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Legacies of a mega sporting event for healthy adolescent development:
A case study of the 2010 Vancouver Olympic and Paralympic Games

Ann Smith

Thesis submitted in partial fulfilment of the requirements of
Sheffield Hallam University for the degree of Doctor of Philosophy

January, 2020

CANDIDATE DECLARATION

I hereby declare that:

1. I have not been enrolled for another award of the University, or other academic or professional organisation, whilst undertaking my research degree.
2. None of the material contained in the thesis has been used in any other submission for an academic award.
3. I am aware of and understand the University's policy on plagiarism and certify that this thesis is my own work. The use of all published or other sources of material consulted have been properly and fully acknowledged.
4. The work undertaken towards the thesis has been conducted in accordance with the SHU Principles of Integrity in Research and the SHU Research Ethics Policy.
5. The word count of the thesis is 87,400.

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OUTPUTS TO DATE

Presentations

- Smith, A. (November, 2019) How long can a mega sporting event legacy last? International Conference on Urban Health Xiamen, China [Poster presentation accepted].
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- Smith, A. (July, 2018) Leveraging mega sporting events to address public health outcomes. International Festival of Public Health, Manchester, UK [Oral presentation].
- Smith, A (October, 2017) Can mega sporting events be leveraged to benefit justice-involved youth? Canadian Congress on Youth Justice, Toronto, Canada [Poster presentation].
- Smith, A. (April, 2016) Can mega sporting events increase sports participation and physical activity among Canadian youth in urban centres? International Conference on Urban Health, San Francisco, USA [Poster presentation].
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Publications

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ABSTRACT

Numerous studies have considered the impact of hosting a mega sporting event on adults. Using the 2010 Vancouver Winter Olympics and Paralympics as a case study, this thesis is the first to consider the impact of such an event on adolescents over a decade pre and post the event. It investigates the legacies of the 2010 Games on physical activity, employment, and community connectedness, and the environmental, psychological and social mechanisms through which any legacies may have occurred.

A mixed-methods approach was used which combined analyses of cross-sectional data from the BC Adolescent Health Survey and Homeless and Street Involved Youth Survey, with sports club membership data and stakeholder consultations. Using self-report data from over 60,000 adolescents—including three subpopulations typically excluded from mega events (adolescents with a disability, experiencing homelessness, and at risk of incarceration)—the study considered positive and negative, planned and unplanned, tangible and intangible legacies, and the time and space in which they occurred (Preuss, 2016).

Results differed by age, gender and location. For example, the 2010 Games were more likely to have both a positive and negative impact on homeless youth in host communities compared to non-host communities. However, across British Columbia, a positive perception of the Games' impact was associated with regular physical activity.

Vulnerable subpopulations generally reported more negative impacts of the Games, but those who reported positive impacts experienced some reduction in health disparities with the general population. However, rather than serving as a catalyst to close the gap in organised sports participation between adolescents with a physical disability and their peers, the disparity increased following the Games.

Stakeholder consultations provided context to these findings, and offered insight into how future mega sporting events might be leveraged to support healthy adolescent development at the population and subpopulation level.

Terminology

At-risk describes adolescents who are deemed to have a lower likelihood of experiencing a healthy transition to adulthood, and includes those at increased risk of criminal involvement (Smith, 2018).

Community connectedness is a perception of closeness, involvement, or affiliation with others, or integration into a social network (Bolland et al, 2016). Terms such as liminality, *communitas*, experience economy and psychic income are all terms which have been used to describe the heightened community connectedness that local people can experience in relation to a mega sporting event (Balduck, Maes & Buelens, 2011; Gibson et al, 2014; Phillips & Barns, 2015; Shaw & Williams, 2004).

Demonstration effect (also called a **trickle-down effect**) is based on Bandura's self-efficacy theory, and suggests that people who observe others enjoy the rewards of athletic success are inspired to attempt to emulate it (Bandura, 1997).

Health is defined by the World Health Organisation as 'a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity' (World Health Organisation, 1948). It incorporates the social determinants of health which include childhood experiences, employment, physical environment, healthy behaviours, access to health services, gender, and social supports (Government of Canada, n.d.).

Healthy adolescent development acknowledges the need to provide young people with the experiences and opportunities to acquire core developmental assets of competence, connection, character, confidence, and caring (Fraser-Thomas, Cote & Deakin, 2005; Lerner, Brown & Kier, 2005; McNealy & Blanchard, 2009).

Host regions/host communities are the three geographical regions which hosted events for the 2010 Winter Olympic and Paralympic Games. These were Vancouver, Richmond and North Shore.

Legacies of a mega sporting event are believed to be the intangible/tangible, positive/negative, planned/unplanned structures that remain over the long-term as a result of hosting a sporting event (Preuss, 2007; Leopskey & Parent, 2015). Legacies of a mega sporting event can be derived directly from the event itself (intrinsic legacy) or from the leverage activities surrounding it (extrinsic legacy; Misener, Darcy, Legg & Gilbert, 2013). An Olympic legacy has been described as what is left for the future by hosting an Olympic Games (Homma & Masumoto, 2013).

Leveraging is defined as *“those activities which need to be undertaken around the event itself which seek to maximise the long-term benefit from events”* (Chalip, 2006).

Mega sporting events are high profile, one off, short-term global single or multi-sports events that are usually organised by a combination of national governments and international non-governmental organizations, and which have a major impact on the host city (Lamberti, Noci, Guo & Zhu, 2011).

Non-host regions/non-host communities are the thirteen geographical regions in BC, which did not host events for the 2010 Winter Olympic and Paralympic Games.

Positive youth development is a strength-based conception of healthy adolescent development, which states that if adolescents can be supported to develop competence, connection, character, confidence, and caring they will not only have a positive transition through adolescence but will also become contributing adults (Lerner et al., 2005; Lerner, Lerner, Bowers & Geldhof, 2015).

Pregnancy period is the time between when the winning bid to host a mega event is announced and when the event take place (Preuss, 2016). In the case of Vancouver 2010, this spanned the period July 2003-January 2010.

Abbreviations

BC - British Columbia, Western Canada

BC AHS - BC Adolescent Health Survey

HSIYS - Homeless and Street Involved Youth Survey

IOC - International Olympic Committee

IPC - International Paralympic Committee

OGI - Olympic Games Impact

OGGI – Olympic Games Global Impact

PA - Physical activity

PCM - Psychological Continuum Model

SES – Socioeconomic status

VANOC - Vancouver Olympic and Paralympic Organising Committee responsible for the planning, organizing, financing and staging of the 2010 Games.

1. INTRODUCTION

1. Introduction
 - 1.1 Context of this study
 - 1.1.1 Evaluating the 2010 Games
 - 1.1.2 The 2010 Games and adolescent PA
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 - 1.2 Study rationale
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1.1 Context of this study

On July 2nd 2003, Vancouver (British Columbia, Western Canada) was awarded the right to host the XXI Olympic Winter Games and the X Paralympic Winter Games (IOC; Olympic Studies Centre, 2010). The Vancouver Olympic And Paralympic Organising Committee (VANOC)'s successful bid was based on a vision of *"a stronger Canada whose spirit is raised by its passion for sport, culture and sustainability,"* a mission to *"touch the soul of the nation and inspire the world by creating and delivering an extraordinary Olympic and Paralympic experience with lasting legacies,"* (VANOC, 2010 p. 2) and seven strategic objectives which included a sustainability objective *"to manage the social, environmental and economic impact and opportunities of our Games in ways that will create lasting benefits, locally and globally"* (VANOC, 2010, p. 5).

The bid promised the *"incorporation of the interests of different groups, such as... youth, people with disabilities, people of colour, immigrants and other groups"* (VANOC, 2009 p10). It also committed the hosts to making affordable event tickets available for 'at-risk' youth, and to *"maximizing access to affordable recreation and*

community sport by giving 'at-risk' youth access to new and upgraded facilities after the Games...and building the sport delivery infrastructure to support recreational initiatives" (VANOC, 2009, p. 10).

In support of Vancouver's bid, the provincial government created an independent organisation called '2010 Legacies Now', which aimed to ensure there was sufficient financial investment to increase and support sport and physical activity programmes in British Columbia (BC). This ensured Vancouver was the first candidate city to attempt to develop a regional sport and recreation legacy ahead of the awarding of the Games, and led other cities to create a similar legacy fund during the bidding phase for the Olympics (Leopkey & Parent, 2012; Weiler & Mohan, 2009).

The goals of '2010 Legacies Now' were to increase the number of BC athletes on the Olympic and Paralympic teams; increase incentives and capacity for sport programs; and raise awareness/impact of BC hosting the 2010 Games (Weiler & Mohan, 2009). '2010 Legacies Now' set out an ambitious plan to partner with community organisations, the private sector and all levels of government to develop sustainable legacies in sport and recreation, physical activity, arts, literacy, accessibility and volunteerism; and to assist communities to develop inclusive social and economic opportunities (Weiler & Mohan, 2009).

Following the awarding of the Games, the City of Vancouver added its own strategic objectives for the event. These included creating social sustainability, accessibility and inclusivity legacies; increasing civic pride and citizen engagement; and creating sports and fitness legacies (City of Vancouver, 2006).

Against these lofty goals, the Winter Olympics took place in Vancouver and the neighboring communities of Richmond and North Shore (including the municipalities of Whistler and West Vancouver) in February 2010, and the Paralympics a month later. This was the third Olympics Canada had hosted. The country had also hosted the fiscally disastrous 1976 Montreal Summer Olympics (Chappelet, 2012) and the 1988

Calgary Winter Olympics, which although financially more successful, ended with few medals for Canada.

Prior to 2010, Canada was the only country to have failed to win Olympic gold on home soil (VanWynsberghe, 2013). In a bid to rectify this, and to achieve VANOC's strategic objective "*to achieve extraordinary performance*" the federal government invested heavily in elite athletes (VANOC, 2010). The federal, provincial and municipal governments also partnered with private investors to finance infrastructure projects, including five new sports venues in the host communities of Richmond, Vancouver and Whistler, and upgrades to existing facilities that would host Games events in Vancouver, Whistler and West Vancouver (Canadian Government, 2010; Potwarka & Leatherdale, 2015; VanWynsberghe, 2013). From a sporting perspective the investment paid off. The hosts won 26 Olympic medals, including the most golds won by any country in Winter Olympics history (Canadian Government, 2010). Canada also won a record 19 Paralympic medals, including 10 golds (Canadian Government, 2010).

There were record national TV and internet audiences for both events, and 2010 became the most watched Winter Olympics up to that point (Canadian Government, 2010; Murray, 2014; Thorpe & Wheaton, 2011). It was reported that 43% of Canadians watched or attended a Paralympic event (VanWynsberghe, 2013). This led the Canadian Paralympic Committee President—Federal Minister of Sport and Persons with Disabilities, and former Paralympian, Carla Quatroug—to state:

"As a result of the coverage of the [Vancouver 2010 Paralympic] Games more Canadians with a disability than ever before are aware of the opportunity to play sports. [This] will lead to greater participation and inclusion in local, provincial, and national sport programs." (quoted in Misener, 2012 p. 353)

Similarly, the April 2010 edition of the online magazine Disabled World stated that the 2010 Paralympics "*have inspired a generation of Canadians with a disability to get involved in sport*" (Canadian Paralympic Committee, 2010).

Prior to 2010, the Olympics were reported to be losing their appeal with adolescent audiences, as competing high-energy action and counter-culture sporting events such

as the X Games gained popularity, and interest in traditional organised sports waned. Vancouver's 2010 Olympic bid emphasised the inclusion of extreme sports, such as snowboarding, to appeal to non-traditional and younger viewers. As a result, the 2003 announcement that Vancouver would host the 2010 Games was met with excitement by many adolescents in the province (Potwarka & Leatherdale, 2015). Organisers also actively sought to engage adolescent audiences during the Games with live graffiti art displays, DJ's, and break-dancers performing during breaks in competition (Self, de Vries Henry, Findley & Reily, 2007; Thorpe & Wheaton, 2011).

Canadian medal success in extreme sports, such as the half pipe and snowboard cross, were also credited with increasing the percentage of adolescents and young adults who watched the Games, and ensured over 30 million viewers watched American snowboarder Shaun White win the gold medal in the halfpipe wearing 'counter-culture' waterproof baggy blue jeans (Murray, 2014; Thorpe & Wheaton, 2011). Canada's success at the 2010 Games, including gold medals for both males and females in the country's national winter sport of ice hockey, was watched by millions live on TV and on giant screens erected across the province, which drew large crowds and spontaneous celebrations (Canadian Press, 2010).

1.1.1 Evaluating the 2010 Games

Mega sporting events, like the 2010 Games, are global short-term one-off events with mass popular appeal which are usually delivered through a partnership between national governments and international non-governmental organisations. It is commonly believed that such events will generate long-term impacts for the host (Garbacz, Cadima Ribeiro & Reis Mourao, 2016; Getz, 2008).

The 2010 Games occurred at a time when there was increasing recognition of the need to critically evaluate mega sporting events beyond elite athletic success and viewing figures, and to consider their impact on host countries, including any lasting legacies in host communities (Weed, 2009). There was also increasing awareness of the need to

leverage mega events to achieve wider benefits than those which would simply occur without planning as a result of hosting the Games (Smith, 2014). For example, the cities of Manchester (2002) and Melbourne (2006) leveraged hosting the Commonwealth Games to achieve additional outcomes which included new Healthy Living Centres, extra-curricular activities for disadvantaged children, and initiatives to increase cultural and community connectedness (Smith, 2014).

A year before the Games were awarded to Vancouver, the IOC officially formalised the need for an evaluation of each Games' legacies through the creation of the Olympic Games Global Impact (OGGI) study framework covering the period before the Games and continuing for a sustained period afterwards (Dickson, Benson & Blackman, 2011). Although no firm definition of a legacy was provided, the framework identified tangible and intangible impacts of hosting the Games in the areas of economic impact, cultural, community, sporting and political legacies, and the value of Olympic education. The IOC also amended its charter to include a mission statement which focused on ensuring a positive legacy for Olympic hosts (Leopkey & Parent, 2012).

The OGGI framework was designed to measure the impact of the Games on host cities and countries, and to identify potential legacies for future host cities. The OGGI was to be conducted by an independent evaluator, such as a local university, and consisted of four evaluation reports over an eleven-year period: A baseline report, a report during the pre-Games period, a Games report and a post-Games report, submitted two years after the Games ended. The Games were to be evaluated against 154 indicators, and completed OGGI reports were to be made available for prospective future hosts wanting to learn from the experiences of previous hosts (VanWynsberghe, 2015).

In 2006, the data collection requirements were reduced to 126 indicators of which only 73 were mandatory, the data collection period was extended by a year, and Global was removed from the title of the study, as it became the Olympic Games Impact study (OGI; Homma & Masumoto, 2013; VanWynsberghe, 2015). The 126 indicators included in the OGI were intended to create a monitoring and reporting framework for measuring the impact of each Olympic Games in the spheres of

economic, environmental and socio-cultural legacies. Quantifiable indicators were categorised into ‘context indicators’, which were not directly related to the staging of the Games, and ‘event indicators’, which directly related to the Games (VanWynsberghe, 2015).

VANOC submitted the required four evaluation reports covering the period 2001 to 2012. However, the data were often missing or of poor quality. For example, for the pre-Games report, data for only 29 indicators were available and of sufficient quality to draw any conclusions (Homma & Masumoto, 2013). Despite these limitations, the final OGI report noted many positive impacts of the Games for the host cities as a result of the major infrastructure developments—such as the new rapid transit line connecting Vancouver International Airport and the host communities of Richmond and Vancouver, and improved accessible facilities for people with disabilities—but concluded the Games had generated little impact beyond Vancouver and Richmond or in areas such as tourism (VanWynsberghe, 2013).

Despite the emphasis on increasing physical activity (PA) in Vancouver’s bid, less than four pages of the 220-page report were dedicated to sport and PA, and only three indicators of PA participation were considered. The first monitored the level of sports practice in the host region, the second measured the percentage of school-age students who played extra-curricular sport at school facilities, and the third assessed the region’s sports facilities (VanWynsberghe, 2013). The report was not unique in its lack of detailed consideration of the impact on sports and PA participation or of the impact of the Games on adolescents, but this oversight is particularly striking as there is evidence to suggest adolescents can be more impacted by a major sporting event than adults (Weed et al., 2015).

1.1.2 The 2010 Games and adolescent PA

The lack of attention to adolescent PA in the OGI was also striking because the awarding of the 2010 Games to Vancouver was lauded by all levels of government as a

chance to reverse the declining rates of PA and sports participation. The federal government set a target of a 10% increase in population level PA and the BC provincial government set a 20% target (Craig & Bauman, 2014; Montoya, Landolfi, Winkelman, Chamberlain, Fisch & Wright, 2013).

Despite these targets, the mechanism through which an increase in population level PA would be achieved or how success would be measured was never clearly articulated (Ogilve, 2012). Additionally, programmes that were implemented to promote PA participation such as 'ActNow BC', a province wide adolescent health and wellbeing programme, which delivered 2010 Olympic-themed physical education curriculum, and local Olympian outreach programmes, were not evaluated (Potwarka & Leatherdale, 2015; Public Health Agency of Canada, 2009). During the time period when it was anticipated there would be population level increases in PA, adult leisure time PA actually dropped for Canadian males and females, with the greatest decreases seen in the Western provinces of BC and Alberta (Montoya et al., 2013).

Canadian adolescents aged 14-19 are the most active of all age groups, yet their participation in leisure time sports and PA also decreased in the build up to the 2010 Games, and sport and PA became optional for BC high school students after Grade 10 (Gordon & Caltabiano, 1996; VanWynsberghe, 2013). For this age group, common reasons for not engaging in sport and PA include not having time and a lack of interest (Canadian Heritage, 2013; Smith, Stewart, Poon, Peled, Saewyc, & McCreary Centre Society, 2014). This lack of time and interest is attributed to increases in the availability of competing leisure time activities (Canadian Heritage, 2013). These population level decreases in PA participation mean it is particularly important to understand if a mega sporting event like the 2010 Games can impact adolescent population level PA or the PA of specific subpopulations of adolescents (Gordon & Caltabiano, 1996; Smith et al., 2014).

Mega sporting events are often criticised for using revenue from residents in regions that will not benefit from the hosting of the event (Kellett, Hede, & Chalip, 2008). The creation of '2010 Legacies Now' was an attempt to be more inclusive of non-host

regions, and ensure they benefitted from increased sports, recreation and other opportunities (Dickson, Benson, Blackman & Terweil, 2013). Additionally, all of the sports featured at the 2010 Olympics and Paralympics held a major championship in Canada in the build up to the Games, and many countries held training camps in communities across BC. It was hoped that exposure to these sports in different communities would encourage more adolescents into sports participation (Canadian Government, 2010).

Many '2010 Legacies Now' projects were aimed specifically at children and adolescents, including the 'Playground to Podium' programme which supported initiatives to engage more young people in organised sports, and the 'BC Sports Participation Program' which claimed to engage more than 100,000 new sport participants in over 100 BC communities (Weiler & Mohan, 2009). '2010 Legacies Now' also toured the province in the build up to the Games, offering adolescents the opportunity to sample Winter Olympic sports, visit sports clubs, meet athletes and engage in interactive displays, sports simulators and skills tests (2010 Legacies Now, 2006; Weiler & Mohan, 2009). Similar opportunities were also created through events like the Olympic and Paralympic torch relay, which visited over 300 BC communities (Canadian Government, 2010; Canadian Olympic Team Official Website, 2009). The impact of these events was not evaluated but the assertion was that these types of free events allowed adolescents to be involved in the Games who otherwise would not have had the opportunity (McGillivray & McPherson, 2012).

Aiming to leverage the Games to increase PA participation, the Canadian Olympic Committee also developed the Canadian Olympic School Program. The educational curriculum was designed to combat physical inactivity by educating students about the benefits of participation, and sharing inspirational Olympic related stories (Mountjoy et al., 2015). Although the impact of this program was not evaluated, educating adolescents about the need to be more physically active has previously been unsuccessful as a stand-alone tool for increasing PA and sports engagement (Wharf-Higgin, Gaul, Gibson, & van Gyn, 2003). Other school and community programs which specifically targeted adolescents included free tickets and low-cost accommodation to

watch Olympic events for organisations serving vulnerable youth, funding for ‘at-risk’ youth sports programming, training for sports coaches in low socioeconomic communities, grants for youth sports teams, and funding for a youth centre (Economics & Statistics Service, 2011; VanWynsberghe & Kwan, 2013). Events associated with the Paralympics included provincial school programmes which offered students the opportunity to try different types of Paralympic sport equipment and to meet Paralympians (Misener, 2012; VanWynsberghe, 2013).

1.1.3 Additional aims of the 2010 Games

Beyond planning to leverage the Games to increase PA participation, VANOC wanted to leverage the event to increase community connectedness and cultural pride. The Games’ cultural programme attracted over six million visitors, and additional on-line events attracted over three million visitors (VanWynsberghe & Kwan, 2013). The cultural programming was reported to have increased awareness of the Games and engagement among Canadian adults (McGillivray & McPherson, 2012). However, other impacts of the programme in relation to building community connectedness were unclear (Edelson, 2011).

Vancouver’s Olympic bid claimed that the 2010 Games would substantially increase employment opportunities for marginalised residents, including the unemployed and those on a low-income. It was also reported that time-limited job opportunities were made available to adolescents (Economics & Statistics Service, 2011). The final OGI evaluation report stated that the Games had positively impacted employment in Vancouver between 2003 and 2009, and that opinion polls indicated there was an increase in Canadian employers willing to hire someone with a disability following the Paralympics (Kennelly, 2017; VanWynsberghe, 2013). However, it was unclear if this intent resulted in any increased employment opportunities for people with a disability.

The building of the Oval in Richmond was also credited with an increase in employment opportunities in the city (Kavetsos & Szymanski, 2010). An official federal

and provincial government-commissioned evaluation reported that the Games had supported around 12,000 BC jobs in 2009, with most of the created jobs in the service sector, construction and tourism. Although there was no increase in employment rates between 2003 and 2009, it was claimed that Olympic related jobs helped to offset the rise in unemployment caused by the 2008 global economic crisis by 0.5% (PriceWaterhouseCoopers, 2010).

It was not possible to assess whether jobs were in any way directly or indirectly related to the Games or whether jobs that were created benefitted adolescents or marginalised groups (VanWynsberghe, 2013). It has been claimed that in reality less than 250 new jobs were created in Vancouver, and disadvantaged youth, such as the homeless, were either unable to access these or were predominantly males employed in short-term, poorly paid construction or security positions (Kennelly, 2017). Also, claims of increases in employment among residents in a low-income community near some of the Games sites were misleading, as they included individuals placed into employment training programmes which existed prior to the Games (VanWynsberghe, Surburg & Wyly, 2012).

In addition to improving job opportunities for those with employment challenges, the 2010 Games bid also intended to leverage the hosting of the Games to reduce inequalities experienced by other disadvantaged groups (Smith, 2014). BC activists sought to ensure this occurred and used the publicity generated by the Games to bring international attention to the Province's challenges including homelessness, the highest child poverty rate in Canada, and the social and economic problems of neighbourhoods in close proximity to the Olympic event venues (Adams & Piekarz, 2015; Kennelly & Watt, 2011).

1.1.4 Addressing social problems through the 2010 Games

At the end of the 1990s, the three levels of government (federal, provincial and municipal) partnered with the local Police Department and Health Board to enter into

the “Vancouver Agreement” to coordinate efforts to address poverty, drug addiction, mental illness and public safety. The group’s mandate was later expanded to ensure cross government and cross sector planning and coordination for the 2010 Winter Olympics (Edelson, 2011).

The BC government specifically wanted to leverage the 2010 Games to increase accessibility for people with disabilities and to reduce homelessness (Boyle & Haggerty, 2011; Kennelly & Watt, 2011; Misener 2012). However, across BC there was concern that funding would be diverted from services supporting marginalised youth and that a legacy of the Games would include increased homelessness and a worsening of an already inflated housing market (Kennelly, 2015). The concerns were particularly prominent in Vancouver, as the city’s largest previous mega event, Expo 86, had resulted in the eviction of residents from low-income downtown accommodations, and Vancouver has a chronic shortage of such housing (Hiller, 1996). Other issues included concerns about civil liberty infringements, safety of vulnerable residents, and the financial burden of major infrastructure projects (Edelson, 2011).

These concerns increased when VANOC removed its original documented promise to address homelessness from the list of event-related deliverables on which it reported (VanWynsberghe, et al., 2012). Additionally, despite a commitment to transparency, VANOC declined to commission an independent evaluation of the impact of the 2010 Games, or to report publicly on the degree to which it was keeping its commitments to inclusivity (Edelson, 2011; VanWynsberghe, et al., 2012).

VANOC’s decision may have been influenced by the fact that a significant amount of social housing was originally promised as a legacy of the 2010 Games, but this promise was not kept (Minneart, 2012; Pentifallo & VanWynsberghe, 2015). A year before the Games began it was reported that there had been a decrease in low-income housing and an increase in homelessness directly related to the urban renewal occurring in Vancouver in anticipation of the event (Hwang, et al, 2011; Kim et al., 2009). Street homelessness doubled in the city between 2003 (when the Games were awarded to Vancouver) and 2010, and remained at the elevated level through 2013 (Eberle, 2013;

Kennelly & Watt, 2011). Based on Vancouver's point-in-time homeless counts, the total number of homeless people almost tripled between 2002 and 2010, from 628 in 2002 to 1,745 in 2010 (City of Vancouver, 2012).

Vancouver's large homeless adolescent population was the subject of aggressive municipal policies in the build-up to the Games, including a police-enforced 'no sit/no lie' policy, the removal of benches in areas where homeless young people congregated, and strict enforcement of the Province's laws on panhandling and trespassing (Boyle & Haggerty, 2011). The police offensive escalated during 2009 and 2010 in the build-up to the Games, when adolescents reported being harassed for offences that were previously disregarded (such as jaywalking, littering, and possession of drugs), and reported their treatment was disproportionate to the actual offence (Kennelly, 2015).

The 2011 OGI evaluation did not consider the impact of the Games on housing and homelessness in the host communities of Richmond or North Shore, but did show an increase in homelessness and reduction in affordable housing units in Vancouver during the build-up to the Games. However, the evaluation report concluded that these outcomes could not be directly attributed to the Games (VanWynsberghe et al., 2011). The host community of Whistler appears to have received the most tangible housing legacy of the Games as the athletes' village was converted to market housing with 720 new housing units created for Whistler employees (Resort Municipality of Whistler, 2016). However, no reduction in homelessness was recorded and media reports claimed that homeless people in the resort were given a one-way ticket out of town before the Games (e.g., Pinchevsky, 2011).

In addition to concerns about the 2010 Games' negative impact on housing and the displacement and harassment of homeless people, there were additional concerns for the health of vulnerable adolescents and adults as it was believed that a high police presence during the Games would disrupt access to health services, and subsequently increase health risk behaviour. However, a small-scale study found that the increased police presence during the Games did not reduce access to health services amongst

local drug users or increase their health risk behaviour (Small, Krusi, Wood, Montaner, & Kerr, 2012).

One disadvantaged group who may experience a positive legacy of a mega sporting event are adolescents with a disability, who can benefit from infrastructure and social legacies (Misener et al., 2013). Opinion polls showed that up to 50% of Canadians credited the 2010 Games with improving conditions for people with disabilities, including increasing the accessibility of buildings and public spaces, and increasing specialised programmes and training for athletes with disabilities. Additionally, 32-40% of Canadians reported their knowledge of sports for people with disabilities increased, as well as their overall acceptance of people with disabilities (VanWynsberghe, 2013). However, BC adolescents continue to report being discriminated against for having a disability (Smith et al., 2014). Also, the involvement of former Canadian Paralympian Rick Hansen in the opening ceremony of the 2010 Games highlighted the lack of inclusivity athletes with disabilities face, as he was unable to fully participate in the lighting of the Olympic flame (Misener, 2012).

Finally, adolescents who engage in criminal behaviour are not generally attracted to conventional sports and large-scale athletic events because of their mainstream popularity and rigid structures. However, the 2010 Games included extreme sports as well as more traditional sports, and it has been hypothesised that the increased media coverage of these sports glorified the risks involved and promoted them as an alternative and thrilling subculture, in which disenfranchised young people may wish to engage (Begg et al., 1996; Donnelly, 1981; Olivier, 2006; Pain & Pain, 2005; Sugden & Yiannis, 1983; Thorpe & Wheaton, 2011).

The contradictory and complex picture that emerged of the impact of the 2010 Winter Olympic and Paralympic Games—and particularly the lack of clarity about the impact of the Games on adolescents— highlights the value of using Vancouver 2010 as a case study to gain a better understanding of the potential positive and negative legacies of a mega-sporting event on this age group. Such a study can help to identify adolescents who may have been affected by an event which increased the availability of sports

venues (including new accessible venues), yet occurred during a time of declining PA. Similarly, it can help us to understand who benefitted from the increased employment opportunities and housing stock legacies which occurred against a backdrop of increased unemployment, homelessness and a global financial crisis. Additionally, what Preuss (2007) would term planned and unplanned, tangible and intangible, positive and negative legacies can be observed by considering some of the tensions that occurred, such as that between the City of Vancouver's strategic goal to use the Games to increase inclusivity, and its police department's increased hostility towards homeless adolescents during the build up to the Games.

Such complexities may partially explain why scant attention was paid by organisers, researchers and evaluators to the impact of the 2010 Games on adolescents. However, the lack of focus on adolescent outcomes was not unique to Vancouver and has been a feature of many mega sporting events. It has been suggested that young people "*have yet to be considered meaningfully as stakeholders within event processes.*

Consequently, relatively little is known about how event processes impact children's rights and interests" (Dowse, Powell, & Weed, 2018, p. 98). This is particularly surprising considering adolescents are at a life stage that is most receptive to developing new, and potentially life-long, health risk or health promoting behaviours, and which is arguably the most likely to be impacted by role models, such as elite athletes (Feinstein, Bynner, & Duckworth, 2006; Schlafer et al., 2014; Steinberg, 2015).

1.2 Study rationale

There have been international calls for greater attention to be paid to adolescent health and development (Resnick, Catalano, Sawyer, Viner & Patton, 2012). This study seeks to answer that call and to fill some gaps in knowledge about long-term social impacts and legacies of a mega sporting events for adolescents (Frawley & Cush, 2011; Horne, 2007; Minneart, 2012). It also aims to address the identified need for more research looking specifically at the impact of mega sporting events on young people facing challenges to healthy development (Minneart, 2012; Misener, et al., 2013).

