observed participants. The physical activity levels include sedentary (e.g., lying down and sitting), moderate (walking), and vigorous (e.g., swimming and running) activity (McKenzie et al., 2006; Shores & West, 2010). The overall inter-observer agreement scores for the instrument have been excellent, ranging from 88% to 99% (McKenzie et al., 2006). The psychometric properties, as evaluated by these prior studies, were determined to be sufficient for use in this study.

Before commencement of the study, the principal researcher randomly visited a small number of the parks on different days and at different times, completed the PARA and SOPARC questionnaires, and took photographs of a small number of features, amenities, and incivilities. The collected data and photographs were discussed with experienced researchers to ensure reliability in data collection, based on the PARA and SOPARC operational definitions, as stated in the protocols.

#### 4.2.2 Data Collection Procedure

Each of the 18 selected parks was visited in the morning, afternoon, and evening, both on weekends and weekdays, for a total of six visits to each park. Each park visit lasted 15-90 minutes, based on whether it was the first visit to a park, on the size of the park, and on the number of participants. The quality assessment of each park feature, amenity, and incivility was conducted on only the first park visit, which was thus longer compared to the other visits. Larger parks with large numbers of features and amenities took more time to visit than smaller parks. Further, the number of children within the target area

also influenced the duration of visit, as target areas with large numbers of children required more time to measure their physical activity levels.

The SOPARC questionnaire was completed on all six visits. The target areas for the observation of physical activity within each park were selected based on the number of features and amenities. Each feature or amenity within a park (e.g., a baseball diamond) served as a separate target area. Each target area was scanned from left to right, observing the participants and the nature of their physical activity. The age, gender, and type of physical activity of each child observed within the target area were recorded.

#### 4.2.3 Data Analysis

All of the data were entered into SPSS software, version 17. The entered data were checked twice by the principal researcher for data verification and validation. The data verification also included preliminary analyses and computing of the frequencies, percentages, and means of the variables to help identify any outliers or incorrect data entry. The descriptive statistics were reported as *M* (Means), *S.D.* (Standard Deviations), frequencies, and percentages.

The predictors with quantitative data included the quality and quality components of the parks and playgrounds, such as features, amenities, and incivilities. The predictors with categorical data included age, gender, and access. The dependent variable was physical activity, measured as an ordinal variable (sedentary, walking, and vigorous). The covariates included weather or temperature, neighbourhood SES, day, and time. Multiple linear-regression analysis was performed to determine the relationship between the quality of parks and playgrounds and quality components (features, amenities, and

incivilities) and park-based physical activity. This method is suited to analyses in which the dependent variable is continuous, such as physical activity. In linear regression, the independent variables can be a mixture of categorical and continuous variables, as in this study.

The first linear regression was performed with age, gender, and quality as independent variables and park-based physical activity as the dependent variable, with day, time, temperature, and neighbourhood SES as confounders. The second linear regression was performed with the same independent and dependent variables and confounders, but quality was replaced by features, amenities, and incivilities. Statistical significance was set at  $p < .05$ . Cases with any missing values were excluded from the analysis.

### 4.3 Results

A total of 1,294 children were observed over 108 visits to 18 parks in 18 different neighbourhoods in London, Ontario. The descriptive statistics of the variables, such as neighbourhood income (neighbourhood SES), the quality, features, amenities, and incivilities scores of all of the parks ( $N = 18$ ), measured using PARA, as well as the mean daily temperature in degrees Celsius on all of the park visits ( $N = 108$ ), are shown in Table 4.

To provide a greater context to study results and findings, overall quality, quality of features, amenities, and incivilities scores measured by PARA for each park ( $N = 18$ ) are provided in Table 5. Further, park use and park-based physical activity levels (sedentary,



moderate, and vigorous) of children ( $N = 1,294$ ) within each park ( $N = 18$ ) are provided in Table 6.

Of 1,294 children, 30.6% were observed to be preschool-aged, and 61.6% were observed to be school-aged. A higher proportion of these children were observed to be boys (57.7%); only 39.9% were observed to be girls. The observed age and gender of 7.8% and 2.4% of the children, respectively, could not be determined by observation. The results showed that 40.1% of the children were involved in sedentary activities, 8.5% of the children were involved in moderate activities, and 51.4% of the children were involved in vigorous activities during brief scans of the target areas. Vigorous physical activity was more frequent in boys (52.94%) than in girls (48.83%) and in school-aged (54.57%) children than in preschool-aged children (46.71%); however, there was no statistically significant correlation between boys and girls  $r(1282) = -.03, p = .18$  and between preschool-aged children and school-aged children  $r(1282) = .05, p = .05$  in terms of physical activity levels. The individual correlation-coefficient values of other variables are provided in Table 7 to elucidate their influences on physical activity in children.

The regression model showed that features, fewer incivilities, and improved access to parks were significant positive predictors, and amenities were a significant negative predictor of physical activity. The selected confounders, such as weekday visits and temperature, had significant positive effects on park-based physical activity. Further, confounders such as afternoon and evening visits had significant positive effects on park-based physical activity, compared to mornings. The standardized beta ( $\beta$ ) and probability values ( $p$ ) of each of the independent variables are provided in Table 8.

Table 4.

*Descriptive Statistics of the Demographics and Park-Based Measures of all the Neighbourhood Parks (N = 18)*

Variable	Mean ( <i>M</i> )	Standard Deviation ( <i>SD</i> )	Minimum	Maximum
Neighbourhood mean income in CAD\$ ( <i>N</i> = 18)	82,378.36	21,677.11	56,850	20,601,4
Quality score of parks ( <i>N</i> = 18)	74.49	5.74	58	83
Features score of parks ( <i>N</i> = 18)	20.96	4.30	12	26
Amenities score of parks ( <i>N</i> = 18)	18.34	4.90	9	28
Incivilities score of parks ( <i>N</i> = 18)	35.18	1.21	32	36

Average Daily Temperature in Celsius on all park visits ( $N =$ 108)	23.15	1.95	16	27
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*Note:* Neighbourhood mean income was average family income of all neighbourhoods ( $N = 18$ ) included in the study, determined from the city of London website. Quality, features, amenities, and incivilities scores were mean scores of all neighbourhood parks ( $N = 18$ ) included in the study, taken by PARA. Average daily temperature was average daily temperature on all park visits ( $N = 108$ ) measured from the Website “The Weather Network.”

Table 5

*Quality Scores for Each Park (N = 18)*

Park Number	Quality of Features	Quality of Amenities	Quality of Incivilities	Overall Quality
1	21	16	36	73
2	24	15	35	74
3	22	16	36	74
4	17	9	32	58
5	25	16	36	77
6	24	15	35	74
7	25	14	32	71
8	15	28	34	77
9	19	15	33	67
10	15	14	36	65
11	23	24	36	83
12	24	20	36	80
13	26	16	34	76
14	14	10	34	58
15	13	14	36	63
16	13	24	36	73

17	17	13	36	66
18	12	18	36	66

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*Note:* Quality of features, amenities, incivilities, and overall quality scores for each park ( $N = 18$ ) were measured using PARA.

Table 6

*Park Use and Park-Based Physical Activity Levels for Each Park (N = 18)*

Park Number	Park Use (Number of Children within Park)	Number of Children Engaged in Sedentary Physical Activity	Number of Children Engaged in Moderate Physical Activity	Number of Children Engaged in Vigorous Physical Activity
1	162	71	21	70
2	39	11	3	25
3	131	28	7	96
4	12	1	0	11
5	138	46	15	77
6	56	25	9	22
7	71	44	3	24
8	145	85	18	42
9	30	7	3	20
10	24	10	0	14
11	205	89	6	110
12	17	3	0	14
13	111	41	9	61

14	12	4	4	4
15	93	40	4	49
16	31	13	1	17
17	7	1	2	4
18	10	0	5	5
	N = 1,294	n = 519	n = 110	n = 665

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*Note:* Park use was measured as number of children within the park and park-based physical activity levels of children were measured ( $N = 1,294$ ) using SOPARC.

Table 7

*Pearson's Correlation (r) Between Independent Variables and Physical Activity Using SOPARC*

Variables	Pearson Correlation (r)	p value
Observed Age	.06	.05
Observed Gender	-.04	.18
Day	.13	< .001*
Access	.08	.006*
Morning	-.14	< .001*
Evening	.13	< .001*
Quality	-.03	.30
Neighbourhood SES	-.02	.50
Features	.06	.02*
Amenities	-.12	< .001*
Incivilities	.10	< .001*
Temperature	.12	< .001*

*Note: \*p < .05.*



Table 8

*Multiple Linear Regression Model Between Independent Variables and Park-Based Physical Activity*

Variables	Standardized Beta ( $\beta$ )	Probability value ( $p$ )
Features	0.07	.02*
Amenity	-0.10	< .001*
Incivilities	0.14	< .001*
Day (weekday/weekend)	0.12	< .001*
Evening	0.16	< .001*
Afternoon	0.08	.02*
Temperature in Celsius	0.10	.004*
Access in minutes	0.17	< .001*
Neighbourhood SES	-0.006	.87
Observed Gender	-0.01	.74
Observed Age	-0.01	.67
Quality	0.01	.95

*Note:* Beta & p values are of second linear regression analysis except for  $\beta$  and  $p$  value of quality, which is of the first linear regression analysis.

\* $p < .05$ .

## 4.4 Discussion

Parks offer opportunities for children to engage in physical activities (Kipke et al., 2007; Prellwitz & Skär, 2007). The study results showed that the majority of children (51.4%) were involved in vigorous physical activity, with sedentary activity observed in 40.1%. Only 8.5% of the children were involved in moderate physical activity. Similarly, a small number of authors have found that the majority of park users were involved in sedentary activities, followed by moderate and vigorous physical activity (Kaczynski et al., 2011; Perry et al., 2011); however, Kaczynski et al. (2011) included visitors of all ages, the majority being adults and older adults, while this study observed only children.

Floyd et al. (2011) conducted a study in the US and found that a large proportion of children (52%) were involved in sedentary activities. Similarly, Cohen et al. (2006) also found that 66% of observed park users were sedentary; however, the above two studies (Cohen et al., 2006; Floyd et al., 2011) found higher proportions of children engaged in moderate park-based physical activity compared to vigorous activity, in contrast to the findings of this study.

This difference in findings could be explained by a variety of factors (park-user characteristics, park setting, the availability of features and amenities, the overall quality of parks or quality assessment, use of different quality-assessment tools, etc.). For example, physical activity was measured by direct observation (using SOPARC) in this study. In contrast, Cohen et al. (2006) used accelerometer measurements to explore the relationships between individual park features and after-school physical activity levels in adolescent girls. After-school physical activity levels include both indoor and outdoor

activities, compared to the park-based physical activity (a type of outdoor activity) measured in this study. Authors have shown that children have higher physical activity levels outdoors (Baranowski et al., 1993; Klesges et al., 1990), leading to the large proportion of children being engaged in vigorous physical activity in this study, compared to Cohen et al. (2006). Similarly, Floyd et al. (2011) measured physical activity levels in children up to 18 years of age, compared to children observed to be up to 12 years of age in this study. It could be that on average, adolescents have lower park-based physical activity levels than younger children, leading to a smaller proportion of children being engaged in vigorous activity levels (Floyd et al., 2011), compared to this study, which did not include adolescents.

Features, amenities, and incivilities are important predictors of physical activity within parks. Overall, the study findings indicated low scores for features and amenities and few incidents of incivilities within parks and playgrounds. The lower rating scores for overall features and amenities of parks are mainly attributable to the absence of features and amenities rather than to their conditions. The results also showed that features  $\beta = .07$ ,  $t(1282) = 2.42$ ,  $p = .02$  were positively associated with physical activity. Similarly, a small number of authors have found that physical activity levels were significantly associated with park features, such as playgrounds, fields, and open space areas, and their quality (Chomitz, Aske, McDonald, Canral, & Hackar 2011; Floyd et al; 2011; Hamilton, 2011); however, Nichol et al. (2010) found no consistent relationships between individual park features and physical activity. Nichol et al. (2010) measured after-school physical activity levels using a survey, leading to insignificant findings, while this study measured park-based physical activity.

The study results showed a significant negative relationship between amenities and physical activity  $\beta = -.10$ ,  $t(1282) = -3.19$ ,  $p < 0.001$ . Similarly, Dymment and Bell (2008) and Rung et al. (2011) also found that amenities such as shelters, drinking fountains, benches, and picnic tables were associated with decreased physical activity levels. Park amenities can be important correlates of park visitation and use, but are associated with decreased physical activity levels (Dymment & Bell, 2008; Rung et al., 2011).

The study results showed no or few incivilities during most of the park visits. The quality rating of incivilities was positively associated  $\beta = .14$ ,  $t(1282) = 4.66$ ,  $p < 0.001$  with park-based physical activity in children. In other words, areas that are clean and well-kept were positively associated with vigorous activity and negatively associated with sedentary activity. Similarly, a recent study showed associations between feature and amenity conditions and cleanliness and physical activity levels (Hamilton, 2011).

The study results showed significant associations between the individual variables of quality of features, amenities, and incivilities with physical activity, but the overall quality of the parks was not significantly associated  $\beta = .01$ ,  $t(1282) = 0.06$ ,  $p = .95$  with park-based physical activity in children. Features and incivilities were positively associated, whereas amenities were negatively associated with physical activity, leading to an insignificant association with overall park quality. Authors have found that improving quality or renovating, by painting existing school playgrounds or play yards, can increase physical activity levels in children (Brink et al., 2010; Stratton & Mullan, 2005).