The study aims to fill a gap in knowledge regarding the potential to leverage a mega sporting event to support adolescents' healthy development. It also responds to a call from Canadian federal and provincial policy makers and public health practitioners to understand better the role that hosting a mega event can play in population and subpopulation level outcomes (such as slowing or reversing the decline in adolescent sports and PA participation, increasing community connections and improving infrastructure) as this was not adequately addressed through the official OGI evaluation framework. The study also considers if hosting a mega event is the most effective way to achieve desired public health legacies.

Frustration at the lack of adolescent outcomes data in the OGI and insistence that no such data were available provided the impetus for this study. At the time the Games were awarded to Vancouver, BC-based community research institute the McCreary Centre Society had just completed data collection for its 2003 BC Adolescent Health Survey (BC AHS). The Society conducts the population level survey of students in Grades 7-12 (age 12-19) every five years. At the request of academic and government partners a survey item about the possible positive and negative impacts of the 2010 Games was added to the 2008 and 2013 waves of the self-report survey, and was answered by over 60,000 adolescents. Although initial interest was shown in utilising the survey results to consider the impact of the Games on adolescents pre and post the event, the data were never used in any official or unofficial evaluation of the Games, despite the Society's offers to provide the data for this purpose. As no funding could be secured for the Society to analyse and publish the data, the author of the current study decided it was of sufficient public interest and importance to form the basis of a PhD.

Population level data collected before and after a mega sporting event (such as that available through the BC AHS) can improve our knowledge of the impact of such events (Veal, Toohey & Frawley, 2012). Despite its limitations, data collected through population level self-report surveys have the advantage of being representative and of sufficient sample size to allow for statistical differences to be assessed and patterns to be identified (Craig & Bauman, 2014).

The study presented here is unique as it includes population level data, collected from BC adolescents aged 12-19, through the BC AHS in the months prior to the 2003 announcement that Vancouver would host the 2010 Games (2003 BC AHS); has data from 2008 (2008 BC AHS), which was the 'pregnancy period' when pre-Games programming, employment opportunities and excitement were increasing (Weed et al., 2009); and includes data collected three years after the Games (2013 BC AHS). It also incorporates self-report survey data from some of BC's most marginalised adolescents pre-and post-Games, including data from the 2007 and 2014 Homeless and Street Involved Youth Surveys (HSIYS), which includes adolescents' perceptions of the Games' impact, and their engagement in informal, extreme and organised sports, as well as their participation in exercise classes.

This study is a valuable contribution to knowledge as most previous studies of mega sporting events have focused on economic impacts rather than longer-term health and well-being legacies, and those that have considered legacies in areas such as PA and sport participation have relied solely on organised sports club membership data. A recent systematic review found that studies that did use population-level surveys did not ask directly about the Games' influence on sports and PA participation (Frawley & Crush, 2011; Weed et al., 2015). Additionally, few studies have focused on residents' perceptions collected after the events, and even fewer have data gathered both before and after the event, or asked adolescents directly about the Games impact. Pre- and post-data are particularly important to policy makers and future mega sporting event planners seeking to understand perceptions about mega events, and any variations in perceptions, which may occur at different time points reflecting anticipation of the event, as well as actual experiences during and after the event (Garbacz, et al., 2016; Gursoy, Chi, Ai, & Chen, 2011; Ritchie, Shipway, Cleeve, 2009).

Previous studies, which have used sports club membership data to establish a connection between an elite sporting event and grassroots PA participation, have often lacked data on adolescents or on subpopulations of adolescents, and therefore despite the limitations of membership data it was sought for inclusion in this study. For example, Weimar and colleagues' (2015) study of the link between mega sporting

events and participation in sports clubs only included males because there was insufficient data available about female sports club membership (Weimar et al., 2015). It was important to include this type of data in the current study to determine if the hosting of a mega sporting event could encourage male and female adolescents to join sports clubs, at a time when the Province's 12–19 year-olds were experiencing increases in sedentary behaviours, obesity and reduced PA (Smith et al., 2014).

Vancouver's final OGI report noted no data were available on the sports and PA participation of people with disabilities in Canada, and included no data collected after 2005 about adolescent sports participation or about sports and PA participation in commercial settings, such as gyms and sports clubs (VanWynsberghe, 2013). Therefore, selecting the 2010 Games as a case study of the impact of a mega sporting event is of particular value, as credible, independently collected adolescent population and subpopulation data are available, which have not been included in previous official or independent studies of the Games.

This thesis combines sports club membership data with adolescent self-report, ensuring both objective and subjective data are included. This also ensures data are included about sports which require club membership in order to access specialist equipment and participate (such as luge, ski jumping), as well as capturing engagement in more informal activities (such as skiing and snowboarding; Veal et al., 2012). In addition to self-report survey data and adolescent sports club membership records, stakeholder consultations are included to gain a qualitative perspective of any legacies that may have occurred as a result of the 2010 Games.

Most studies of the impacts of mega-events have focused on adults and have found little evidence of an association with increased sports participation, yet there is emerging evidence that adolescents and certain subpopulations may be more likely to be influenced by such an event (Craig & Bauman, 2014; Potwarka & Leatherdale, 2015; Weed & Coren, 2012). Additionally, any impact of the event is most likely to have occurred at the epicentres of the Games—i.e., in the host communities of Vancouver, Richmond and North Shore (which includes Whistler and West Vancouver)—as these

are nearest to the actual events and where enthusiasm for the Games is greatest (Potwarka & Leatherdale, 2015). Therefore, analyses at the regional level will also be conducted to assess if such an epicentre effect occurred.

Adolescents 'at-risk' of being detained in a custody centre are a particularly vulnerable subpopulation in BC, and were specifically targeted by event organisers as a group whose outcomes would be improved by the hosting of the Games (VANOC, 2009). They are a particularly relevant group to consider in this study as a new federal Youth Criminal Justice Act came into force in the province in 2003, the year the Games were awarded to Vancouver. The Act ensured that over the timeframe of this study (2003-2013) there was a substantial decrease in the adolescent incarceration rate (Kong, 2009; Moreau, 2014; Statistics Canada, 2014). However, outcomes for these adolescents remained poor. For example, less than 30% graduate high school and 64% are dependent on welfare benefits in adulthood (BC Representative for Children and Youth & Office of the Provincial Health Officer, 2009). A census study of incarcerated 12–19-year-olds in BC found that prior to serving a custodial sentence these adolescents were more likely than their same-age peers to have experienced substance use problems, hunger, family problems, housing instability, abuse, victimisation, and challenges at school (Smith, Cox, Poon, Stewart, & McCreary Centre Society, 2014). These experiences have been shown to be barriers to adolescents' participation in PA, as well as to finding and maintaining employment, and engagement in community life—which were intended legacies of the 2010 Games (Smith et al, 2014).

Homeless adolescents in BC show a similar pattern of disadvantage, including a history of physical and sexual abuse, family problems, problems with the police, substance use challenges, and reduced access to needed health services. Indigenous youth, sexual minority youth, those with government care experience, and youth with mental health challenges are all at increased risk of homelessness before the age of 19 (Smith, Stewart et al., 2015). BC youth with a physical disability also experience poorer health, higher rates of abuse and victimisation, and mental health and substance use challenges than their peers without a disability (Hutchinson & Sparks, 2014).

Given their poor health picture during adolescence and into adulthood, it is important to understand if there is a role for a mega event in encouraging 'at-risk' youth into positive health behaviours such as engagement in PA, and if this has other positive associations such as reduced criminal behaviour and the increased community connections. It is also important to understand if already disadvantaged adolescents may be further marginalised by the presence of a mainstream global event like the Winter Olympics, particularly as mega sporting events have been associated with increases in criminal behaviour and victimization (Bell, 2007; Mihalik & Cummins, 1995).

The current study will therefore consider the impact of a mega sporting event on different adolescent populations over an extended time period, as well as the mechanisms which contribute to any identified impacts. This study has limitations as it was designed retrospectively and is relying on cross-sectional data and the availability of sports club membership records. However, there is a strong rationale for a study which focuses on adolescents' perception of the 2010 Games collected pre and post the event, and which includes both objective and subjective data about their engagement in sports and PA. Additionally, the limitations of the study can improve our understanding of effective methodologies for gathering data about the impact of a mega event and can offer recommendations for the design of future mega sporting event evaluations.

1.3 Aims and objectives of this study

The current study focuses on the positive and negative, planned and unplanned, tangible and intangible legacies of a mega sporting event for healthy adolescent development. It uses Vancouver 2010 as a case study, and takes into consideration the time and space in which any legacies may have occurred.

The aim is to critically evaluate the legacy of the 2010 Winter Olympic and Paralympic Games on BC youth aged 12-19 at both population and subpopulation levels, including

three specific subpopulations of vulnerable adolescents: those with a disability, those at increased risk of incarceration, and those experiencing homelessness.

Using data from two adolescent self-report health surveys, sports club membership records, and stakeholder consultations, the objectives of the study are to assess:

- Demographic and other characteristics of youth who reported (vs. did not report) tangible legacies of the Games such as increased PA and sports opportunities;
- Demographic and other characteristics of youth who reported (vs. did not report) other positive or negative tangible and intangible impacts of the Games (e.g., more or fewer employment opportunities; increased or reduced access to housing or services; increased or decreased community connectedness);
- The time and space in which any legacies occurred, including an assessment of the presence of an epicentre effect in host (vs. non-host) BC communities;
- Implications of the findings for policy makers seeking to attract major sporting events to BC; and
- Implications for future mega sporting event evaluations.

1.4 Theoretical framework of this study

Pawson and Tilley (1994) argue that *“outcomes unearthed in empirical investigation are intelligible only if we understand the underlying mechanisms which give rise to them and the contexts which sustain them”* (p. 292). Therefore, before any evaluation of the impact of a mega event is possible, it is necessary to develop a theoretical framework which, although it can later be adapted, provides an overarching lens through which to view the results of the study. The development of this framework assumes that change can occur as a result of the Games, and that there is a theoretical explanation for any observed change (Tilley, 2004).

This study is being undertaken through a critical realist philosophical lens (discussed in more detail in Chapter 3), and as such seeks to identify the structural mechanisms which can explain the observed results. The overarching organisational framework being applied is Preuss' legacy cube (Preuss, 2007). The legacy cube illustrates that *"legacy is the planned and unplanned, positive and negative, intangible and tangible structures created through a sport event that remain after the event"* (Gratton & Preuss, 2008, p. 1924). which can be encapsulated using programme theory.

Programme theory (or the theory of change) provides a theoretical structure to assess what positive and negative changes may have occurred as a result of hosting a mega sporting event, what contributed to those changes, why they might have occurred, the sequence of change and how transferable the findings may be (Kadiyala, Rawat, Roopnaraine, Babirye & Ochai, 2009; Weiss, 1997). Programme theory is a useful technique because it can be applied after an event and is led by scientific evidence but can include divergent as well as complementary theories, and acknowledges it may not have considered all possible theoretical explanations (Brouselle & Champagne, 2011; Funnell & Rogers, 2011; Rogers, 2008; Weiss, 1997).

Programme theory acknowledges that an 'intervention' such as the staging of the 2010 Games in isolation will not change attitudes and behaviours but can be part of a sequence of events (Coalter, 2012; Weiss, 1997). For example, the Games may provide a catalyst for positive personal and social experiences, and offer a mechanism through which adolescents can increase their engagement in employment, community and PA participation. This in turn can provide opportunities to build positive social connections, access role models and mentors, and experience a positive health promoting environment.

Applying programme theory takes this study beyond what is possible with official evaluations of the impact of a mega sporting event, such as the OGI evaluation framework currently applied to Winter and Summer Olympics. As an impact evaluation, the OGI examines only impact indicators, and does not consider the theoretical processes that link the hosting of a sporting event to its intended

outcomes. As such, the OGI cannot provide insight into why or how the hosting of an Olympic Games met or failed to meet its intended outcome, making it difficult to transfer learnings to other mega sporting events. In contrast, the application of programme theory requires the consideration of both impact and process, which means that the knowledge generated may be transferable to other contexts.

A logic model is a key component of programme theory. It illustrates the application of the theoretical framework to the intended outcomes, and highlights the complex (uncertain and emergent) and complicated (multiple component) nature of the study of a mega sporting event, which includes many multi-faceted 'interventions', encompasses multiple public and private sector agendas and relationships, and has simultaneous and alternative causal mechanisms, as well as emergent outcomes (Rogers, 2008).

Applying the logic model created for this study to the results allows for the identification of any 'tipping point', which can suggest that small investments or simple interventions result in large gains (Rogers, 2008). For example, the study findings can offer important insight into whether it is necessary to invest heavily in sporting infrastructure legacies for young people to increase their PA engagement, or if this can be achieved in part or wholly through a considerably less expensive psychological mechanism, such as the demonstration effect (discussed in further detail in Chapter 3).

It is challenging to visualize the complex legacy of a mega sporting event over a decade with a few arrows and boxes. However, developing a logic model is key to applying programme theory (Benijit & Lagae, 2012), because it illustrates the set of beliefs that underline the observed actions (Brousselle & Champagne, 2011). Furthermore, it details how the intervention under study is believed to work. However, there is a risk that a linear model reflects perceptions about operating mechanisms and causality which are incomplete or erroneous (Brousselle & Champagne, 2011).

For these reasons, a logic model which incorporates a theory of change and a theory of action is used in the current study. The theory of change demonstrates the processes

(such as psychological and social processes) by which change might occur for individuals, groups, or communities. The theory of action explains the operationalisation of the theory of change (Funnell & Rogers, 2011; Rogers, 2008). By linking the outcome indicators to the different mechanisms of the logic model, it is possible to measure whether the theory of change worked as initially expected and, if not, to identify where and how it was unsuccessful (Benijts & Lagae, 2012).

A logic model for a complicated and complex event such as the 2010 Games which will have planned and unplanned, tangible and intangible outcomes can be structured in numerous different ways. This type of model allows for the relationships to be less linear, and places less emphasis on a single concrete causal relationship, while still illustrating the targets, means, and ends of leveraging the event to improve adolescent health (Alter & Egan, 1997). The model for this study therefore shows the general flow towards outcomes which is anticipated to occur but does not assume one element automatically causes a specific effect. Rather it provides a framework for the analyses to be conducted even though the diversity of participants, mechanisms, and outcomes under consideration means *“the nature and extent of impacts and outcomes depend on the interaction of a variety of factors”* (Coalter, 2012 p 607).

The logic model (Figure 1.1) illustrates the theory of the anticipated causal relationships between the hosting of the 2010 Games (the intervention) and the potential planned and unplanned, positive and negative, tangible and intangible legacies which were identified for the Games, as well as the time and space in which it is anticipated these changes will have occurred. The model highlights the psychological, social and environmental mechanisms through which any impact of a mega sporting event may have occurred, Within these three broad mechanisms, two psychological theories (demonstration effect and Psychological Continuum Model: PCM), one social (social control theory) and one environmental (behaviour settings) theory are considered (discussed in Chapter 2). The focus on these four theories may have meant that equally applicable or more feasible theories were omitted, and there may be several competing theoretical explanations of the findings. The operationalisation of these theoretical mechanisms (theory of action) through

infrastructure development, and psychological and social impact are captured in the model. However, establishing what 'causes' change is complex and challenging, and it is possible that there are multiple causal factors and mechanisms at play (Bauman, Sallis, Dzewaltowski & Owen, 2002; Hodgson, 1999). This is discussed in more detail later in this thesis when the utility of the model is reconsidered, including whether the model may have failed to capture or explain adequately other factors which might have influenced the results.

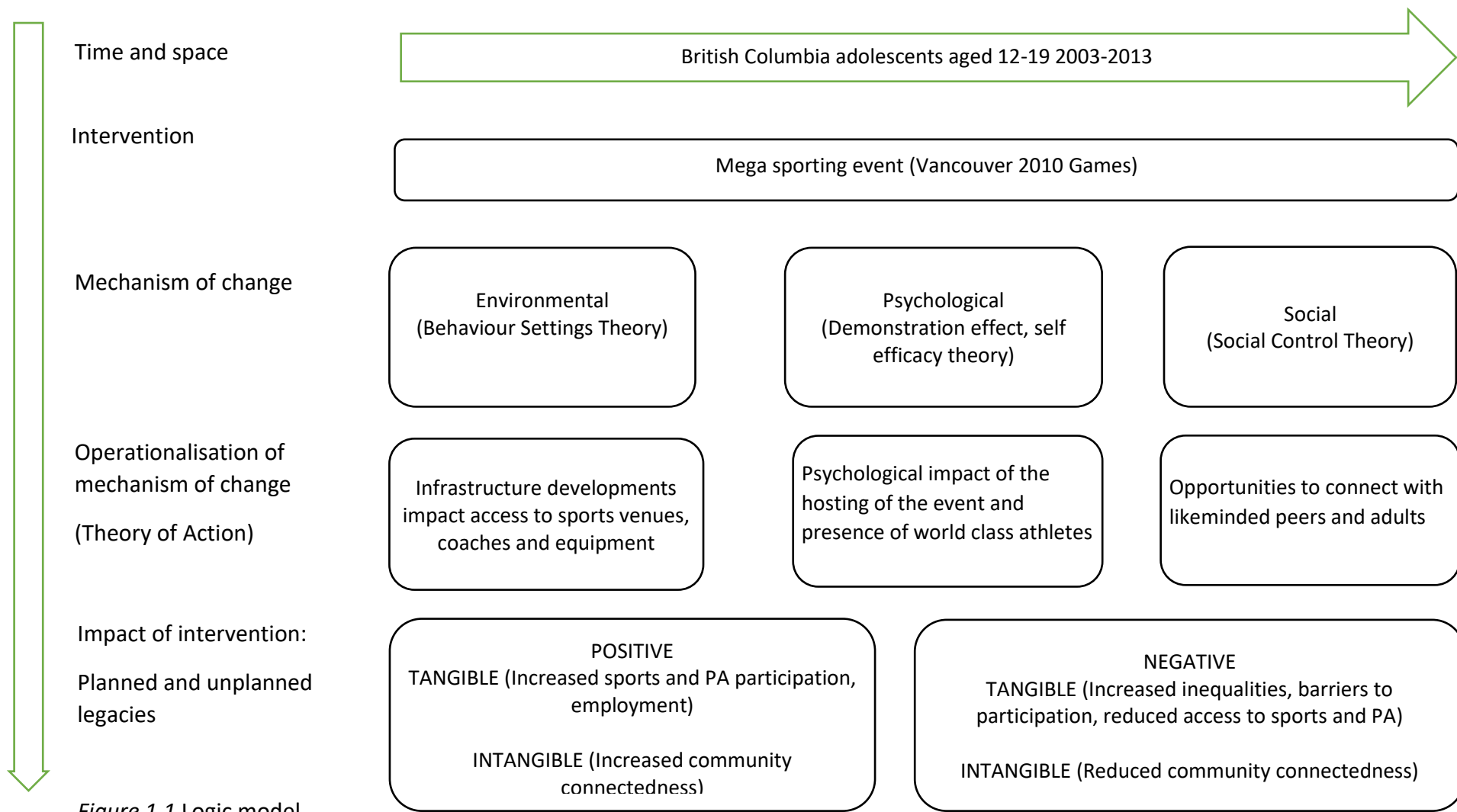


Figure 1.1 Logic model

1.5 Thesis structure

This study considers the impact of a mega sporting event on adolescent health, using the Vancouver 2010 Winter Olympic and Paralympic Games as a case study. This chapter has introduced the study, explained the context in which the 2010 Games occurred, provided a rationale for using these Games to identify potential legacy impacts of a mega sporting event and set out the study's aims and objectives. It has also explained the theoretical and organisational framework being applied.

This introductory chapter is followed by a literature review which assesses current knowledge of the importance of healthy adolescent development, barriers and supports to healthy development, and the potential positive and negative, tangible and intangible, planned and unplanned legacies of a mega sporting event for adolescents. It concludes with a summary of what is known and what remains unclear from previous literature and identifies the research questions for the current study.

The methodology chapter provides the philosophical approach to the study, explains the choice of a case study approach, discusses data sources and explains the analyses which were conducted.

There are two results chapters. The first focuses on population level results and the second on results for vulnerable populations. Both chapters include stakeholders' reflections and a discussion of the results in relation to the study's guiding research questions. The second results chapter also discusses the implications of the results for future event organisers.

The concluding chapter critically reviews the philosophical, theoretical and organisational framework applied to the study, suggests an alternative approach to evaluating the impact of a mega sporting event, and discusses the study's contribution to knowledge.

2. LITERATURE REVIEW

1. Introduction
2. **Literature review**
 - 2.1 **Literature review methodology**
 - 2.2 **Adolescent development**
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 - 2.6 **Addressing gaps in the literature**
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4. Results – population level
5. Results – Vulnerable populations
6. Conclusion
7. References

The aim of this study is to critically evaluate the legacy of the 2010 Winter Olympic and Paralympic Games on BC youth aged 12-19, using Preuss's legacy cube as an organisational framework. As such, the literature review focuses on findings from previous studies which inform the study's focus on planned and unplanned, positive and negative, tangible and intangible legacies of the Games. To be useful and meaningful, it must build on previous studies on this topic, and must address the strengths and weaknesses of those preceding studies (Boote & Beile, 2005).

After a brief review of the methodology used for this literature review, this chapter begins by offering a thorough review of existing literature about adolescent development and the barriers and supports, which young people may experience during this developmental stage. This provides the foundation to consider the benefits to adolescents of participation in sports and PA, employment and of community connectedness (intended tangible and intangible legacies of the 2010 Games). The chapter also identifies adolescents who may be at risk of missing out on positive legacies or experiencing negative legacies of the Games and discusses current knowledge of the role that a mega sporting event can play in promoting healthy adolescent development. The penultimate section of this chapter reflects on what the literature has shown, and highlights the gaps in knowledge which this study seeks to address. It precedes a final section which articulates the research questions which have been developed through the process of identifying those gaps and which meet the study's aim to critically evaluate the legacy of the 2010 Winter Olympic and Paralympic Games.

The focus of the literature review is restricted to articles which inform the study's aim to measure the legacy of a mega sporting event on adolescents and includes those specifically relevant to the study's objectives of identifying characteristics of youth who may be likely to report increased positive or negative impacts of the Games, or which discuss the time and space in which legacies have occurred, or the implications of previous mega event evaluations.

2.1 Literature review methodology

A narrative literature review is designed for use with topics that have been studied by researchers across diverse disciplines who may have conceptualised the issues under study differently (Snyder, 2019). It is the chosen review methodology for this study as it allowed for a comprehensive overview of the potential of a mega sporting event to impact healthy adolescent development across a variety of domains. A narrative approach also allowed for the consideration of alternative and contradictory view

points, and for the inclusion of commentaries and grey literature which provided unique insights that would have been missed by a systematic review or meta-analysis (Kwan & Walsh, 2018).

The use of a narrative literature review methodology was preferred to a systematic review because of the broad topic under consideration, which meant a systematic review's narrow inclusion criteria and focus on a specific question would not have been appropriate (Horwood & Chockalingam, 2017). Similarly, a meta-analysis approach (which uses statistical methods to assess the consistency of effect sizes from one study to another) was considered inappropriate for this literature review due to the small number of available studies with a focus on the impact of a mega event on adolescents. Additionally, the studies that were found did not assess the same outcome or present results in similar ways, making a meta-analysis problematic (Borenstein, Hedges, Higgins & Rothstein, 2009).

Despite the choice of a narrative review methodology, elements of other types of literature reviews were included, as few literature review methodologies are mutually exclusive (Grant & Booth, 2009). For example, the review was conducted in a systematised and structured manner, and rather than focusing exclusively on study results, also offered a critical review of the data sources, strength of sample and conclusions drawn for a number of the studies cited in this review.

The review integrates our current state of knowledge about healthy adolescent development as well as offering a critical analysis of studies which consider the impact that factors such as PA and sports involvement, employment and community connectedness can have at the population and subpopulation level. The review also considers the findings of studies that have previously evaluated (or omitted) the impact of mega sporting events on adolescents.

The literature review was conducted in person at Sheffield Hallam University (SHU) and Vancouver Public Library and through SHU's online library and academic databases. Search engines included PsycINFO, SPORTS DISCUS, CINAHL, ERIC, Medline,

PubMed, Education Source, Social Sciences, and Academic Search Complete databases as well as Google Scholar.

A search of the grey literature included Canadian federal and provincial government websites and organisation websites such as BC Ministry of Health, VANOC, 2010 Legacies Now, International Olympic Committee and International Paralympic Committee. Relevant articles were also identified by reviewing the references cited in reviewed articles and through the “similar articles” feature available with some online databases.

Examples of search terms included combinations of the following:

- Adolescent, teen, youth, young people, student, junior
- Mega events, mega sporting events, Olympics, Paralympics, Winter Olympics, Vancouver Olympics, 2010 Olympics
- Legacies, impact, leverage, effect
- Physical activity, sports, sports clubs, leisure activity
- Homeless, street-involved, justice involved, disabled, youth with a disability

Due to the paucity of literature about the impact of a mega sporting event on adolescents, no date restrictions were applied to the literature search, although articles were limited to those published in English.

The search yielded few studies which were directly related to the impact of a mega sporting event on adolescents and even fewer which related specifically to the Winter Olympics or Paralympics. Several documents, which specifically referenced the 2010 Winter Olympics could not be located as the websites where they were stored were no longer available or pages had been removed. For example, the federal, provincial and municipal governments removed or condensed content from their websites, meaning that several links were no longer active.

2.2 Adolescent development

Adolescence is a distinct developmental stage characterised by significant changes in physical, social, emotional, and cognitive development. This stage is when values, health promoting and health risk behaviours, and thinking patterns are established, all of which have enormous ramifications for future health and well-being (Shlafer et al., 2014). It is also a time of experimentation, risk taking and growing independence (Galla, 2017).

Following early childhood, adolescence is recognised as the second most significant 'window' of opportunity and risk in development (Moretti & Peled, 2004). It is a time when an individual's choice to engage in healthy or risky leisure time pursuits can impact their long-term health, well-being, and social and civic engagement (Feinstein, et al., 2006). During adolescence many health-related behaviours are established which persist into adulthood. For example, participation in sport and PA during adolescence increases the likelihood of being active throughout adulthood (Kjønniksen, Fjørtoft & Wold, 2009). Similarly, early and regular substance use is associated with substance use challenges in adulthood, and other health risk behaviours established in adolescence are also more likely to persist into adulthood, such as poor nutrition and tobacco use (Bond, 2012; Goriounova & Mansvelder, 2012; Homel, Thompson, & Leadbeater, 2014). Adolescence can be associated with the onset or exacerbation of a number of other health-related problems, including depression, eating disorders, risky sexual behaviour, antisocial and delinquent activity, and school dropout (Moretti & Peled, 2004).

Adolescence is also a critical period of brain development when the capacity for abstract thought and complex problem solving emerges, and when individuals begin to recognise alternative perspectives, and have a deeper understanding of others around them and how they might be seen by others (Moretti & Peled, 2004). As such, it is a time when established behaviours and attitudes can be challenged and replaced with healthier ones. Influential peers, role models and experiences are more likely to influence an adolescent's behaviour than they are an adult's behaviour for whom the

brain has moved beyond its plasticity stage to a more rigid and stable form (Steinberg, 2015).

This study explores whether a mega sporting event can capitalise on the changes occurring during adolescence to support the development of healthy behaviours (such as a tangible positive legacy of sustained sports and PA participation) or even if such an event can pose a risk to healthy development.

2.3 Barriers to healthy development

One of the study's objectives is to determine which adolescents report positive or negative, tangible and intangible impacts of the Games, and for this reason includes a focus on adolescents experiencing homelessness, at-risk of justice involvement, and those with a physical disability. Experiencing homelessness and being at-risk of justice involvement pose barriers to healthy development. They are associated with many negative health outcomes during adolescence and into adulthood, including a lack of PA, a lack of social and community connectedness, and the effects of poverty, disadvantage and discrimination (Smith et al., 2014). Being born with a physical disability or developing one during childhood or adolescence can also be a barrier to healthy development as it can impact a young person's capacity to perform developmentally appropriate tasks and participate in activities to the same extent as their peers without a disability (Currie & Khan, 2012).

The current study will consider the positive and negative (tangible and intangible) impacts of the 2010 Games on those already facing barriers to healthy development, and the time and space in which they occur. It will also discuss the implications of the findings for policy makers seeking to attract major sporting events to Canada, and how such events can reduce barriers to healthy adolescent development.

2.3.1 Insufficient physical activity (PA)

A major objective of this study is to identify the impact of the 2010 Games on adolescent PA involvement as increased PA is one of the most touted tangible impacts predicted to occur from the hosting of a mega sporting event (Veal, Toohey, & Frawley, 2012). The World Health Organisation (WHO) has classified insufficient PA as the fourth leading risk factor for mortality from non-communicable diseases and notes that insufficient PA is responsible for 5.5% of all deaths (Mountjoy et al., 2015). Physical inactivity is associated with diseases such as coronary heart disease, hypertension, osteoporosis, Type 2 diabetes, and breast and colon cancers (Lee et al., 2012). It is also associated with shortened life expectancy (Babis et al., 2014; Bailey, 2005; Lee et al., 2012). It is believed that physical inactivity is responsible for 9.1% of all deaths in Canada and 16.9% of all deaths in the UK, and if physical inactivity could be reduced by 25%, around 1.3 million deaths a year could be prevented worldwide (Lobelo, Puska, Blair & Katzmaryzk, 2012). Physical inactivity is therefore a major public health issue that requires population and subpopulation interventions to offset its consequences.

A Canadian study (Shields, 2006) found that in 2004 (a year after the 2010 Winter Olympics were awarded to Vancouver), 26% of Canadian children and adolescents aged 2–17 were overweight and 8% were obese. This represented a tripling of the obesity rate and doubling of those who were overweight over the course of 25 years. However, this is likely an unreliable estimate as Shield (2006) calculated the percentages of adolescents who were overweight and obese using self-reported measures of height and weight from the Canadian Community Health Survey—measures which were removed from the BC Adolescent Health Survey (BC AHS) used in the current study—due to high rates of missing data, inaccurate adolescent self-report and the measure’s lack of sensitivity to different cultural backgrounds.

The more screen time adolescents report, the greater their likelihood of being overweight or obese (Shields, 2006). The length of time young people spend engaging in sedentary behaviour is higher in lower socioeconomic groups, in older adolescents,

in non-white adolescents, in more mature adolescents, and in young people who live in homes where they have high exposure to electronic forms of entertainment and where parents set few limits around screen-based entertainment (Mountjoy et al., 2015). Whilst engagement in sedentary behaviours (such as online gaming) are often seen as directly negatively influencing PA, sedentary behaviours and PA can co-occur in adolescence. However, it is the sedentary behaviour which appears more likely to be maintained into adulthood (Nelson, Gordon-Larsen, Adair, & Popkin, 2005).

Adolescence has been identified as a key risk period for PA attrition, particularly for girls following entry into puberty (Babic, Morgan, Plotnikoff, Lonsdale, White, & Lubans, 2014; Comte, Hobin, Majumdar, Plotnikoff, Ball, McGavock, et al., 2013; Gorely, Marshall, Biddle & Cameron, 2007; Knowles, Niven, & Fawkner, 2011). International studies suggest that 25–40% of young people satisfy current health-related PA recommendations of a minimum level of moderate-to-vigorous physical activity of 60 minutes per day (Mountjoy et al., 2015; Reimers, Jekauc, Mess, Mewes, & Woll, 2012). Few Canadian adolescents meet these guidelines and it is estimated that three out of five are not active enough to achieve optimal health (Colley, Garriguet, Janssen, Craig, Clarke, & Tremblay, 2011; Comte, et al, 2013; Wharf-Higgins, et al., 2013). One of the current study's objectives is to consider the time and space in which any legacy of the Games occurred for adolescents. This is pertinent because although BC is considered to have one of Canada's more active populations, there has been a steady decline in the percentage of the province's adolescents who have met the Canadian activity guidelines since the Games were awarded to Vancouver in 2003 (Smith et al., 2014).

In general, male adolescents participate in a greater number of sports than females at every age level. Males also tend to play competitive team sports whereas females prefer individualised sports, such as swimming and athletics (Bailey, 2005). The global decline in adolescent sports participation has been less pronounced among girls, although their participation rates remain below those of males. For example, a study using the Canadian General Social Survey found that between 1992 and 2005, sports participation among boys aged 11-14 declined from 66% to 56%, while rates for girls

decreased from 49% to 45% (Clark, 2011). However, it is worth noting that the Canadian General Social Survey is only completed by Canadians aged 15 and above, does not include first-hand data from younger individuals, and may inadequately capture females PA beyond sports participation.

Some young people are at greater risk of missing out on opportunities to engage in quality PA and sports opportunities in the primary school years. These include girls, students with a disability and those growing up in low socioeconomic neighbourhoods. By the time these students reach high school, they are less likely to engage in the specialist sports programmes which are available because they have missed out on the basics through which they would have established PA orientated motivation, and a sense of competence and confidence (Kirk, 2005).

It has been suggested that the decrease in PA during adolescence is a result of increasing academic demands, a developing social life and competing leisure time priorities, particularly if the individual has not already developed a commitment to a particular sport (Green, 2007; Kjønnsen, et al., 2009). Participation in PA in Canada also varies by immigration status and region, with higher participation among Canadian-born adolescents and among those living in smaller BC cities and rural areas (Ogilve, 2012). Although urban adolescents are generally less likely to be active, those in rural areas are also at risk for not meeting PA guidelines as they often have poorer access to services and lack sports and recreational infrastructure (Comte et al., 2013; Giles-Corti & Donovan, 2002; Gordon & Calabiano, 1996; Gordon- Lankford, Kowalski, Grybovich, Schuarte, & Neal, 2007; Larsen, Nelson, Page, & Popkin, 2006; Smith et al., 2011).

Whilst there is a significant body of evidence that suggests adolescent PA is declining and sedentary behaviour is increasing, it is worth noting that many of the studies reviewed for this thesis focused on specific metrics such as traditional sports and PA involvement, focused exclusively on moderate to vigorous activity (e.g., by using specific self-report survey question wording such as 'getting sweaty or out of breath'), or asked about 60 minutes of PA in a way that may have discouraged adolescents from

reporting PA that totalled at least 60 minutes but was accumulated in smaller chunks throughout the day. It is therefore likely that at least some adolescents are engaging in PA not captured with these measurements, such as through active means of transportation to school, and being engaged in physically active employment, volunteer activities, play and household chores. Similarly, caution should be exercised before placing too much emphasis on findings from studies that drew conclusions based on the use of activity monitoring devices, such as pedometers, as these devices only measured certain types of PA and would not have recorded active engagement in cycling, skateboarding, scooters or other non-step based forms of PA which are currently popular with adolescents.

Disadvantaged and marginalised adolescents participate in sports and PA at lower rates than their more advantaged peers (Girginov & Hills, 2008; Gorely, Atkin, Biddle & Marshall, 2009). Additionally, in Canada, Indigenous and immigrant adolescents often have different sporting interests to the historically Eurocentric sports offered in schools and communities. As a result, these youth continue to be under-represented in the Canadian sports system as participants, coaches, volunteers and leaders (Frisby, Thibault & Cureton, 2014; Smith et al., 2011). Certain cultural groups can also experience additional barriers to PA participation. For example, Muslim girls may require female-only areas to participate, which may not be available (Ball, 2006).

Adolescent PA is also influenced by factors as diverse and complex as age, gender, disability status, perceived activity competence, mental health, previous PA engagement, access to community sports, sensation seeking, sedentary behaviour, parent support, support from others, sibling PA involvement, and opportunities to exercise (Bailey, 2005; Griffiths & Armour, 2013; Sallis, Prochaska & Taylor, 2000; Wharf-Higgin et al., 2003). Declines in organised sports participation in particular have been linked to competing leisure time pressures; the reduced availability of sports clubs since the 2000 recession; and a societal shift away from collective identities to more individualistic ones, which has reduced the number of volunteers available to

run such clubs and adolescents' interest in joining team activities (Harris, Nichols & Taylor, 2017).

In addition to an increasing number of adolescents who have never engaged in extracurricular sports, there are many reasons why adolescents who have engaged in sports drop out. These include losing interest or enthusiasm, getting injured, having a developmentally appropriate desire for autonomy which is often not encouraged within rigorous sports structures, no longer being able to afford it, being too busy with other commitments, and feeling they do not have the skill or motivation to continue. Reasons for disengaging may have nothing to do with the sport itself, such as developing new relationships with peers who are not engaged in sports (Lindner, Johns & Butcher, 1991; McCreary Centre Society, 2015).

The reasons marginalised groups of adolescents are excluded from participating in organised sports programmes include having competing priorities (such as finding somewhere to spend the night if they are homeless), having little to no disposable income, a lack of transportation to access available opportunities, and a lack of social inclusion (Sherry, 2010; Skinner, Zachus & Cowell, 2008). Additionally, young people who come from families who are less affluent and less well educated may have fewer positive attitudes towards engaging in sports, which means building affordable sports facilities (one of the mechanisms intended to create a tangible legacy of the 2010 Games) or lowering costs to participate may not necessarily increase participation (Minneart, 2012).

Despite claims that a tangible legacy of the Games would be increased sports participation among Canadians with a disability (Misener, 2012), little is known about the PA involvement of adolescents with a disability. Data from the 2002 Health Behaviours of School Aged Children Survey showed that Canadian adolescents with a physical disability or long-term illness were equally likely as their peers without such conditions to engage in moderate to vigorous PA. Also, males with a disability participated in PA at the same rate as females with a disability, a finding not seen among non-disabled youth and for which no explanation could be offered (Rintala et

al., 2011). However, Rintala and colleagues' (2011) study focused exclusively on 13- and 15-year-olds, and the Health Behaviours of School Aged Children Survey only samples those aged 11, 13 and 15 and therefore does not capture information from adolescents at key stages in their development (i.e., at ages 12, 14, 16, 17 and 18). This may explain why findings from the Health Behaviours of School Aged Children Survey were not supported in other studies, which found that adolescents with a disability experienced significant barriers to participating in PA (DePauw & Gavron, 2005).

Only 16% of young people in the UK with a disability participated in extra-curricular sporting activities, compared to 45% of the general sample. Barriers to participation included self-consciousness, low levels of confidence, and negative school experiences (Bailey, 2005). Other common barriers to participation include a lack of awareness of how to include people with a disability in sport; limited opportunities for participation, training, and competition; and limited access to information and resources (DePauw & Gavron, 2005). Additionally, school age adolescents with a disability have reported feeling that sport and PA participation was not important to them (Wilhite, Muschett, Goldenberg, & Trader, 1997).

2.3.2 Lack of connectedness

Community connectedness is one of the intangible legacies of the 2010 Games being considered in this study. Community connectedness is defined as a perception of closeness, involvement, or affiliation with others, or integration into a social network (Bolland et al, 2016). It has been identified as a critical human motivation and psychological need, which can be particularly beneficial during adolescence as it gives young people meaning and encourages the development and use of coping strategies in stressful situations (Bolland et al., 2016). Community connectedness can offer adolescents who lack positive family relationships the opportunity to develop healthy relationships with local non-familial adults and institutions (Foster, 2017).

A lack of actual or perceived social connections and poor community integration are major risk factors for suicidal behaviour in adolescents (Daniel & Goldston, 2012). Lack

of community connectedness has also been associated with other negative outcomes in this age group, including behavioural problems, mental illness and criminal or antisocial behaviour (Bolland et al., 2016; Daniel & Goldston, 2012). Adolescents who are not connected to their community are also more likely to anticipate they will not engage in community life when they are older (Smith et al., 2014).

Disadvantaged and marginalised adolescents are less likely than their more advantaged peers to feel connected to their community, particularly if that community is under-resourced and has a high number of social challenges (Foster et al., 2017). For example, in BC only 32% of homeless 12–19-year-olds felt connected to their community. Homeless youth who did not feel connected were more likely to miss out on needed health care and less likely to report positive mental health or to feel positive about their current life circumstances than their homeless peers who felt a sense of connection (Smith et al., 2015). Similarly, incarcerated youth in this age group who did not feel connected to their home community were more likely to anticipate a future that included a return to jail, in comparison to those who felt connected (Smith, Cox, et al., 2013).

Whilst a lack of community connectedness has been identified as a barrier to healthy adolescent development in a number of studies, many of those studies have been correlational (e.g. Smith et al., 2013; Smith et al., 2014). Therefore, lack of community connectedness may be an outcome of other disadvantage and marginalisation, rather than a predictor.

2.3.3 Disadvantage and marginalisation

In addition to population level analysis, this thesis considers the potential positive and negative impacts of a mega sporting event on three specific vulnerable adolescent populations: the homeless, those with a disability and those at elevated risk of incarceration. Considering these youth as unique populations will support the objectives of the study to identify the characteristics of adolescents reporting tangible and intangible effects of the Games, and support the study's objective to provide

evidence for policy makers and organisers of future mega events about the potential impact of such an event on marginalised populations.

These subpopulations of adolescents are given particular consideration because they are not only generally less likely to be engaged in PA and have lower community connectedness than their peers, but also experience many additional barriers to healthy development, including high rates of abuse and victimisation, hunger, and school dropout (Smith, Saewyc, Albert, MacKay, Northcott & McCreary Centre Society, 2007; Smith et al., 2014). Adolescent homelessness is also associated with a range of physical and mental health problems, as well as decreased sports and PA participation and unemployment into adulthood (Bottrell, Armstrong & France, 2010; Harrison & Narayan, 2003; Nesdale & Pinter, 2000; Smith et al., 2014).

Adolescents with a disability are over-represented in the youth homeless population and in many other marginalised populations, and can face significant barriers to healthy development (Smith et al., 2015). The UN Convention on the Rights of Persons with a Disability states that persons with a disability should have the right to participate on an equal basis in community life including recreational, leisure, and sporting activities (United Nations, 2006). However, the Canadian government's Annual Report on Disability Issues noted that around half (51%) of people with disabilities were denied the opportunity to participate in cultural and leisure activities of interest to them by barriers such as inaccessible facilities and transportation, and the need for specialised equipment (HRSDC, 2012) – barriers which were intended to be addressed by the hosting of the Games.

The 2010 Games organisers recognised that having sports which highlighted risk taking could be a way to engage adolescents (Thorpe & Wheaton, 2011). Risk taking is a key part of development for adolescents (Sharland, 2006). Adolescents growing up in healthy, functioning families and in communities with healthy peer relationships have opportunities to engage in pro-social risk taking through extra-curricular activities such as sport, whereas those growing up in situations where substance use and antisocial

behaviour are common are exposed to different risk-taking opportunities and cultural norms (Sharland, 2006).

Hirschi's social control theory was developed over forty years ago and is considered a highly credible explanation of adolescent behaviour (Popp & Peguero, 2012). Hirschi theorised that the strength of an adolescent's social bond to conventional individuals and society influences their engagement in prosocial or antisocial behaviour. The weaker the social bonds, the higher the probability that an adolescent will engage in criminal behaviour (Barnes, Hoffman, Welte, Farrell, Dintcheff, 2007; Wong 2005).

Engaging in illegal activities can offer disenfranchised young people many of the same social benefits that their more advantaged peers receive through engagement in sports, by providing opportunities to spend time with like-minded friends, build connections, take risks and reduce boredom (Bottrell, et al, 2010). Additionally, adolescents without the income or opportunity to participate in organised sports are more likely to engage in informal sports with peers in similar disadvantaged situations and without adult supervision, which has also been associated with increased antisocial behaviour (Bottrell, et al., 2010). It has been suggested that engaging in organised sport, and particularly team sports and contact sports, can also be associated with antisocial behaviours, such as drink-driving, substance misuse, risky sexual behaviour, violence and aggression, and negative health outcomes among high-risk adolescents (Beaver, Barnes & Boutwell, 2016; Burton & Marshall, 2005; Hartman & Massoglia, 2007; Wichstrom & Wichstrom, 2009).

These findings of potential risks and benefits of sports engagement for 'at-risk' adolescents support the need for a study such as this which critically evaluates the positive and negative, tangible and intangible legacies of a mega sporting event on different sub-populations of adolescents. This suggests there is a need to understand more clearly the dynamics involved in adolescent sports participation and whether a mega sporting event could (or even should) aim to engage these young people.

2.4 Supporting healthy adolescent development

As an individual moves through adolescence, they typically spend increasingly less time with parents and more time with peers and engaging in community activities and employment (Moretti & Peled, 2004). As a result, healthy adolescent development is influenced by environmental, social and individual factors (Giles-Corti & Donovan, 2002). Social Control Theory is one of the mechanisms of change considered for this study. The theory states that if young people can spend their leisure time in healthy pursuits with prosocial friends and positive peer and adult role models who model positive social behaviours and emotional control, they will be less likely to find themselves in unsupervised situations with more antisocial peers where they might engage in health-risk behaviours with potentially negative outcomes (e.g., Burton & Marshall, 2005).

‘Positive youth development’ is a strength-based approach to the conception of healthy adolescent development that is particularly popular in Canada and in which adolescents are viewed as having ‘resources to be developed’ rather than ‘problems to be solved’. It is believed that if adolescents can be supported to develop the five C’s—specifically, Character (respect for societal and cultural norms), Compassion (a sense of empathy and sympathy), Competence (social, academic, cognitive, and vocational skills), Confidence (self-efficacy and global self-regard), and Connection (positive exchanges between peers, family, school, and community)—they will not only have a positive transition through adolescence, but will also develop a ‘sixth C’ of Contribution (to self, family, school, community, and civil society) as they enter adulthood (Lerner, Brown & Kier, 2005; Lerner, Lerner, Bowers & Geldhof, 2015).

Bernant and Resnik (2006) suggest that implementing strategies to support positive youth development ensures adolescents receive the support, relationships, experiences, resources, and opportunities they need to reduce their health-risk behaviours and support them to become successful and competent adults. Adolescents are more likely to successfully transition to adulthood when they have opportunities to develop skills and competencies, and have positive experiences with

caring adults who have high but reasonable expectations and a positive attitude toward young people (Bernant & Resnik, 2006).

Bernant and Resnik (2006) state that many risk and protective factors associated with healthy development are consistent across gender, race, and ethnicity. Engagement in sport, community activities and employment are seen as supporting positive youth development, as they have the potential to reduce antisocial behaviour, and offer opportunities for adolescents to engage in prosocial activities with positive mentors (Barnes et al., 2007). These are all intended positive legacies of the 2010 Games and are discussed in more detail below. However, assuming a 'one size fits all' for adolescents implies they are a homogeneous group when in reality differences exist for different populations and in different contexts. For example, employment may be a stronger protective factor for justice-involved males than females, while the presence of supportive adults may be a stronger protective factor for females (Peled & Smith, 2012).

Although the mechanisms for how this occurs are not always well understood, it is assumed that opportunities such as those to engage in employment or interact with non-familial adult role models allow adolescents to develop external and internal protective factors (supports, skills and assets; Holt et al., 2017). External assets are developed through participation in activities that foster the development of supportive relationships, and can offer adolescents a sense of empowerment, clear boundaries and expectations, and constructive uses of their leisure time. Internal assets are fostered through opportunities to develop a commitment to learning, positive values, social competencies, and positive identity. Holt and colleagues (2017) found that the most successful positive youth development opportunities are those which take place in safe and health-promoting facilities; offer clear and consistent boundaries and expectations; offer supportive sustained relationships; provide opportunities for meaningful inclusion, belonging and leadership; display positive social norms; support efficacy and autonomy; provide opportunities for skill building; and in which there is some level of coordination among family, school, and community efforts.

2.4.1 Benefits of PA and sports participation for adolescents

An aim of the Canadian Federal Government was that the 2010 Games would leave a tangible legacy of a 10% increase in PA across Canada (Craig & Bauman, 2014). The World Health Organization (WHO) has proposed that increasing PA at the population level should be a main strategy for fighting the current obesity epidemic and other lifestyle diseases. The IOC is one of a number of global organisations that recognises the health and wellness benefit of sport and PA for young people, and the need for the Olympics to raise awareness of those benefits (Mountjoy et al., 2015). The importance of PA is also being recognised at the national and local level, as school policy-makers in some countries are increasing the time students spend in PA with the aim of creating PA involvement which will continue after school and across the life span (Kjønniksen et al., 2009).

Engagement in PA during adolescence can not only reduce the risk of current and later life health challenges but can have positive effects on aerobic fitness, body composition, glucose metabolism, and skeletal health (Bailey, 2005; Babic et al., 2014; Sallis et al., 2000). Sport and PA have also been shown to improve anxiety, depression, stress, self-confidence, energy, mood, efficiency and general mental well-being among clinical and non-clinical populations in a way not seen with other extra-curricular activities (Babic et al., 2014; Bailey 2005; Carter, Morres, Meade, & Callaghan, 2016). Additionally, engagement in PA has been found to help children develop respect for their body; increase self-esteem; enhance social development and academic achievement; and develop an understanding of the importance of being active (Babic et al., 2014; Bailey, 2005). Even if the Games were associated with small moves from sedentary behaviours to increased PA, this could have positive health implications, as decreasing sedentary behaviours is considered key to promoting adolescent health (Gorely, et al., 2007). However, to benefit from PA an adolescent must not only perceive there are benefits from participation, but also value those benefits and believe that those benefits would be greater than those obtained from a competing non-active priority (Green, 2005).

From a public health perspective, sport participation can be an important form of PA for children and adolescents, and there is an increasing focus on the role of sport in positive youth development approaches. Sport participation can provide adolescents with opportunities to learn physical, personal, social and emotional skill, as well as develop positive relationships with peers and supportive adults (Cairney, Clark, Kwan, Bruner, & Tamminen, 2018). Engaging adolescents in sports programmes which are developmentally appropriate are believed to build the five c's of competence, confidence, character, connections, and compassion (Fraser-Thomas, et al., 2005; Lerner et al., 2015).

When Hirschi developed Social Control Theory, he focused on the benefits of extracurricular team sports, which he believed could provide adolescents with positive peer support networks, strong adult role models, and the opportunity to spend time in a healthy activity, whilst decreasing the time and inclination to engage in antisocial behaviour or socialise with criminally involved peers (Burton & Marshall, 2005; Miller, Melnick, Barnes, Sabo & Farrell, 2007; Popp & Peguero, 2012). However, later social control theorists also saw the benefits to adolescents of individual sports (such as extreme sports and many of those included in the Winter Olympics and Paralympics). Such sports can also provide intangible benefits such as the opportunity to develop prosocial bonds through interactions with other athletes, and participants who may otherwise engage in antisocial behaviours can be admired by others for their positive sports skills, bravery and daring (Taylor Nanney, Welch, Wamser-Nanney, & Rachel, 2016). It is not exclusively the PA associated with sports participation which is beneficial to adolescents. For example, Coalter (2012) points out that PA does not reduce offending but the personal and social opportunities provided in the context of sports participation are what can influence behaviour change and reduce recidivism. Coalter (2012) interviewed 'at-risk' male adolescents and young adults (aged 14-21) who were engaged in organised sports programmes, and concluded that whilst sport was initially what engaged them, they also stayed involved in the programmes and made positive behavioural changes because of the relationships they developed with peers and supportive adults. However, it is unclear from this study if results would be

similar for females or younger adolescents, or what the outcomes were for those who dropped out of the programmes.

Engagement in extra-curricular sports allows adolescents to explore their identity and autonomy outside of the family setting, and offers opportunities to build positive relationships, take on different social roles, develop social skills, and learn to manage emotions (Bailey, 2005; Gordon & Caltibainao, 1996). As most juvenile crime occurs during periods of unsupervised leisure time, participation in out-of-school sport can also be particularly beneficial for reducing criminal involvement among 'at-risk' adolescents (Burton & Marshall, 2005; Gordon & Caltabiano, 1996; Minneart, 2012).

The 2010 Games organisers believed that increased sports participation would be a positive legacy of the Games (VANOC, 2019). Regular sports participation has been put forward as a strategy to ameliorate the effect of coming from a disadvantaged family background (Feinstein et al., 2006). For marginalised youth, sports participation can reduce isolation, offer a sense of community, increase positive social networks and lead to re-engagement and commitment to school and community (Adams & Piekarz, 2015; Griffiths & Armour, 2013; Sherry, 2010; Wong, 2005). For example, a study of US high school students aged 11-13 found organised sports participation reduced the likelihood of substance use, antisocial and criminal behaviour, and having friends with antisocial attitudes, particularly for boys (Hastard, Segrave, Pangrazi & Petersen, 1984; Miller et al., 2007; Taylor et al., 2016).

For females, sports engagement has been specifically linked to reduced engagement in violence (Taylor, Wamser, Sanchez & Arellano, 2010). For both genders, participation in sport has been associated with reducing truancy and vandalism, and encouraging characteristics such as loyalty, honesty and integrity (Andrews & Andrews, 2012; Hartman & Massoglia, 2007; Minneart, 2012; Purdy & Richard, 1983; Richardson, 2012). Regular engagement in organised sport can increase adolescents' pro-social behaviours and networks, and reduce antisocial ones; regardless of their socioeconomic status (SES), gender and length of participation in sport (Burton & Marshall, 2005; Donnelly, 1981; Hartman & Massoglia, 2007; Hastard, et al., 1984).

It is theorised that being able to identify as part of a sport team may be particularly important for adolescents' psycho-social development, with the stronger the sense of connection to an extra-curricular sports team the stronger the link to positive youth development (Bruner et al., 2017). Studies have also suggested that sports club membership can have a greater impact on health and well-being than other forms of PA because of its social element, structure and sense of community (Eime, Harvey, Brown, & Payne, 2010; Frawley & Van den Hoven, 2015).

A Dutch study found that young people aged 11–18 who were members of a sports club were at lower risk for mental health problems such as depression and anxiety, and reported lower antisocial behaviours, than those who participated in PA outside of sports clubs or were inactive (Monshouwer, ten Have, van Poppel, Kemper, & Vollebergh, 2013). Adolescents who are members of sports clubs have also been found to have higher levels of health literacy than non-members (regardless of age or gender), as they often learn health-related skills such as the benefits of sleep and healthy eating (Paakkari, Kokko, Villberg, Paakkari, & Tynjälä, 2017).

The current study includes a consideration of the Games' legacy on sports club membership by gender. Membership may be particularly beneficial for adolescent girls. Compared to girls without sports club membership, girls with membership have been found to have higher levels of PA participation, lower Body Mass Index, higher levels of perceived PA competency, and more PA-oriented leisure preferences and life priorities (Eime, et al., 2010). However, it may be that these benefits are a result of more affluent and stable families having the resources to support their children's engagement in sports clubs. For example, an Australian study found that girls who were members of sports clubs typically came from two parent monolingual households where at least one parent was well-educated, both parents were employed, and where the girls reported high levels of parental engagement and support. Sports club membership was also positively correlated with neighbourhood SES, particularly in metropolitan areas, and mediated by access to facilities (Eime, Harvey, Craike, Symmons, & Payne, 2013). These findings are also of interest to the current study, not only because of their focus on sports club membership but because

they again highlight (yet fail to address) the barriers which are faced by adolescents in many rural and remote BC communities, and ignore the role that informal sports and other forms of PA can play for adolescent girls, particularly if organised sports are unavailable or unappealing.

Additionally, it does not appear that organised sports participation is necessary to ensure engagement in PA during adulthood for females. For example, a Norwegian longitudinal study found that whilst participation in organised sports during adolescence was the strongest predictor of PA at age 23 for males, for females the strongest predictor of being active in adulthood was having a positive attitude towards PA during adolescence (Kjønniksen et al., 2009).

The current study is considering the spatial context in which any legacies of the 2010 Games occurred for adolescents. In Canada, researchers have noted significant benefits of sports participation for male and female youth in small isolated communities, because of the development of a sense of community, engagement, leadership, mentoring, health and fitness, psychological benefits, cultural pride, and increased social interactions (Lankford et al., 2007). It has also been suggested that the economic costs of the problems associated with loneliness and disconnection in isolated communities can be reduced through investment in sport and PA (Skinner et al., 2008). However, the opportunities to engage in competitive or organised sports are limited within most rural and remote communities in BC, as there are often insufficient facilities, individuals or investment to allow for the creation and maintenance of sports teams, thus highlighting the need to consider other forms of PA, and for mega sporting event organisers to consider these factors when developing legacy strategies.

Within Canada, there appears to be a preoccupation with the perceived value of traditional organised sports programmes, particularly for adolescents considered 'at-risk'. For example, Fraser-Thomas and colleagues' 2005 Canadian study discussed above was conducted because of the authors concerns about the future of 'today's

youth': *"Concerns stem[ming] from an increase in adolescent problem behaviours (delinquency, drug use), coupled with changing social forces (both parents working, single parent homes, increases in youth unsupervised time at home alone...)"* (Fraser-Thomas et al., p. 19). Such studies perpetuate myths about adolescents at a time when juvenile crime and substance use are declining (Smith et al., 2014). They also often fail to consider the role that other forms of PA can play for adolescents (such as informal sports or exercise classes considered in this study) and over-emphasize or simplify the role that organised sport can play for adolescents dealing with multiple barriers to participation.

Coalter (2012) talks about the need to 'de-centre' the emphasis on the benefits of organised sport for adolescents, and particularly those at-risk of offending. It has been shown that any programme which is made available to at-risk youth where no such programme previously existed is important in improving outcomes, building assets and supporting healthy development, and that the programme does not have to emphasize organised sports participation to be effective.

Weed (2018) further emphasised the importance of examining the effects of PA beyond sports participation. This appears to be particularly so when considering adolescent health outcomes associated with a mega sporting event, as studies reviewed for this thesis which focused solely on sports participation and sports club membership as an outcome are likely excluding 'at-risk' and multi-barriered adolescents and their participation in other forms of PA.

Similarly, a 2016 study by Weed addressed the need to differentiate sport from other activity choices, including formal exercise (such as aerobic classes or visiting the gym) and informal PA (such as walking), and to increase the emphasis on these when thinking about improving population health outcomes. He also warned of the danger of subsuming these types of PA into a discussion about sport, particularly when seeking to engage the least active who may be averse to the idea of playing sport.

For adolescents who often reject or are denied opportunities to participate in organised sport (such as those with a history of justice involvement), engagement in snowboarding and other alternative 'high-risk' Winter Olympic sports can be particularly appealing (Brymer & Schweitzer, 2012; Sugden & Yiannis, 1983). The affordability of participating in organised versions of these sports may be prohibitive to disadvantaged youth. However, relatively easy access to iced-over ponds/lakes and snow-covered backcountry terrain is available for many Canadian adolescents and may allow them opportunities to participate in unauthorised versions of these sports. No direct evidence to support this hypothesis has been found but a study of Canadian adolescents' leisure time PA found that whilst participation in PA decreased in the winter months for both males and females, engagement in PA was higher among girls on the outskirts of urban areas and in rural areas, than in urban centres. This may suggest that access to no-cost outdoor leisure spaces is a contributing factor to PA involvement (Nadeau, Letarte, Fratu, Owen, Waygood & Lebel, 2016).

High-risk and extreme sports allow young people to feel a sense of control over their own lives, express opposition to mainstream culture and values, release tension, gain peer respect, and identify with a sub culture, all of which are believed to equip young people with the skills and competencies that are required to support a healthier transition to adulthood (Gonzales & Field, 1994; Pain & Pain, 2005; O'Connor, Sanson, Toumberou, Norrish & Olssen, 2017; Self, de Vries, Findley & Reily, 2007). Such sports can build self-confidence, encourage independence and offer opportunities for young people to learn from their mistakes (Sharland, 2006). They can also provide a positive outlet for aggression, improve self-esteem, alleviate boredom, create excitement, and build pro-social communication skills (Andrews & Andrews, 2003; Gordon & Caltabiano, 1996; Hartman & Massoglia, 2007).

The first objective of this study is to identify demographic and other characteristics of youth who reported (vs. did not report) tangible legacies of the Games such as increased PA and sports opportunities, including participation in extreme sports. Extreme sports can be particularly appealing to 'at-risk' adolescent boys as they can provide a sense of unconventionality and personal challenge, and can allow

participants to exhibit fearlessness and develop a positive reputation for overcoming nature's harsh climate and terrain, which cannot be obtained through conventional sports with their rules, authority figures and rigid schedules (Brymer & Schweitzer, 2012; Sugden & Yiannis, 1983).

Any type of communal PA has been argued to have added benefits for adolescents with a disability, not only in terms of supporting them to better cope with their disability and decrease symptoms, but also because of the increased opportunities for socialising and developing a peer group. However, Rintala and colleagues (2011) argue that children with physical disabilities are frequently excluded by peers and discouraged from participating in typical childhood PA experiences, which can lead to avoidance of PA later in life. This underscores the importance of supporting adolescents with a disability to engage in PA, and understanding how a mega sporting event might contribute to this.