The study results did not show any significant difference in physical activity between observed preschool-aged and school-aged children  $\beta = -.01$ ,  $t(1282) = -0.43$ ,  $p = .67$  or between observed boys and girls  $\beta = -.01$ ,  $t(1282) = -0.33$ ,  $p = .74$ . However, park and playground use was common in observed older age children (61.6%) and boys (57.7%), compared to observed younger age children (30.6%) and girls (39.9%), consistent with the findings reported by a small number of authors (Floyd et al., 2011; Perry et al., 2011; Reed et al., 2012). Floyd et al. (2011) found differences in physical activity levels between younger and older children and between boys and girls, compared to this study. This difference might be related to the broad age range of the sample (children up to age 18 years old) in that study, compared to this study (children observed to be up to 12 years of age). Adolescents had lower physical activity levels compared to younger children, leading to a significant difference in physical activity between adolescents and younger children in the above study (Floyd et al., 2011).

Park access was measured as the duration of the walk in minutes from the closest London Transit Commission bus stop to the closest park entrance. The study results showed a significant influence of park access  $\beta = .17$ ,  $t(1282) = 5.32$ ,  $p < .001$  on park-based physical activity in children. In other words, park use and physical activity levels in children were increased in accessible parks (close to LTC bus stops), compared to inaccessible parks (far from LTC bus stops). However, this study did not interview park visitors, so it cannot be stated with certainty how many children used public transport to reach parks. Similarly, many studies evaluating the relationships between park characteristics and physical activity have shown significant associations of park

availability, number of parks, distance to parks, and perception of nearby parks with physical activity (Cohen et al., 2006; Dowda et al., 2007; Kipke et al., 2007).

The study results showed that temperature  $\beta = .10$ ,  $t(1282) = 2.92$ ,  $p = .004$ ; week day  $\beta = 0.12$ ,  $t(1282) = 3.80$ ,  $p < .001$ ; afternoons  $\beta = .08$ ,  $t(1282) = 2.32$ ,  $p = .02$  and evenings  $\beta = .16$ ,  $t(1282) = 4.52$ ,  $p < .001$  were associated with park-based physical activity in children. Increased physical activity was found in children on weekdays versus weekends and afternoons and evenings versus mornings. The significant effect of temperature on physical activity might be due to use of water features, such as swimming pools and splash pads. High temperatures increased the use of water features (Davison & Lawson, 2006). Cradock et al. (2009) also found that female adolescents were significantly less active on weekends compared to weekdays and that temperature had a marginally significant association with activity. In contrast, Hino et al. (2010) found that visits on weekends were associated with increased park use and physical activity, compared to weekdays. This finding was not observed in this study, as the study was conducted in the summer, when children can visit on both weekends and weekdays. The results also showed an insignificant effect of neighbourhood SES  $\beta = -.006$ ,  $t(1282) = -.16$ ,  $p = .87$  on the relationship between the quality of parks and playgrounds and physical activity within them. Similarly, Boone-Heinonen and Gordon-Larsen (2011) also found no effect of median household income on moderate-to-vigorous physical activity.

## 4.5 Study Limitations

There were some limitations to this study. The cross-sectional design precluded making causal inferences between the quality of parks and playgrounds and physical activity.

The study did not use objective measurements, such as accelerometers, to measure physical activity. Accelerometers are a current standard used to measure physical activity, and they can measure daily or weekly physical activity levels. However, in addition to park-based physical activity levels, the type of physical activity (e.g., organized sports or free play) is also important when evaluating the role of the quality of parks and playground characteristics on physical activity; that information cannot be provided by an accelerometer (Kirby et al., 2012). One practical disadvantage of accelerometers is that they cannot be used during activities such as swimming (Kirby et al., 2012). Further, use of accelerometers is expensive and can require multiple units within settings such as parks.

One of the limitations of the SOPARC is that an individual counted in a target area scan could be counted twice when scanning another target area; however, large areas were scanned quickly, so the possibility of counting a child twice was diminished, especially when there were few children in these target areas. Second, the interest was in the number of observations; counting the same child in another target area would not have affected the findings. For target areas where a large number of children were observed, such as soccer fields, the target area was divided into sub-target areas that were scanned individually, limiting the likelihood of missing observations. Another limitation is that brief scanning of target areas might not produce data that are truly representative of



children's overall physical activity levels in parks. The park-based physical activity levels and behaviours of a child engaged in different games and activities vary greatly over time.

It was possible that a small number of children might have been incorrectly included or excluded, as this was an observational study and did not involve interviews with parents, generating misclassification bias. However, considering the large sample size in this study, misclassification of these cases likely would have had a negligible influence on the findings. Moreover, all of the cases in which the child's observed age or gender could not be determined were excluded from the final analysis.

Furthermore, the study was conducted in the summer, and a significantly greater proportion of children use water features during hot summers, compared to late autumn, winter, and early spring; however, children are also in school during other seasons. This study was conducted during the summer holidays, and it provided information on park use and the related physical activity of school-aged children on different days of the week and at times that were not possible at other times of the year. Further, most of the municipal parks in London are maintained and managed only in the summer, spring, and fall. Thus, a quality evaluation of the specific cleanliness of features such as water features and grassy areas was not possible in winter.

## 4.6 Implications of Research

The study findings provide information that could be valuable to city planners in making cost-effective decisions while creating park features and amenities or improving the

quality of existing parks (park renovation). Quality of features has a greater influence on park-based physical activity in children than amenities. Most of the parks had few or no incivilities; however, the small number of features in most of the parks suggests that urban planners should provide more features in parks because features were associated with physical activity in children.

## 4.7 Conclusion

The study findings showed that the majority of children visiting parks were engaged in either vigorous or sedentary physical activity. High-quality features and fewer incivilities were positively associated with park-based physical activity levels in children, compared to amenities. The quality of amenities was inversely associated with physical activity levels. Both quality and park access were associated with physical activity. Further, park-based physical activity was also associated with weekdays versus weekends, afternoons and evenings versus mornings, and higher temperatures. It is recommended that good quality park features be provided to increase the number of users who are active during their visits while at parks. City planners and recreation staff, as well as public-health professionals, might find the results of this study useful as they plan to promote park-based physical activity, particularly in children.

## 4.8 References

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## Chapter 5

### 5 Qualitative Results and Discussion

#### 5.1 Background

Physical inactivity in children is a growing concern, as it is associated with many adulthood conditions, such as cardiovascular, respiratory diseases, and hormonal disorders (World Health Organization [WHO], 2002). A number of built environment factors, including attributes of parks and playgrounds such as availability and presence of features and amenities as well as the presence of incivilities, are associated with increased park and playground use and physical activity (Coen & Ross, 2006; Perry, Saelens, & Thompson, 2011; Reed, Price, & Grost 2012; Rung, Mowen, Broyles, & Gustat, 2011). However, many of these studies did not explore the relationship in terms of condition and cleanliness of parks and playgrounds and had not measured their physical activity within parks, particularly in children (Cohen et al., 2006; Davidosn & Lawson, 2006; Floyd et al., 2011; Moody et al., 2004; Ries, Yan, & Voorhess, 2011; Timperio et al., 2008).

Therefore, a new study was conducted to explore the relationship between the quality of parks and playgrounds and park-based physical activity in children. Identifying the influence of the quality of parks and playgrounds on park-based physical activity patterns in children could help future researchers to conduct quasi experimental designs and intervention studies by improving the quality of existing parks and playgrounds (park and

playground renovation) and evaluating how these changes can influence physical activity patterns (mild, moderate, and vigorous activities) in children (Floyd et al., 2008, 2011).

The objective of the qualitative study was to provide a greater context and description of the relationship between quality of park and quality of features, amenities, and incivilities and observed park-based physical activity in children. Another objective of the qualitative study was to explore the influence of observed age and gender, weather, temperature, neighbourhood SES, day, and time on the relationship between park quality and park-based physical activity. An Embedded Design, a mixed-methods study design, was used whereby the quantitative method was the primary one and the qualitative method was the secondary one; each was applied concurrently in the study. This chapter will focus only on qualitative data collection and analysis. The qualitative data were recorded as field notes. Therefore, the key points of quantitative findings are provided before moving on to qualitative data collection and analysis.

The quantitative analysis found:

- Parks and playgrounds with higher quality of features and few incidents of incivilities were positively associated with park-based physical activity in children; however, higher quality amenities were negatively associated with park-based physical activity in children.
- Child's observed age and gender, and neighbourhood SES had insignificant associations with park-based physical activity levels in children.

- Parks and playgrounds access, visits on weekdays, afternoons, evenings, and higher temperature were positively associated with park-based physical activity in children.

## 5.2 Qualitative Data Collection

The observational study was conducted between May and August 2011 in London, Ontario in a total of 18 neighbourhood parks. Parks that were maintained by the city staff, incorporated a playground, and contained at least three or more features were included in this study. The selected parks and playgrounds were visited in mornings, afternoons, and evenings, on both weekdays and weekends (108 visits). The visits were between 15 and 90 minutes in duration, depending on the amount of quantitative and qualitative data collected in the visit. During each visit, field notes that described the presence, condition, and cleanliness of features, amenities, and incivilities as well as the physical activity behaviours of the observed children were recorded. In addition, the condition and cleanliness of features, amenities, and incivilities based on the operational definitions and pictures provided in the PARA (Physical Activity Resource Assessment) protocol were recorded (Lee, Booth, Reese-Smith, Regan, & Howard, 2005).

Furthermore, the physical activity levels of the observed children were recorded as sedentary/mild (lying down, sitting, and standing), moderate (walking) and vigorous activities (walking at brisk pace, running, and swimming), based on the operational definitions and pictures shown in the SOPARC (System for Observing Play and Recreation in Communities) protocol (McKenzie, Cohen, Sehgal, Williamson, & Golinelli, 2006).



Each of the features and amenities was selected as a target area, and their quality characteristics were recorded as field notes. The field notes were not part of the PARA or SOPARC questionnaires, but they were recorded to extend and explore the quantitative findings and to identify the possible reasons for the associations observed in the quantitative findings, as described in the Methods chapter. For example, while observing the target area of a baseball diamond, the field notes recorded quality characteristics, such as whether the surface of the field was uniform or uneven, was safe or unsafe (had rocks), had overhead lighting, and had benches for players and spectators as well as the condition of the backstop fencing. For target areas such as splash pads and skate boarding areas that were not present in the PARA questionnaire, the field notes gathered information related to the condition of these areas, such as whether the ground surface (smooth or uneven) was clean (free from garbage and litter), structures spraying water were of different types and painted, and water was clean.

In addition to the brief scanning of the quality characteristics of the target areas, the type of physical activity (either free play or organized) performed by children within that area and their involvement in games (such as players, reserved players, and spectators) were recorded. The field notes recorded information on the physical activity levels of children who were observed for a longer duration of time (1 minute) within a few selected target areas. For example, within a selected target area of the baseball diamond, the type of activity (either free play or organized) and the level of physical activity (such as walking, standing, sitting, and running) of children playing baseball were observed for 1 minute and recorded as field notes. The physical activity levels of children who were watching

this game as spectators seated around the baseball field or who were involved as reserved players were recorded (for 1 minute).

In addition to collecting data on the quality characteristics of parks and playgrounds and the physical activity in children, the field notes recorded information on the children's observed ages and genders and the weather, temperature, day, and time to analyze how physical activity in children within parks and playgrounds (i.e., lower- and higher-quality parks and playgrounds) varied with respect to these variables. To provide a better understanding of what information was recorded in field notes, two scanned images of field notes recorded during visit to two different parks are provided as Appendix D.

### 5.3 Qualitative Analysis

The qualitative analysis was based on quantitative results and findings. The primary purpose of the qualitative analysis was to explore and extend the quantitative findings and to explore the influence of different variables on the relationship between park and playground quality and the park-based physical activity in children that were identified from the quantitative analysis.

The thematic analysis was performed on the collected field notes, which involved reading and re-reading the field notes recorded at each visit to identify common themes. The field notes were categorized using both preset and emergent categories. In the preset categorization, the data were searched for text that matched the list of themes and categories prepared in advance based on the quantitative results, such as overall quality, quality of features, amenities and incivilities, observed age and gender, neighbourhood

SES, day, time, and temperature. The emergent categorization included reading the text and finding the themes that emerged from the field notes and that were relevant to the objectives of the study. These themes, categories, and observational findings were subsequently discussed with the supervisor.

The qualitative analysis also included a case study of two parks and playgrounds in which a detailed description of their quality was discussed in relation to the physical activity in children and the influence of variables, such as the children's observed ages and genders and the temperature, weather, day, and time.

#### 5.4 Measures Adopted to Ensure Trustworthiness in the Qualitative Methods

Guba (1981) and Lincoln's (1995) evaluation criteria based on credibility, transferability, dependability, and confirmability were used to establish the trustworthiness of the qualitative data collection and analysis. Credibility in qualitative research refers to a "truth value" that is subject-oriented and obtained from human experiences as they are lived and perceived by informants (Krefting, 1991). The following procedures were used to enhance credibility in the qualitative data collection and analysis:

- The inclusion of all of the children in the study who were observed during each park and playground visit controlled the researcher's bias in the selection of study participants.

- In total, 18 neighbourhood parks were included in the study, and each park was visited on different days (weekdays and weekends) and times (morning, afternoon, and evening).
- A detailed description of the quality characteristics within high- and low-quality parks and playgrounds and how the day of the week, time of day, temperature, and weather at the time of the visit influenced the types and physical activity levels among children was also obtained for ensuring credibility.

Transferability, which is defined as the extent to which the study findings are applicable to other situations (Merriam, 1998), provides a detailed description of the research context and phenomenon under study to enable the readers to decide on transferring study inferences in their context (Shenton, 2004). Transferability is achieved by a detailed description of context, such as study settings, description of type, and intensity levels of physical activities in children of different observed ages and of either gender.