2.4.2 Benefits of community connectedness and communitas for adolescents

Mega sporting events have been stated to offer intangible legacies such as increased community connectedness, therefore this study is considering the association between the 2010 Games and any positive or negative changes in adolescents' sense of community connectedness at the population and subpopulation level. Community connectedness has been defined as a perception of closeness, involvement, or affiliation with others, or integration into a social network (Bolland et al, 2016). Terms such as liminality, communitas, experience economy and psychic income have all been used to describe the heightened community connectedness that local people can experience in relation to a mega sporting event (Baldock et al., 2014; Phillips & Barns, 2015; Shaw & Williams, 2004).

Erikson's (1968) theory of development states that as young people move through adolescence, they are increasingly independent and autonomous in their neighbourhood and community. During this time, they experience a need to situate themselves within a larger social context and to find a constructive and comfortable

role for themselves outside of their family setting (Erickson, 1968). As such, they are particularly receptive to external influences and can increase and diversify their social capital as they have access to a wider pool of supportive adults and a sense of safety and protection (Kliewer, et al 2004; Matlin, Molock & Tebes, 2011; Smith, Peled, Poon, Stewart, Saewyc, & McCreary Centre Society, 2015). Having a positive relationship with a non-parental adult is not only a factor in feeling connected to community but has also been associated with improved education and employment outcomes; improved psychological and physical health outcomes; and reduced problem behaviours during emerging adulthood (Ahrne, 2011).

Although little research has focused on community connectedness as a type of social support for adolescents, connection to community can play an important role in supporting adolescent mental health by providing a sense of belonging and personal value or worth. Community connectedness has been associated with lessening the problems associated with living in a disadvantaged neighbourhood by offering adolescents access to supportive adults and additional resources outside their home environment, and increasing their feelings of safety and security (Kliewer et al., 2004; Matlin et al., 2011). It has also been associated with positive aspirations such as planning to attend post-secondary education for even the most vulnerable and disadvantaged young people, as well as with engagement in extra-curricular activities including informal and organised sports (Smith, Peled, et al., 2015).

Engaging in a community sports club or other organised community activities has been shown to be one way to increase adolescents' sense of community connectedness as they develop relationships with peers and adults outside of their school and family, and are exposed to different values and experiences (Ogilve, 2012). Watching sport can also build social relationships and a sense of community, and break down barriers between different age groups, ethnicities and economic groups through a shared sense of identity and belonging (Skinner et al., 2008).

The sense of *communitas* generated by an out-of-the-ordinary event—such as a mega or large-scale sporting event, music festival or civil action—can generate a temporary

sense of well-being, harmony and connectedness among those in attendance (Thompson, Lewis, Greenhalgh, Smith, Fahy & Cummins, 2015). *Communitas* differs from community connectedness in that it is transitory and lacks rules, ties and structure. This can make it particularly impactful for adolescents who are developmentally seeking out new experiences and new ways of belonging and interacting outside their familiar environment. The sense of *communitas* which young people experience when they share a unique, short-term, bonding experience has been shown to enhance their confidence and self-esteem. Also, the interactions they engage in support them to develop the communication skills required to successfully transition to adulthood (Ashworth, 2017). It can be particularly effective in generating a sense of connection among those who are disadvantaged or who lack ties to a mainstream community (Muller, 2006).

Despite the benefits of community connectedness which have been identified, it is also worth noting that the studies referenced in this section have an underlying assumption that community connectedness is a positive outcome in and of itself or is associated with other positive outcomes. Yet, supporting the importance of considering the intended and unintended intangible consequences of a mega sporting event, BC adolescents have also reported risks associated with feeling excluded and detached from their community and with feeling connected to a particular community, such as if that community is heavily gang involved, suffers from high rates of alcoholism, unemployment or crime, or experiences high levels of discrimination (McCreary Centre Society, 2015).

2.4.3 Benefits of employment for adolescents

In addition to considering the effect of the 2010 Games on adolescent sports and PA participation and community connectedness, this study also considers any positive and negative impacts the Games may have had on employment opportunities at the population and subpopulation levels. Tangible and intangible benefits to part-time paid employment during adolescence have been identified, if that employment does

not exceed 15 hours per week (Apel, Bushway, Brame, Haviland, Nagin, & Paternoster, 2007; Kingston & Rose, 2015).

Employment during high school provides opportunities to develop skills such as time-keeping, money management and multi-tasking. It also offers adolescents new social roles, increases their emotional, social and financial autonomy, and provides opportunities to develop relationships with supportive adults outside the family and school (Hansen & Jarvis, 2000). Marginalised adolescents (such as those at risk of incarceration or with a disability) can experience tangible and intangible benefits from employment opportunities, especially when there are positive mentors and role models at the workplace, opportunities for skill development, and the job is such that it does not interfere with school hours (Kingston & Rose, 2015).

Part-time employment has been associated with higher school attainment, improved psycho-social functioning, heightened independence, increased self-esteem, reduced substance use, decreased deviant behaviour, and increased likelihood of adult employment (Kingston & Rose, 2015; Raushcer, 2011). Rauscher (2011) also suggests that it serves to increase young people's maturity and responsibility, which in turn can improve school performance and attendance.

Unemployment in adulthood has adverse social and financial consequences and has been associated with poorer self-reported physical and mental health, including depression, anxiety and suicide (Egan, Daley, & Delaney, 2016; McLeod, Lavis, MacNab, & Hertzman, 2012). Adolescents who are unemployed have been found to be at greater risk for early parenthood, substance use, and criminal and violence involvement as victims and/or perpetrators (Henderson, Hawke, & Chaim, 2017). Adolescent employment has been specifically associated with reducing the risk of adult unemployment by increasing educational achievement and adult employment opportunities among low-income urban adolescents, through opportunities to increase communication and maths skills, as well as skills such as conflict resolution, team work and decision making (Kingston & Rose, 2015; Purtell & McLloyd, 2013).

Most studies considering employment have assumed that adolescent employment is a desirable component of healthy development and would constitute a positive legacy of a mega sporting event. Yet studies of BC adolescents have suggested that employment among 12–19-year-olds can also be associated with negative and unplanned outcomes such as skipping school, reduced intent to complete high school and with increased substance use (McCreary Centre Society, 2015).

2.5 The role of a mega sporting event in supporting healthy adolescent development

Having discussed the barriers and supports that appear to influence a healthy passage through adolescence and a successful transition into adulthood, it is important to consider if and how a mega sporting event can support a legacy of healthy adolescent development. However, the existing body of literature pays minimal attention to the positive or negative, planned or unplanned impacts of a mega sporting event on children and adolescents (Dowse, et al., 2018). The lack of literature likely reflects the lack of thought given by event organisers to strategically leverage a mega sporting event to improve adolescent health outcomes.

The intent of this case study of the 2010 Winter Olympics and Paralympic Games is to contribute to our understanding of the tangible and intangible, planned and unplanned legacies that a mega sporting event can have on healthy adolescent development. Specifically, to learn about the adolescent populations who may be positively and/or negatively impacted by such an event, where they are located, when they experience a legacy and how their identification can inform the leveraging and evaluation of future mega sporting events.

The Winter Olympic Games are one of the largest and most complex sporting events in the world, requiring enormous financial and human resources, yet their sustained impact on host communities remains unclear and strongly debated, and the impact on adolescents largely ignored. For every example of a positive infrastructure or tourism legacy linked to the Games, there is a counter example of funding removed from

grassroots sport and needed services for vulnerable members of the population in order to support elite athletes and competitions (Ogilve, 2012). Additionally, as greater emphasis is placed on legacy planning, there is an evolution away from a focus on immediate economic impacts to a need to identify more sophisticated and complex interconnected legacy goals, which address the needs of a diverse number of stakeholders (Leopkey & Parent, 2012).

The idea that hosting a mega sporting event can improve the local environment and influence health behaviour is long established (Cornelissen, 2011). The Athens Games of 1896 were credited with creating a sense of community connectedness and improving sports development in the city, following the renovation of the ancient Pantheon Colosseum to host athletic events (Leopkey & Parent, 2012). However, the idea of a mega sporting event being intentionally leveraged to create a legacy of improved athletic facilities was first referenced in the build-up to the Melbourne Summer Games of 1956, and the idea of the Games leaving wider legacies took several decades to be formalised and incorporated into the bidding process (Leopkey & Parent, 2012; Misener et al., 2013).

The need to differentiate the short-term impacts of an event (such as the sense of *communitas* generated in 19th century Athens) from sustained legacies (long-term changes as a result of the Games), and to consider the perspectives of various stakeholders, led to the development of a broad holistic framework, articulated and later refined by Preuss (2007, 2016) in a legacy cube. This legacy cube is providing the organisational framework for this study as it was designed to capture the planned and unplanned, positive and negative, intangible and tangible outcomes of a mega sporting event and the length, breadth and depth of any impact.

Preuss (2016) also identified several key propositions for a legacy theory framework. Of particular relevance to this study are the propositions that the value of a legacy must be measured by how much it improves quality of life for a particular stakeholder group; and that any claimed legacy must be the result of event-related changes to the host cities, which would not otherwise have occurred. Preuss' original legacy cube has

been criticised for a lack of inclusion of Paralympic research and of the potential impact of a mega sporting event on people with a disability (Dickson et al., 2011; Misener, 2015). However, Preuss appears to have taken this criticism into consideration when he updated the framework and identified six key propositions:

- The value of a legacy is measured by how much it improves quality of life;
- Legacies are distinguished from sustainability, impact and leveraging;
- The identification of a legacy depends on the host city's long-term development plan;
- Legacies may be positive or negative and must be evaluated in the context of a particular stakeholder group;
- Legacies change in importance over time and can be latent; and
- Legacies are the result of event-related changes to the host city (Preuss, 2016).

Preuss' original legacy cube framework has previously been applied to a study of the 2010 Games, and led the author to conclude that an unintended consequence of the Games was the further marginalisation of street-involved young people (Kennelly, 2017). Preuss' updated framework is applicable to this thesis as it takes a more holistic approach than the original 2007 legacy cube theory and has the added dimension of considering who is affected by Games-related changes, and how and when any legacy has value to different stakeholders (Preuss 2016). Agha (2016) encourages its application on studies such as this one because it has measurable legacy dimensions of time, space, tangibility, planning and positivity, as well as the inclusion of positive and negative legacies. Preuss' updated framework also includes consideration of the legacy any event might have on hampering non-event related development (Preuss, 2016). This is of particular relevance to this study given the concerns that homeless adolescents in BC may have lost out on housing and other services as funding was redirected away from areas of social need towards the Games (Kennelly & Watt, 2012).

Preuss (2016) proposed that changes that occurred only for the event—and are not included in the host city’s long-term development legacy strategies—can still leave a lasting legacy, both during the pregnancy period and afterwards. This notion is explored in the current study. For example, increased ticketing for minor offences and more aggressive policing during the Games could impact homeless adolescents’ relationship with the police over the longer term (Misener, 2012).

The lead author of the 2010 OGI evaluation recommended the addition of the lens provided by the legacy cube framework when reflecting on how the evaluation of a mega sporting event could be improved, because of the framework’s ability to situate the impacts of a mega event (infrastructure, knowledge, image, emotions, networks, culture) within the intersection of three dimensions of its legacy—planned/unplanned, positive/negative, and tangible/intangible—as well as within a spatial context. However, VanWynsberghe (2015) warns that several legacy cubes may be needed to capture the impact of an event at different times and spaces.

Although not specifically applying a legacy cube lens, the Sydney 2000 Games were the first to attempt to systematically (rather than anecdotally) record legacy impacts (Leopkey & Parent, 2012). It was seven years later before the International Paralympic Committee (IPC) stipulated that the Paralympics host organising committee must set aside resources to focus on tangible legacy outcomes including accessible infrastructure in sport facilities and urban development; development of grassroots and elite sport structures and organisations for people with a disability; opportunities for people with a disability to be completely integrated into their community and to reach their full potential; and intangible outcomes such as positive attitudinal changes towards people with a disability (Misener, 2012).

In 2007 the IPC mandated organising committees to include a legacy plan in their proposal and set aside resources to measure the specific impact of the Paralympics for the host city, region and country (Misener et al., 2013). However, as with the IOC, the IPC tended to assume that event legacies would be positive with the potential for negative legacies ignored or minimised. Also, as Misener and colleagues (2013) point

out, with governing bodies conducting their own evaluations it has been challenging for independent researchers to gain approval for studies or access to data held by those governing bodies.

As thinking about the potential impact of a short-term mega sporting event has evolved, the emphasis has shifted from a focus on the potential legacies that might be left behind to a more intentional consideration of how such an event could be purposefully leveraged to achieve specific goals (e.g., Chalip, 2014). Around the same time the IOC was beginning to formalise a focus on (positive) legacies, Cashman (2003) identified six areas where mega sporting events could be leveraged to have a sustained impact. Veal and colleagues (2012) later expanded this list to ten potential legacies for host countries and communities. Three were general—economic impact; built environment (non-sporting); and public life, politics and culture—and seven were specific sporting legacies—information and education about sports; elite performance; mass participation; physical infrastructure; administrative infrastructure; symbols, memories and history; and health.

As it has become increasingly necessary to justify the enormous amount of funding required to host a mega sporting event, legacy planning in these ten areas has become a central component of the Games bid process (Misener et al., 2013). The potential of positive legacies to occur in these areas are among the greatest attractions for cities who bid to host the Games. Yet it remains generally unclear if and how any such long-term and sustained impacts may occur, and through what mechanisms the enthusiasm generated through the Olympics and Olympic related events can be translated into increased sports and PA participation or other sustained community benefits (Bell & Gallimore, 2015; Girginov, 2011).

Preuss (2007) differentiates a mega event's legacy from its impact by using the example of the economic effect of hosting an event. Event tourism and associated Games spending can influence the economy but is short-term and considered an impact rather than a legacy. An economic legacy occurs if there is a sustained rise in post-event tourism due to the increased interest in the event city as a result of its

global exposure through the Games. Therefore, to maximise the potential of a legacy occurring, national policy may be necessary to proactively harness the interest and support for further development that is inspired by the event and by any infrastructure it leaves behind (Cornelissen, 2011). Smith and Westerbeek (2007) also note that mega sporting events can also be used as catalysts to engage businesses to invest in community projects they would not otherwise have been inclined to do, which can be considered a legacy.

The official evaluation of each Summer and Winter Olympic Games is completed within a couple of years of the Games ending, yet it has been argued it can take up to twenty years for a true legacy effect to be recognised. For example, the 1976 Montreal Summer Olympics were considered to leave few positive legacies at the time, as the city was left with immediate negative tangible legacies such as massive debt and displacement, and negative intangible legacies such as public distrust and disapproval (Chan & Forsyth, 2018). However, there is some evidence that in the long term the Games were partially responsible for Montreal's transformation into one of the most advanced sports communities in Canada, as Games-related investment in transportation, volunteers, and technology, and the positive image of Montreal that was projected raised the city's profile with international visitors (Kidd, 2011, as cited in Ogilvy, 2012). Similarly, in 2005 it was reported that \$86 million (US) of the profits generated from the 1984 Los Angeles Olympics had benefitted sports participation among two million children and youth. However, the sustained impact of this on adolescent lives and how it continues to relate to the original event of the 1984 Games is harder to determine as the foundation established to distribute the profits continues to diversify its programming and revenue sources (Veal et al., 2012).

Whilst the legacy of a mega event can be difficult to establish, and it can be challenging to definitively attribute changes which do occur in a community to that event, there is some evidence that the Paralympics have left a tangible legacy for people with physical disabilities. For example, the 2000 Sydney Paralympic Games led to improved accessibility at venues and on public transportation; the 2008 Beijing Paralympic Games led to improvements in accessibility infrastructure, which included

accommodations, sporting venues, pavements and transportation; and London 2012 ensured an accommodation legacy when the athletes' residences were converted into accessible housing units (Misener et al., 2013).

There remain concerns that ambitious plans to leverage a mega sporting event to improve health outcomes are simply a way to justify the public money that is spent on hosting such an event (e.g., Rogerson, 2016). However, findings such as those above appear to show the potential for achieving a positive legacy for at least some populations of adolescents.

2.5.1. Adolescent spectatorship at mega events

This study is considering the spatial context in which any legacy of the 2010 Games may have occurred and seeks to understand if young people need to be in proximity to the Games sites or if adolescents in non-host communities can also experience tangible or intangible legacies. Young people are often the target of leveraging efforts as they are believed to be more likely than adults to be positively influenced by watching sporting events and athletic stars (Cornelissen, 2011). A demonstration or 'trickle down' effect is suggested to be the mechanism of change which occurs when individuals are inspired to participate in sport after watching elite athletes perform at elite sporting events, if they believe they have the skills to recreate what they are observing (Bandura, 1997; Hindson, Gidlow, & Peebles, 1994; Weimar et al., 2015). It has been suggested that the effect not only inspires some individuals to want to play sport at the level they have witnessed, but can also inspire those who know they are not talented enough to play at the elite level to want to succeed at lower levels or simply to participate (Frawley & Van den Hoven, 2015).

The demonstration effect is the most common theoretical explanation applied in studies which have sought to identify a link between sports participation and a mega sporting event (Weimar, Wicker, & Prinz, 2015). There are three key mechanisms through which the demonstration effect is suggested to influence sports and PA participation among adolescents. The first is when they are inspired to take up a sport

because a national athlete or team was successful at a major sport event. Second, they may be inspired by a particular elite athlete's personality and wish to be like them and experience similar sporting success. Third, if a major sport event is witnessed live 'on home soil' it can inspire the host population to join a local club in order to participate in the same space as the athletes (Weimar, Wicker, & Prinz, 2015).

An indirect demonstration effect can also occur through infrastructure developments completed for a mega sporting event (another of the mechanisms of change theorised to increase adolescent sport and PA in this study). Such developments leave the host community with improved training and competitive facilities, and an improved 'supply' of talented athletes. An indirect demonstration effect may also occur outside the host communities. For example, seeing a mass participation marathon, fun run or cycling event can lead other communities to develop these and inspire host and non-host residents to participate (Veal et al., 2012). However, some studies have suggested that for a true demonstration effect to occur it may be necessary for individuals to be in proximity to the event and able to relate to the athletes (e.g., through shared nationality and gender; Mutter & Pawlowski, 2014). Additionally, developing a mass sports participation event such as a fun run or marathon is considerably more achievable for the vast majority of Canadian communities than creating an opportunity for residents to watch elite athletes perform.

The demonstration effect is often illustrated using the sports development pyramid model (e.g., Bailey & Collins, 2013), with successful elite athlete performances at the apex creating a broader base of increased grassroots participation. It is also suggested that the better the standard of performance and success witnessed from athletes at the top of the pyramid, the more it can serve to inspire and encourage participation at lower levels (Frawley & Van den Hoven, 2015). It is considered particularly applicable to children and adolescents, because the reality of becoming an athlete is greater for younger people, who may also be more impressionable and are more likely to believe they can develop the skills of the elite athletes they observe (Carter & Lorenc, 2013).

The demonstration effect has its roots in Bandura's (1977) social learning theory and its subsidiary self-efficacy theory. Bandura devised social learning theory to explain how individuals' model human action, thought, and motivation. It is typically used when considering self-efficacy, athletic outcomes, and deviance as it offers an explanation of socialization, and specifically of the concept of a role model (May, 2009). According to Bandura (1977), a role model can be anyone with whom an individual comes into contact that might influence that individual's behaviours, attitudes, and aspirations. This includes direct 'everyday' role models such as parents and teachers, and indirect role models, such as professional athletes, who are observed to have certain character traits, attitudes and exhibit certain behaviours that the adolescent believes they should adopt if they wish to achieve similar success (May, 2009). However, the role of Olympic athletes as inspirational role models is complex (Lines, 2001). It has been suggested that for sports stars to influence sustained engagement in PA among adolescents, they must seem relevant and their achievements attainable. For example, UK high school students who perceived their sporting role models to be focused on personal improvement, effort, learning and task mastery were more likely to play the same sport as their idols than those whose role models did not exhibit these qualities (Carr & Weigand, 2001). Additionally, some Olympians have been criticised for the unintended negative influence of their behaviour away from their sport, and female sports stars remain under-represented in the media and are rarely mentioned by adolescent males or females as role models or inspirational figures (Lines, 2001). It therefore remains unclear what impact stars of the 2010 Games might have on BC adolescents, particularly as studies of the impact of female sports stars on adolescent participation have not previously been conducted in Canada where female athletes like BC born footballer Christine Sinclair are held in high esteem.

Both self-efficacy theory and the broader concept of a demonstration effect were used to explain leisure time PA increases in Canada during Winter Olympic years, as it was believed Canadians were more likely to be inspired to participate in winter sports than in summer Olympic sports due to the popularity of winter sports, higher likelihood of Canadian success in winter sports, and the infrastructure available (Montoya et al.,

2013). Self-efficacy theory has also been used in different contexts to specifically explain participation in extreme sports, a key component of this study as well as at recent Winter Games and popular among Canadian adolescents (Slanger & Rudestam, 1997).

The demonstration effect is often used as a justification for public funding of elite athletes (Donnelly et al., 2008). This justification occurred in BC, as event organisers and politicians predicted there would be a link between residents watching Canadians achieve Winter Olympic success on home soil and an increase in sports participation. However, despite the findings of Montoya and colleagues (2013) noted above, it has been difficult for researchers to find evidence of a direct link (Weimar et al., 2015). This may be because the demonstration effect is a potential effect that needs to be leveraged by other supporting activities, rather than an inherent effect (Weed et al., 2015).

This study considers the timeframe in which any legacies occur. It has been suggested that a true demonstration effect is most likely to occur during the pregnancy period of a mega sporting event and there may also be a short-term rise in PA during the actual event (Weed et al., 2015). The hosting of mega sporting events is often associated with increased funding for sport programmes and infrastructure in the event lead-up period which can make it challenging to separate a demonstration effect from the environmental effect of increased opportunities to participate (Frawley & Van den Hoven, 2015). For example, the success of Norwegian biathletes in the Winter Olympics and World Championships has been associated with an increase in the number of registered participants in the sport in Norway. However, rather than this increased supply of elite athletes being solely the result of a demonstration effect, increased income for the successful sports federations has been used to encourage new participants into the sport through a variety of programmes and promotion efforts, including training more coaches. This in turn has allowed the country to build the infrastructure necessary to increase participation and support athletic development at all levels (Hanstad & Skille, 2010).

It has also been suggested that rather than attracting new people into sport, the demonstration effect may be more likely to increase levels of participation among those already active, may see former players return, and may encourage already active people to switch sports. For example, an increase in curling club membership in Scotland following the success of Scottish women in the 2002 Winter Olympics was attributed to female participants switching from other sports rather than as a result of attracting new participants into sport. However, as with most studies of the presence of a demonstration effect, this study focused on adult sports club membership, and did not consider adolescents (Weed et al., 2015).

To further complicate the picture, a small-scale UK study suggests that watching the Paralympics may be more likely to inspire inactive adults without a disability to engage in PA than watching the Olympics (Carter & Lorenc, 2013). It has also been claimed that the demonstration effect may work in reverse for those who are inactive or unskilled in sports. It is theorised that watching elite athletes perform at the highest level may have an unplanned discouraging effect on those who realise they cannot perform at that level (Hindson et al., 1994). The current study will consider adolescents who reported their PA was negatively impacted by the 2010 Games, as previous studies that have noted this phenomenon have focused on adults and have tended to have a small sample size (e.g. Carter & Lorenc, 2013). The few studies that have considered adolescents have not found evidence of such a detrimental effect (Lockwood & Kunda, 1997; Veal et al., 2012).

The link between adolescent behaviour and watching a mega sporting event is not well understood (Bell & Lovell, 2007; Lines 2000; Miller, 2013). Additionally, there is little evidence to demonstrate that watching regular sports translates into watching events which take place every four years, such as the Winter Olympics (Lines, 2000). The reason in part is that it is common for adolescents to be priced out of these mega events, where older tourists make up a large percentage of attendees (Andresen & Tong, 2012). However, attending a sporting event is not only influenced by cost but also by the social acceptance and desirability of attending that event, which may be particularly influential for adolescents (Wakefield, 1995). It has also been suggested

that watching team sports may be more attractive to adolescent audiences than watching individual sports, and it remains unclear how this might impact Winter Olympic attendance which combines both (Lines, 2000).

Mega sporting event attendance can also have negative associations for adolescents such as an increased risk of injuries and hospitalisations as a result of event-related assaults, as well as with rises in crime, antisocial behaviour and sexual exploitation in the host community, all of which can be detrimental to healthy adolescent development. However, this did not appear to be the case in Vancouver as the Games coincided with a decrease in the adolescent crime rate (CBC News, March 17th 2010; Statistics Canada, 2011). Official government records also showed Vancouver experienced none of the increases in crimes against adolescents previously associated with large scale sporting events such as human trafficking or sexual exploitation (Public Safety Canada, 2016). However, it is important not to place too much emphasis on studies which use official crime statistics as many crimes, particularly petty offences, go unreported. Also, adolescents might not recognise or report when they have been the victim of a crime (e.g., Smith et al., 2014)

One of the few studies to consider the role of watching sports among adolescents involved over 3,000 Scottish high school students. None of the potential negative legacies associated with playing sports, such as substance use, were present for watching sports (Miller, 2013). Adolescents who witnessed spectators appreciating athletic skill from opponents as well as their own team were found to want to develop those skills (Cairney, et al., 2018). However, it is unknown if the findings from this study would be replicated if those adolescents watched a mega sporting event.

There may be some unplanned negative consequences to missing out on opportunities to attend a mega sporting event. A small-scale study into the regional effects of London 2012 found that adults who attempted to get tickets and were unsuccessful felt excluded and sceptical of any legacy impact of the event (Mackintosh, Darko & May-Wilkins, 2016). It is unknown what the impact on adolescents may be, or the findings had this study had been conducted with a larger sample.

2.5.2 Creating an Olympic legacy of sports and PA participation among adolescents

To support the consideration of the demonstration effect as a mechanism of change in this study, the Psychological Continuum Model (PCM) is also considered because it explains the mechanism through which a demonstration effect can occur. It also takes into account any planned and unplanned impacts of Olympic related initiatives, such as those which encourage adolescents to try Olympic sports (Beaton & Funk, 2008; Funk & James, 2001).

Like other staged models of sports participation which have sports participation as their outcome—such as the Trans Theoretical Model (Prochaska, DiClemente & Norcorss, 1992) and the Exercise Adoption Model (Brooks, Lindenfield & Chovanec, 1996)—the PCM identifies initial stages relating to attitude changes, and changes in intention and awareness which occur prior to any behavioural change (Weed et al., 2015). The four stages identified in the PCM which would be required for an adolescent to become a regular committed participant in a sport are: Awareness, Attraction, Attachment, and Allegiance. *Awareness* of sports and sporting opportunities is the first step towards participation. *Attraction* follows exposure to a sport, as youth are motivated to try it or to increase their current level of engagement and begin to develop a sense of self-efficacy. *Attachment* occurs when an individual assigns emotional, functional, and symbolic meaning to an activity and they begin to feel a growing connection to it (Funk & James, 2006). As the connection with the sport increases, the individual wishes to engage in it in a more organised or competitive manner and can move through this stage to the allegiance stage (assuming they have the resources). *Allegiance* occurs when an activity is fully integrated into a person's life and becomes part of how they identify (Funk & James, 2006). Individuals at the allegiance stage enjoy being around others who share their interest in the sport, and organise their lives to ensure they dedicate time to participating (Beaton, Funk, Ridinger & Jordan, 2011).

Understanding the psychological mechanisms at play can support a key objectives of this study to determine any positive or negative impact on sport and PA participation

which may have occurred for BC adolescents in the context of VANOC and the provincial government's aims that the Games would inspire the population to become physically active (Soteriades et al., 2006).

Despite this oft repeated aim, requiring host cities to create a legacy of sports participation is relatively new. Beijing 2008 was the first city mandated to collect PA participation data, including data about grassroots participation rates in a range of sports (e.g., individual sports, school sports and through sports facilities; Veal et al., 2012). The data collected at Beijing showed some association with increased PA in host communities. For example, the mass sport policy development programme which was implemented in Qingdao, host of the 2008 Olympic sailing regatta, reported residents' participation in regular PA increased in the build-up to the Games from 38% in 1987 to 45% in 2004, to 50% in 2006 (Wang & Theodoraki, 2007). However, the study also highlighted discrepancies between rural and urban sports development, and raised concerns about access to the new water sports facilities for the majority of the local population due to the high costs of participation in water sports and to use the new facilities (Wang & Theodoraki, 2007). Additionally, it is unclear how transferable the findings would be from a city that hosted only one type of event (a water sport) to the experiences of adolescents exposed to multiple winter sports events in BC's host communities. It is also unclear if any of the increases in participation seen in Qingdao were maintained post-Games.

In their bids to host the Games, Vancouver 2010 and London 2012 made specific references to their intention to leverage the event to increase PA across the whole of the host country, not just in host communities. In Canada, Federal 2010 Olympic Minister Hon. David Emerson declared "*The Olympics are about emerging athletic participation, fostering community engagement and building a sports legacy that will benefit all Canadians.*" He also spoke of the Games "*leaving lasting legacies for the province [of BC]*" and noted that a \$10 million investment in the sustainable operation of legacy facilities would ensure "*young British Columbians will be able to make their Olympic dreams come true*" (Canadian Newswire, 22nd May 2007). Both Vancouver and London pledged to create a sport and PA legacy that would increase participation

among children and adolescents through investment in local grassroots sport organisations, communities and schools. The UK government also declared specific intentions to remove barriers to participation for marginalised young people and to make it mandatory for 5–16-year-olds to complete five hours of sports per week (Girginov, 2011).

A previous systematic review found evidence that targeted programmes linked to the Games can have a positive impact on child and adolescent PA, at least at the local level. For example, activities such as meeting athletes and organised use of sports facilities for adolescents at the Calgary 1998 Winter Olympics were credited with an increase in local children and adolescents' PA and sports engagement (Weed et al., 2009). The 1976 Montreal Summer Olympics were also reportedly associated with increased demand on sports facilities by young people and the creation of a number of new junior teams (Iron, 1988, as cited in Veal et al., 2012). However, a small-scale mixed-gender study in the UK (n=25) which looked at the relation between watching large sporting events (Euro 96, Wimbledon and the 1996 Atlanta Olympics) and daily PA among 14–15-year-olds found that participation in the featured sports increased during the events, but was not sustained. The increases in participation appeared to be associated with changing sports, as much as with increasing engagement. For example, during Euro 96, 60% of the adolescents played football, but this decreased to 18% during the Olympics, whereas swimming rates were higher during the Olympics than during Euro 96 (Lines, 2007). Participants in the study reported that despite their increase in participation in the sport they were exposed to during an event, it was difficult to maintain motivation afterwards, especially when they realised they could not emulate the skills they had observed from the elite athletes (Lines, 2000; Lines, 2007).

It is unknown if similar results would be found with a larger scale study or in a study that also surveyed adolescents younger and older than ages 14–15. However, it has been suggested that, whilst watching mega sporting events may temporarily increase young people's engagement in sports and PA, it may not be an appropriate mechanism for sustained change at the population level (Kohe & Bowen-Jones, 2015). To capitalise

on the interest generated by a mega sporting event, providing immediate opportunities for young people to sample sports and receive coaching may be a successful way to sustain their enthusiasm and participation. Such an approach would differ from the way that sport is typically taught in schools and clubs, where children and adolescents often have to focus on learning the relevant skills and doing drills first before playing (Kirk, 2005).

Collecting accurate data on the impact of a mega event on PA has proved challenging. For example, the only national study of the impact of Vancouver 2010 on the PA of 5–19-year-olds was conducted over a seven-month time period and found no difference in PA rates before and after the Games when measured by pedometer. As a result, the study called for a more thorough evaluation of the impact of a mega sporting event on adolescent PA, conducted over a longer time period (Craig & Bauman, 2014).

Veal and colleagues (2012) also described challenges in their attempts to measure the impact of the 2000 Sydney Olympics on Australian sports participation, due to changes in national surveys which made pre- and post- data incomparable, partly because the post-Games surveys excluded data on adolescents under 18 years of age. The available data showed little to no increases in sports participation associated with the Sydney Games. There was a rise in female adult participation and a decrease in male adult participation between November 1999 and November 2000 (two months after the Games), although the increase among females was insufficient to counter previous declines in PA involvement (Toohey & Veal, 2005; Toohey et al., 2006; Veal & Frawley, 2009; Veal et al., 2012). However, when Veal and colleagues (2012) undertook some ‘correction analysis’ to identify the impact of the differences in survey methodologies pre- and post-Games, they predicted that had the survey methodology remained consistent, and included adolescents aged 15–18 at both time points, the data would have shown a sustained rise in sports participation rates following the Games. It is also worth noting that surveys conducted exclusively post-Games indicated sports participation among children aged 5–14 rose between 2000 and 2009. In the years immediately after the Games (2000–2003), children’s participation in

Olympic sports rose, whilst participation in non-Olympic sports decreased slightly (Veal et al., 2012).

Another study of sport participation data collected before and after Sydney 2000 showed a positive effect on junior sport club membership (under 15 years of age) in Australia, with Olympic sports demonstrating greater increases in members than non-Olympic sports—a finding not replicated with adults (Veal, Toohey, & Frawley, 2012). However, the authors found it difficult to explain this finding and pointed out that the failure of relevant sports organisations to collect adequate and consistent data made any conclusion extremely speculative (Veal et al., 2012).

More reliable data were available for the 2006 Melbourne Commonwealth Games, which showed that the Games were not associated with an increase in adults' participation in Commonwealth Games or non-Commonwealth Games sports. However, declines in sports participation slowed in comparison to previous years and children and youth's participation in Commonwealth Games sports grew at a rate greater than for other sports between 2006 and 2009, suggesting an impact of the Games on children's participation (Veal et al., 2012).

A study of male participation in 12 Olympic sports found a significant positive effect of hosting a major sport event in Germany on sports club memberships across the country in the year the event took place and the following year. There was a greater increase for juniors than seniors, which they credited to children and adolescents being more likely than adults to be influenced to join a sports club if their friends were members. The study also suggested that the increased media coverage which occurs when such events take place on home soil also helps to explain the greater increase in junior participation, and the authors recommend that mega sports event leveraging activities should be targeted at young people as they are the ones most likely to be inspired by such an event (Weimar, Wicker & Prinz, 2015). This recommendation appears premature and requires further exploration considering no female adolescents were included in the study, and the study did not include data on sports and PA involvement outside of sports club membership.

Positive sporting legacies have been reported at Barcelona 1992, Salt Lake City, 2002 and Turin 2006, although Barcelona 1992 was the only one of the three to produce quantitative evidence of increased sport participation in the host community (Veal et al., 2012). However, the quality of the evidence is questionable and includes a small-scale study of a junior sport programme conducted in association with the Games and a study of adults which, when broken down, appeared to show an increase in PA participation for females and a decrease for males, as was replicated in Sydney (Sust, 1995; Veal et al., 2012). It is also difficult to tease out the impact of the Games from any similar impact that may have been experienced as a result of FC Barcelona winning the European Cup the same year as the city hosted the Olympics (Weed et al., 2015).

A review of systematic reviews concluded that there was little evidence that the Olympics led to increases in sports participation and no evidence that the Paralympics impacted participation (Maharatni et al., 2012). The review did not consider the Winter Olympics or adolescent participation and could only locate two systematic reviews for inclusion in its meta-review, both of which cited a paucity of credible or conclusive studies (Maharatni et al., 2012). A subsequent study of Vancouver 2010 looked at national and provincial data and concluded that the Winter Games “*had no measurable impact on objectively measured PA or the prevalence of overall sports participation among Canadian children*” (Bauman, 2014, p. 107). However, this study did not ask participants directly about the impact of the Games or consider the impact on different adolescent subpopulations or age groups.

The aim of the current study is to critically evaluate the legacy of a mega sporting event on youth aged 12-19. Data which have previously been gathered on adolescents has often not separated junior and adult participation, or has been based primarily on data provided by individuals aged 15 years and over. Previously collected data should therefore not be used to draw conclusions on the legacy of a mega event on sports and PA participation for adolescents as a whole, and speaks to the need for further studies of younger adolescents (Frawley & Cush, 2011).

A mixed methods study of the impact of the London 2012 Games showed an overall increase between 2007 and 2013 in membership of fencing and judo clubs. Quantitative data were not available by age groups but qualitative interviews showed that the increase in participants was largely among former participants who were inspired to return and among new youth members who joined following participation in Olympic sports taster programmes at school in the build-up to the Games (Pappous & Hayday, 2015). The study's authors concluded that there was a positive increase in grass-root participation in these non-traditional English sports among young people, as a result of the combination of watching elite athletes perform and of having the opportunity to try the different sports and learn about clubs at Olympic-related events (Pappous & Hayday, 2015).

Developing and implementing community-based programmes during the build up to the Games when interest and excitement were high was instrumental to the increases in fencing and judo sports club membership seen around the time of the London Olympics (Pappous & Hayday, 2015). Although it is unknown the extent to which findings on minority sports, such as fencing and judo, are generalisable in a Canadian context, the study does support the suggestion that a demonstration effect is only likely to occur if it is used as a means to leverage other supporting activities, and is unlikely to occur in isolation (Weed et al., 2015).

Despite the seemingly positive association between the Games and fencing and judo participation, the results from London 2012 are mixed. Another UK study, which surveyed Year 7 adolescents ($n = 2,727$) from 25 schools in East London six months before the Games and again six months post-Games showed a decline in participation in eight of the ten Olympic sports post-Games, and no change in two sports. Adolescents who recorded the highest levels of excitement about the Olympics pre-Games were more likely than the least excited to participate in five of the ten sports post-Games, compared to pre-Games. These youth also reported decreased time spent online, while rates of time online rose among the whole sample. The authors concluded that while a demonstration effect from a mega event was unlikely to motivate population-level increases in sports participation, there is the potential for a

sports participation legacy to occur if a variety of engagement strategies can be employed to capture the interest of a greater proportion of young people (Smith, Lewis et al., 2014). However, a limitation of Smith and colleagues' study might be the presence of a seasonal effect occurring where the students were switching from specific summer sports to winter ones not included in the Olympics.

Whilst evidence from the Olympics is often contradictory or inconclusive, other large-scale sporting events have been associated with increases in adolescent sports participation which, like the Olympics, may have been masked by adult participation data. Australian Rugby's governing body intended to use the hosting of the 2003 Rugby World Cup to increase rugby club registrations by 15%. This target was not met for adults but was exceeded for juniors. In 2004, junior rugby registrations increased across every Australian state and territory, and seven of the eight regions saw increases every year from when the World Cup hosts were announced in 2000 through to 2008. Junior rugby club registrations increased by 68% between 2000 and 2008 in traditional rugby playing states, and by 71% in regions not traditionally associated with rugby. Interestingly, over the same time period rugby league (a rival for recruiting participants and a more popular sport in the country) experienced a larger increase in participation rates (Frawley & Cush, 2011; Veal et al., 2012).

It is also important to acknowledge that no self-report data were collected about the reasons for the increase in adolescents' participation in rugby (union or league) and, therefore, it cannot be concluded that the World Cup was their inspiration, as other initiatives were going on simultaneously to the event and therefore may also be at least partially responsible for these increases. Weimar, Wicker and Prinz (2015) argue that increases in sports club memberships such as seen in Australian rugby are influenced by a combination of internal factors (through individuals being inspired to participate as a result of watching elite competition and elite athletes) and external factors such as access to a sports club, and efforts made by sports clubs to engage new participants.

Proximity to an event may be important, and is referred to as 'space' in Preuss' legacy cube (2016). Some studies—which are cited as evidence that there is no association between watching a mega sporting event and increased engagement in sport and PA—have considered the impact of these events on non-host communities or countries. For example, one study explored the impact that the 1992 Barcelona Olympic Games had on sport participation in New Zealand, and found no effect (Hindson et al., 1994).

Weed and colleagues' (2015) systematic review of the presence of a demonstration effect at mega sporting events noted one report (Faber Maunsell, 2004) which had quantitative data showing a 19% increase in sports participation among 6 to 15-year-olds in the North West following the 2002 Commonwealth Games in Manchester. However, the extent to which this is the result of demonstration effect, strategic leveraging of the Games—such as by linking the event to a series of neighbourhood-level initiatives—or other factors could not be ascertained based on the available data (Weed et al., 2015).

There was a rise in PA in all Canadian provinces and territories during the year BC hosted the 2010 Games (Montoya et al., 2013). However, data from the Canadian General Social Survey showed that any rise in PA associated with the 2010 Games was not sustained nationally as leisure time sports participation decreased among adolescents aged 15–19 from 58% to 54% following the Games. However, younger adolescents were excluded from completing the survey and it was the Eastern provinces (furthest from the Games) where the decreases occurred, while in the host province of BC overall participation rates actually rose by 1% (Canadian Heritage, 2013). Similarly, high school students in a school close to the 2012 London Games sites reported more positive attitudes towards sports participation inside and outside of school than those in a school 120 miles away (Kowe & Bowen-Jones, 2015). The current study is able to build on previous studies by including adolescents aged 12–19 in over 600 schools throughout the province.

There was a decrease in German tennis participation during the 1980s and 1990s when German players such as Boris Becker, Michael Stich and Steffi Graff were most

successful on the international tennis circuit. It has been hypothesised that this decline occurred in part because the success took place abroad (Fedesen et al., 2009). However, whilst this often-cited study clearly shows a decline in grassroots participation over the time period when Germany dominated international tennis, a less widely reported finding of the same study was that adolescent tennis club membership increased by 11.8% the year of Becker's first Wimbledon win in 1985, and continued to increase by 2.9% annually between 1986 and 1995 (Fedesen et al., 2009).

As noted earlier, there was a significant increase in sports club membership following German success in a mega sporting event among German male adolescents. However, the most significant increases occurred three years after the event, and would be missed in most studies of the impact of a mega sporting event. The study authors suggest this lag might be because children and youth take up a sport informally at first as a result of watching the event, and only later, as they become more accomplished or wish to play competitively, do they seek out sports club membership. The study also found a rise in junior sports club membership in the season after an athlete won a prestigious Sports Star of the Year award. These findings prompted the authors to make the rather sweeping claim that the study provided evidence to support continued funding of elite sport and for hosting major sporting events, because elite success and sport personalities inspire young males (Weimar et al., 2015). Whilst this claim may be a leap, it does support the need to consider the timing of when legacies may occur and for whom.

Weimar and colleagues (2015) only had data on male adolescents' sports club membership, and as noted earlier, the impact of a mega sporting event may differ by gender. For example, a study looking at the impact of Australia's qualification for the 2006 Football World Cup identified a 31% growth in football participation for males and a 29% growth for females aged 15 and over between 2003 and 2009, with the greatest growth occurring following qualification. However, records from junior clubs showed that football participation for boys actually fell by 8.3% between 2003 and 2009 but increased for girls by 51% (Frawley & Van den Hoven, 2015). Meanwhile, the increases in Australian rugby union participation seen following the country's hosting

of the Rugby World Cup was significantly higher among males than females, suggesting that this event was less influential for females (Veal et al., 2012).

Gender may not be the only factor which influences the role a mega event can play in creating a legacy of sport and PA participation. For example, an overall decline in sports participation was seen among adolescents and young adults in the UK following the awarding of the 2012 Games to London in 2005 (Mahatrani et al., 2012). Among the factors which are likely to have negatively affected sport and PA participation during this time are the 2008 UK and Canadian recessions, which were followed in 2009 by the declaration of a global recession. For example, a study of the impact of the recession on adolescent sports participation conducted in Ontario, Canada found that the recession had the highest impact on sports participation among lower SES households (Peddle, 2011).

Following the recession, data collected through the Active People Survey showed an increase in sport and PA participation three months before the 2012 London Games after two years of decreases, and overall modest increases in participation among women, upper middle-class groups and people with a disability in 2011-12 (Collins, 2013). This increase in participation around an Olympic event among individuals with a disability was also previously seen in Canada, where there was a significant growth in disability sports following the 1976 Toronto Olympiad for Disabled People, which was supported by a Federal Government legacy fund established to improve sport and recreation opportunities for people with a disability (Misener et al., 2012).

Olympic hosts have often been unsuccessful in their aims to offer sustainable opportunities for disenfranchised young people to engage in sports and PA (Reis, Sousa-Mast, & Vieira, 2013). One marginalised group who may have benefitted from the hosting of the Olympics are immigrant adolescents. For example, an unplanned legacy of the Sydney Games was that Australians born in non-English-speaking countries were more enthusiastic in their anticipation of those Games than those born either in Australia or in another English-speaking country (Waite, 2001; Waite, 2003). Additionally, immigrant youth may be more inspired to take up sport and PA after

experiencing a mega sporting event. For example, one qualitative study found Somalians living in the UK reported that seeing refugee Mo Farah winning gold at the London Olympics inspired them to also want to run for their adopted country (Mitra, 2014). Any positive legacies of the Games on adolescents who arrived in BC as refugees will be considered quantitatively in the current study.

The evidence presented in this literature review about the role of a mega sporting event in increasing sports and PA highlights the need for the current study to identify the characteristics of adolescents who reported increased PA and sports opportunities as a result of the 2010 Games (as well as those who did not report such an impact, and those who reported the Games decreased their PA and sports opportunities). Previous studies have shown that it is unclear if there was a sustained increase in adolescent PA participation as a result of Vancouver 2010, and if any observed increases could be attributed to the Games. The evidence of a correlation between other mega sporting events and increases in sport and PA participation are also generally inconclusive, absent or localised and offer little consideration of external factors which might have influenced study results (such as gender, the economic recession, and the presence of competing leisure time activities).

2.5.3. Creating legacies through infrastructure development

Mega sporting events have evolved to become high-profile, short-term international events that encourage the transformation of the urban environment, with the intention of providing long-term positive effects on host cities (Chen & Spaans, 2013). Yet few studies have considered environmental mechanisms which may be at play for adolescents as a result of a mega sporting event, such as improved access to transportation and sporting infrastructure, the proximity of sport and recreation facilities, and the role of newly built structures, such as hotels and sports stadiums, which provide employment opportunities.

Behaviour Settings Theory is the environmental mechanism of change being explored in this study. It states that an adolescent's built environment can reduce or increase

the likelihood they will engage in PA and employment, or feel connected to community. This theory has been supported by studies which have shown environmental stressors such as neighbourhood violence and crime, a lack of pavements, heavy traffic and airborne pollution can all negatively influence adolescent behaviour, whilst the presence of sports facilities, playing fields, bike lanes and safe, walkable areas can enhance community engagement and engagement in PA (Giles-Corti & Donovan, 2002; King, Stokols, Talen, Brassington, & Killingsworth, 2002; Reimers, Jekauc, Mess, Mewes, & Woll, 2012). Behaviour Settings Theory also acknowledges that regardless of the built environment, adolescents may prefer spending time in a virtual environment (online) to being outside in the physical environment (King et al., 2002).

Previous studies' lack of consideration of the role of the built environment may be because a number of hosts of mega sporting events have experienced a negative and unplanned infrastructure legacy of large, inappropriately designed and expensive to maintain stadiums (Jago, Dwyer, Lipman, van Lill, & Vorster, 2010). However, others have benefitted from new sporting venues and the impetus the events have provided to develop or renovate non-sporting infrastructure (Garbacz, et al., 2016). For example, in addition to the direct Games-related sporting infrastructure developments, other major projects planned to coincide with Vancouver 2010 included the construction of a light rail line and a convention centre, a multibillion-dollar upgrade to the highway between Vancouver and Whistler, and significant investment in walking trails (Boyle & Haggerty, 2011; Derom & Lee, 2014).

These types of non-sports related infrastructure investments can have direct public health benefit. For example, improved highway safety may reduce road crashes, and improved housing stock—as occurred in Whistler with the widening of the highway and conversion of the Olympic Village accommodation—can have health benefits. Also, the mobile medical unit created for the Games has been deployed across BC since 2010, and in London the local clinical facilities created for the Games have become part of an innovative health and well-being centre (MacAuley, 2015).

Environmental changes, which occur as a result of the investment in infrastructure, may explain the mixed results of an association between a mega sporting event and sports and PA participation (Frawley & Cush, 2011; Green, 2005). For example, the presence of infrastructure legacies such as new community sports and recreation venues left by the hosting of Sydney 2000 were thought to explain why around half of non-Olympic sports showed an increase in participation rates between 2000 and 2001, whilst two-thirds of the 23 sports included in the Games recorded a decline in participation (Veal et al., 2012).

Communities not directly hosting a mega event but which are within the same part of the country will be considered in this study as it has been suggested that infrastructure legacies can have an impact beyond the host community. For example, Potwarka (2015) compared university students' perceptions in the non-host BC community of Victoria with students in Waterloo, Ontario (a town over 4,300 km away on the opposite side of the country). Despite Victoria not benefitting directly from the sporting or non-sporting infrastructure developments associated with Vancouver 2010, Victoria students were more likely than those in Ontario to believe that the Games would offer positive tangible legacies such as infrastructure development, including increasing programmes and facilities, which in turn would make it easier for them to increase their activity levels in response to the event. However, given that most students attending university in Victoria are from other parts of the province, including a significant percentage from the host communities of Richmond, Vancouver and North Shore, future studies should ensure data about student's home community is captured to ascertain the extent of any impact on individuals from communities outside of the host communities.

Olympic bids often claim that proposed improvements in the host community's infrastructure will increase access to sport and other aspects of community life for marginalised groups, such as 'at-risk' and homeless youth, and those with a disability. Yet it appears that those who are positively impacted by a mega sporting event tend to be the more privileged and those already involved in sports, and there is little to no

positive impact on marginalised populations (Girginov, 2011; Minneart, 2012). For example, the 2016 Rio Olympic Games aimed to increase PA and sports infrastructure in marginalised and high-crime communities close to the host sites. However, the sports programmes and infrastructure included in the 2007 Olympic bid did not materialise and two established national sports programmes which provided 'at-risk' youth with an alternative to violence and crime were terminated in the build up to the Games, and could be defined as negative legacies (Reis et al., 2013).

Similarly, 20 impoverished African communities were promised new 'Centres for Hope' which combined football, health and education facilities to coincide with the 2010 Football World Cup, yet several months after the tournament ended only four of the centres had been completed and the remainder were indefinitely delayed (Cornelissen, 2011). In BC, an Amateur Sport Legacy Fund was established to be funded through a percentage of the profits of the 2010 Winter Games. However, the event did not make a profit and the fund was cancelled (Leopkey & Parent, 2015).

Any mega sporting event aiming to leave a legacy of increased adolescents' PA and sports engagement needs to invest in both the physical and social environment to achieve sustainable effects (Reimers, Jekauc, Mess, Mewes, & Woll, 2012). However, simply building a new venue will not mean that young people and particularly disadvantaged groups will increase their sports and PA participation, as they need to be able to get to it, afford and want to participate in what is on offer, and feel welcome and included (Giles-Corti & Donovan, 2002; Skinner et al., 2008). It is necessary to create a physical environment which is safe, attractive, comfortable, accessible and convenient, and which can foster individual and social factors (Giles-Corti & Donovan, 2002). For example, it may be necessary to create opportunities to engage in event-related community activities including opportunities to try free informal sports and PA activities and visit sporting venues in the build up to the hosting of a mega event, particularly among those who have not previously contemplated participation (Weed et al., 2009).

Finally, it may be possible to leverage infrastructure developments to create intangible legacies. Venues, monuments and sculptures constructed for the event (such as Vancouver's Olympic flame) can positively impact community connectedness if they have architectural value and become tourism landmarks. These landmarks can offer a sense of enjoyment and pride among local residents and can be enjoyed at no cost and without any rivalling effects (Alm, Solberg, Storm & Jakobsen, 2016). This may be particularly important for adolescents, as these landmarks can provide low barrier places to socialise and connect.

2.5.4 Creating a legacy of community connectedness

The major intangible potential outcome of the 2010 Games being explored in this study is community connectedness. Mega sporting events seek to increase a sense of community connectedness, believing this can foster social values and create a sense of celebration and togetherness (Chalip, 2006). However, Social Control Theory states that if adolescents connect to a community, they will model the behaviour and beliefs of those with whom they connect regardless of whether those community norms are prosocial or antisocial (Popp & Peguero, 2012; Thompson, Smith-DiJulio, & Matthews, 1982). This study therefore considers community connectedness as a potential positive or negative legacy of a mega sporting event.

Adolescents' sense of community connectedness has been shown to be influenced by the quality of the exchanges they have with adults, the availability of outlets for creative engagement, awareness of opportunities for meaningful input, sense of safety, feeling welcome in public spaces, having knowledge of community events, and an awareness of young people's ability to impact community policies. Positive relationships with at least one parent, a young person's grade level, group involvement, and ethnicity are also believed to contribute to community connectedness (Whitlock, 2007).

Reflecting the vision of Baron Pierre de Coubertin, IOC Rule 44 states that a programme of cultural events must accompany the Olympic Games and provide

opportunities for those attending to develop positive relationships and an increased understanding of different cultures (McGillivray & McPherson, 2012). Indicators measuring community connectedness are prescribed within the OGI evaluation framework. Creating a sense of community pride, reducing social isolation and improving community infrastructure are often touted as some of the most beneficial legacies of mega sporting events (Cornelissen, 2011; Ritchie, et al., 2009). Despite these potential benefits, the focus of most Games is on the economic benefits of the event rather than on the culture and sense of community that is created or celebrated (Weed, 2007).

The construct of community connectedness is often intangible and difficult to define, and the heightened sense of ‘communitas’ generated by mega sporting events can be difficult to quantify and analyse (Cornelissen, 2011). Additionally, the sense of community connectedness that may be created amongst sub groups, such as those campaigning against the hosting of the Games in their community, are typically considered outside the scope of mega event related evaluations (VanWynsberghe, 2015). For these reasons, many evaluations of mega events have failed to consider such impacts (Ritchie et al., 2009).

Despite the measurement challenges, there is evidence to suggest that mega sporting events can create positive social impacts such as increased national, community and cultural pride; the development of a collective identity; a sense of trust, reciprocity, hope and acceptance of diversity; and an intangible ‘feel good factor’ among those in the host community or country (Chalip, 2006; Hiller & Warner, 2015; Kavetsos & Szymanski, 2010; McGillivray & McPherson, 2012; Murphy & Bauman, 2005; Preuss, 2007; Veitch, 2013). A review of systematic reviews suggests that the sense of community created by the Games temporarily increases community engagement but it is not sustained (Mahtani et al., 2012).

Chalip (2006) theorised that there are elements of the Olympics which mark it as unique from other events in its potential for leveraging, which include the sense of solidarity created in the host community that accompanies the knowledge among

residents that this is a once-in-a-lifetime event. The Games differ from other mega sporting events in that there is greater interaction between different visiting supporters, and among residents from different backgrounds and life circumstances, than would be seen at events like the FIFA World Cup where fans are typically segregated (Kennelly & Watt, 2012).

During the Games, the sport becomes secondary to the heightened sense of community, camaraderie and celebration that occurs, and this, in turn, can offer a distraction from economic and social problems, which it is not possible to achieve under regular circumstances (Chalip, 2006; Hiller & Warner, 2015).

This unique sense of community can be intentionally leveraged in combination with economic resources to achieve public policy objectives and social benefits (Balduck, et al., 2006; Smith, 2009; VanWynsberghe, 2015). However, if no additional leveraging efforts are developed, the enhanced sense of community will be short lived. For example, a qualitative study of local sports clubs in Vancouver noted that the 2010 Games were associated with a temporary intangible sense of community and positive relationships among participants in sports featured in the Games, but the clubs were not able to harness this sense of community into tangible benefits, such as increased participation or volunteerism (Ogilve, 2012).

The potential of a mega sporting event to achieve positive intangible outcomes—such as to improve social interaction, develop community cohesion, increase cultural and social understanding, and improve community pride—appears to be particularly important at present, as both adults and adolescents are reporting increased social isolation (Bell, 2007). The health impacts of isolation and loneliness among adolescents is only beginning to be understood but is associated with a number of health and well-being challenges in adulthood and has been widely documented to reduce life expectancy (Holt-Lunstad, Smith, Baker, Harris, & Stephenson 2015).

It is theorised that a deliberate strategy to foster social interaction could be developed by creating event-related social events, facilitating informal social opportunities,

producing ancillary events, and ensuring there is widespread theming. The resulting sense of connectedness developed through these approaches could be leveraged to build social capital and empower communities to address social issues in the longer term (Chalip, 2006).

Positive mood shifts seen in Vancouver (2010) and London (2012) during the Games were felt to be enhanced by the sense of happiness or celebration at the success of local athletes. However, similar positive mood shifts were also seen at the 1988 Calgary Olympics where Canadian athletes did not fare well, but which provided many opportunities for people to come together for free cultural and community events. These opportunities and the resultant positive emotional response they elicited are credited with leading people to view the Games more favourably (Clark, 2012; Hiller & Warner, 2015). In Vancouver as the 2010 Games progressed, local residents who were initially hostile to the hosting of the event reported becoming increasingly engaged and more likely to report a positive impact of the Games, which they credited to their ability to participate in free cultural and community events. Some of the residents who were most positive about the hosting of the Games included full-time students and households with adolescents (Hiller & Warner, 2015). However, the impact on younger adolescents was not measured.

It is believed that the sense of connectedness created by a mega sporting event does not necessarily require physical attendance at the event to be successful but can be experienced by viewing events on television (Balduck et al., 2011; Bull & Lovell, 2014; Hiller & Warner, 2015; Kavetsos & Szymanski, 2010; Weed, 2006). The 2010 South Africa World Cup intended to capitalise on this enhanced sense of community to increase unity and youth engagement across the African continent, which was partly based on the success of the 1995 South Africa Rugby World Cup in creating a temporary sense of national reconciliation (Cornelissen, 2011).

It appears that the sense of community connectedness generated by a mega sporting event can override the negatives associated with costs and disruptions, and also raise spirits in economically difficult times (Clark, 2012). For example, Beijing residents rated

the sense of national pride they experienced from hosting the 2008 Olympics as its most important impact (Gursoy, et al., 2011). Also, event-related community connectedness, pride and self-esteem were associated with a higher tolerance of event-related costs for the 2002 Winter Olympic Games in Salt Lake City, among residents (Gursoy & Kendall, 2006). Following the 2002 FIFA World Cup in Japan and South Korea, perceptions of cultural and social benefits increased while perception of material benefits decreased (Kim, Gursoy & Lee, 2006). Additionally, a study which used adult self-report data from 12 European countries found that hosting major football events (FIFA World Cup or UEFA Championship) created a feel-good factor nationally which was sustained for two months after the event for all gender and age groups. No such impact was present for the Olympics (Kavetsos & Szymanski, 2010). However, this study used pooled life-satisfaction cross-sectional data, and therefore other factors may have been responsible for the recorded increases in happiness levels.

The sense of community created by an event may be greater among adolescents and young adults than among older adults (Ritchie, et al., 2009). Young adults are more likely to perceive positive social impacts of mega sporting events than older residents, even if they do not live close to the sites (Ritchie et al., 2009). A study of British adolescents found that watching British sports success on TV created a sense of community at the local level with peers at school, and a sense of a national 'coming together' through conversations they overheard and media coverage, which was stronger for males than females (Lines, 2000).

Among disadvantaged young people, the relation between a mega event and community connectedness is complex. Ideally such an event could be leveraged to improve social interactions and belonging and reduce isolation and disadvantage, and there is some evidence that this can occur (Chalip, 2006; Gibson et al, 2014; Veitch, 2013). Following the 2010 World Cup, disadvantaged young male and female residents in five South African cities reported an increased sense of community, connection and pride eight months after the event, which was not present three months before the event or among older or more advantaged residents (Gibson, et al., 2014). Similarly,

adolescents living in deprived neighbourhoods near the 2010 London Olympic venues reported increased community pride, community engagement, social inclusion and community cohesion, although these youth were unsure of how some of these feelings could be sustained when the focus on the area decreased (Thompson et al., 2015).

Other studies have found a lack of evidence that creating a sense of community around a mega sporting event does anything to reduce disparities, and in fact might further marginalise the vulnerable and disenfranchised and reinforce their exclusion from society (Kennelly & Watt, 2012; Pringle, 2001). Rather than creating intangible benefits, it may actually cause 'intangible injuries' to homeless youth and other marginalised populations. These intangible injuries included a sense of worthlessness and disconnection from community (Kennelly, 2017). Studies of homeless or unstably housed adolescents living near the Vancouver 2010 and London 2012 Olympic sites reported feeling excluded and disconnected from their community as a result of the Games (Kennelly & Watt, 2012; Kennelly, 2017). Another study noted that whilst inner city London adolescents generally enjoyed the improvements in their community during the 2012 Games, they were aware that the improvements were temporary and were not aimed at them (Thompson et al., 2015).

These contrasting findings suggest more studies are needed with an extended time frame such as the current study, which consider how the sense of community generated among some young people by the Games can be sustained and harnessed to accomplish long-term social goals, including reducing disparities for the more disadvantaged (Gibson et al., 2014). It also appears that without a concerted effort, the hosting of a mega event can lead to unplanned negative legacies such as citizen disengagement and can reduce the sense of connection individuals feel towards their local community, especially when there is an authoritarian approach to developing community infrastructure, and the most vulnerable and disenfranchised in society are excluded from engagement activities (Ermolaeva, 2014).