Dependability refers to whether the work and study findings are replicable within similar environments, sample characteristics, and methods (Shenton, 2004). To address dependability issues, researchers should provide sufficient detail of the processes in the study, such as research design and its implementation and the operational details of data collection, to enable another researcher to repeat the work (Shenton, 2004). Sufficient detail of how field notes were recorded and data were collected, along with pictures that illustrate the quality of features and amenities, were used to ensure dependability. The collected data and pictures were discussed with experienced researchers to ensure dependability in the data collection.

Confirmability refers to ensuring that the study results and the interpretation are based on sample experiences and behaviour, not on the researcher's preferences (Shenton, 2004).

To address confirmability of the qualitative data analysis, the study data, field notes, and themes were discussed with the supervisor, thereby minimizing the researcher's preferences within the qualitative analysis and interpretation (Thurmond, 2001).

## 5.5 Results

### 5.5.1 Description of Park and Playground Quality

The majority of the park features had overall good condition and cleanliness; however, many of these good-quality features had a few mediocre- or poor-quality characteristics. For example, many baseball diamonds had a smooth surface, uniform grass coverage, well-mowed grass, and dugouts (good-quality characteristics); however, the majority of these good-quality baseball diamonds had no overhead lighting, benches, or shaded structures for spectators and dugouts (mediocre-quality characteristics).

Several features, such as splash pads and skate boarding areas, were observed only in a few parks and playgrounds. A splash pad or spray pad is an area for water play that has no standing water. Splash pads of different shapes, such as rainbow-type and tree-type pads, spraying clean water were observed in a few parks and playgrounds ( $n = 3$ ). These structures were painted, and the surface of the area was smooth and free from garbage and litter. Several parks and playgrounds ( $n = 2$ ) had skate boarding areas with ramps and obstacles. The ground surface of these skate boarding areas was smooth and clean.

The majority of the park amenities had overall good-condition characteristics and were clean. However, these good-quality amenities had a few poor- or mediocre-quality characteristics. For example, most of the bathrooms were well lit, functioned well, and had water sinks for washing hands (good-quality characteristics). However, many of these bathrooms had no toilet paper or soap/sanitizer (mediocre- and poor-quality characteristics). A couple of parks and playgrounds ( $n = 2$ ) had locked bathrooms during all of the visits and one had a temporary bathroom that was not well lit, with no toilet paper or washing soap. Furthermore, the majority of the parks and playgrounds were in good condition with few areas of overlying grass or no grass. Most of the parks and playgrounds were clean, and few parks and playgrounds had graffiti and litter (plastic bottles, straws, and plastic cups) lying in different areas.

### 5.5.2 Role of Park and Playground Quality on Their Use and Children's Physical Activity Levels

The majority of the features that had good-condition characteristics and cleanliness had large numbers of children involved in different activities, such as running, swimming, climbing equipment, and playing with balls, compared to features with mediocre-condition characteristics that had small numbers of children involved in these activities. For example, large numbers of children engaged in playing baseball (running, exercising, and ball throwing) were observed around baseball diamonds that had smooth surfaces, uniform grass coverage, well-mowed grass, and dugouts (good-quality characteristics) compared to baseball diamonds that had areas with no grass, rough ground surfaces and without dugouts (mediocre-quality characteristics).

In addition to feature conditions and cleanliness, the type of feature is also important. Large numbers of children were observed engaged in running and walking briskly on baseball diamonds that were good-condition and were clean (good-quality characteristics) compared to sandboxes with good quality characteristics that had a small number of children involved in activities, such as sitting or standing and playing with sand. Similarly, large numbers of children around swimming pools were observed to be engaged in swimming, running, diving, and playing with balls compared to good-condition and clean tennis and basketball courts that had fewer children. Large numbers of children were observed running and playing with balls in and around different types of splash pads that were clean and well painted compared to only a small number of children who were observed skate boarding in different skateboarding areas.

In addition to overall quality characteristics, individual quality characteristics of a particular feature are important. Few characteristics of a particular feature, such as baseball diamonds that had smooth surfaces, uniform grass coverage, well-mowed grass, and dugouts, had large numbers of children compared to baseball diamonds with similar characteristics, but without dugouts. Similarly, soccer grounds that had well-mowed uniform grass had large numbers of children playing soccer compared to soccer grounds that had areas of sparse or overlying grass.

Large numbers of children were observed sitting on benches and at tables that were not painted and were slightly crooked but were safe and usable compared to only small numbers of children observed in and around good-condition and clean amenities, such as drinking fountains, display fountains, and shelters. Large numbers of children were observed climbing play equipment, running on grass and around splash pads, playing

soccer and baseball, and swimming in parks and playgrounds that had no or few incidents of incivilities, such as the presence of empty cigarette packs, plastic plates, cups, and straws and several areas of overlying or no grass.

### 5.5.3 Organized Sports Versus Free Play

A difference between organized sports and free play was an emergent theme that originated from the qualitative data analysis. In this study, organized sports were defined as the presence of a referee, coach, or instructor (Guevremont, Findlay, & Cohen, 2008) and a certain number of players required to play that sport. Large numbers of children were involved in organized sports, such as baseball and soccer, during visits to many parks and playgrounds. However, large numbers of children were also engaged in free play activities, such as swimming, walking, and running around splash pads; climbing different structures, slides, and monkey bars; and playing with a ball during several visits to the same park and playground. This difference in the type of activities within the same park or playground on different visits may be related to a particular day of the week or time of day, which will be described in the discussion.

One-minute observations of physical activities of several children involved in organized sports revealed that many of the children present in and around baseball and soccer fields were either standing or sitting, waiting for their turns, or watching these games as spectators. Many of the children who were playing baseball were involved in activities, such as walking at a slow pace or standing and sometimes even sitting for most of the 1-minute duration.



#### 5.5.4 Observed Age and Gender and Park and Playground Use and Physical Activity

A large number of preschool-aged children were engaged in free play, such as swinging, climbing, sliding, and running on grass and splash pads, compared to school-aged children, who tended to be involved in organized sports, such as baseball and soccer. Similarly, boys, for the most part, were involved in playing organized sports, such as baseball and soccer, followed by free play activities, such as playing with balls, playing around equipment, and swimming. However, girls were involved, for the most part, only in free play activities, such as playing around splash pads and equipment.

#### 5.5.5 Weather, Temperature, Time, Day, and neighbourhood SES

During adverse weather conditions, such as rain and drizzle, a small number of children gathered under shaded areas, compared to pleasant weather, such as sunny weather, when large numbers of children were engaged in basketball and soccer (organized sports) and free play activities, such as standing and running around splash pads, climbing structures, and swimming. Large numbers of children were involved in organized sports and free play activities during times of higher temperatures, in afternoons and evenings, and on weekdays. Good-condition and clean features and amenities and large numbers of children engaged in organized and free play activities, such as running, swimming, playing with balls, swinging, and climbing, were observed in both in higher and lower SES neighbourhoods.

## 5.6 Examples of High- Versus Low-Quality Parks and Playgrounds That Were Selected as Case Studies

A description of the quality characteristics of one high- and one low-quality park and playground, with respect to different visits at different times, on different days, and in different weather and temperatures as case studies will provide a rich picture of the relationship between park and playground quality and the park-based physical activity of children. Descriptions and vivid pictures of context as case studies are also one means for ensuring credibility in qualitative research.

### 5.6.1 Park and Playground One (High-Quality Park and Playground)

This park and playground are located in the Oakridge neighbourhood, city of London, Ontario, at the intersection of Oxford West Road and Hyde Park Road. The Oakridge neighbourhood total population in 2006 was 16,710; 4,570 people were between the ages of 0 and 19 years. The median household and family incomes of the neighbourhood were \$83,965 and \$96,755 (CAD), respectively. This park and playground are located at a 1-minute distance from the nearest LTC (London Transit Commission) bus stop.

#### 5.6.1.1 Quality

No noticeable change in terms of quality characteristics were observed during any of the six visits. The main entrance, which was clearly marked with the name of the park, led to a large parking area with several marked parking slots. The parking area was clean,

smooth, and free from debris. The park and playground had one side entrance that was narrow, had overgrown grass, and had no signage or posting. On several occasions, the side entrance was obscured upon entering the park and playground.

Two baseball fields/diamonds had uniform and even surfaces with no rocks or stones. There were several patchy areas with no grass, although the surface of the baseball diamond was uniform. The grass around the corners was thick and overgrown. Overall, the diamonds were clean and did not have trash or debris. The trash containers on the side of the diamonds were partially filled and clean from the exterior. There were benches for reserve players; however, there were no shaded areas for spectators. During several visits, the majority of the spectators sat on the grass around the diamonds.

The tennis court surface was even, without cracks, with markings, and with a net without holes. The surface was clean and free from debris or trash. The swimming pool and surrounding areas were clean, with no debris or trash on the surrounding surface. The sidewalks were smooth, with no cracks, even surfaced, clean, and without debris or trash. There were different types of play equipment, such as slides, swings, and monkey bars that were not painted, but they were clean, firmly fixed to the ground or to supports, and there was no trash or debris in the area. Splash pads of different shapes, such as rainbow-type, and tree-type pads, were painted and had clean water. The swimming pools were clean with no debris or trash on the surrounding surfaces.

There were a few benches and tables; all were usable, most were not painted, and a few were crooked, but they were still safe and firmly fixed to the ground. The bathroom was clean and well stocked with toilet paper and hand sanitizers. Working, clean drinking

fountains were observed outside the bathroom, with a clean surrounding area in all the visits. The landscaping, such as trees and grass, was attractive, lush, and colorful. The few available shelter areas were clean and present near the bathrooms. Trash cans were clean on the outside and were distributed throughout the park and playground, although they were not placed at equal distances from each other. The majority of the trash containers were half-filled or less; a few trash containers were filled just below the brim.

There were no incidents of incivilities reported during any of the six visits. No irritating sounds, such as train passing on a railway line or traffic noise, were observed during any of the visits. Grass uniformly covered most of the park and playground areas, with sparse areas of grass coverage in several places. A few areas, especially the corners of the park and playground, had some overgrown grass. The majority of the areas were free of debris and trash, except for areas where some trash and debris on the grass were observed. Furthermore, no broken pieces of glass were observed, except for a couple of visits when a few broken glasses were found in several locations on the grass. There were no refuse piles or unattended dogs, alcohol bottles, cans, and syringes at any of the visits, except for a couple of visits when a few plastic bottles, straws, and plastic cups were observed.

#### 5.6.1.2 Physical Activity

The descriptive data for each visit, such as date, day, time, mean temperature, temperature at the time of the visit, and weather are shown in Table 9.

Table 9

*Descriptive Information of Variables With Respect to Park and Playground One and Two*

Par k #	Visit #	Date	Day	Time	Mean Temperature	Visit Temperature	Weather
1	1st	15 <sup>th</sup> July	Friday (weekday)	3 p.m. (afternoon)	22	28	Hot and sunny
	2nd	16 <sup>th</sup> July	Saturday (weekend)	11 a.m. (morning)	23	27	Hot and sunny
	3rd	16 <sup>th</sup> July	Saturday (weekend)	2 p.m. (afternoon)	23	29	Hot and sunny
	4th	16 <sup>th</sup> Aug ust	Tuesday (weekday)	11.30 a.m. (morning)	22	23	Cloudy with sunny intervals
	5th	16 <sup>th</sup> Aug ust	Tuesday (weekday)	7.00 p.m. (evening)	22	26	Sunny & hot
	6th	20 <sup>th</sup> Aug	Saturday (weekend)	6.30 p.m.	21	19	Overcast and after

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		ust					shower
2	1st	9 <sup>th</sup> July	Saturday (weekend)	7.00 p.m. (evening)	22	27	Sunny & hot
	2nd	11 <sup>th</sup> July	Monday (weekday)	1.30 p.m. (afternoon)	25	29	Overcast & sunny
	3rd	16 <sup>th</sup> July	Saturday (weekend)	3.30 p.m. (afternoon)	23	30	Extreme hot & sunny
	4th	25 <sup>th</sup> July	Monday (weekday)	11.45 a.m. (morning)	24	25	Sunny with cloudy intervals
	5th	31 <sup>st</sup> July	Sunday (weekend)	10.00 a.m. (morning)	26	22	Overcast and drizzle
	6th	3 <sup>rd</sup> Aug ust	Wed (weekday)	7.00 p.m. (evening)	22	25	Pleasant with cloudy intervals

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*Note:* Temperature is given in Celsius scale, visit temperature is temperature at the time of visit and mean temperature is the average temperature of the day.

#### 5.6.1.2.1 The First Visit

On the first visit, a small number of preschool and school-aged children, both boys and girls, were observed standing, running, or sitting around the splash pads. Small numbers of school-aged boys and girls were also observed swimming and sitting outside the pool, along with adults. The primary reason for observing children in a swimming pool during this visit (afternoon) compared to other visits was the limited operational hours of the swimming pool. The majority of the swimming pools present in the parks and playgrounds in the city of London function only between 12 and 4 pm, as stated on a board in front of the swimming pools. Several preschool- and school-aged boys and girls were observed around play equipment.

#### 5.6.1.2.2 The Second Visit

In contrast to the first visit, large numbers of children were observed in and around baseball diamonds compared to other areas of the park and playground. A 1-minute scanning of the target area (a baseball diamond) revealed that the majority of the children playing baseball game were standing or walking for most of the duration. Furthermore, large numbers of school-aged and preschool-aged children (both boys and girls) were observed either sitting on the grass watching the game or standing or walking slowly. In addition to organized sports, a small number of children (observed to be preschool- and school-aged boys and girls) were found running and walking briskly around splash pads.

### 5.6.1.2.3 The Third Visit

A large number of children were observed in this visit compared to the first visit. A 1-minute scanning of the target area revealed that out of 22 school-aged boys playing baseball, the majority of them were standing or walking slowly, and only a small number of children were running. Furthermore, a total of 30 school-aged boys were observed either sitting or standing outside the baseball diamonds in the dugouts, waiting for their turn. In addition, a small number of children were observed around play equipment and climbing structures.

### 5.6.1.2.4 The Fourth, Fifth, and Sixth Visits

A small number of children were present during the fourth visit compared to the second and the third visits. A school-aged boy was observed climbing the equipment and a school-aged girl and boy were observed walking on the grass during this visit. During the fifth visit, a large number of children were observed compared to the fourth visit. A 1-minute scanning of the baseball diamond revealed that out of 11 school-aged boys playing baseball, the majority of the players were standing or walking slowly rather than running. Furthermore, a total of 16 school-aged boys were warming up (jogging, stretching, etc.), and a few school-aged girls ( $n = 7$ ) were watching the game as spectators. Additionally, a small number of children (both preschool- and school-aged boys and girls) were observed playing around the equipment area. The sixth visit was after a quick rain shower. Only two school-aged boys were observed walking on the grass, and a school-aged boy and girl were observed playing around the climbing structures.



## 5.6.2 Park and Playground Two (Low-Quality Park and Playground)

This park and playground are located in the Hamilton neighbourhood at the intersection of Trafalgar Road and Highbury. The total population of the neighbourhood in 2006 was 15,380; 3,490 people were between the ages of 0 and 19 years. The median household and family incomes were CAD\$48,707 and CAD\$59,442, respectively. The neighbourhood has three sports and recreational facilities, two of which are positioned very closely to each other. This park and playground are located at a 4-minute walking distance from the LTC bus stop.

### 5.6.2.1 Quality

The main entrance was clearly marked with the name of the park and playground, leading to a medium-sized (compared to other parks and playgrounds) parking area. The parking area was clean, smooth, and free from debris. However, during one of the visits, standing water was observed in the parking area, although it was not raining at that time. Other access points were clear, visible, free of debris, and with overgrown grass, although one side entrance had some trash and debris on the grass, with patchy areas of no grass or overgrown grass. There were a couple of baseball fields/diamonds, mostly uniform surface with no rocks or stones, although many areas in the diamonds had no grass. Both diamonds had benches (without shade) for only the players (not for the spectators).

The football grounds (not soccer grounds) were clean and covered with uniform grass.

The surface was smooth, even, and with few areas of overgrown grass. The swimming

pool was clean with no debris or trash on the surrounding surface. The sidewalks were unclean (debris was present) and had a few cracks, although overall, they were smooth, uniform, and usable. The sand box was clean, but it was only half-filled. There were different types of play equipment, such as slides, swings, and monkey bars that were not painted, but firmly fixed to the ground or to supports, and did not have trash or debris.

For the most part, the benches were not painted, and a few were crooked, but they were safe, usable, and firmly fixed to the ground. The bathroom was clean and well stocked with toilet paper and hand sanitizers. The trash containers were clean from the outside, were mostly half-filled or less and were distributed throughout the park and playground, although they were not placed at equal distances from each other. Plastic bottles, straws, and plastic cups were observed on several occasions at different areas in the park and playground.

### 5.6.2.2 Physical Activity

#### 5.6.2.2.1 The First and Second Visits

During the first visit, only a girl was observed climbing the monkey bars. Papers, wrappers, empty bottles, and plastic cups were found in different areas of the park and playground. During the second visit, a baby in a stroller and a preschool-aged girl walking with an adult were observed. Furthermore, a few school-aged girls and boys ( $n = 4$ ) either swimming or entering the gate of the swimming pool were observed. Three school-aged boys playing with a tennis ball and a few children ( $n = 3$ ) walking on the grass were also observed.

#### 5.6.2.2.2 The Third and Fourth Visits

The most prominent physical activity observed during the third visit was around the swimming pool. Many school-aged boys and girls were swimming or standing in the water. Papers, wrappers, empty bottles, and plastic cups were found in different areas of the park and playground. During the fourth visit, one boy was found biking, one boy was climbing the equipment, and one boy was observed sitting on the grass next to the play equipment. Papers, wrappers, empty bottles, and plastic cups were found in different areas of the park and playground, similar to other visits. Standing water in the parking lot was observed.

#### 5.6.2.2.3 The Fifth and Sixth Visits

Papers, wrappers, empty bottles, and plastic cups and no children were observed on both visits, despite pleasant weather conditions.

### 5.6.3 Summary Discussion of Case Studies

The overall quality and the quality of features, amenities, and incivilities were better in park and playground one rather than two. There were different types of features and amenities in park and playground one compared to two. The condition and cleanliness characteristics of the features and amenities were also better in park and playground one than two. Similarly, large numbers of children (preschool- and school-aged boys and girls) were observed in the higher-quality park and playground compared to the lower-quality park and playground. Larger numbers of preschool- and school-aged children were observed, engaged in organized activities and free play activities, in the higher-

quality park and playground compared to the lower-quality park and playground. Larger number of girls and boys were involved in organized sports and free play activities in the higher-quality park and playground compared to the lower-quality park and playground. Finally, large numbers of children were engaged in organized sports and free play activities on weekdays and during afternoons and evenings in both of the parks and playgrounds.

## 5.7 Discussion

The majority of the parks and playgrounds that were visited in the city had good condition and cleanliness (good-quality) features and amenities. The overall condition and cleanliness of each feature and amenity are dependent on several quality characteristics. Most of the overall good-quality features and amenities had many higher-quality characteristics, but they also had several lower-quality characteristics, which highlighted the need for improvement in park and playground quality characteristics, despite overall good quality.

Similarly, several authors had found that the majority of the playgrounds and landscapes were in good condition, clean, and safe; however, a few parks and playgrounds had dead grass and reduced areas for play (Colabianchi, Maslow, & Swayampakala, 2011; Loukaitou-Sideris & Stieglitz, 2002). Perry et al. (2011) found that the quality of most of the parks included in their study was poor. The difference in findings between these studies may be related to use of EAPRS (Environmental Assessment of Public Recreation Spaces). EAPRS is a long questionnaire that has a checklist for the assessment of different park and playground characteristics, and not every park or playground has all of

these features and amenities. Absence of any of these characteristics can lower the quality scores of parks and playgrounds. Therefore, studies such as Colabianchi et al. (2011) who used only those portions of the EAPRS measurement tool that focused on the playground features and amenities, had good quality scores for parks compared to Perry et al. (2011), who used the entire EAPRS questionnaire.

The study results indicated that the overall condition of the features and amenities did not change among the park and playground visits; however, the overall cleanliness of features and amenities varied among the visits. For example, there was no garbage or litter on the baseball and soccer fields during a few visits to a park and playground compared to a few incidents of garbage and litter observed during other visits. Refuse (garbage and litter) was also a significant problem in several parks that were visited in Los Angeles, where parents complained about health hazards, such as broken glass and bottles in the mud (Loukaitou-Sideris & Stieglitz, 2002).

These findings of poor condition and cleanliness among parks and playgrounds within a park and playground at different visits are attributed to several reasons. First, it is likely that these parks and playgrounds are not managed regularly because a large empty cardboard box (garbage) was lying on one of the soccer fields within a specific park and playground during all of the six visits that were conducted within a week. This finding may also be due to the large number of children within a particular park and playground area because studies have shown that the presence of a large number of park visitors within a specific park area may decrease the cleanliness of that area (Colabianchi et al., 2011).

Overall, the study results indicated that not only the presence of features but also their quality characteristics are important. Large numbers of children engaged in vigorous activities (such as running, swimming, and playing with a ball) were observed in and around features with good-condition characteristics and cleanliness compared to the same park and playground features with mediocre-condition characteristics. However, the observations also indicated that there were a few good-quality features, such as baseball diamonds that had a small number of children, compared to mediocre-quality baseball diamonds, where a large number of children were observed.

In addition to the overall condition and quality of a feature, individual characteristics of a feature are important. An overall good-quality feature, e.g., a baseball diamond that had a few poor- or mediocre-quality characteristics, such as the absence of dugouts with shade, had smaller numbers of children engaged in sedentary-to-moderate activities (stretching, walking, etc.) than overall good-quality baseball diamonds that had dugouts with shade. This finding highlights that, in addition to overall quality characteristics (overall condition and cleanliness), individual quality characteristics are important, thereby influencing the number of children and their physical activity levels within the features. Similarly, Rung et al. (2011) found that the good condition of features in parks and playgrounds influences the number of park visitors and their physical activity levels.

The study results revealed that the number of children and physical activity levels not only varied among the visits to different parks and playgrounds but also among the different visits to the same park and playground. These differences in the number of children and their activity levels within a park and playground at different visits may be attributed to issues of cleanliness (such as garbage and litter) because large numbers of

children engaged in vigorous activities (running) were observed when a soccer field was clean and free from garbage and litter compared to other visits to the same soccer field.

This difference may also be attributed to the scheduled organized activities at that time.

Large numbers of children were observed in and around features, such as baseball diamonds and soccer fields, when organized activities were scheduled compared to empty baseball diamonds and soccer grounds during other visits (when organized activities were not scheduled) within the same park and playground and during visits on the same day and time within different parks and playgrounds with similar-quality characteristics.

During a couple of visits, large numbers of children were engaged in playing organized sports (baseball) in baseball diamonds that had a few mediocre-quality characteristics, such as no dugouts and lighting and a few areas of sparse grass. This finding highlights that scheduled organized activities can increase the number of children and the amount of physical activity, even in mediocre-quality features in parks and playgrounds. Only a few features had overall mediocre-quality characteristics in this study.

A few authors have assumed that participation in organized sports such as soccer will result in children engaging in vigorous physical activity (Bergeron, 2007; Santos, Gomes, & Mota, 2005); however, 1-minute observations of children involved in sports such as baseball in this study indicated that the majority of the children involved in these games were engaged in moderate-to-sedentary activities (standing or walking slowly) or were watching these games as spectators. Similarly, a few studies have shown that children involved in organized sports are mostly engaged in sedentary and moderate activities compared to vigorous activities (Leek et al., 2011; Scheck, 2011). Guagliano,

Rosenkranz, and Kolt (2013) also determined that children spent more time in vigorous activities during training or practicing compared to playing a game.

The study findings indicated that participation in organized sports was different between observed preschool- and school-aged children and between observed boys and girls.

More preschool-aged children and girls were observed around features that promoted free play, such as play structures, splash pads, sand boxes, and swimming pools, compared to school-aged children and boys, who were engaged in organized activities in and around baseball diamonds and soccer fields and free play activities (preschool-aged boys in particular were mostly involved in free play activities). Similarly, authors have noted increased participation in organized sports among boys and older children compared to girls and younger children (Perry et al., 2011). However, Loukaitou-Sideris and Stieglitz (2002) found that both girls and boys were involved in similar activities, such as biking and sports games. This difference in participation in organized sports within parks and playgrounds between these studies may be attributed to the scheduling of organized activities, such as soccer and baseball.

The study results revealed that the number of children and their activities varied according to weather conditions, day of the week, time of day, and temperature. Large numbers of children were engaged in organized activities in and around baseball diamonds and soccer fields on evenings compared to mornings. Similarly, swimming pools were operational only in the afternoons and had reduced hours on weekends, limiting their use in the mornings and on weekends. Large numbers of children were engaged in swimming and running in and around splash pads (vigorous activities) during high-temperature and sunny weather compared to overcast and rainy weather. McMurdo



et al. (2012) observed large numbers of children engaged in vigorous activities during sunny weather compared to rainy weather (Brockman, Jago, & Fox, 2011). Studies have shown that the number of visitors and their involvement in different activities varied according to the temperature, day of the week, and time of day (Cradock et al., 2009; Hino et al., 2010; Wolff & Fitzhugh, 2011).

In addition to the quality of features, the quality of incivilities (lack or few incidents of incivilities) is important. The majority of the parks and playgrounds had few incidents of incivilities during most of the visits. Parks and playgrounds with more incidents of incivilities (in terms of amount of garbage and litter) had smaller numbers of children compared to the parks and playgrounds that had few incidents of incivilities. However, large numbers of children were observed in parks and playgrounds with few incivilities compared to parks and playgrounds that had no incivilities at all. This finding may be attributable to the amount of refuse that is generated with large numbers of children use parks and playgrounds (Colabianchi et al., 2011; Rung et al., 2011).

Amenities with good-quality characteristics had large numbers of children compared to amenities with mediocre-quality characteristics. However, in contrast to the quality of features and incivilities, large numbers of children were found around benches and tables with mediocre-quality characteristics, but the benches and tables were usable and safe. This finding highlights that the use of amenities, such as benches, tables, and fountains, may not be dependent on whether the amenities have good- or mediocre-quality characteristics; rather, their use is dependent on whether they are safe and usable. Moreover, regardless of the quality of the amenity, the majority of the children were observed to be sitting, standing, or walking at a slow pace in and around amenities (both

good- and mediocre-quality amenities), such as benches, tables, and shelters. Similarly, authors have shown that amenities, such as shelters, drinking fountains, benches, and tables, are associated with decreased physical activity levels (Dyment & Bell, 2008; Rung et al., 2011).

### 5.7.1 Study Limitations

There were several limitations in the study. One limitation was that the brief scanning of target areas may not be truly representative of each child's physical activity behaviours, particularly in organized sports, such as baseball and soccer games. The physical activity behaviours of a child playing these games vary greatly over a short time. To counteract this limitation, a 1-minute scanning of a few baseball and soccer games was performed to explore the physical activity behaviours of the children for a slightly longer duration than just brief scanning.

Two of the limitations of direct observation field notes are selection bias and observer bias. However, the study included all of the children who were observed within the selected parks and playgrounds, which minimized the selection bias of the researcher. To counteract the observer bias, descriptive field notes were taken that provided detailed observations. Collecting data on multiple settings (18 parks and playgrounds) at different times (six visits in each park and playground), providing detailed descriptions of higher- and lower-quality parks and playgrounds in relation to the activities performed by children on different days and at different times as case studies, and providing scanned images of the field notes from visits of two parks and playgrounds as examples were means for reducing observer bias in this study.