This study aims to identify any changes in community connectedness among adolescents (including more vulnerable populations), which could be associated with

living in a host community, and if findings are different for residents in non-host communities. The study will also discuss the implication of any relevant findings for policy makers seeking to attract major sporting events to BC, and for future mega sporting event evaluations.

2.5.5 Creating an employment legacy

Factors which influence community connectedness and adolescent employment may be beyond a single theoretical explanation. For example, engagement in adolescent employment is explained by developmental, life course, sociological and psychological theoretical frameworks (Zimmer-Gembeck & Mortimer, 2006). Adolescent employment is also influenced by factors as diverse as family, peers, education, culture and social settings (Zimmer-Gembeck & Mortimer, 2006).

As in this study, one theory that is commonly applied to adolescent employment is Social Control Theory which states that employment provides adolescents with opportunities to interact with healthy peers and positive adult role models, and can provide opportunities to see tangible and intangible rewards of prosocial and conforming behaviours. Employment can also offer an adaptive way for adolescents with challenges at school or in the family home to disengage from these institutions and create new bonds with another prosocial institution (Thompson et al, 1982).

Prejudice among employers against hiring adolescents and particularly those with additional barriers to employment—such as a disability, no permanent address, or a criminal record—can increase the risk that young people will be unemployed into early adulthood (Nesdale & Pinter, 2000). Like many other mega sporting events, it was believed that the 2010 Games would alleviate some of this for young people in BC, as the Games were associated with substantial capital investment, which can create short-term construction jobs and business opportunities in the build up to the Games and longer-term ones in tourism and the maintenance and development of infrastructure legacies, such as new venues (Davies, 2012; Gratton & Preuss, 2008; Kavetsos, & Szymanski, 2010; Misener et al., 2013).

Adolescents may particularly benefit from any such employment legacies as youth employment opportunities tend to be in service industry jobs, such as retail and food service (Hansen & Jarvis, 2000; Kingston & Rose, 2015). For example, the building of the Richmond Oval for the 2010 Games may have increased employment opportunities for adolescents, as jobs created within sports facilities are often part-time, casual, low skilled, and low waged. Therefore, although the lasting impact of a new sports venue is unlikely to make a significant contribution to local employment it may have specifically improved job opportunities for adolescents (Kavetsos & Szymanski, 2010). However, there is little evidence that the Games have any lasting effect on employment in host communities (Horne, 2007; McCartney, et al., 2010; Minneart, 2012; Tomlinson, 2014).

Short-term employment opportunities that are created usually benefit skilled workers and out of town contractors and not locals with employment challenges (Minneart, 2012). Additionally, while the Olympics in Seoul and Atlanta were reported to create positive short-term employment opportunities in the host cities, the findings have been less conclusive for other mega sporting events (Hagn & Maennig, 2008). There is also little evidence that the hosting of the Paralympics translates into a legacy of increased employment opportunities and improved conditions for disabled workers in host cities, despite expectations that these improvements will occur as a result of increased understanding and awareness of hiring individuals with a disability and the development of accessible and inclusive infrastructures (Misener et al., 2013).

In the build up to London 2012, there was a pre-Games content analysis of 131 local newspaper articles, which referenced potential increases in employment opportunities for adolescents in Newham (an inner-city London Borough near the Olympic venues). The authors of the study noted that through the development of a new shopping complex, new fast food restaurants, and a hotel, all of which would not have been built without the Games, over 10,000 new jobs were created. However, it was unclear how many of the new positions were filled by local adolescents, and youth unemployment in the area remained the highest in London (Selvanayagam, Thompson, Taylor, Cummins & Bourke, 2012).

For Vancouver 2010, formal legal agreements were developed between host cities and private developers to secure jobs, job training, and on-the-job support for inner-city and First Nations residents. This was heralded as the kind of agreement that could be used as a precedent for future large-scale development (Edelson, 2011). However, VANOC considered the major unemployment issues in low-income neighbourhoods too complex to tackle and the agreements were developed without input from employment experts or the development of adequate outcomes measures (Ogilve, 2012). This led VanWynsberghe and colleagues (2012) to conclude that the emphasis placed on job creation in Olympic bids is a misguided attempt to reduce the negative impacts of the Games by assuming that employment will address the other social issues associated with the Games such as affordable housing and homelessness, but with little thought for how this may occur or how to engage disenfranchised groups.

To date there appears to be little evidence to suggest that an event like the 2010 Games can create long term employment opportunities and it appears that adolescents may often be excluded from short-term opportunities which do arise. The current study will enhance our understanding of the relationship between a mega sporting event and adolescents' employment by including BC adolescents' perception of the events impact on their job opportunities. The study will also address the specific objectives of increasing knowledge about which adolescent may benefit or not benefit from employment associated with the Games, and provide a discussion of the implication of these findings.

2.5.6 Missing out on positive legacies

Mega sporting events disproportionately negatively affect the most vulnerable members of host communities, and generally fail to consider the situation of children and adolescents as stakeholders in event processes (Dowse et al., 2018). Despite this, mega sporting events continue to be heralded as an opportunity to engage disenfranchised young people and to remove barriers to social inclusion (Girginov, 2011; Preuss, 2015). For example, it is widely believed that events like the Paralympics cannot only influence employment as noted above, but can also leave more general

intangible legacies such as more positive perceptions of people with disabilities, and tangible legacies of accessible infrastructure facilities and equipment, which in turn can remove barriers to participating in PA and other aspects of community life (Kaplanidou & Karaakis, 2010; Misener et al., 2013; Misener, McGillivray, McPherson, & Legg, 2015).

It has been suggested that watching elite athletes with disabilities perform at the Paralympics may lead people without disabilities to have unrealistic attitudes about those with disabilities, which can create an unplanned barrier to participation for adolescents with a disability (Darcy, 2003). Additionally, Scott (2014) noted that an evaluation of the impact of the 2012 London Olympics reported that despite an inspirational Paralympics, for 89% of accessible sports clubs there was no increase in membership—a finding which was attributed to a lack of government funding, but which also suggests that more needs to be done to leverage the inspirational component of the Games.

Potential negative consequences of hosting a mega sporting event are generally ignored, especially by host organisations. Moreover, the impact of mega sporting events on marginalised and disadvantaged groups has not been widely studied (Leopkey & Parent, 2012; Minneart, 2012). For example, the IOC's proclamation that the 2000 Sydney Olympics had encouraged disadvantaged Australian adolescents to 'take a greater interest' in sports participation have not been quantified or assessed in a systematic manner (Misener et al., 2013; Veal et al., 2012).

The studies conducted to date have identified few if any tangible or intangible benefits from either the Summer or Winter Olympics for vulnerable populations living in host countries or host communities, and suggest these groups may actually experience negative legacies (Adams & Piekarz, 2015; Jago et al., 2010; Tomlinson, 2014). These negative legacies can include increased hostility from other local residents and the police, higher living costs, and increased social polarisation (Gursoy et al., 2011; Horne, 2007; Jago, Dwyer, Lipman, van Lill, & Vorster, 2010; Kennelly, 2015; Minneart, 2012; Smith, 2014; Ziakas, 2015).

This study is considering negative as well as positive legacies of the 2010 Games and this is particularly important as the Olympics has a long history of elitism, exclusion, oppressive colonial practices, and gender and heteronormative stereotyping. These practices have resulted in many who could potentially have benefitted from increased access to healthy activities and legacy venues to have missed out (Smith, 2014; Thorpe & Wheaton, 2011; Ziakas, 2015). Additionally, such events have traditionally been linked to increasing homelessness in host communities as low-cost rental housing is reduced, tenants are evicted, and house prices rise (Edelson, 2011; Horne, 2007).

Housing stock which is purpose-built for the Olympics rarely improves the provision of low-income housing (Horne, 2007; Minneart, 2012; Pentifallo & VanWynsberghe, 2015). Additionally, the Atlanta, Seoul, and Beijing Olympics and South Africa FIFA World Cup were all associated with forcible rehousing or evictions. Also, in Sydney, house prices in the previously low-income neighbourhood near the Olympic Park increased beyond the reach of low-income residents (Adams & Piekartz, 2015; Horne, 2007; Jago et al., 2010). Such legacies can serve to make already vulnerable groups more vulnerable and encroach on civic rights (Cornelissen, 2011).

Dowse and colleagues (2018) state that the housing dimension of mega event hosting projects are a core area of risk and opportunity for children and adolescents, yet these are rarely a consideration. It is believed that Sydney 2000 is one of the only Summer or Winter Olympics to have recorded a lasting positive legacy for marginalised groups, as the city implemented a protocol to protect homeless adolescents from being moved along during the Games, which has continued to offer them lasting protection (Minneart, 2012). The 2014 Glasgow Commonwealth Games is also cited as an example of an event that recorded some improvements from which vulnerable children and young people benefitted, as the hosting of the event bolstered the city's regeneration activities by facilitating affordable housing. In contrast, the Brazil FIFA World Cup has been named as an event that led to children being re-located to poorly built, over-crowded housing with increased risk of malnutrition and other poor health outcomes (Dowse et al., 2018).

Although mega sporting events seek to build community connectedness, community displacement can occur for marginalised adolescents through both physical relocation and ‘gentrification.’ However, little is known about who is most affected, how many young people are impacted or what effect this has on adolescent development, and if this differs from the experience of displaced adults (Dowse et al., 2018).

Research that has considered legacies has tended to focus on the Olympics and ignore the Paralympics (Misener et al., 2013). From the limited data available from the Vancouver and Sydney Paralympics, it appeared that both events were associated with some increases in positive attitudes towards people with disabilities, but were not associated with environmental changes such as increased access to sports and recreational activities (Darcy, 2003; VanWynsberghe, 2013). Additionally, the lack of integration between the Olympic Games and Paralympics can reinforce negative stereotypes of people with a disability as ‘different’ (Misener et al., 2013; Veal et al., 2012). It therefore appears that mega sporting events can be leveraged to create remedial changes but are less effective in changing societal structures (Cornelissen, 2011).

In the build up to the 2010 Games, VANOC made 37 promises that the organisation and its partners would maximise opportunities and reduce potential negative impacts on Vancouver’s inner-city neighbourhoods, and would work in partnership with local community groups. However, few resources were allocated to this work and it proved hard to engage communities in a meaningful way. There was little evidence that the initiative led to any improvements in community capacity (VanWynsberghe, Kwan & Van Luijk, 2011). Additionally, the 2010 Games OGI evaluation intended to measure the impact of the Games on four indicators relating to accessibility for people with disabilities—employability of people with disabilities, perceptions about people with disabilities in society, professional sports education for people with disabilities, and accessibility of public services—yet included no pre-Games data for any of these measures (VanWynsberghe, 2015).

In sum, the findings to date on the impact of a mega sporting event on marginalised young people have been scarce and inconclusive. The current study will address this gap by using Vancouver as a case study to examine marginalized adolescents' self-report data on the positive and negative legacies of the 2010 Olympic and Paralympic Games. The study will also consider potential unplanned legacies such as reduced access to housing, employment and services.

2.5.7 Presence of an epicentre effect

Proximity and access to opportunities to engage in sport and PA are correlated with sport participation and PA, and it is therefore assumed that geographical proximity to a mega-sport event is likely to influence its effects (Potwarka, 2015; Potwarka & McCarville, 2010; Waitt, 2003). However, the extent of that proximity has not been clearly established in the literature and has included local neighbourhoods (e.g., Smit, Lewis et al., 2014), host cities (e.g., Cashman 2006), host regions (e.g., Faber Maunsell, 2004 in Weed et al, 2015), and host countries (e.g., Veal, 2012). To clarify the spatial legacy of the impact of the 2010 Games, this study will consider the presence of an 'epicentre effect', assuming that potential impacts would be greatest in the host communities of North Shore, Richmond, and Vancouver, in comparison to other non-host BC communities.

An epicentre effect has previously been recorded for sports participation and PA following a mega event, and is believed to be caused by inter-connected factors such as improved local infrastructure, sports promotion and ease of access to activities and events, and/or as a result of opportunities to engage in activities in the same spaces as Olympians and medal winners (Potwarka & Leatherdale, 2015). It has also been suggested that the cause of this 'epicentre effect' is from witnessing athletes succeed at close quarters and being inspired to participate (Potwarka & Leatherdale, 2015).

Where studies have registered a positive legacy of a mega sporting event on PA levels it has been within Olympic cities which have reported improvements in access to sport and/or recreation infrastructure post-event. For example, in Australia, the closer

residents lived to the Sydney 2000 venue, the more likely they were to report being motivated to increase their PA in response to that event and to report positively on their view of the Games (Waitt, 2003). Similarly, in comparison to those living in communities further away, Australians living near the Games sites were more likely to report intangible benefits such as positive intentions to engage in PA in the year before the Games, as well as afterwards (Bauman et al., 2003). However, it is unknown if this intention resulted in actual PA increases.

Potwarka and Leatherdale (2015) studied leisure-time PA rates before the 2010 Winter Olympics (2007–2008), the year the event was staged (2009–2010), and post-event (2011–2012) nationally and provincially, including in the epicentre communities of Richmond, Vancouver and North Shore. As seen with other studies, the proportion of adolescents in Canada classified as moderately active/active during leisure time did not increase significantly across the time points. Analysis at the community level also indicated no significant increase in the proportion of male adolescents classified as moderately active/active during leisure time in the host (North Shore, Richmond, and Vancouver) and non-host BC communities (Victoria). However, the percentage of females in Richmond classified as moderately active/active during leisure time increased from 2007–2008 to 2011–2012 (Potwarka & Leatherdale, 2015).

That these PA increases were sustained for at least two years following the Games is counter to previous research, which has suggested that any increased activity levels are usually not sustained post-event (Potwarka & Leatherdale, 2015). These findings may be driven by the record number of Canadian female athletes who won medals at the Richmond Oval, reflecting previous research around the demonstration effect which has suggested that individuals are most likely to be inspired by the outstanding performances of others, when the athletes are demographically similar and their achievements appear attainable (Lockwood & Kunda, 1999; Potwarka & Leatherdale, 2015). A need for local relevance has been suggested as necessary for a demonstration effect to occur (e.g., Weed et al., 2015).

As these findings appear to show the presence of an epicentre effect for females at the local population level in one host community, further research into the spatial and gender differences in BC is warranted. One reason put forward for the importance of further research on the topic is that males generally have higher PA participation rates than females, and other studies have found some mega-sporting events are more likely to influence adult men than women or have no effect on adult PA participation (Bauman et al., 2003; Montoya et al., 2013; Potwarka & Leatherdale, 2015, Weed et al, 2009). Potwarka and Leatherdale (2015) also suggest future studies should compare the impact of witnessing elite sport success combined with infrastructure developments and changes to the built environment, in contrast to exclusively having the opportunity to witness a mega event for different subpopulations living in host regions.

2.6 Addressing gaps in the literature

This literature review has considered the evidence of how a mega sporting event might support healthy adolescent development, including increasing access to employment opportunities, engagement in sports and PA, and connection to community. It has found little that would conclusively show a link between hosting such an event and these outcomes, but does appear to show some initial support for the presence of an epicentre effect and evidence that marginalised adolescents could be at risk of further marginalisation by such global events.

It is important to address the lack of attention paid to leveraging mega sporting events to improve public health outcomes and support healthy adolescent development. The IOC, IPC, host governments, host populations, and prospective hosts all seek to understand the potential return-on-investment of such expensive short-term events, and their ability to generate sustainable long-term benefits (Leopkey & Parent, 2012; Misener et al., 2013). Evaluating the potential positive and negative, planned and unplanned, tangible and intangible legacies of a mega sporting event can systematically assess the effectiveness of such events in reaching some of their targets of population-level impacts. It can also improve the planning, implementation, and

effectiveness of future events and enhance our knowledge of how to address social problems and improve quality of life (Chen, 2015).

Like many cities that bid to host a mega sporting event, Vancouver's 2010 Winter Olympic and Paralympic bid specifically referenced the event's ability to increase opportunities for disadvantaged groups (Smith, 2014). However, successive OGI evaluations and independent studies have struggled to identify if and where sustainability goals have been achieved in relation to minimising the events' negative social impacts and maximising the positive ones for vulnerable populations. Typically, the emphasis of evaluation studies has been on the more easily quantifiable economic and environmental impacts of the Games rather than on intangible benefits such as the potential social outcomes for the population as a whole or for subpopulations (VanWynsberghe, 2015).

The current study seeks to begin to address the gap in knowledge of the environmental, social and psychological mechanisms through which a mega sporting event can be leveraged to create a legacy of healthy adolescent development and considers the operationalisation of those mechanisms of change (infrastructure development, a demonstration effect from watching elite athletes perform, and opportunities to connect with likeminded individuals), using the 2010 Winter Olympics and Paralympics as a case study. It considers outcomes in the areas of sport and PA, employment, and community connectedness. It looks in detail at three specific populations of young people who have been identified as at-risk of missing out on positive legacies of a mega sporting event and of experiencing negative legacies (adolescents with a physical disability, those at increased risk of incarceration and those who are homeless). It also seeks to address the criticism of the OGI's spatial reach by including data from host and non-host communities. The OGI's lack of inclusion of self-report and qualitative data is also addressed through analysis of adolescent quantitative and qualitative survey responses and qualitative stakeholder interviews.

This study includes data from homeless youth collected four years after the Games, and stakeholder reflections collected eight and nine years after the event, which goes some way to addressing concerns that the OGI evaluation framework is of insufficient length to accurately capture any sustainable impacts (Mangan, 2008). Another concern addressed by this study is the lack of previous consideration of the role of the Paralympics, and particularly its impact in the build up to the Games. To date, London 2012 was the only Games to collect data about the legacy impact of the Paralympics pre-event, whereas the few other studies conducted on Paralympic legacies were all post-hoc studies (Misener, et al., 2013).

Most previous independent Olympic studies have focused on the Summer Olympics, and there have been few studies which have considered the intangible social legacies of a mega sporting event (Misener et al., 2013). Prior to the current study, there also appear to have been no studies which have addressed the role of such an event in relation to healthy adolescent development, or its effects on subpopulations of adolescents at risk of not experiencing positive development.

The study is timely because the IOC's 'Olympic Agenda 2020' developed four years after Vancouver 2010 is intended to provide a strategic blueprint for the future of the Olympic Movement. The document states that the IOC is placing a focus on monitoring legacy and sustainability post-Games, but pays little attention to how this will be evaluated. In fact, there are only two references to evaluation in the Agenda's 40 recommendations. Recommendation 24 is a specific recommendation to "Evaluate the Sports for Hope program" with a goal of the programme becoming self-funding and ceasing reliance on IOC investment, and Recommendation 27 is to "comply with basic principles of good governance" which recommends self-evaluation by organisations involved in the Olympics in respect to their governance (International Olympic Committee, 2014). Independent studies therefore remain critical if we are to increase our understanding of the Games' potential legacies.

Criticisms of the current OGI evaluation framework often suggest that the impact of a mega sporting event is too complex to measure, and that attributing causality is often

speculative (VanWynsberghe, 2015). This study is unique in that it captures adolescents' self-perception of the legacies of the Games rather than simply assuming causation. The lack of qualitative data included in the OGI evaluation is also criticised as a gap, and its inclusion would enrich and help to explain the quantitative findings. Similarly, the lack of data about regional comparisons between host and non-host communities within a host country is a significant gap in evaluation studies to date, and such data could add considerable value to the mega event literature (Potwarka & Lauderdale, 2015; VanWynsberghe, 2015).

Potwarka and Lauderdale (2015) argue that the general lack of evidence of sustainable impacts of mega sporting events is a result of inappropriate use of population level data. They suggest that a more robust evaluation of such an event, particularly in the area of PA and sport involvement, would involve analysis at the jurisdictional level to determine an epicentre effect, and should delineate by gender and other sociodemographic characteristics. As a result of their unique findings of a gendered, localized demonstration effect, they advocate strongly for the need for studies such as this one, which explore the presence of such an effect. Additionally, comparisons between geographical areas in the current study will add strength to the interpretation of causal connections (Wellings, Datta, Wilkinson & Petticrew, 2011).

In addition to these gaps, a number of other specific gaps in the literature have been identified which the current study will seek to address, and are summarised in Table 2.1. By beginning to address these gaps in our knowledge, and further our understanding of which adolescents might experience positive or negative outcomes of a mega sporting event, the current study can enhance the evidence base which already exists, and allow other researchers to build on the findings.

Table 2.1

Addressing Gaps in Knowledge of the Impact of Mega Sporting Events on Adolescents

What is known	Gaps in knowledge addressed by current study
✓ There is a paucity of credible or conclusive studies about the legacies of mega sporting events, and specifically for adolescents.	○ Population-level survey data which ask directly about the Games' influence on sports and PA participation.
✓ The link between adolescent behaviour and watching a mega sporting event is not well understood, but there is some evidence adolescents may be more likely to be impacted than adults.	○ Impact of a mega sporting event beyond organised sports participation, including informal sports, extreme sports and exercise classes. ○ Adolescents' (and specifically those under the age of 15) self-reported perceptions of the Games' impact, collected pre and post the event.
✓ There is a need for more studies of adolescents because it is a key development stage when life-long health behaviours can be established, including engagement in sports and PA.	○ The extent and proximity of an epicentre effect for adolescents, and the impact of that event in host and non-host communities.
✓ Vancouver 2010 occurred at a time when adolescents' engagement in sport was declining.	○ Whether a Winter Olympics can produce a demonstration effect, through what mechanism and how long any effect may last.
✓ It is challenging to measure legacies.	○ Gender differences in the impact of a mega sporting event for adolescents.
✓ Positive legacies generally do not spontaneously occur but need to be leveraged.	○ Engagement of adolescents with a disability in sport, PA, employment and community, and how a mega sporting event can impact these.
✓ Few if any benefits have occurred from a mega sporting event for vulnerable populations.	○ The role that increased availability of sports facilities may play in increasing PA participation, particularly for marginalised adolescents. ○ Whether engagement in sports, employment and community should always be viewed as a positive outcome for adolescents. ○ Negative legacies a mega sporting event can have for adolescents in host and non-host communities.

2.7 Research questions

This study seeks to identify and critically evaluate the characteristics of adolescents who report positive and negative, tangible and intangible, planned and unplanned impacts of the 2010 Games, and establish the time and space in which any legacies occurred. These objectives are explored through the following research questions:

1. To what extent was the 2010 Winter Olympics associated with planned, positive, tangible benefits for different subpopulations of adolescents in BC, either during the pregnancy period or after the Games?
2. Were there intangible benefits of a positive perception of the Games, such as increased community connectedness?
3. To what extent and in what time and space did adolescents report negative unplanned legacies of the Games, such as decreased access to housing, employment or services?
 - a) Was reporting a negative legacy of the Games associated with other tangible or intangible experiences?
4. Was there a spatial impact of the Games (i.e., was the impact of the Games different in host communities, in comparison to non-host BC communities)?
5. Were there sustained changes over time in BC sports club membership for any of the sports which were featured in the 2010 Winter Olympic and Paralympic Games?
6. What are the implications of the findings for leveraging future mega events to support healthy adolescent development?

3. METHODOLOGY

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Chapter One laid out the context, introduced the study, and detailed the theoretical framework (programme theory). Chapter Two discussed the current state of our knowledge and gaps in that knowledge, including our ability to apply Preuss' legacy cube to determine to what extent a mega sporting event could improve quality of life for particular stakeholder groups (Preuss, 2016). This chapter responds to Dowse and colleagues' (2018) call for a methodology which can increase our knowledge of the consequences of a mega sporting event on children and adolescents, and which can start to fill the gaps in the literature in terms of the risks and opportunities associated with such an event. The chapter provides details of this study's methodology. It

outlines the overarching philosophical approach being taken, lays out the research design, quantitative and qualitative methods, data sources (including a discussion of the reliability and validity of these sources), ethics process and limitations.

Figure 3.1 summarises the philosophical framework which underpinned this research, the theoretical framework applied, and the specific methods which were employed.

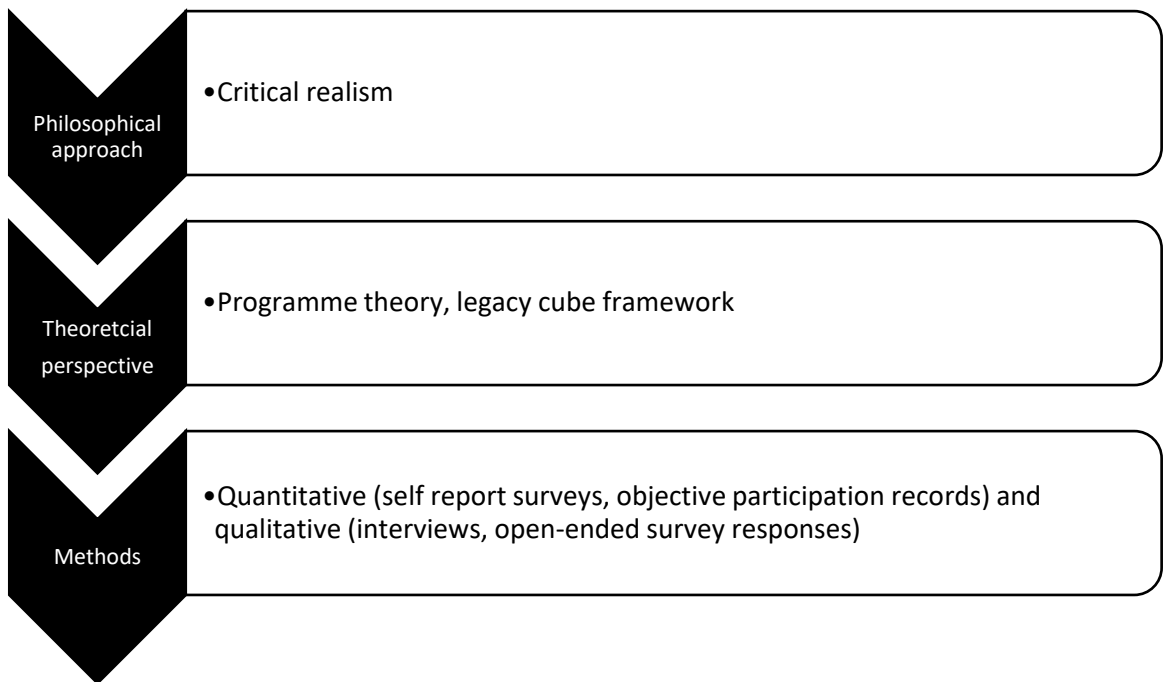


Figure 3.1. Overview of methodological approach to this study

Any study of a mega event legacy needs to explore the presence of multiple simultaneous causal mechanisms, consider underlying mechanisms which might be operating and explore alternative ways of achieving intended outcomes explored. Pawson and Tilley (1996) also argue than an evaluation such as this one requires not just a strong theoretical framework but a balance of theory and method, quality and quantity, and ambition and realism. Achieving this balance requires a philosophical approach which does not stray beyond what is appropriate or realistic, and for this reason a critical realist philosophical perspective is applied.

3.1 Philosophical approach

It is important for a study such as this one to clearly articulate its epistemological (theory of knowledge) and ontological (theory of being) assumptions because these philosophical perspectives shape the way the study is conducted, demonstrate the methodological coherence and explain how the emerging knowledge is generated. Additionally, Bhaskar (1978) argued that by conducting a study within a clear philosophical ontology we avoid being confined in our questions about knowledge, and move beyond the knowledge of the world produced by science.

The current study assumes a critical realist ontology linked to an interpretivist epistemology (as defined by McEvoy & Richards, 2003; Weed, 2009).

It goes beyond positivism's focus on using quantitative data to observe and describe cause and effect objectively, to also consider qualitative data and acknowledge the role of subjective reality and the value of interpretation (Henderson, 2011). Any attempt to define the reality of the impact of the 2010 Games is based on probability rather than certainty (Shibli, 2015). Additionally, it is acknowledged that any view of reality proposed through the research comes from the author's perspective, and another researcher may offer alternative interpretations of the same data (Shibli, 2015).

Critical realism has been adopted as the ontology of this thesis because although no study of a mega sporting event can fully measure the interaction and causal relationships occurring as a result of such an event, a mixed methods multi-measurement approach such as the one adopted here can move us closer to understanding 'what', 'when,' 'where' and for 'who' the hosting of a mega sporting event can impact adolescent health and well-being. An interpretivist epistemology can offer complementary explanations as to 'how' any impacts occurred, allowing for an exploration of both individual factors, such as adolescents feeling inspired into physical activity, and systemic factors, such as the increased availability of sports opportunities.

This approach was also applied because it does not necessarily entail a commitment to a specific theory, as competing explanations can be explored and any theory that is put forward can be amended or replaced by another theory if it offers a more complete explanation of what has been discovered (Hodgson, 1999).

Critical realism was originally developed by Bhaskar to provide a philosophical framework for the natural sciences, but has since been adapted for the social sciences (Kemp, 2005). It stems from a dissatisfaction with the rigidity of other approaches, such as positivist approaches which are seen as overly concerned with regularities and rules, and a purely interpretivist approach which places too much emphasis on the complexity and interpretations of the individual being studied (Cruickshank, 2004). It has been described as a post post-positivist approach which goes beyond the anti-realist dualism of positivist and post-positivists to incorporate a realist perspective (Patomäki & Wight, 2000).

By moving away from such polarised philosophical approaches, critical realism allows for an exploration of the uniqueness yet interconnectedness of individuals and structures by considering associations, mechanisms, alternatives and potential and actual results (O'Mahoney, 2016). Because of its meta-theoretical basis—which combines the use of different quantitative and qualitative research methods alongside an understanding of the connections and interdependence of those methods (Blom & Moren, 2011) —it is the most suitable approach for a study seeking to understand both the role of infrastructure changes resulting from the hosting of a mega sporting event and the potential occurrence of a demonstration effect on individual adolescents, whilst acknowledging that these may not be distinguishable.

Whilst positivists seek to establish a strict replicable truth, critical realists accept that there are underlying mechanisms present behind any study which switch the emphasis beyond simple observable replicability, to include consideration of the coherence of the results and the achievement of consensus on their meaning (Bisman, 2010).

Critical realists acknowledge that the theories which identify causal mechanisms that are driving social events and activities are developed using rational judgment of these

events and can be multi-layered and multi-dimensional (Fletcher, 2016; Outhwaite, 1987). For example, in the current study a positivist might end their enquiry after investigating and documenting the statistical correlation between the 2010 Games and adolescents' engagement in physical activity, whereas the current study also considers the generative mechanisms associated with those observed correlations.

As a philosophical framework, critical realism is regularly applied in social science research to explain social events and offer practical policy recommendations to address social problems, without being tied to any particular set of methods (Fletcher, 2016). It is a useful approach when conducting research into causal mechanisms as it acknowledges that there are unobservable events which explain observable ones (Brante, 2011; Fletcher, 2016). It also acknowledges the role age, gender and other social determinants of health can play on observed outcomes (McEvoy & Richards, 2003).

In this study, finding correlations in the data can help us to identify potential causal mechanisms by which mega sporting events might affect healthy adolescent development, and to explore the environmental, social and psychological mechanisms which may be in operation but which are not directly observable. As such, it will increase our knowledge and get closer to understanding the reality of the impact of a mega sporting event on adolescents (McEvoy & Richards, 2003). For example, the identification of correlations between self-report of the 2010 Games' impact and engagement in sports and PA, and in other areas such as employment and community connectedness can contribute to our understanding of mega event legacies, which can then be further developed and revised as new knowledge emerges (Weed, 2009).

The current study used both quantitative and qualitative data to explore underlying causal mechanisms. Critical realists believe quantitative measures are necessary for identifying variables and differentiating between their properties. The stronger the statistical associations, replicated across studies, the greater confidence there can be in the relationships which are identified (Bauman, et al, 2002). The inclusion of qualitative methods are also necessary because they provide context and explanations that cannot be easily captured quantitatively (McEvoy & Richards, 2003).

3.1.1 Limitations of the philosophical approach

As with any philosophical approach, the one taken here is open to criticism. For example, by seeking to identify and articulate generative mechanisms, critical realism has the potential to venture beyond science and into ideology without sufficient grounds to make recommendations (Hodgeson, 1999; McEvoy & Richards, 2003). A critical realist approach has the potential to allow for interpretations of the data that are incorrect and which allow the researcher to make claims of causation where these are not valid, by first claiming there is a reality which is beyond our empirical understanding, then offering an explanation of that reality (Cruickshank, 2004). Therefore, critical realism's focus on what appears to be truthful, and what Wiltshire (2018, p. 532) refers to as "*for the time being conclusions*" can inadvertently arrive at incorrect causal explanations, which are subsequently used to make recommendations about policies and practices that have problematic consequences for the lives of individuals and subpopulations (Wiltshire, 2018). The current study aimed to address this by clearly articulating the limitations of the research undertaken and by including a range of stakeholders' perspectives on the findings.

Kemp (2005) is critical of wrapping a study such as this one in any philosophical framework and is particularly critical of adopting a critical realist lens, arguing that scientific reasoning should be led by a particular domain of research rather than by a generalised philosophical approach. Kemp believes too much emphasis is placed on the power of philosophy to guide social science research, and that this restricts the depth and breadth of research possible because the research is constrained by common-sense assumptions, which have not been proven. He cautions that philosophy should not supersede empirical evidence when designing a study, and believes there is limited value in applying a philosophical interpretation to research findings, especially if doing so shifts the emphasis away from specific empirical findings to generalised interpretations.

However, Kemp (2005) does acknowledge that critical realism can have a productive role in a study such as this one if it is used modestly, offers a few guiding principles and

focuses on the production of valid explanations of the actual research, rather than on creating an ontological framework which imposes a wide-ranging conceptual structure on researchers. These valid criticisms are duly noted and the philosophical approach applied to the current study is intended to offer a guiding framework for the research without venturing beyond what was evidenced.

3.2 Research design

Based on the philosophical and theoretical underpinnings of this thesis, a case study approach has been applied. A case study which combines semi-structured interviews with descriptive statistics and statistical analyses is an appealing methodology for critical realists because it allows the researcher to delve into the underlying mechanisms of the phenomenon under study (Bisman, 2010). It also allows for the explanation of complex causal links and provides valuable descriptive information about the real-life context in which a mega sporting event took place, as well as a description of specific outcomes of hosting such an event (Yin 1994).

A major criticism of taking a case study approach is that results will not be generalizable. Yin (1984) refutes such criticism by differentiating between analytic generalisation and statistical generalisation, and argues that analytic generalisation is valid because it compares the results of the case study to previously developed theory. He also argues that critics of case study research often make incorrect assumptions that a case study is based on a small sample and dismiss it as such, without consideration of the size, depth and breadth of that sample – a counter argument worth considering given this study includes the perspectives of over 60,000 adolescents.

A lack of external, internal, and construct validity checks is another criticism of a case study methodology (Tellis, 1997). Such criticism is addressed by the mixed methods approach taken in this study, as using multiple sources of evidence can ensure construct validity, and the articulation of previously generated theories can provide external validity for any generalisation of results. The internal validity is offered

through the articulation of the units of analysis being studied, the robust previously validated data sets being used and the established analytical processes being applied (Yin, 1994).

Critical realists' studies embrace a combination of quantitative and qualitative methodologies. Qualitative approaches provide richness, depth, density and context, whilst quantitative approaches allow for the assessment of the capacity for the broader applicability of observed patterns in data. Taking a mixed methods approach is therefore generally considered preferable to a mono method approach (Johnson & Onwuegbuzie, 2004).

This study encompassed the collection of qualitative stakeholder perspectives and the analysis and interpretation of both quantitative and qualitative data. Applying quantitative methods provided a statistical picture of the impact of a mega sporting event on adolescent health, and the qualitative approach enabled an in-depth exploration of the statistical findings. The main advantages of using a mixed methods approach were that they increased the comprehensiveness of the overall results by providing qualitative explanations of the quantitative findings; expanded the dimensions of the research topic, and increased the methodological rigour as findings could be checked for consistency (Chow, Quine, & Li, 2010). Applying a combination of methods allowed the study to use quantitative data to establish the specific legacy impacts which occurred, the populations who were affected, and the timeframe in which they occurred. The qualitative data offered explanations as to the mechanisms which drove the results (Chow et al., 2010).

In critical realist research, qualitative methods often precede the quantitative. This sequence enables questions, propositions and models to be developed, clarified and modified before the knowledge generated is applied to the quantitative data and additional knowledge concerning broader mechanisms and tendencies is produced (Bisman, 2010). However, in this study, the qualitative phase was conducted after the quantitative phase to allow stakeholders to review, explain and provide commentary on the quantitative findings (Chow et al., 2010).

The limitations of this study are discussed in Section 3.7, and it is acknowledged that it will inevitably raise more questions than it answers. However, as the first study to include population and subpopulation cross-sectional data about the impact of a mega sporting event collected pre and post that event, it will increase our knowledge of the role such an event can play in the healthy development of adolescents.

3.2.1 Vancouver 2010 as a case study

There have been no studies to date which have considered the role of mega sporting events in enhancing positive youth development. The current study is using a case study approach to consider the impact of one particular mega sporting event on adolescents.

As a research strategy, the distinguishing characteristic of a case study is that it attempts to examine a contemporary phenomenon within a real-life context, when the boundaries between phenomenon and context are not clearly evident. It is not tied to a particular data collection method or to a particular type of analysis (Yin, 1981). A case study is therefore the preferred methodology for the study of a contemporary phenomenon, such as a global short-term mega sporting event that occurs within a real-life context over which the researcher has no control or authority (VanWynsberghe, Bischel et al., 2011; VanWynsberghe, Surborg & Wyly, 2012; Yin, 1994; Yin, 2014). Case study is also considered to be the ideal methodology when a holistic, in-depth investigation is needed (Tellis, 1997).

When using a case study approach, a clear theoretical framework is critical to the research design and to provide structure and guidance to the study. It also allows for the generalisation of the case study results (Yin, 1994). A strong conceptual framework is needed for any case study to describe why and how a mega sporting events might be leveraged to improve adolescent health (Bauman et al., 2002).

A realistic theoretical explanation of how a mega sporting event can support healthy adolescent development should include psychological, social, environmental and

situational influences within the micro and macro environment. It should also include consideration of local conditions within the home, school, and community, as well as regional and national factors such as the design of transit systems, cultural values, and political conditions (King et al., 2002). A case study approach, conducted through a critical realist lens, allows for a practical application of all plausible theoretical models.

The Vancouver Winter Olympics and Paralympics are particularly appropriate to use as a mega event case study because Vancouver's bid to host the 2010 Games explicitly recognised the need to focus on sport development and community capacity-building legacies within the host province and was the first to commit funding to this from the bidding phase of an Olympic Games (Leopkey & Parent, 2012). Vancouver 2010 is also particularly important as a case study of the impact of such events on adolescents with a disability, as some tangible accessible infrastructure legacies were created at sporting venues in the host communities of Vancouver and Richmond. Yet other promised legacies, such as the sledge hockey facility planned for Whistler, did not materialise prompting criticism that, as with other mega events, it was accessible venues that were removed from the infrastructure plans when the financial situation became difficult (Canadian Government, 2010; Misener, 2012).

Using the 2010 Games as a case study will help to clarify our understanding of the gender differences which may be occurring in event legacies, as whilst some previous studies have found females may be more likely to take up sports and PA as a result of mega events, one of the very few studies of the impact of Winter Games appears to show a more positive effect on PA for male Canadians than females, and a more positive effect of the Winter Games than Summer ones (Montoya et al., 2013).

A case study methodology is appropriate to use for this thesis because this is a mixed-methods study, combining subjective self-report surveys and stakeholder interviews; and objective sports club membership records. The use of multiple data sources allows the study to include different paradigms, incorporate different disciplinary approaches, and delineate different units of analysis—which is a necessary methodology for the study of the impacts of a mega event (VanWynsberghe, Kwan &

Van Luijk, 2011; VanWynsberghe et al., 2012). The analysis of data from adolescent self-report surveys and sports club membership records can provide information about *who, what, where* and *how many*, and learnings from the stakeholder interviews allows for consideration of the *how* or *why* this mega event may have impacted change (Yin, 1994).

Five components of a research design are important when using a case study to draw wider conclusions. These include the study's questions, its proposition, its units of analysis, the logic linking the data to the propositions, and the criteria for interpreting the findings (Yin, 1994).

This study's overarching questions are those offered by Preuss when considering the legacy of a mega sporting event:

- What constitutes an event-related change?
- Who is affected by the change?
- How does a legacy affect a particular stakeholder?
- When does a legacy occur, how long does the legacy last, and how constant is it over time? (Preuss, 2016)

The proposition for this study also pulls from Preuss' legacy theory and assumes that there will be positive and negative, tangible and intangible legacies of the hosting of the 2010 Games for different subpopulations of adolescents, and the purpose of the study is to identify these legacies. Tangible benefits which the study will explore include increased sport and PA, employment and housing opportunities, and intangible benefits include increased community connectedness. It will also explore differences in reported effects between subpopulations of adolescents in host and non-host communities, and offer evidence of any negative legacies for these subpopulations. Including data from marginalised populations in this case study (collected pre and post event) will enhance our understanding of which young people are likely to experience positive and negative legacies, and intended and unintended consequences of such an event, and at what times these occur (Preuss, 2016).

The units of analysis for this study are adolescents (aged 12–19) living in host and non-host communities in BC, during the period 2003–2013. These young people offer a critical view of adolescent residents' perceptions of a mega sporting event pre and post the event. The inclusion of post-event perceptions provides the most meaningful information regarding a long-term legacy and helps to establish if, how, and for whom the event was successful (Garbacz et al., 2016).

The fourth and fifth elements of the case study research design (linking the data to the propositions and defining the criteria for interpreting the findings; Yin, 1994) represent the steps for the analysis which are detailed in Section 3.3 below, and the interpretation of that analysis form the basis of the discussion sections of the results chapters and the concluding chapter of this study.

3.3 Methods

Lee (n.d.) argues that the use of a logic model can restrict thinking because it is designed prior to results being available, and can mean the emphasis becomes on fitting data into the model rather than on being driven by the results. To avoid this pitfall, this study combines stakeholder consultations with the use of multiple data sources to allow any unexpected findings to surface. The stakeholder consultations were also designed to surface (or eliminate) alternative explanations of the quantitative findings (Benjit & Lagae, 2012). The logic model created to illustrate the programme theory framework (Figure 1.1) was also revisited in the conclusion to this thesis, to consider if it needed to be adapted for future studies based on the evidence that emerged.

This mixed-methods study used quantitative data from two adolescent cross-sectional surveys, the BC Adolescent Health Survey (BC AHS; 2003, 2008 and 2013), and the Homeless and Street Involved Youth Survey (HSIYS; 2007 and 2014), and BC sports club membership records, combined with qualitative data from open-ended response options on the BC AHS and HSIYS and stakeholder interviews.

As described in Chapter 2, sports club membership records are the most common source of data used to measure the impact of a mega sporting event, as they do not require primary data collection, are considered objective, and can be analysed at the level of a specific sport. However, there are a number of limitations with relying solely on this data source, not least of which is the availability and accessibility of sports clubs for young people. Additionally, sports club membership data for participation in Winter Olympic sports is reliant on the record keeping of predominantly amateur, volunteer-run minority sports associations, and as such is unlikely to be of sufficient quality to allow in-depth analyses to be conducted. Therefore, additional quantitative data sources were sought for this study.

3.3.1 Use of self-report surveys

Just as analysis of sports club membership data is the most commonly used method of assessing the impact of a mega sporting event, self-report is the most frequently used method of assessing the PA and sport participation of adolescents and can provide useful information about types of PA, the setting and contexts in which PA takes place, and can inform public health messaging and policy (Mountjoy et al, 2015; Subar et al, 2015). For this reason, and because this is a retrospective study (and therefore could not include other methods of data collection such as activity monitors), self-report surveys were sought for inclusion in this study. The BC AHS and HSIYS were selected as they both target BC adolescents and contain survey items relating to adolescents' perceptions of the 2010 Games (2007 and 2014 HSIYS, and 2008 and 2013 BC AHS). This meant that data were captured pre and post the event, and allowed for an evaluation of the event at the population and subpopulation levels.

The BC AHS and HSIYS were administered using pencil and paper at each time point. This is a strength of the methodology, as it is known that changing administration methods from paper to online impacts the validity of the results (Morrison, 2013). Additionally, a number of studies have found that adolescents prefer pencil and paper surveys to online versions, most commonly because of concerns about the confidentiality and anonymity of online surveys (Nulty, 2008). Adolescents are also

more likely to ask questions if needed and to see the survey as important if it is in paper format (Morrison, 2013). Response rates are generally higher for paper surveys (Nulty, 2008; Morrison, 2013), and they can be completed in less time (Morrison, 2013).

A study of 158 male adolescents aged 11–17 compared their reactions to three survey methodologies – pencil and paper, electronic, and interviewer administered. Results showed that participants not only took less time to complete a pencil and paper survey than an electronic one but also provided more complete information to open-ended questions about their leisure activities on a paper and pencil survey than when interviewed. Responses to the three survey methodologies were similar between older and younger adolescents (Wright & Ogbueho, 2014). Although these findings support the use of pencil and paper surveys with adolescents, the sample consisted of male American boy scouts, and it is unknown if results would be similar with a mixed gender sample of more diverse adolescents in Canada.

It is widely acknowledged that by 12 years of age children are developmentally capable of completing a standardised questionnaire if it uses straightforward language and questions are unambiguous and concrete (De Leeuw, 2011). The use of survey data, such as the BC AHS and HSIYS, therefore has a number of advantages including the ability to reach a large number of diverse participants with a precise data collection tool, which is sufficiently standardised to allow for statistical analyses (Sincero, 2012). However, to produce meaningful results, a survey needs extensive planning and preparation (Jones, Baxter & Khanduja, 2013). It is particularly important that any questionnaire given to adolescents is pilot tested to ensure the completion instructions and the item wording are fully comprehensible and the length of time it takes to complete is assessed (De Leeuw, 2011).

Testing of any survey for adolescents should also include focus groups, as this can help to generate question topics, evaluate the data collection methodology, and assess reactions to sensitive questions (De Leeuw, 2011). The BC AHS and HSIYS are both extensively pilot tested before each wave of the survey, and focus groups are

conducted to ascertain adolescents' comprehension of the items and their reaction to sensitive items.

Surveys designed for adolescents also require consideration of their ability to understand consent (De Leeuw, 2011). For the BC AHS and HSIYS, consent procedures were developed to reflect the age and stage of participants, and administrators were trained to share consent information in a way that was accurate and easily understood, including a clear discussion of confidentiality and specific occasions when it may be breached.

Self-report questionnaires have been found to be advantageous when assessing sensitive topics among adolescents, and have been found to be generally reliable across domains. However, there are concerns that adolescents might willfully or inadvertently provide inaccurate responses that can bias parameter estimates, effects, and conclusions drawn from these analyses (Fish & Russell, 2018). It is particularly important with adolescents to screen surveys for validity as studies have shown some students may under or over report risk behaviours, depending on their situation, comprehension level and their belief in the confidentiality and anonymity of the survey (Cornell, Klein, Konold, & Huang, 2012). Completed BC AHS and HSIYS surveys are all individually screened by trained researchers and invalid surveys are removed from the analyses (Saewyc, Stewart, & Green, 2014).

Adolescents are particularly susceptible to peer pressure and group norms, and it is therefore important to ensure privacy and confidentiality for survey respondents to maximize accuracy of reporting (De Leeuw, 2011). Both surveys are administered in ways which ensure their confidentiality, including the provision of seals to ensure no one except authorised researchers can open completed surveys (Saewyc et al., 2014).

Student attitudes toward completing a survey may also be influenced by their attitudes toward their school, the institution requesting the survey, and the survey administrator, as well as by their understanding and appreciation of the purpose of the survey (Cornell, et al., 2012). The most common items in which students provide false

information are about risk behaviours such as substance use, weapon carrying and sexual behaviour (Cornell et al., 2012). However, in school-based samples (such as BC AHS) it tends to be a small minority who do so and this has been found to have little impact on overall results, even among small subpopulations (Fish & Russell, 2018). Adolescents' accurate recording of health-related behaviours—including behavioural problems and risky behaviours—on self-report questionnaires points to the validity of this methodology (Ivanova et al, 2007; Taubman-Ben-Ari, Eherenfreund & Giacomo, 2016).

Both the BC AHS and HSIYS have particularly low missing and invalid response rates (Saewyc et al., 2014). This is likely because of the participatory approach to the survey development which engages adolescents in identifying the topics to be included on the surveys, and because the survey administrators are seen as trusted allies. The BC AHS is administered by nurses, and the HSIYS is co-administered by youth workers and a previously homeless young person (Smith et al., 2014).

3.3.2 Cross-sectional data

The BC AHS and HSIYS are both cross-sectional instruments. Cross-sectional studies are designed to measure indicators in a population at a single point in time. Although it is possible that adolescents who participated in the 2008 BC AHS when they were in Grade 7 participated again in 2013 in their Grade 12 year, the survey cannot be considered longitudinal as it does not intentionally track changes in individuals over time.

Although using longitudinal data may have yielded important information about the sustained impact of the 2010 Games on individual adolescents over time, it is not always desirable for a study which is considering the impact of a mega sporting events on adolescents as an age group. Longitudinal studies can be hard to make generalisations from, and external validity can be problematic, especially when the studies include difficult to reach populations who typically have high attrition from studies (Chassin, Presson, Sherman, Montello, & McGrew, 1986). This issue can be

particularly problematic among 'at-risk' adolescents who have been found to have the highest likelihood of dropping out of longitudinal studies about their health behaviours, leading to an under-representation of their data in such studies (Chassin, et al., 1986).

This study intends to offer lessons learned from Vancouver 2010 which can be of value to future Olympic hosts and to Canadian organisers of other future mega sporting events (such as the 2026 FIFA World Cup). It is therefore important that findings can be generalizable and that results can be externally validated.

The advantage of large-scale cross-sectional population level surveys, such as the BC AHS, is that data are gathered from a representative sample of participants with varied demographics (including age, gender, geographical locations, and immigration status), and typically contain multiple variables of interest. Around 30,000 adolescents completed the BC AHS and 700 completed the HSIYS at each time point. This allows for the inclusion of a diverse sample which would be prohibitive for a longitudinal study due to cost and time constraints.

The primary disadvantage of cross-sectional studies is that it can be difficult to establish cause and effect. However, both the BC AHS and HSIYS asked participants directly about the impact of the 2010 Games, and these data sources are supplemented by other methodological approaches. Additionally, the critical realist approach being taken to this study renders concerns about proving cause and effect meaningless, as the results are viewed in the context of the underlying processes. The aim is not to 'prove' the direction of a bi-directional correlation but to consider the results in the context of the generative mechanisms which might be influencing those correlations (Pawson & Tilley, 1996; Spicker, 2011). Additionally, Scott (2014) points out the need to identify a time sequence where the causal variable precedes the effect. Although the BC AHS and HSIYS were point-in-time surveys, they did follow a cause and effect sequence, as they asked about the effect of the 2010 Games on current behaviour, increasing the plausibility of the direction of the relationship.

3.3.3 Stakeholder consultations

Key stakeholders were consulted for their feedback about the results of this study. These consultations are an important part of the research process because stakeholders can provide context to the results, assess their validity in the context of their own expertise, and identify key findings which otherwise may have been overlooked (Last, 2018).

Semi-structured interviews were the chosen method of consultation, as they are an effective method to collect qualitative, open-ended data, and to explore participants' thoughts, feelings and beliefs about a particular topic (DeJonckheere & Vaughn, 2011). This method typically consists of a dialogue between researcher and participant, guided by a flexible interview protocol and supplemented by follow-up questions, probes and comments (DeJonckheere & Vaughn, 2011). It is a preferred method of data collection when the researcher is limited to one encounter with the stakeholder, and is unlikely to have opportunities to ask follow up questions outside the scheduled interview.

The overall purpose of using semi-structured interviews for data collection is to gather information from key informants who have personal experiences, attitudes and knowledge about the topic of interest. Semi-structured interviews can be a particularly useful qualitative method to test hypotheses or explain quantitative results within a study (DeJonckheere & Vaughn, 2011). Such interviews can provide reliable, comparable qualitative data, and researchers can draw meaningful conclusions through interviews with as few as 8–12 participants (DeJonckheere & Vaughn, 2011). Additional advantages include the benefits of having questions prepared ahead of time whilst allowing the stakeholders the freedom to express their views in their own terms (Cohen & Crabtree, 2006). Disadvantages can include participants being unwilling or unable to answer the questions asked of them, and it can require significant resources to ensure the correct participants are recruited (DeJonckheere & Vaughn, 2011).

Figure 3.2 illustrates the anticipated sports legacies of the 2010 Games in the federal and provincial government’s commissioned evaluation of the event (PriceWaterhouseCoopers, 2010). It was used to identify some of the stakeholders whose perspectives were sought for this study.

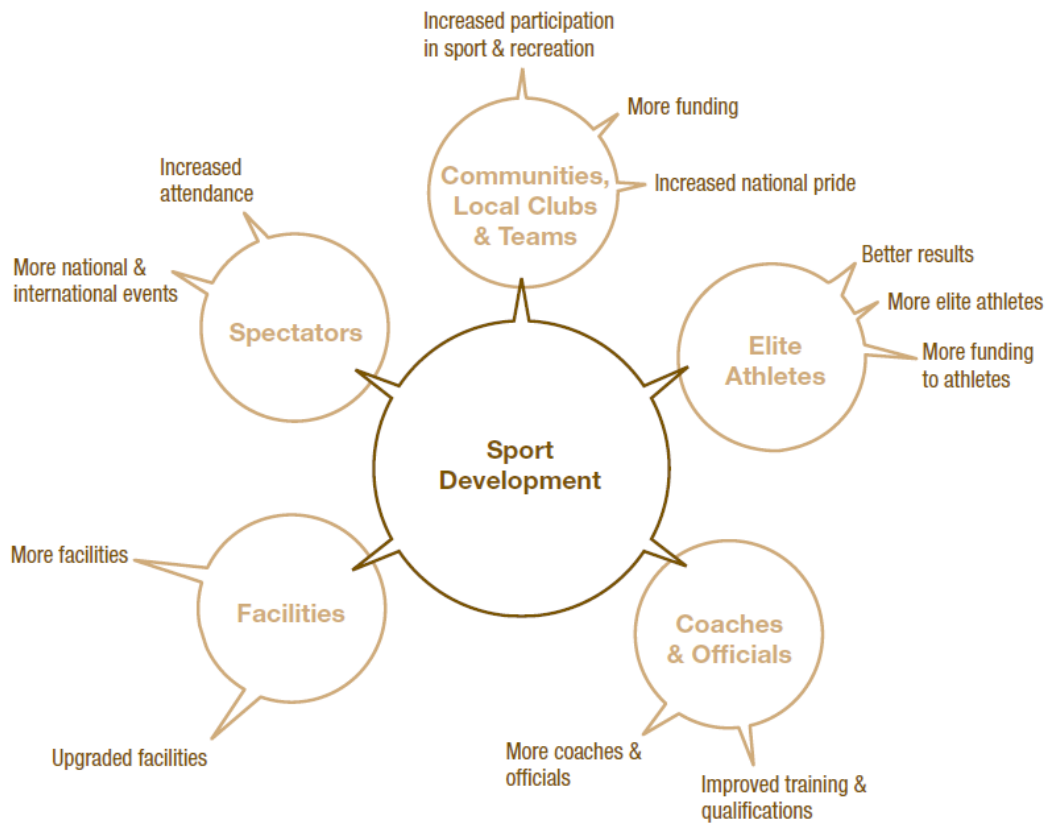


Figure 3.2. Anticipated sports legacies of the 2010 Games (PriceWaterhouseCoopers, 2010)

Consultations with 16 stakeholders took place between 2018 and 2019, and lasted between 30 minutes and two hours. Interviews were conducted in-person, by phone or via Skype. The guiding questions for the semi-structured interviews are detailed in Appendix 3. Not all questions were applicable to each stakeholder.

Nine male and seven female stakeholders were interviewed. They included a manager at a sports and recreation facility renovated for the Games; two senior administrators

at sports and recreation facility built for the Games; a project manager responsible for the construction of the Olympic Village; a senior administrator with Surrey Minor Hockey and manager responsible for leveraging sponsorship of the 2010 Games for the BC government; an administrator with BC Junior Hockey; a senior administrator with Richmond Minor Hockey; a senior administrator with the Vancouver Whitecaps Football Club; a former elite athlete, grass roots junior coach and Olympic torchbearer; a former Paralympian and member of Paralympics organising committee; a published Paralympic researcher; a member of the 2010 Canadian Olympic athletes health support team; a youth housing and support services provider; a senior administrator with ParaNordic; and two senior administrators with the Sports Branch of the BC government.

3.4 Data sources

This study incorporated qualitative and quantitative analysis of three waves of the cross-sectional BC AHS (2003, 2008 and 2013). It also includes data from two waves of the HSIYS (2006 and 2014), and provincial sports club membership data (2003-2013).

According to the National Institute of Health (NIH) in the United States, primary data analysis is the analysis of data by the researcher(s) that collected the data, which are conducted to answer the original hypotheses proposed in a study. All other data analyses are considered 'secondary analyses of existing data', whether or not the person(s) conducting the analyses participated in the collection of the data (Cheng & Phillips, 2014). This study is using secondary analysis of existing data sets (sports club membership records and cross-sectional surveys), with additional data collected through stakeholder interviews.

A study using secondary analysis of survey data generally has the benefits of being lower cost and less time consuming than a study which requires primary data collection. It can also answer research questions without putting subjects at risk of adverse reactions or other harms associated with participation in a research study (Doolan & Froelicher, 2009).

A limitation of secondary analysis can be that the researcher is using a data source that was planned for a different research question, and therefore sample size, sample composition, methods and measures used may differ from those that might have otherwise been selected (Doolan & Froelicher, 2009). This is a serious limitation of the sports club membership data, but occurs to a lesser extent with the BC AHS and HSIYS data sets, because the author of the current study was Co-Principle Investigator on the 2008 and 2013 BC AHS, and the 2007 and 2014 HSIYS. The role of the author in the creation of the original surveys ensured the inclusion of items relating to the impact of the 2010 Games, despite the Games not being a primary focus of the BC AHS or HSIYS.

Another major limitation of secondary analysis of existing data was avoided because of the author's familiarity with the data set. As Executive Director of the McCreary Centre Society (the agency responsible for the BC AHS and HSIYS), the author was involved in the oversight of the data collection and primary analysis process, and therefore was aware of limitations and nuances in the performance of survey measures in a way that most researchers conducting secondary analysis would not be.

Doolan and Froelicher (2009) suggest that:

"For secondary analysis to be appropriate, the PI must have an important research question and a data set that is adequate to address the question. The PI should consider if a data set has an appropriate sample, measures, and recency". (p. 205)

The two adolescent health data sets chosen for this study clearly meet these criteria. The BC AHS and HSIYS are used to gather information about a range of health promoting and health risk behaviours. The BC AHS has been administered to students in Grades 7–12 in public schools approximately every five years since 1992, and the HSIYS in communities since 2000. The administration methods have remained the same for each wave of the surveys, and are discussed below.

3.4.1 BC Adolescent Health Survey (BC AHS)

The BC AHS uses a cluster-stratified random sampling method, stratified by grade and by the 16 local Health Service Delivery Areas (HSDAs) in BC. This study used the 2003

(N=30,588), 2008 (N= 29,315) and 2013 (N =29,832) data sets. The 2003 data were collected in the months preceding the announcement that the Games had been awarded to Vancouver, the 2008 data were collected in the ‘pregnancy period’ of the Games when excitement was building and pre-Games programming was occurring in the province, and the 2013 data were collected three years after the Games took place.

The Games host communities of Vancouver and Richmond are large school districts and each is also a HSDA. Whistler (referred to as Sea-to-Sky School District) and West Vancouver are smaller and combine with four other school districts to make up the North Shore HSDA. Across BC, 45 school districts participated in the 2003 BC AHS, 50 in 2008 and 56 in 2013. This was considered representative of 72% of the student population aged 12–19 in 2003; and increased to 92% in 2008, and 98.5% in 2013. All host communities participated in the 2003, 2008 and 2013 surveys.

In 2008 and 2013, the BC AHS included items which asked adolescents about the effect of the 2010 Winter Olympics and Paralympics. Response options included *I am more physically active, I am less physically active, I have more sports opportunities, I have less sports opportunities, I have more job prospects, I have less job prospects, No effect at all, I haven’t thought about it* and ‘Other’ with the option to write a qualitative explanation. Students were instructed to mark all response options that applied to them.

In all three waves of the BC AHS there were items which asked about formal and informal exercise participation, and other health promoting and health risk behaviours. Items which were recoded from the original variables are detailed in Appendix 1. Subpopulations of adolescents were also identified within the BC AHS data, and two of those are considered within the analyses of vulnerable populations – youth with a physical disability and youth who were at increased risk of incarceration.