Another limitation was the fact that this study depended on the park-based physical activity of children who were each observed for a limited time and not for an entire visit. An alternate approach would have been to directly observe the physical activity behaviours of a single child for the entire period of stay or to combine direct observations with interviews from either the parents of young children or older children themselves regarding the types and durations of activities performed during park and playground visits. Direct observation was used to measure children's ages and genders. There were a few occasions where classifying a child into preschool- or school-aged and into male and female categories was not possible, despite using broad categories for classifying children's ages ( $\leq 5$  and  $> 5-12$  years).

### 5.7.2 Implications for Future Research

The presence of features increased the numbers of children within parks and playgrounds and the physical activity levels more than the amenities. Thus, city planners and recreational managers should focus on creating additional features or improving the quality of existing features within the parks and playgrounds when they design and construct recreational areas. The researcher identified issues of condition and cleanliness in a few parks and playgrounds that may hinder their use. Future studies should identify the primary reasons behind the poor condition and cleanliness of these areas to increase the use of parks and playgrounds and the level of physical activity in children who visit these places.

The study results indicated that some good-quality features had large numbers of children and encouraged vigorous physical activity levels compared to other good-quality

features. This finding may help urban planners to make cost-effective decisions by including those features that have more influence on the number of children within parks and playgrounds and their physical activity levels.

The study findings might also help in making assumptions related to the interests and preferences of preschool- and school-aged children and boys and girls regarding the characteristics of parks and playgrounds. These findings have implications for planners in terms of the features, amenities, and aesthetics that they can include in parks for children of all ages and both genders.

The study findings indicated that a large number of children were present when organized activities were scheduled within parks and playgrounds. The scheduling of organized activities will not only increase the participation of children in these games but will also increase the use of these features in the future because the children visited these places for training, practicing, and improving their game and skills.

Many of the good-quality features, such as soccer and baseball fields and basketball courts, were empty in many of the visits to parks and playgrounds, despite pleasant weather and weekday evenings, when a large number of children were expected, based on study findings. These features may be used for free play activities in which a group of children may play soccer, baseball, and basketball without any prescheduled event or required number of players. Public health consultants and researchers should build strategies that can motivate children to utilize park and playground features and perform free play activities, in order to increase physical activity levels in children.

## 5.8 Conclusion

Most of the parks and playgrounds in the city of London were of high quality and had good-quality features and amenities and fewer incidents of incivilities. Most of the high-quality parks and playgrounds not only had large numbers of children but also vigorous activity levels compared to low-quality parks and playgrounds. The presence of features attracted more children and encouraged vigorous physical activity compared to the presence of amenities. Good conditions and clean features also encouraged large numbers of children and vigorous physical activity levels.

Overall, large numbers of school-aged children and boys were observed compared to preschool-aged children and girls. The physical activity between preschool- and school-aged children and boys and girls did not vary by observed intensity level (sedentary/mild, moderate, or vigorous) but rather by observed type (organized vs. free play). Overall, the study results revealed that weather, temperature, day of the week, and time of day all influenced the number of children within the parks and playgrounds and their physical activity levels. Organized sports were common in observed to be school-aged children and boys compared to free play, which was common in observed to be preschool-aged children and girls. Another interesting finding that emerged during the qualitative analysis was that the majority of the players involved in organized sports were either walking at a slow pace or standing (sedentary or moderate activities) for most of the duration of play.

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## Chapter 6

### 6 Discussion

#### 6.1 Overview of the Study

The primary purpose of this thesis was to explore the relationship between park and playground quality and the park-based physical activity in children. The EST was used as a theoretical framework to explore this relationship. Child development is based on progressive, complex, and reciprocal interactions between a child and his or her immediate environment. These interactions are influenced by environmental characteristics (i.e., contextual elements and their characteristics) and individual characteristics. Contextual elements are placed within the subsystems of EST (micro, meso, exo, macro, and chrono systems) that are hierarchically arranged in concentric circles. The quality of parks and playgrounds and the quality of features, amenities, and incivilities were included as contextual elements of the macrosystem that can mediate park-based physical activity in children.

A scoping review with a systematic search strategy was performed to identify gaps and to collate and summarize the nature of the literature on the relationship between park and playground quality and their use and related physical activity in children. This review revealed that the presence of features, amenities, and safety in parks and playgrounds were related to the increased use and, to a limited extent, park-based physical activity in children in the case of features only. The reviewed literature also highlighted the limited

influences of age and gender on the relationship between park and playground quality and physical activity in children. Few studies ( $n = 2$ ) revealed contrasting findings between the condition and cleanliness of parks and playgrounds and their use by children; however, there was a scarcity of literature specifically addressing physical activity. It was recommended that original studies should be conducted to evaluate the relationship between park and playground quality, in particular their condition and cleanliness, and park-based physical activity in children.

After the review, a mixed-methods study using an Embedded Design was conducted between May and August 2011 to explore the relationship between park and playground quality, quality components (i.e., the quality of features, amenities, and incivilities) and park-based physical activity in children in London, Ontario. A total of 18 neighbourhood parks in London, Ontario that fulfilled the designated selection criteria were selected using multistage random sampling. Each of the selected parks and playgrounds was visited in the morning, afternoon, and evening, each on weekdays and weekends.

Physical Activity Resource Assessment (PARA) questionnaire was completed only on the first visit to each park and playground (Lee, Booth, Reese-Smith, Regan, & Howard, 2005), whereas physical activity using SOPARC (McKenzie, Cohen, Sehgal, Williamson, & Golinelli, 2006), time, day, weather, temperature, and field notes were recorded on each park and playground visit. The quantitative data were analyzed using multiple linear regression analysis, whereas the qualitative data were thematically analyzed both inductively (searched new themes) and deductively (preset categories). The quantitative and qualitative results and how qualitative findings extend the quantitative findings are discussed in the following section.

## 6.2 Key findings of Quantitative and Qualitative

### Results

- Presence of features and to a lesser extent their condition and cleanliness and presence of few incidents of incivilities were positively associated with park-based physical activity in children.
- Good-quality amenities were associated with a larger number of children engaged in lower levels of physical activity, as compared to amenities of mediocre quality.
- Park-based physical activity behaviours of children revealed that organized sports such as baseball and soccer were more common in observed school-aged children and boys compared to observed preschool-aged children and girls who were mostly involved in free play activities. However, most of the children involved in organized sports spent most of the time in sedentary and moderate activities, based on 1-minute observations of the target area.
- The results showed a large number of boys and school-aged children, as compared to girls and preschool-aged children within parks and playgrounds. However, there was no difference in physical activity levels between boys and girls or school-aged and preschool-aged children.
- Access to parks and playgrounds was positively associated with park-based physical activity levels in children.
- Adverse weather conditions revealed a small number of children and lower physical activity levels, as compared to sunny weather. The findings showed a large number of children and moderate to vigorous physical activity levels during

higher temperature versus lower temperature, weekdays versus weekends and afternoons and evenings versus mornings. SES of the neighbourhood had an insignificant association with park-based physical activity in children.

## 6.3 Discussion of Quantitative and Qualitative Findings

### 6.3.1 Influence of the Quality of Parks and Playgrounds and the Quality of Features, Amenities, and Incivilities on Their Use and Related Physical Activity

A review of the quantitative results revealed that there were many features and amenities mentioned in the PARA questionnaire that were not found in the majority of the visited parks and playgrounds. Furthermore, most of the features and amenities were found to be in overall good condition and states of cleanliness. Upon reviewing the field notes, most of the features and amenities were of good overall quality, several were of mediocre overall quality, and none were of poor quality. However, most of the good-quality features, amenities, and incivilities had a few mediocre- and poor-quality characteristics. Similarly, most of the mediocre-quality features, amenities, and incivilities had a few good-quality characteristics. This finding highlights that despite the overall good condition of characteristics of parks and playgrounds, several issues related to the condition of parks and playgrounds required additional exploration of the limiting factors in this area and demonstrated a definite need for improvement.

Feature quality was directly associated with park-based physical activity in children. The presence of features, such as water features, baseball diamonds, soccer grounds, and play equipment, had large numbers of children and vigorous physical activity levels compared to the sand box, basketball, and tennis courts. Splash pads, which were not included in PARA, were found to be one of the commonly used features. Large numbers of children were engaged in vigorous activities around splash pads; however, only a few neighbourhood parks and playgrounds had this feature. In the future, researchers and recreational planners should include features such as splash pads and should evaluate how their presence influences the related physical activity in children compared to features with limited use.

The condition and cleanliness of features influence their use and the related physical activity. Good-condition features were associated with larger numbers of children engaged in moderate- to-vigorous physical activity levels compared mediocre-quality features. Among quality characteristics of features, a few characteristics had more influence on the use of parks and playgrounds and park-based physical activity levels compared to other characteristics. For example, soccer grounds with uniform, well-mowed grass had a large number of children playing soccer compared to soccer grounds with overlying or sparse grass areas. In addition to feature conditions, the features of parks and playgrounds that were clean, had large numbers of children engaged in moderate-to-vigorous physical activity levels compared to features that were unclean.

The overall quality rating of the incivilities was directly associated with physical activity levels in children. The study results revealed small numbers of children in parks and playgrounds that had large amounts of garbage and refuse (mediocre-quality rating for



incivilities based on PARA) compared to parks and playgrounds that had few incidents of incivilities. Similarly, Hamilton (2011) and Ries et al. (2009) found that park use and physical activity levels were associated with their condition and cleanliness.

However, during several visits, more children and moderate-to-vigorous physical activity levels were observed when parks and playgrounds had some incidents of incivilities (such as few items of litter and graffiti) compared to other visits when the parks and playgrounds lacked incivilities. The above finding may be related to the reason that large numbers of park and playground users lead to incidents of incivilities within parks and playgrounds compared to parks and playgrounds that had no use and no incidents of incivilities (Colabianchi, Maslow, & Swayampakala, 2011; Rung, Mowen, Broyles, & Gustat, 2011). However, due to the cross-sectional nature of the study design, it cannot be stated with certainty that increased use of parks and playgrounds leads to incidents of incivilities or vice-versa.

The results indicated that the quality of amenities was inversely associated with the park-based physical activity in children. Among the amenities, a few amenities, such as benches and tables, had large numbers of children around them compared to shelters and fountains. Furthermore, good-condition and clean benches and tables had large numbers of children engaged in lower physical activity levels compared to benches and tables with lower-quality characteristics. These findings highlight that amenities, irrespective of their type and quality, are the primary sources of sedentary activities compared to features and incivilities. Similarly, several authors had shown that amenities, such as shelters, drinking fountains, benches, and tables, were associated with decreased physical activity levels (Dyment & Bell, 2008; Rung et al., 2011).

### 6.3.2 Organized Sports

The study findings revealed that the number of children and physical activity levels not only varied among parks and playgrounds but also among different visits to the same park and playground. Large numbers of children and vigorous physical activity levels were found in a few visits compared to small numbers of children and moderate-to-vigorous physical activity levels on other visits to the same park and playground. One of the primary reasons for this difference was scheduled organized activities. Large numbers of children and moderate-to-vigorous physical activity levels were found in and around good-quality baseball diamonds and soccer fields during organized sports compared to when there was no organized activity scheduled.

Organized sports can attract large numbers of children to visit parks and playgrounds and can increase their use because large numbers of children were found watching these organized sports as spectators, waiting for their turn, or warming up as reserved players. Children visiting parks and playgrounds to watch these games may be motivated to participate in them (Stuntz & Weiss, 2010), thereby leading to increases in the parks' and playgrounds' use and the related physical activity levels in children. Thus, scheduling organized sports can be one way to increase the use of parks and playgrounds and physical activity in children.

Children participating in organized sports are usually assumed to be involved in vigorous activities (Bergeron, 2007; Santos, Gomes, & Mota, 2005). However, 1-minute observations of the children involved in organized sports (such as baseball and soccer) revealed that most of the children participating in organized activities were involved in

mild or moderate activities, such as standing and walking, for most of the duration of the minute. Similarly, a few studies showed that children involved in organized sports such as soccer were for the most part involved in mild or moderate activities compared to vigorous activities (Leek et al., 2011; Satchek, 2011). Guagliano, Rosenkranz, and Kolt (2013) confirmed that children spent more time in moderate-to-vigorous activities while training or practicing compared to playing a game.

Canadian Physical Activity Guidelines state that school-aged children between the ages of 5 and 11 years should perform at least 60 minutes of daily moderate-to-vigorous physical activity (Trembley, Kho, Tricco, & Duggan, 2010). Studies measuring physical activity levels of children by participation in organized sports did not provide sufficient information on the amounts of physical activity spent in moderate-to-vigorous physical activity and whether the children followed the recommended guidelines for physical activity. In addition to gauging the participation of children in organized sports, future studies should measure their duration of activity (mild, moderate, or vigorous) rather than their mere involvement in organized sports to determine whether children involved in organized sports follow the recommended guidelines for physical activity.

The results showed that participation in organized sports was different between observed preschool- and school-aged children and between observed boys and girls. Large numbers of preschool-aged children and girls were found to be engaged in free play activities, such as play structures, splash pads, sand box, and swimming, compared to school-aged children and boys, who tended to be engaged in organized sports, such as baseball and soccer. Similarly, several authors observed that park use was greater for boys than girls (Perry, Saelens, & Thompson, 2011) and that organized sports

participation was more common in older children and boys compared to younger children and girls (Guevremont, Findlay, & Cohen, 2008; Ifedi, 2008; Loukaitou-Sideris & Stieglitz, 2002).

The above discussion indicates that associations between age, gender, type of physical activity, and sports exist. However, these findings did not demonstrate whether the increased participation of school-aged children versus preschool-aged children and boys versus girls in organized sports was attributed to interest or choices of activities with respect to observed age and gender or due to lack of scheduled, organized sports for preschool-aged children or girls. Authors should explore the reasons for these findings in the future. Despite the differences in the types of activities with respect to observed age and gender, the study results did not show any significant differences in physical activity levels between observed preschool- and school-aged children and between observed boys and girls.

Furthermore, many good-quality baseball diamonds and soccer grounds within accessible parks and playgrounds were found to be empty, despite weekday evenings and pleasant weather. These features can be used outside of organized sports. Thus, public health researchers and consultants should develop and implement strategies that can motivate children to use good-quality features and to perform free play activities within them, thereby leading to increased overall physical activity levels in children.

### 6.3.3 Influence of Access on the Use of Parks and Playgrounds and Physical Activity

In addition to the quality components (features and incivilities) of parks and playgrounds, their access was also directly associated with park-based physical activity in children. Parks and playgrounds that were located close to bus stops had large numbers of children and encouraged vigorous activity levels compared to parks and playgrounds that were not within walking distance to bus stops. This finding indicates that there is an association between traveling time from the park entrance to the nearest LTC bus stop and park-based physical activity. However, park and playground visitors were not interviewed in this study; therefore, it cannot be stated with certainty how many visitors used public transportation to visit these places. Future studies should investigate different measures for park and playground access, such as the proportion of visitors using public transportation, the routing schedule of public transportation, and the influence of traveling time between the bus stop and the park entrance by interviewing children and their parents, so that future strategies may be built based on these results.

### 6.3.4 Influence of Neighbourhood SES, Day of the Week, Time of Day, Temperature, and Weather on the Use of Parks and Playgrounds and Physical Activity

The results indicated that variables such as weekdays, afternoon, evenings, and higher-than-average temperatures were significantly associated with park-based physical activity in children. The majority of the parks and playgrounds visited in this study had water

features, particularly swimming pools, which attracted large numbers of children and physical activity during higher temperatures compared to lower temperatures and afternoons compared to mornings (swimming pools were not operational in the mornings). Park-based physical activity was also decreased during rainy weather conditions compared to sunny and pleasant weather. McMurdo et al. (2012) found that the presence of sunny weather increased physical activity levels compared to rainy weather (Brockman, Jago, & Fox, 2011). Cradock and colleagues (2009) and Wolff and Fitzhugh (2011) also found that higher-than-average temperatures increased feature use and physical activity.

Furthermore, the operational hours of swimming pools were reduced on weekends, which may be the reason for observing small numbers of children and lower physical activity levels on weekends compared to weekdays. Increased park-based physical activity during evenings was primarily due to organized sports. Most of the parks and playgrounds visited in the city had baseball diamonds and soccer fields. Organized sports, such as baseball and soccer, were commonly scheduled in the evenings, which led to large numbers of children engaged in vigorous activity levels in the evenings. Similarly, Hino et al. (2010) observed that more children and adolescents were in the parks in the evenings. The neighbourhood SES was not associated with park-based physical activity in children in this study. Similarly, Boone-Heinonen and Gordon-Larsen (2011) found an insignificant influence of neighbourhood SES on moderate-to-vigorous physical activity levels.

## 6.4 Discussion of Study Findings and EST

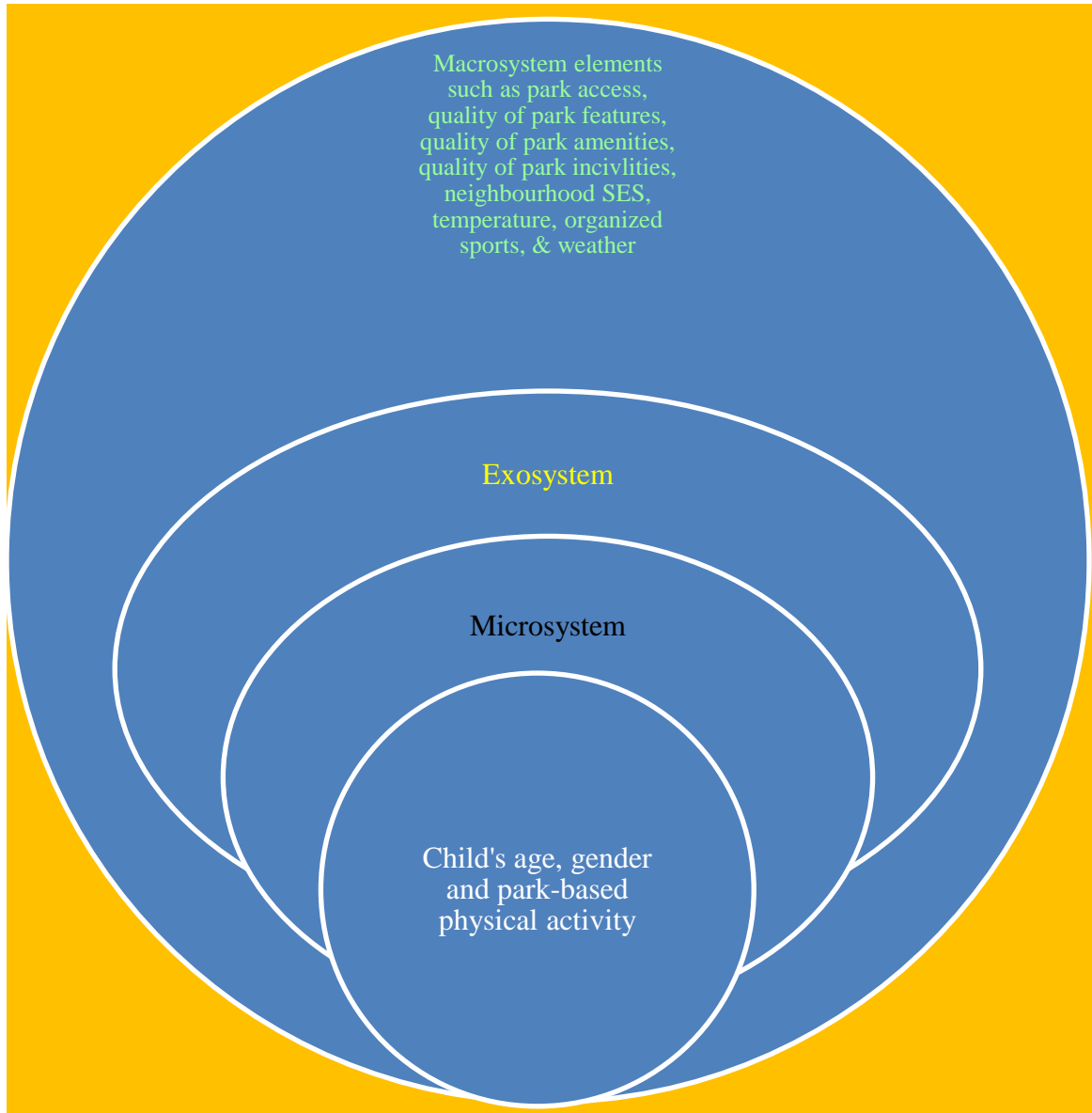
Overall, the study findings fit consistently with Bronfenbrenner's ecological theory. The following concepts of the theory will be discussed in relation to the findings:

- Influence of macrosystem elements, based on the hierarchical arrangement of subsystems on park-based physical activity in children.
- Influence of elemental characteristics (within subsystems of EST) on park-based physical activity in children.
- Influence of interactions between contextual elements (within EST) on park-based physical activity in children.
- Influence of the individual characteristics of children on park-based physical activity in children.
- EST Chronosystem and park-based physical activity in children.

### 6.4.1 Influence of Macrosystem Elements, Based on the Hierarchical Arrangement of Subsystems on Park-Based Physical Activity in Children

This discussion is focused on the influence of macrosystem elements on park-based physical activity in children, as shown in Figure 3. Macrosystem elements are expected to have a weak influence on children, as subsystems within EST are hierarchically arranged (the outermost system has a weak influence on children). The study results supported this concept of EST. Macrosystem elements, such as quality components of

parks and playgrounds, their access, neighbourhood SES, and temperature had a weak influence ( $\beta < 0.3$ ) on park-based physical activity.



*Figure 6:* Macrosystem elements that influence park use and physical activity in children, based on study results.



However, the study findings indicated that one of the macrosystem elements, such as neighbourhood SES, had a very weak ( $\beta < 0.02$ ), insignificant ( $p > 0.05$ ) influence on park-based physical activity in children compared to the relatively stronger and significant influences of access and quality of features, amenities, and incivilities. This difference in strength and significance of findings between the elements of a similar subsystem may be related to the inappropriate placement of elements within a subsystem. Based on the results, the quality components of parks and playgrounds (i.e., the quality of features, amenities, and incivilities), their access, and temperature can be placed as exo system elements and neighbourhood SES as a macrosystem element. However, contextual elements, such as access and quality, are guided by local government policies and are managed and maintained by municipal government. Therefore, these elements should be included as macrosystem elements along with neighbourhood SES (Bronfenbrenner, 1994).

The issue of the placement of elements within the subsystems has also been identified in several studies. Authors have inconsistently used elements in different subsystems. For example, Stevenson (2010) included community elements within the exosystem, and Crosby et al. (2010) included the presence of features and facilities as micro elements. The primary reasons for these inconsistencies are that Bronfenbrenner (1979) did not provide any specific criteria for the inclusion of contextual elements within the subsystems and that there are ambiguities between the boundaries of the subsystems (Freysteinsdóttir, 2004; Tang, 2012). Bronfenbrenner (1979, 1994) has stated that a contextual element is placed within a subsystem based on the strength of the influence of that subsystem and based on whether that element follows the characteristics of that

subsystem. However, many elements have characteristics that resemble the characteristics of more than one subsystem within EST, which leads to placement issues. Furthermore, Bronfenbrenner did not identify those conditions that may indicate that the boundaries between the subsystems have been violated (Tang, 2012).

The issue of placement of an element within a subsystem is important because it has implications for practice. For example, the park and playground quality (a contextual element) placed in the macrosystem would enable public health researchers to conduct interventions (improving quality by renovating parks and playgrounds) at the macro and community levels and to better understand how a change in park and playground quality at the macro level can influence the park-based physical activity levels of the children in the community. However, considering park and playground quality, an exo, meso, or micro subsystem element would require interventions targeting school and family and individual levels rather than interventions that are community-targeted. Thus, the appropriate placement of an element within a subsystem is essential for understanding how interventions can be planned and implemented.

One way to avoid these placement issues within the subsystem is to use a broad term of context (rather than subsystems), as included in an advanced version of EST, the Process-Person-Context-Time model (PPCT) (Bronfenbrenner & Evans, 2000; Bronfenbrenner & Morris, 2006; Tudge, Mokrova, Hatfield, & Karnik, 2009). Other ways to avoid these issues include combining the subsystems into micro (including micro and meso subsystem elements) and macro subsystems (including exo and macro subsystem elements). Davison and Birch (2001), using EST to explore the factors related to childhood obesity, have combined the micro and mesosystem (and their elements such as

parenting styles, family characteristics, and community) and exo and macrosystem (and their elements such as demographic, and societal characteristics). Using a broad term of context or combining adjacent subsystems into one subsystem may reduce confusion of issues of placement of an element within the appropriate subsystem and inconsistencies and may enable researchers to focus on important concepts of EST, such as how elemental characteristics (and their interactions with other components of EST) influence park-based physical activity in children so that interventions can be designed based on these influences.

#### 6.4.2 Influence of Elemental Characteristics (Within a Subsystem) on Park-Based Physical Activity in Children

The elemental characteristics (within subsystems of EST) influence park-based physical activity levels in children. Proximal processes are influenced by both environmental (context) characteristics and also person, outcome, and time (Bronfenbrenner, 1994). The study results supported this concept of EST and showed that the influence of the quality of features (contextual element) and their characteristics, such as presence of water features, baseball diamonds, soccer fields, and play equipment, condition, and cleanliness, were positively associated with park-based physical activity in children.

The study findings also highlight that among different characteristics of a contextual element, a few characteristics, such as the presence of shaded dugouts in baseball diamonds, had more influence than other characteristics. Similarly, among the quality characteristics of amenities, benches and tables had more children around them compared to fountains, and benches and tables in good condition had larger numbers of children

compared to benches and tables in mediocre condition. Based on the review of the study findings, the way that any contextual element influences the proximal process within EST is dependent on the characteristics of that element. Each character of an element has a different influence on the proximal process, and an overall influence of any element is dependent on the cumulative influence of all of its characteristics. For example, the cumulative influence of the quality of features on physical activity is dependent on the individual influence of the characteristics of presence, condition, and cleanliness of features on physical activity. Authors have explored different contextual elements of the built environment (macrosystem elements), such as roads, parks, public spaces, and their characteristics, such as availability, accessibility, and condition of recreational spaces, and have shown different levels of influence on physical activity in children (Davison & Birch, 2001; Galvez, Pearl, & Yen, 2010).

However, the study results revealed that, in contrast to feature quality characteristics, the quality of amenities had a negative association with park-based physical activity.

Identifying contextual elements and their characteristics, such as feature quality and the presence of water features and baseball diamonds that have more influence on park-based physical activity levels in children compared to other elements would have implications for urban planners.

The study findings also indicated that a few of the good-quality baseball diamonds and soccer fields within good-quality parks and playgrounds were empty. This finding highlights that in addition to elemental characteristics such as quality, other factors influence park-based physical activity in children. One of these factors may involve how these elements interact with the elements of other subsystems.

### 6.4.3 Influence of Interactions Between Contextual Elements (Within EST) on Park-Based Physical Activity in Children

EST is an open system consisting of several elements arranged within different subsystems, which are interconnected (Bronfenbrenner, 1979, 1994; Bronfenbrenner & Evans, 2000). The study findings support this concept of EST. The study results indicated that the quality of features and the presence of incivilities were significantly associated with park-based physical activity levels. However, several inconsistencies in this association were observed when the interactions of variables were explored. For example, small numbers of children engaged in mild or moderate activities were observed during visits to high-quality parks and playgrounds on weekend mornings compared to weekday afternoons or evenings. Similarly, lower levels of physical activity were observed during rainy weather or when there was no organized activity.

These findings highlight that park and playground quality alone cannot increase physical activity levels; however, the influence of park and playground quality on physical activity is also dependent on whether they are accessible and on the influence of natural environment factors (such as weather and temperature), day, and time. This discussion also highlights the importance of choosing mixed methods in this study. The qualitative data provide a data richness that the use of quantitative data alone would not have provided.

EST states that influence on a child is dependent on how contextual elements interact with each other (both within and between systems). Each contextual element has a different influence (both in strength and direction) on a child. The interactions between

contextual elements that influence the child in opposite directions (positive and negative influences) may decrease the strength of the influence. The study findings revealed that the quality of features and the quality of incivilities had significant positive influences on park-based physical activity levels in children, whereas the quality of amenities had a significant negative influence. However, combining these quality characteristics resulted in an insignificant influence of quality on park-based physical activity levels in children in this study. Thus, to maximize the park-based physical activity levels, the public health researchers and recreational planners should combine and provide only those modifiable contextual elements that promote park-based physical activity levels and should not include those elements that hinder park-based physical activity levels in children.

A few studies have used EST while identifying predictors and factors related to childhood obesity and physical activity (Davison & Birch, 2001; Galvez et al., 2010). These studies have shown that parenting styles and family characteristics, such as parental activity patterns, their perceptions, and encouragement, interact with access to recreational facilities, parental working hours, and SES to influence child weight status. However, none of these studies have explored the study findings in relation to the above concepts of EST. Future studies should identify other elements from micro, meso, and exo subsystems and should explore how these elements relate to each other within the EST to influence physical activity in children.

#### 6.4.4 Influence of the Individual Characteristics of Children on Park-Based Physical Activity in Children

The earlier version of EST was based primarily on the understanding that childhood development is influenced by different types of environmental systems, thereby minimizing the role of the individual in his or her development. The study results supported this concept as far as the demand variables that were included in this study. Overall, there were no differences in physical activity levels between younger versus older children and between boys versus girls. However, further exploration of physical activity levels in children found that large numbers of school-aged children and boys were involved, for the most part, in performing organized sports compared to preschool-aged children and girls. This finding highlights that the influence of demand characteristics is based on the level of outcome that is at either a broader level of physical activity (sedentary/mild, moderate, or vigorous) or at a narrow level of physical activity type (free play or organized sports).

Large numbers of school-aged children and boys were found in and around baseball diamonds and soccer fields compared to preschool-aged children and girls, who were commonly observed in and around splash pads and play equipment. Similarly, authors have observed increased participation of boys and adolescents in organized sports compared to girls and younger children (Guevremont et al., 2008; Ifedi, 2008). Ifedi (2008) explored the prevalence of sports participation in Canadian children between 1992 and 2005 and found that participation in organized sports is more common in adolescents and in males.

#### 6.4.5 EST Chronosystem and Park-Based Physical Activity in Children

The chronosystem includes change or consistency of either personal or environmental characteristics over time (Bronfenbrenner, 1994). The study findings, along with the available literature, were used to explore the types of park-based physical activities performed by Canadian children in the current time. Overall, organized sports were common in school-aged children and boys compared to preschool-aged children and girls. Similarly, authors have reported increased participation of older children and boys in organized sports (Guevremont, et al., 2008; Ifedi, 2008; Loukaitou-Sideris & Stieglitz, 2002). The study results indicated that most of the organized activities were performed in baseball diamonds and soccer fields compared to free play activities in and around water features (swimming pools and splash pads) and play equipment. Similarly, Cohen et al. (2007) found that park-based organized sports were common in target areas of baseball diamonds and soccer fields. Organized sports, such as basketball, swimming, and tennis, are also common among Canadian children, in addition to baseball and soccer (Ifedi, 2008). However, organized sports, such as basketball and tennis, were rarely observed during visits to parks and playgrounds in this study.

It is usually assumed that participation in organized sports will result in vigorous physical activity levels in children (Bergeron, 2007; Santos et al., 2005). However, the results showed that the physical activity levels (mild, moderate, and vigorous) of children engaged in organized sports were dependent on the type of sport being played. More



children were engaged in moderate-to-vigorous activities (running) while playing soccer than baseball, where most of children were engaged in sedentary-to-moderate activities.

Moreover, not only the level of physical activity but also the duration of that activity is important because Canadian guidelines on physical activity recommend at least 60 minutes of daily moderate-to-vigorous activity in school-aged children (Trembley et al., 2010). The study results indicated that many of the children involved in organized sports had moderate-to-vigorous physical activity levels during the brief scanning used to obtain the SOPARC observations of activity. However, a slightly longer observation of the physical activity levels of the children involved in these games revealed that the majority of the children had lower levels of physical activity, such as standing and walking, for most of the 1-minute duration. Similarly, authors have shown that children involved in organized sports and games spent most of their time in moderate-to-sedentary activities (Guagliano et al., 2013; Leek et al., 2011; Sacheck, 2011).

Small numbers of children were found during many of the visits to the good-quality baseball diamonds and soccer grounds, despite the pleasant weather conditions and weekday evenings. This finding highlights that many of these good-quality baseball diamonds and soccer pitches are not used outside of organized sports. Many of these good-quality facilities can be used for free play, such as playing soccer in fields without nets, without a referee or supervised staff and without a designated number of players on each side. Thus, researchers should explore the reasons why children do not use good-quality fields outside of organized sports.

One of the main concepts of the chronosystem is change or consistency over time (Bronfenbrenner, 1994). Longitudinal studies that measure the interactions between children and park and playground quality by assessing the frequency of visits and the duration of each visit should be conducted to evaluate the influence of the chronosystem on park-based physical activity levels in children, as conceptualized by Bronfenbrenner (1994).

#### 6.4.6 Future Work

The discussion of the findings in relation to EST highlights the following areas where future work is needed:

- Future researchers should combine different subsystems within EST and explore how this strategy resolves the theoretical issues related to appropriate placement of elements within the subsystem and influences the practical implications related to park-based physical activity in children.
- The discussion of the influence of individual characteristics on park-based physical activity levels was restricted to children's observed ages and gender in this study. Future studies should explore the influence of other demand characteristics, such as ethnicity, and force characteristics, such as motivation, preferences, and individual self-determination, which may influence park-based physical activity in children.
- One of the important components of EST is the influence of contextual elements on child development over a long period of time and the measurement of change and inconsistencies over time. Longitudinal studies should be conducted in the

future to measure the influence of the chronosystem, as conceptualized by Bronfenbrenner (1994).

## 6.5 Practical Implications of the Study

These findings are important for municipal officials, health care professionals, and researchers. The study identified a number of key findings and issues related to the topic that can promote or hinder park-based physical activity behaviours in children.

The study findings indicated that the presence of features and fewer incidents of incivilities had a strong influence on park-based physical activity. This relationship provides valuable information to city planners and recreational managers to make cost-effective decisions when deciding on features that have more influence on park-based physical activity levels such as swimming pools, baseball diamonds, and soccer fields compared to features such as basketball and tennis courts that are used occasionally. Similarly, the presence of amenities, such as benches, tables, and landscaping, increased the number of children within parks and playgrounds compared to fountains and shades; however, the amenities had negative influence on park-based physical activity levels. Thus, while designing parks and playgrounds, city planners should include a combination of those features and amenities that have more influence on the use of parks and playgrounds and related physical activity than features and amenities that have limited influence.

From the study results, it is recommended that recreational planners should provide features, such as splash pads, that can increase the overall use of parks and playgrounds

and physical activity in children. Furthermore, the condition and the cleanliness of parks and playgrounds also influence their use and physical activity levels in children, although to a limited extent. Few of the study visits highlighted issues, such as the presence of garbage, graffiti, and litter, in a few parks and playgrounds accompanied by a lack of maintenance, evidenced in the presence of overlying grass, no grass, and lower-quality baseball diamonds and soccer grounds. These issues can be easily resolved and managed and can increase the number of visitors. The issues of cleanliness and poor park and playground conditions may be due to several reasons, including municipal management issues. Future research is warranted to explore the limiting factors in this area to determine where changes need to be made in the municipal system.

The reviewed findings in this study may help in understanding the interests and preferences of preschool- and school-aged boys and girls regarding the features, amenities, and aesthetics of parks and playgrounds. Most of the preschool-aged children and girls were observed around play equipment, compared to school-aged children and boys who were mostly observed around baseball and soccer fields. These findings have implications for planners in terms of the features, amenities, and aesthetics that they can include in parks and playgrounds to increase their use in children of all ages and of either gender.

Many children were engaged in organized sports in areas such as soccer grounds and baseball diamonds during a few of the visits. However, there was no physical activity in these areas during other visits to the same park areas, despite pleasant weather.

Interestingly, these findings highlight the fact that these areas are not regarded as potential places for physical activity outside of organized sports. Children may use these

sports areas for playing baseball and soccer on their own without a scheduled sporting event, an act that was not observed in this study.

The study results revealed that most school-aged children and boys were involved in higher physical activity levels while performing organized sports, such as soccer.

However, a 1-minute observation of physical activity levels of children engaged in organized sports revealed that the majority of the children were involved in moderate or mild activities for most of the 1-minute duration. Mere involvement in organized sports is not a true indicator of a child's physical activity levels because physical activity levels varied considerably during games. Future researchers should measure the park-based physical activity levels in children for a longer duration or preferably for the entire duration of a game rather than assessing mere involvement in organized sports.

The study results indicated that parks and playgrounds that are accessible had increased use and related physical activity. This finding highlights that recreational planners should also take into consideration accessibility issues as they design parks and playgrounds to increase their use and related physical activity.

Based on the findings in this study, future researchers and public health consultants should design and conduct intervention studies to improve the quality of features and amenities that are more influential in increasing the use of parks and playgrounds and related physical activity and should explore how changes in these characteristics can promote the parks' use and increases in related physical activities in children.

## 6.6 Limitations

The quality instrument PARA and the physical activity measurement tool SOPARC have several limitations. Physical Activity Resource Assessment tool contains a list of features, amenities, and incivilities; not all of these items were present in every park and playground. The absence of any of these items can drastically lower the quality score of that park, regardless of their condition. However, the selection of PARA was justified, as it assesses all of the relevant quality characteristics of parks and playgrounds, such as features, amenities, and incivilities, on the basis of presence, conditions, and cleanliness; it takes only 10-30 min to complete; it has a good inter-rater reliability; and it has been used in several studies (Adamus, Mama, Sahnoune, & Lee, 2011; DeBate et al., 2011).

One of the limitations of SOPARC is that an individual may be counted twice during the scanning of a target area. However, large areas were scanned as target areas, reducing the chances of counting an individual twice in the data collection. Second, the researcher was interested in the number of observations, and counting the same child in another target area will not affect the study findings. Furthermore, measuring the physical activity of a child during a brief scanning using SOPARC is not truly representative of the amount of time spent in physical activity and the overall physical activity levels of a child during that visit. Interviewing the parents of the observed child would have provided an approximate estimation of their usual park-based physical activity behaviours, in addition to direct observation. However, 1-minute observations of the target areas were conducted to determine physical activity behaviours of the children for a slightly longer duration.

Accelerometers are a current standard used to measure physical activity, in addition to direct observation measures, and can measure daily or weekly physical activity levels; however, they cannot provide additional types of information (Kirby et al., 2012), such as the type of physical activity, games and sports played and the types of free play activities performed in relation to different areas of the parks and playgrounds. Further they are expensive, require multiple units and cannot be used to measure activities such as swimming.

There may be a few occasions where the classification of a child into a particular age group was not possible. However, all of those observations in which classification of a child's age and gender was not possible were excluded from the analysis. Furthermore, the frequency of cases that could not be classified into age group or gender was negligible considering the large sample size of the study. Additionally, direct observation measures have been used in a few studies to classify children's ages into different categories (Floyd et al., 2011; McKenzie et al., 2006).

The annual family and household incomes of the neighbourhood were used as a measure for determining the SES of visitors to the parks and playgrounds and was based on the assumption that the majority of the visitors would be from the local neighbourhood.

Visitors to the parks and playgrounds were not interviewed in this study. Therefore, it cannot be stated with certainty that the park and playground visitors were residents of the neighbourhood in which that particular park and playground were located.

Furthermore, the study was conducted during the summer; both feature use (e.g., water features) and related physical activity levels may be different during the fall, autumn, and

winter. The reason for conducting the research in the summer (during summer vacations) was to provide an opportunity to observe park-based physical activity levels of school-aged children during weekday mornings and afternoons. School-aged children are normally in school during these times, except for summer vacations.

EST was used as a conceptual framework to explore the relationship between park and playground quality and park-based physical activity levels in children. EST includes micro, meso, exo, macro, and chronosystems nested within each other. However, only macrosystem elements were included in this study, thereby limiting the exploration of the other subsystems within the theory.

## 6.7 Conclusion

The study results revealed that most of the children visiting parks and playgrounds were involved in either vigorous or sedentary physical activities rather than moderate physical activities. Good-quality features and amenities in the presence of fewer incidents of incivilities had more users compared to mediocre- or poor-quality features and amenities and the presence of more incidents of incivilities. Good-quality features (primarily the presence of features) and the presence of fewer incidents of incivilities were directly associated with park-based physical activity. However, the majority of the amenities and aesthetics within parks and playgrounds only promoted sedentary activities. Not only park and playground quality but also access were directly associated with park-based physical activity in children.



Large numbers of observed school-aged children and boys were found in parks and playgrounds compared to observed preschool-aged children and girls. There were no differences in terms of park-based physical activity levels between preschool- and school-aged children and between boys and girls. However, the majority of the school-aged children and boys were found to be involved in organized sports compared to preschool-aged children and girls, who were mostly engaged in free play activities. Interestingly, children engaged in organized sports spent most of their time in mild or moderate activities rather than vigorous activities (based on 1-minute observations of the participants).

Moreover, the use of parks and playgrounds and park-based physical activity levels were greater during sunny and pleasant weather versus rainy weather, during afternoons and evenings versus mornings, and on weekdays versus weekends. High temperature was directly associated with park-based physical activity compared to lower temperature.

It is recommend that substantial opportunities in the form of good-quality features be provided to increase the number of park and playground users who are active during their visits and the amount of time visitors spend engaged in active behaviours while at the park. Urban planners, recreation staff, and public health professionals may find these results useful as they plan strategies to promote park-based physical activity in children.

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APPENDICES

## Appendix A:

## Search Strategy

## Medline Ovid:

- 1) Obesity or overweight or excessive weight or body mass index (BMI) or weight gain or body weight or body fat or adipose tissue or physical activity or motor activity = 597974
- 2) Quality or feature or characteristic or attribute or property or trait or condition = 1232676
- 3) Park or play ground or public facility or open space = 8370 ENGLISH 7917
- 4) Combination of 2 AND 3 = 49
- 5) Combination of 1 AND 2 AND 3 = 24
- 6) (Child\* or children or young\* or youth or childhood or adolescent or kid or teen\* or teenager or toddler)= 2635406
- 7) Combine all 12 reviewed

## ISI Web of Knowledge:

- 1# Quality or feature or characteristic or attribute or property or trait or condition = 3,222,930
- 2# Obesity or overweight or excessive weight or body mass index (BMI) or weight gain or body weight or body fat or adipose tissue or physical activity or motor activity = 342,279
- 3# Park or play ground or public facility or open space = 75,148

# 4 = # 1 AND # 2 AND # 3 = 21

# 5 Child\* or young\* or youth or childhood or adolescent or kid or teen\* or teenager  
or toddler = 2,262,387

# 6 = # 4 AND #5 = 7

ISI WEB of Science:

Topic = (park or play ground or open space or public facilities) = 109,041 AND  
Topic = (obesity or excessive weight or over-weight or weight gain or body fat or body  
mass index or physical activity) 568,309 AND Topic = (Quality or characteristic or  
feature or property or trait or condition or attribute) 7,426,378= 901 AND Child\* or  
young\* or youth or childhood or adolescent or kid or teen\* or teenager or toddler  
1,857,403 = 179

EMBASE:

- 1) National park or park or play ground or public facility or open space = 1862
- 2) Quality or quality of life or feature or characteristic or attribute or property or trait  
or condition or total management quality = 1312454
- 3) obesity or excessive weight or over-weight or weight gain or body fat or body  
mass index or physical activity = 690871
- 4) Child\* or young\* or youth or childhood or adolescent or kid or teen\* or teenager  
or toddler =2808390
- 5) 1 AND 2 AND 3 AND 4= 20
- 6) 1 AND 2 AND 3 = 77

7) Combine 1 AND 2 = 297

SCOPUS:

- 1) Quality or characteristic or feature or property or trait or condition or attribute =  
11532155
- 2) Park or play ground or public facilities or open space = 601
- 3) Child\* or young\* or youth or childhood or adolescent or kid or teen\* or teenager  
or toddler = 3676410
- 4) Obesity or excessive weight or weight gain or body fat or overweight or body  
mass index or physical activity = 6599
- 5) Combine 1 AND 2 AND 4= 0
- 6) 1 AND 3 = 1783

## Appendix D:

## Example of Field Notes

Park Name / Neighborhood Hamilton  
 Date 11 July Day Mon Time 1:30 Mean temp 25  
 Visit temp 29 weather Sunny  
 Area 4 mi.

2 baseball diamonds, clean, uniform, even surface, no lighting, <sup>no shade</sup> benches,  
 fencing present, ~~no~~ <sup>no</sup> overgrown grass at few areas.  
 Softball ~~is~~ <sup>is</sup> clean, uniform, even surface, few areas of overgrown  
 or no grass some pieces of trash / shoes / cups  
 Side walls ~~clean, even, smooth~~, usable, partly even.  
 Swing sets clean with levels, proper entrance  
 Sand box half filled but clean, usable, edging good  
 condition  
 Play equipment: swings, monkey bars & slides not painted,  
 fixed, usable, good condition, clean.  
 Bike racks painted, usable  
 Bathrooms separate, light, clean, soap & tissue, well stocked  
 Benches ~~but~~ <sup>but</sup> not tables. Clean, not painted, fixed, good condition  
 Trees present colorful / green.  
 Trash cans clean (exterior) little filled inside, far  
 apart  
 Access pt. (2) clean with name, wide  
 Car park large but not neat, clean.

Overall few areas of no or overgrown grass  
 Trash cans / plastic cups / shoes / pieces of paper were observed.  
 One baby in stroller, 1 pre girl walking on grass with adult  
 2 school girls & 2 boy outside ~~near~~ <sup>near</sup> swimming pool.  
 3 school aged boys playing with a ball on grass  
 2 boys & 1 girl walking on grass (school).

Park Name / Neighbourhood: Oxleyridge  
 Date = 15/7/2011 Day Fri Time ~3.00 Mean temp 22°  
 Visit temp. 28 Weather Sunny & Hot  
 Access = <1min

2 Baseball fields uniform, even surface, few areas no or overgrown grass, clean, no lighting, benches & fencing.  
 Tennis courts, uniform, even, clean, no cracks, with nets, visible markings.

Side walls smooth, even and clean. Bike painted, usable.

Play equipments:- Monkey bars, slides, swings, others, clean, ground in good condition, not painted, firmly fixed.

Trails smooth & even, clean, repairs not needed.

Swimming pools: clean, surrounding surface in good condition, proper entry/exit point, change room, different levels shallow/deep.

Splash pads different types, painted, clean, clean water, working well.

Main entrance clean, well marked, named, with car park (smooth, slots, large). Side entrance narrow, not named, ~~not clean~~ with leaves overgrown grass.

Bathrooms separate, lighting, clean, rolling papers, tissues, hand soap. Clean drinking fountains outside them, under the shades were clean. Trees & grass present green. Benches & tables in good condition, usable, not painted (mostly), firmly fixed, clean, few were crooked but still usable. Trash cans were clean from outside & only less filled, at far distance from each other.

Few areas of overgrown or no grass, couple of plastic cups/stains papers.

2<sup>pre</sup> school age boy running around splashpad, one pre girl running, 2 boy & 1 girl sitting around (school age). 1 boy

School standing  
 3 school age boys & 2 girls swimming. 2 school age boys & 4 girls sitting outside/standing. 5 boys 2 girls standing

or floating in water. → (1) standing  
 2 pre boy climbing, 2 pre girls & 1 boy & 1 school girl running  
 2 boys walking around equipment.

## CURRICULUM VITAE

HAMMAD ALI QAZI

### **Education:**

- Doctor of Philosophy, Health and Rehab Sciences, Faculty of Health Sciences, Western University, London, Ontario, 2009-2013. Thesis Title: The Relationship Between Quality of Parks and Playgrounds and Park-Based Physical Activity in Children.
- Master of Science, Public Health and Health Promotion, School of Health Sciences, University of Wales, Bangor, Wales, UK, 2006-2009. Thesis Title: Gastric Symptoms and Quality of Life.
- Bachelor of Medicine & Bachelor of Surgery (MBBS), Medicine & Surgery, Dow Medical College, Karachi, Pakistan, 2000-2005.

### **Work Experience:**

- Researcher in IMSCAR (Institute of Medical and Social CARE Research), Bangor, Wales, UK.
- Senior Research Analyst in College of Physicians & Surgeons (CPSP), Karachi, Pakistan.
- Medical Researcher Consultant in Tabba Heart Hospital, Karachi, Pakistan.
- Researcher in World Bank Health projects.
- Researcher in Auto-21 projects (Canada).
- Consultant and workshop facilitator in many hospitals including Liaquat National Hospital, Karachi, Pakistan.
- Health Research methodological consultant, advisor and investigator for many pharmaceutical companies in Pakistan.
- Peer Reviewer in many international Journals.
- Teaching Assistant, Western University, London, Ontario, Canada. Clinical Internship and worked as a medical doctor in Karachi, Pakistan.
- Guest Editor: Primary Health Care Open Access Journal

### Publications:

1. Qazi HA, Soomro JA, Hashmi A, Qadri MH, Rasheed F and Karim MT. "Public Health Problems in High and Low socioeconomic area of Karachi, Pakistan". Iranian J Public Health.2009;38(3):105-8.
2. Qazi HA. Childhood obesity and parks and playgrounds: A review of issues of equality, gender and social support. Journal of Research in Medical Sciences, 2011; 16(4).
3. Qazi HA. Evaluating goodness in qualitative research. Bangladesh Journal of Medical Sciences. 2011, 10 (1).
4. Qazi HA. "Gastric Symptoms and Quality of Life" Bangladesh Medical Research Council Bulletin 2009 Aug; 35(2):72-4.
5. Qazi HA, Soomro JA, Soomro TK, Soomro FA, Rasheed F and Hashmi A. "Spirometric screening of Chronic Obstructive Pulmonary Disease in smokers presenting to tertiary care center." Journal of Medicine Bangladesh, 2009 July;10(2):40-4
6. Qazi HA, Hashmi A, Soomro JA and Rasheed F. "Reasons behind vasectomy in clients presenting to tertiary care government centers, Karachi, Pakistan". Turkish Journal of Public Health 2009; 7(1):1-8.
7. Qazi HA and Hashmi A. Factors Promoting Tubal Ligation in Females Presenting to Tertiary Care Centers. Journal of Family and Reproductive Health 2009;3(3) : 83-86.
8. Qazi HA, Hashmi A, Raza SA, Soomro JA, Ghauri A. Factors associated with modern contraceptive use in female clients visiting female reproductive health care center of Karachi, Pakistan. Journal of Family and Reproductive Health. 2010, 4 (1).
9. Soomro JA and Qazi HA. Factors Associated with Relapsed Tuberculosis in Males and Females: A Comparative Study. Tanaffos 2009 Aug; 8(3): 22-27.
10. Shaikh AH, Hanif B, Lakhani MS, Malik F, Qazi HA, Mujtaba I. Role of serum Troponin I in identifying Left Ventricular Ejection Fraction of  $\leq 40\%$  in Patients with Acute Anterior ST Elevation Myocardial Infarction. J Coll



Physicians Surg Pak 2009 Sept;19(9):544-7.

11. Shaikh AH, Pathan A, Hasan K, Malik F, Qazi HA, Mujtaba I. Primary percutaneous coronary aspiration of thrombus from infarct related artery. J Coll Physicians Surg Pak. 2009 Dec;19(12):791-3.
12. Aslam M, Taj T, Ali A, Mirza W, Hammad Ali and Dar MI. Needle Stick Injuries Among Health Care Workers of Public Sector Tertiary Care Hospitals of Karachi. Journal of the College of Physicians and Surgeons Pakistan 2010, Vol. 20 (3): 150-153.
13. Shaikh AH, Bashir H, Malik F, Qazi HA and Mujtaba I. Association of ST segment depression >5 min after exercise testing with severity of coronary artery disease. JPMA (Journal of Pakistan Medical Association). Journal of Pakistan Medical Association 2010; 60: 288.
14. Shaikh AH, Bashir H, Malik F, Qazi HA and Mujtaba I. Doppler derived gradient of ST Jude mechanical prosthesis early postoperative assessment. JPMA (Journal of Pakistan Medical Association). Journal of Pakistan Medical Association 2010; 60(5):374-376
15. Qazi HA, Saleem K, Mujtaba I, Hashmi A and Soomro JA "Prevalence and Risk Factors of HCV (Hepatitis C Virus) seropositivity in Islamabad, Pakistan."Acta Medica Iranica. 2010 Nov-Dec;48(6):394-8.
16. Siddiqui MS, Shaikh AH, Bashir H, Hammad Ali and Mujtaba I. Procedure Indications and Outcomes of Percutaneous Coronary Interventions in a Tertiary care Hospital. JPMA (Journal of Pakistan Medical Association). JPMA 61:575; 2011.
17. Shaikh AH, Bashir H, Qazi HA and Mujtaba I. Coronary artery disease in patients undergoing valve replacement at a tertiary care cardiac centre. JPMA (Journal of Pakistan Medical Association). Journal of Pakistan Medical Association. J Pak Med Assoc. 2011 Apr;61(4):340-2.
18. Qazi HA, Kashif SM, Siddiqui S, Mujtaba I and Jakhriani N. Factors associated with co-existence of Tuberculosis and Diabetes. Accepted. Iranian Journal of Clinical Infectious Diseases.
19. Qazi HA. Effect of Bevacizumab (Avastin) in the treatment of Macular Edema: A

systematic Review of Randomized Controlled Trials. JRMS. Accepted.

20. Qazi HA. Effect of gastric symptoms age and gender on quality of life. Accepted. Scientific Research and Essays.

21. Qazi HA, Polgar JM. The Relationship between Quality of Parks and Parks Based Physical Activity in Children. In process of Submission.

**Research areas of Interest:**

Childhood obesity, pediatric diseases including cardio-pulmonary, infection, public health research and so forth

Reproduction and contraceptive measures.

Epidemiology and Biostatistics.

Adult clinical cardiology and gastroenterology.

Respiratory diseases TB and COPD.

Built Environment including parks and playgrounds.

Systematic Reviews and Meta-Analysis.

Mental Health Diseases.

Randomized Controlled Trials.