The BC AHS question wording relating to physical disability on the 2003, 2008 and 2013 BC Adolescent Health Survey was not consistent. In 2003 and 2008, sensory disability was included in the definition of a physical disability, whereas in 2013, sensory disability was asked separately from physical disability. To be comparable to the earlier surveys, the sensory and physical disability items were combined for all analysis of the 2013 data. Similarly, the 2003 and 2008 survey question asked participants if their physical disability was severe enough to prevent them from doing things other youth their age could do, whereas the 2013 survey asked about the severity of the disability in a separate question. For comparability, analysis with the 2013 data were only conducted among adolescents who reported they had a physical or sensory disability and also reported that it was severe enough to prevent them from doing things other people their age could do.

In Canada, as in many countries, prevalence estimates of children and youth with physical disabilities is lacking (Blackburn, Spencer & Read, 2010). However, the percentages reporting a physical disability (including a sensory disability) on the 2003, 2008 and 2013 BC AHS corresponds to that of school age adolescents in the USA (Centre for Public Education, 2014). In 2013, 1.2% (n=357) of BC students who completed the BC AHS reported having a debilitating physical disability. This percentage was similar to the rates in 2003 (1.1% of the sample, n= 340) and slightly lower than in 2008 (1.5%, n=430).

Key risk factors for being incarcerated in a BC youth custody centre include having little parental/guardian supervision, living outside the parental home, a history of government/foster care, a diagnosis of Fetal Alcohol Spectrum Disorder (FASD), going to bed hungry, and a history of physical and/or sexual abuse (Smith, Cox, et al., 2013). Questions about these risk factors were included in the 2013 BC AHS.

Findings from the 2013 BC AHS indicated that 0.8% (n= 243) of adolescents in BC had been detained in a custody centre, and 28.4% of youth (n= 8,499) had at least one of the identified risk factors for incarceration. Age and gender adjusted odds ratios (AOR) were conducted and confirmed that the six identified factors were predictors of having

been incarcerated (see Section 3.5.1 for an explanation of the use of AOR and Appendix 2 for the results of those analyses).

Each of the six risk factors was dichotomised, and a composite variable was created (adolescents who had two or more of these risk factors vs. those who had fewer). Further analysis showed that 7.4% (n= 2,241) of the total BC AHS sample had two or more of these risk factors (e.g., a history of abuse and of government care).

Among youth with two or more risk factors for custody detainment, 56.9% had already spent time in a youth custody centre, compared to 7.0% of those with fewer risk factors. AORs indicated that having at least two of the risk factors substantially increased the likelihood adolescents had been incarcerated (AOR = 17.341, 99% CI 12.122-24.806). Therefore, the analyses for this study focused on youth with multiple risk factors for custody detainment (i.e., two or more risk factors).

Most of the items on the BC AHS were previously validated with the age range under study and derived from other North American adolescent health surveys, including the questions pertaining to engagement in sports and PA (from the Canadian National Longitudinal Survey of Children and Youth) and employment (originally included in the Minnesota Adolescent Health Survey; McCreary Centre Society, 2008).

An omission from the BC AHS (and therefore also the HSIYS) was a reliable measure of SES. SES is known to negatively impact healthy adolescent development (Schreider & Chen, 2013). However, each wave of the BC AHS to date has failed to accurately capture this. Different measures of SES and poverty were trialed on the 2003, 2008 and 2013 waves of the survey, but none provided a reliable estimate of SES or its impacts, and therefore were not included in this study.

3.4.2 BC Homeless and Street Involved Youth Survey (HSIYS)

The multi-city cross-sectional HSIYS is adapted from the BC AHS and targets BC adolescents aged 12–18 who identify as street homeless, as well as those who are

currently or have recently been couch surfing; involved in a street life; or living in unstable conditions such as a motel, squat, tent, abandoned building, or in a home without adults (Smith et al., 2015). The current study used data from the 2006 and 2014 HSIYS. The 2006 survey was conducted in nine BC communities (N=762 youth), including the Olympic host community of Vancouver, and the 2014 survey was conducted in 13 communities (N=681), including Vancouver and North Shore.

The HSIYS was not conducted in all regions of BC and therefore cannot be considered representative of communities which did not participate, including the host communities of North Shore in 2006 or Richmond in 2006 or 2014. However, as Richmond and North Shore have limited homeless services, adolescents in those communities travel to Vancouver to access support (Plant & Beno, 2011) and may have been included in the Vancouver sample. Additionally, the communities which did participate were identified because they were known to have at least a small population of homeless adolescents.

For some analyses, individual items about the Games' perceived effects had to be collapsed into more generalised positive and negative impacts of the Games. All recoded measures are detailed in Appendix 1.

Most questions on the HSIYS were taken directly from the BC AHS. Following consultations with homelessness experts in BC, the BC AHS question about the 2010 Games was adapted to include a focus on the effect of the Games on access to housing and services (instead of sports and PA). Other response options were maintained.

The BC AHS asked participants about their employment during the school year. As many homeless adolescents are not in school, the question was modified to the following: *In the past 30 days, did you obtain money from any of the following sources?* with response options that included 'A legal job.' Sports and PA questions also had to be modified from the BC AHS. HSIYS participants were asked about PA involvement before and after they became homeless rather than over the previous 12 months (Appendix 1).

Additional questions included in the analysis for this study tapped the unique experiences of homeless adolescents, which would not be anticipated in a mainstream school population. For example, in 2014, items asked '*In the past 12 months did you come in contact with the police?*' and '*In the past 12 months did the police...?*' Response options included '*Search you*', '*Arrest you*', and '*Ask you to move on*' (Mark all that apply).

3.4.3 BC sports club membership data

To supplement the self-reported data of adolescents who completed the BC AHS or HSIYS, adolescent sports club membership data for the decade 2003–2013 was sought by age, gender and location from all provincial sports club associations for sports which appeared in the 2010 Olympic and Paralympic Games. For sports where information was not published, the relevant sports associations were contacted via email and/or telephone and data were requested which showed adolescent sports club membership broken down by age, gender, and location. When no data could be obtained, national membership associations and community-level clubs were contacted.

3.4.4 Reliability and validity of data sources

Although there are limitations with all the data sources in this study, traditional concepts of data reliability (consistency), and validity (accuracy) are rooted in positivism and are viewed differently by critical realists. Data is considered valid if it allows us to construct a consistent and coherent account of our experiences, and combining quantitative and qualitative methodologies can strengthen our ability to generate reliable and valid data (Bisman, 2010).

Such an approach allows research questions to be answered by identifying, documenting and elaborating on the themes and patterns which arise in the data, and by articulating how they do or do not correspond to the underlying theories. This *"differs from the more constrained and less detailed statistical generalisations*

produced when positivist approaches are applied to the analysis of data” (Bisman, 2010, p. 11).

Mixed methods studies, such as this one—which use multiple data sources and offer several theoretical perspectives—are considered more reliable and valid than those which rely on a single theory, method and/or data source. The validity of a study is also strengthened when findings are discussed in the context of previous research (Bisman, 2010).

The reliability of the sports club membership data used in this study was compromised by the lack of consistent data collection across different sports. In BC, several provincial sports associations were formed as a result of the infrastructure developments which took place for the 2010 Games, and therefore no data were available during the Games’ pregnancy period. Among the Paralympic sports, only Para-Nordic was able to provide any membership records, but no information was available prior to 2010. This mirrored the findings of other studies into Canadian sports club membership. For example, Mair (2004) found that 51% of Canadian curling clubs did not maintain a membership data base.

Despite extensive efforts, no valid data could be obtained for the Winter Olympic sports of cross-country skiing, freestyle skiing, ski jumping, Nordic combined, bobsleigh, luge, skeleton and snowboarding, or for any Paralympic sports except Para-Nordic. Data from the Olympic sports of alpine skiing (downhill and slalom skiing), biathlon, curling, figure skating, ice hockey, and speed skating was obtained but varied significantly in quality, and only two sports provided comprehensive participation data by age and gender (alpine skiing and ice hockey). Although this study was not able to look at data from all Winter Olympic sports in the way originally envisioned, the data from ice hockey and alpine skiing were of sufficient quality to contribute to the discussion about the legacy of a mega sporting event.

Questions relating to the 2010 Games which were included in the adolescent self-report surveys were developed based upon the knowledge of potential effects of mega

sporting events which was available in 2006/07. Different questions yielding different information would have been included on the survey were it to be developed within the context of our current state of knowledge. Additionally, if the study was repeated using different data sources or in a different setting, it is possible that different results would emerge (Archer, 1995).

However, the survey items used on the BC AHS (and adapted for use on the HSIYS) to assess exercise, sport and PA involvement have been used since 1992 in BC and have also been adapted for use with school age adolescents in the United States and New Zealand, and are considered valid measures of adolescent PA (Clark et al., 2013; Nelson, MacLehose, Davey, Rode & Nanney, 2018). These same survey items have also been retained to the present day and were included in the 2018 BC AHS.

No study to date has included these measures of various types of PA and sports involvement or of the impact of a mega event administered on cross-sectional surveys to adolescents. Therefore, comparisons with previous research are limited, and there is no ability to compare inter-study reliability. However, as the first study of its kind, it can provide a baseline for future studies.

The BC AHS was administered in mainstream public schools and therefore did not assess the health picture of adolescents in private schools, alternative schools, or who were home schooled. It also only includes students who were present on the day the survey was administered to their class, and as such likely missed some of the most vulnerable students who may have been absent due to competing responsibilities or health challenges. A caution of any study completed using this data set is therefore that it may offer results which are not representative of some subpopulations of adolescents.

The different consent procedures required for the BC AHS may have impacted the results of this study, as a minority of school districts required written parental consent for students to participate. This may have contributed to the under-reporting of health risk behaviours in those school districts (McCreary Centre Society, 2017). However,

previous analysis of the BC AHS has shown that increases in school district participation and changing parental consent procedures have limited impact on the results (Smith et al., 2014). Additional analyses were conducted within the North Shore HSDA sample to ensure that any trends which were reported were not influenced by the participation of Central Coast school district in 2013 following the non-participation of this small school district in 2003 or 2008, or by changes in consent procedures which occurred in four of the other six North Shore school districts (Poon et al., 2015).

Just as the BC AHS may not have included data from the most vulnerable adolescents, the HSIYS may not be representative of all homeless 12–18-year-olds, particularly in the larger participating cities (Smith et al., 2015). Although it was believed that close to a census was achieved (particularly in smaller communities), it is difficult to estimate the number of homeless adolescents in BC because few access shelters or use homeless services (Smith et al., 2015). Subsequently, they are not included in many of the province's counts of homeless people (Smith et al., 2007). Additionally, adolescent homelessness is often episodic rather than chronic, and typically follows a pattern of running away and/or being kicked out of home interspersed with periods of relative stability, before adolescents leave home permanently (Smith et al., 2007).

Participants in the HSIYS were approached to complete the survey when accessing services or on the street. This may have affected their ability to fully engage in the survey. For example, questions about physical activity involvement before and after becoming homeless, access to community services, and the 2010 Games were answered by fewer than 80% of participants in 2014. The item about the 2010 Games was question 147 of 150 in 2006 and question 122 of 129 in 2014. In 2014, 23.5% of youth who completed the survey (160 youth) did not answer the question, and the missing rate was 32.3% (n=47) in Vancouver, meaning there were insufficient responses to a number of the 2010 Games items to allow for the data to be reported at the community level.

Conducting stakeholder interviews is a fundamental step in the research reporting process because of its role in defining the relevance of the results which have been gathered and establishing how they should be interpreted and communicated. However, it is important that stakeholders have legitimacy and a thorough understanding of the topic on which they are being consulted (Manetti, 2011).

The involvement of key stakeholders (e.g., individuals in winter sports club leadership, legacy infrastructure sports, youth services, and recreation building management) who are knowledgeable about the impact of the 2010 Games within their field was designed to improve the quality and relevance of this study. Their involvement can also enhance the validity of the findings because of the unique perspective and expertise that the stakeholders bring. Reviewing the findings of a study with stakeholders can also ensure the results are comprehensible and of value to a lay audience, and can help the researcher to accurately interpret their data (Brett et al., 2012).

To avoid being tokenistic, it was important to ensure enough time and resources were committed to engaging with relevant stakeholders to get their feedback on the results (Brett et al., 2012). A summary of the study results and semi-structured interview script were created to assist stakeholders to review findings from this study and to provide their feedback (Appendix 3). Additionally, the documents were independently reviewed to ensure there were no leading questions and that the study results were reported with integrity—which is considered best practice when engaging stakeholders (Manetti, 2011).

Taking a critical realist perspective, it was anticipated that stakeholders would view the results from this study through their own experiences of the 2010 Games, their values and belief system, which may differ from those of the author and of other stakeholders (Watson, Wilson, Smart & MacDonald, 2018). The presence of divergence in views and interpretations assisted the author to question assumptions and ensured the final thesis is as relevant as possible and has a broader applicability than would otherwise have been achieved.

3.5 Data analyses

The majority of analyses conducted for this study used the self-report survey data. Also, descriptive statistical analyses were conducted on the available sports club membership data, and a thematic analysis of the stakeholder interviews was completed. Thematic analysis is a method for identifying, analyzing, and interpreting themes within qualitative data. It is commonly used by critical realists because it is not tied to a particular theory and takes an organic approach to coding responses. The process includes summarizing the data content, and identifying and interpreting key features of the data whilst being guided by the research question to produce rigorous and high-quality analysis. It is a technique which can be used with any sample size, and has previously been validated in studies with adolescents (Clarke & Braun, 2017).

Analysis of adolescents' forced-choice and open-ended survey responses about positive and negative legacies of the 2010 Games identified tangible benefits and harms of the Games from an adolescent's perspective. Intangible benefits and harms were less easily identifiable but correlational analyses of the Games in relation to community connectedness, and discrimination experiences (among youth with a disability) were conducted. Additional correlational analysis considered associations of the Games impact with police involvement (among homeless adolescent), and criminal and anti-social behaviour (among adolescents at risk of incarceration). Thematic analysis of the qualitative responses also offered some evidence of tangible and intangible (planned and unplanned) positive and negative legacies. The inclusion of data collected three years after the event (BC AHS) and four years after the event (HSIYS) allowed for legacies identified in Preuss' cube to be explored beyond the short time frame of most mega event legacy studies (Preuss, 2016).

3.5.1 Self-report surveys

SPSS Complex Samples software (Version 24.0) was used for most of the analyses of the BC AHS data due to the need to adjust for the complexity of the random cluster-stratified design of the sample and weighted data (Saewyc & Green 2009). Customised

Excel spreadsheets designed for use with the BC AHS were used to conduct exact tests and gap analyses, as these are not possible within SPSS Complex Samples. Analyses of the HSIYS did not require Complex Samples and was conducted using SPSS 24.

The complex design of the BC AHS, which uses different sampling rates in various geographical locations, and samples entire classrooms rather than individual students, makes it inappropriate to calculate standard errors (SE) based on simple random sampling theory (Green, 2004). This design effect was accounted for with the use of SPSS Complex Samples which generates standard errors showing the likely difference between the sample estimates and if a census had been conducted.

In this thesis, data are published without qualification if it has a SE less than 5.00. For SEs between 5.00 and 12.49, the data are published with an asterisk (*) indicating the estimate should be interpreted with caution as it was higher than anticipated but still within a releasable range. Data with a SE greater than 12.49 is suppressed (Saewyc et al., 2014). In both surveys, cell sizes less than 10 were not reported due to the risk of deductive disclosure, and are indicated with an NR ("not releasable") in the text and tables.

In line with recommended practice, comparisons within the whole BC AHS sample were conducted using 99% Confidence Intervals (alpha level of .01). Analyses of sub samples, trend analysis and gap analysis were conducted using 95% Confidence Intervals (alpha level of .05), as were all analyses of the HSIYS. This means there is up to a 1% likelihood of any within-year population level results (i.e., BC AHS) occurring by chance and up to a 5% likelihood that other reported results occurred by chance. Reported differences in proportions or percentages between groups (e.g., comparisons by gender or by age, or across survey years) in the text were statistically significant unless noted. Statistically significant differences are indicated in bold in tables.

Frequencies were run to establish the prevalence of adolescents' reporting direct effects of the Games in areas such as increased PA and reduced employment opportunities. Independent sample *t*-tests were conducted to examine differences

between mean ages – for example of youth who reported they were more physically active as a result of the Games compared to those who did not report such an effect on their PA. As there is no procedure specifically for doing independent samples t-tests in SPSS Complex Samples, a General Linear Model procedure was conducted to obtain these results for the BC AHS.

Cross tabulations were carried out to assess the associations between adolescents' perceptions of the effects of the Games and other variables of interest, such as community connectedness. Prevalence rates, their confidence intervals, and *p*-values were derived from these crosstabs. Cross tabulations and chi-squares were also conducted to assess changes over time, and differences between subpopulations (males vs. females, host vs. non-host communities, older vs. younger youth). The purpose of these analyses was to identify if there were disparities between groups.

Odds ratios (OR) are effect sizes which are commonly used in cross-sectional studies such as this one to determine the magnitude of an effect (Szumilas, 2010). As noted earlier, this study included adjusted odds ratios (AOR) derived from age and gender-adjusted logistic regressions (or age adjusted logistic regressions where analyses were conducted separately by gender). It was important to control for age and gender in the regression analyses because outcomes under consideration such as engagement in sports, PA, and employment have all been linked to age and gender (Wharf-Higgin et al, 2003). An age- and gender adjusted odds ratio (AOR) lower than 1.00 indicated that a given group had lower odds of experiencing a certain behaviour or situation than did the reference group, whereas an AOR greater than 1.00 indicated greater odds. Odds ratio confidence intervals that included 1.00 indicated a non-significant difference.

Gap analyses were conducted to determine whether the disparities in PA participation between different populations (i.e., those in host vs. non-host communities; and those with and without a physical disability) had widened, narrowed or were unchanged between 2003 and 2013. For cluster-stratified samples, such as the BC AHS, there are no available statistical tests to compare changes in disparities across three time points. Therefore, Homma, Saewyc, and Zumbo (2016) developed the gap analysis technique

to test for changes over time in health disparities within Complex Samples. The technique requires obtaining percentage estimates for all years (2003, 2008 and 2013), for all groups (e.g., three host communities and non-host communities); conducting age-adjusted logistic regression analyses to examine trends over time for each group; conducting age-adjusted logistic regression analyses to identify disparities between groups at each time point; and conducting age-adjusted logistic regression analyses with interaction terms to look at trends in disparities.

Where gender differences are reported, they include only adolescents who identified as male or female, as the number who indicated being transgender or another gender identity was too small to include. Trends over time which are reported for the overall sample compare all school districts (BC AHS) and all participating communities (HSIYS). Additional analyses were conducted to determine if results were different if only the communities or school districts which participated in both waves of the HSIYS and all three waves of the BC AHS were included in the analyses. No statistically significant differences were found.

3.5.2 Thematic analysis of stakeholder consultations

As noted previously, thematic analysis is a flexible method of identifying and summarizing patterns or themes within qualitative data, which is not tied to a particular epistemological or theoretical perspective (Maguire & Delahund, 2017). This study used Braun & Clarke's (2006) six-step thematic analysis framework to analyse the qualitative data collected through the stakeholder consultations. This process involved becoming familiar with the data by transcribing and reviewing the notes from each consultation (Step 1); organizing the data and generating initial codes for the different comments provided by the stakeholders (Step 2); identifying, reviewing and defining themes which emerged from the coded data (Steps 3-5); and writing up the results (Step 6).

Having completed each stakeholder consultation, comments were coded and initial overarching themes were identified. These were categorized into positive and negative legacies, and refined to include sub themes (such as tangible and intangible legacies; short- and longer-term impacts; effects at the population and subpopulation levels). Upon completion of all stakeholder interviews, the themes were reviewed and further refined to reflect where there was consensus or contradictory perspectives among the stakeholders. The results were written up and integrated into the results sections of the report to which they applied.

3.6 Ethics approval

Each wave of the BC AHS and HSIYS received ethics approval from the Behavioural Research Ethics Board of the University of British Columbia, based on Article 2.4 of the Canadian Institutes of Health Research Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans. Ethics approval was not required for secondary analysis of these two surveys as it is pre-existing, anonymous data (Canadian Institutes of Health Research, 2014). The current study was approved by the McCreary Centre Society's research advisory committee.

The stakeholder consultations also did not require additional ethics approval under Tri-Council Policy Statement (TCPS2). The primary purpose of collecting the data was to evaluate the quantitative findings of this study in the context of the stakeholders' expertise, to discuss how future mega sporting events might be designed to increase the likelihood of contributing to improvements in adolescent health, and to discuss how future events could be more effectively evaluated.

3.7 Limitations of the methodology

As with all studies, this one has limitations in its methodological approach. The study is also challenged by being a retrospective investigation into the impact of a mega sporting event. A preferred methodology would have begun prior to 2003, and

included qualitative and quantitative data collected at regular intervals before, during and for some considerable time after the event (Kowe & Bowen-Jones, 2015; Veal et al., 2012).

The current study is limited to the available data (sports club membership records, adolescent self-report surveys, and stakeholder consultations), and can for the most part only offer prima facie evidence of the effect of a mega sporting event (Veal et al., 2012). The full impact of a mega sporting event can never be measured and the methodology of this study will offer an incomplete explanation of the impact of the 2010 Games on healthy adolescent development (Weed, 2009). Any impact of the Games which is found may be indirect and may also be attributable to other related or unrelated activities (Weed et al., 2011). For example, sport participation, employment and community connectedness are all influenced by numerous factors, of which hosting a mega sporting event is only one (Veal et al., 2012). However, this study is the first to include the direct self-report of the impact of a mega sporting event provided by over 60,000 adolescents.

Whilst no study of a mega sporting event can fully measure the causal relationships occurring as a result of such an event, the mixed methods multi-measurement approach used in this thesis can contribute to a better understanding of the relationship between the hosting of a mega sporting event and its impact on healthy adolescent development. Therefore, despite its limitations, a pragmatic approach towards interpreting the findings ensures that the study can be of significant practical as well as theoretical value, and can be used to inform policy makers and future event organisers about the potential to leverage a mega sporting event to address adolescent health and development outcomes. To do this Pawson (2012) argues we need to stop believing that evidence needs to come in "*finite chunks offering certainty and security to policy decisions*" and be more accepting of accumulating partial knowledge as a useful strategy "*in good scientific enquiry*" (Pawson, 2012, p. 386).

As the first study to include adolescent population and subpopulation data collected pre and post event over such an extended time period, it is the first to be able to consider longer-term effects of the impact of a mega sporting event on this age group. Also, by applying gap analysis to consider changes over time in disparities between groups, the study offers an important methodological contribution for future researchers working with cluster-stratified random samples, as it is the first to use the analytical technique to consider geographical differences.

Despite its limitations, this study's innovative use of emerging statistical techniques (gap analysis)—combined with its access to self-report data about the impact of the 2010 Games from the perspective of over 60,000 adolescents (including those who are marginalised and at-risk)—provides a unique contribution to knowledge by increasing our understanding of how a mega sporting event may positively and negatively impact this age group.

According to Weed and colleagues (2015), there has been:

“A paucity of studies on post-Games participation in sport and, in particular, to question whether an Olympic ‘bounce’ is short or long-term. Such studies, where they do exist, mostly retrospectively utilise quantitative secondary data (largely population level surveys) that measure sport participation, but do not ask more qualitative questions about the factors that have influenced such participation” (p. 207).

By asking 30,000 adolescents directly about the impact of the 2010 Games on their PA and access to sports opportunities three years post-Games, this study will contribute to addressing this gap in our knowledge. The study is also one of the first to address the need for adolescents to be viewed as stakeholders in mega sporting events, with distinct vulnerabilities and opportunities, as identified by Dowse and colleagues (2018).

3.8 Summary of methodological approach

The methodological approach for this retrospective case study takes a critical realist approach which considers psychological, social and environmental mechanisms (as

described in chapters 1 and 2). It uses a mixed methods design and relies primarily on cross-sectional self-report data collected pre and post a mega sporting event, supported by sports club membership data and the perspectives of relevant stakeholders.

Despite the study's limitations detailed in Section 3.7, the methodological approach taken will contribute to the field and to our knowledge about the impact of a mega sporting event on adolescents. It will also add to the discussion on how such an event can be leveraged to promote positive youth development.

4. RESULTS - POPULATION LEVEL

1. Introduction
2. Literature review
3. Methodology
- 4. Results - Population level**
 - 4.1 Tangible benefits of the 2010 Games**
 - 4.1.1 Increased employment**
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 - 4.1.3 Participation in weekly PA 2003-2013**
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 - 4.2.1 Stakeholders' reflections on intangible benefits of 2010 Games**
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 - 4.3.1 Stakeholders' reflections on negative legacies of the 2010 Games**
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5. Results - Vulnerable population
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7. References

This is the first of two Results chapters. It investigates the legacy impact of the 2010 Winter Olympic and Paralympic Games on BC adolescents at the population level. The second Results chapter (Chapter 5) considers the Games' impact on three vulnerable subpopulations—homeless adolescents, adolescents at risk of incarceration, and adolescents with a physical disability. In both chapters, positive and negative, tangible and intangible legacies of the Games are explored, including the impact of the Games on PA, access to sports opportunities and employment. Any evidence of an epicentre effect is also explored, and both chapters conclude with a discussion of the results presented in that chapter. Chapter 5 also discusses the results presented in Chapters 4 and 5 in the context of leveraging future mega events to improve adolescent health. A wider discussion of the philosophical and theoretical context of the findings, and the implications for policy makers seeking to attract major sporting events to Canada, is

addressed in Chapter 6. Reflections on the results provided through stakeholder consultations are incorporated in the following three chapters where relevant.

Analysis conducted in this chapter included population estimates (frequencies), associations (cross tabulations and logistic regressions), trend analysis and gap analysis. Data from three waves of the BC Adolescent Health Survey (BC AHS; 2003, 2008 and 2013) and from provincial sports club membership records were used to answer five specific research questions:

1. To what extent was the 2010 Winter Olympics associated with planned, positive, tangible benefits for different subpopulations of adolescents in BC, either during the pregnancy period or after the Games?
2. Were there intangible benefits of a positive perception of the Games, such as increased community connectedness?
3. To what extent and in what time and space did adolescents report negative unplanned legacies of the Games, such as decreased access to housing, employment or services?
 - a) Was reporting a negative legacy of the Games associated with other tangible or intangible experiences?
4. Was there a spatial impact of the Games (i.e., was the impact of the Games different in host communities, in comparison to non-host BC communities)?
5. Were there sustained changes over time in BC sports club membership for any of the sports which were featured in the 2010 Winter Olympic and Paralympic Games?

4.1 Tangible benefits of the 2010 Games

***Research Question 1:** To what extent was the 2010 Winter Olympics associated with planned, positive, tangible benefits for different subpopulations of adolescents in BC, either during the pregnancy period or after the Games?*

A survey item on the 2008 and 2013 BC AHS offered eight forced choice response options about any impact of the 2010 Games on survey respondents' PA, access to sports opportunities, and employment. It also asked if they had not thought about the Games impact on them, and if it had no effect. There was also the option to write in an open-ended response (Table 4.1).

Table 4.1

Adolescents' Self Report of 2010 Games' Impact

	2008	2013
I am more physically active	9.1%	12.6%
I am less physically active	0.8%	0.9%
I have more sports opportunities	6.0%	6.4%
I have less sports opportunities	0.5%	0.3%
I have more job opportunities	5.8%	2.0%
I have less job opportunities	0.5%	0.3%
Haven't thought about it	43.9%	42.6%
No effect	45.6%	49.7%
Other	2.1%	4.8%

Note. Bolded percentages indicate a significant difference between 2008 and 2013 at $p < .05$.

Adolescents in 2013 were more than twice as likely to provide a qualitative comment (4.8% vs. 2.1% in 2008). A thematic analysis of the open-ended responses showed that there were significantly more negative, unplanned impacts in 2008 than 2013, and the majority of comments in 2013 identified positive legacies.

In 2008, the majority of those who provided a qualitative response were anticipating or already experiencing negative impacts they attributed to the Games. Impacts already experienced included the following: *"You can't get on the hill to snowboard anymore", "Gas prices have gone up", "Transit costs more", "We can't afford to move house now", "There is less money for our school district now and we are on a 4 day school week", "The homeless are being treated horribly", "Prices are going up all the time to pay for it", and "Poor animals are losing their habitat just for a few weeks of the Olympics."*

Concerns of future impacts included *“If they put the rent up again we will have to move”*. *“I hate it! Don’t put the rent up anymore!”* and *“What is going to happen to the wildlife and the trees?”*

In 2008, positive responses included being excited to watch the competition and to participate in related events, and hoping for tangible impacts of the Games such as employment or employment training. In 2013, the most common positive responses indicated that participants had become more active as a result of the Games. Examples included *“I snowboard way more now”*, *“I started to watch and play hockey”*, *“I ski now”*, *“I got into speed skating”*, *“I am determined to become a pro-snowboarder now”*, *“My dream is to get on the girls Olympic hockey team”* and *“I am trying to be an Olympian and training more now.”*

There were also comments about being inspired beyond Winter Olympic sports – for example *“I am exploring more creative ways of exercising now”*, *“I started playing soccer”*, *“I train harder to meet my goals now”*, *“I enjoy myself in sport more”* *“I am trying to get to Rio for swimming now”* and *“I decided to lose 50 pounds that summer!”*

The next most common category of responses related to intangible benefits such as feeling a sense of pride and/or community. Examples included *“I am so proud to be Canadian. We should bid again”*, *“My pride in BC has gone up”*, *“A community came together”*, *“I love my city more”*, *“A sense of pride in Canada”* *“An increase in my national pride”*, *“Be involved in community now. Yay!!!”* *“I felt more involved in my community,”* *“It brought the community together”* and *“I have a greater sense of community.”*

Infrastructure developments were also noted. For example, *“It’s a lot nicer drive to Whistler now”*, *“Better facilities now”*, *“The athletes village gym and funding for racing now”*, *“The biathlon track at Whistler”*, *“Classes at the Oval now”*, and *“I get better dance training now because my trainer was in it.”*

Negative comments were fewer and mainly related to the cost and a concern that other services had been neglected because of the Games “[Prime Minister] Stephen Harper prioritised sport over poverty, Indigenous sovereignty, etc.”, “It cost too much and is too much of a burden on the community”, “Now the government has no money for things we need”, “I hate the Olympic committee – it caused homelessness”, “Less money for education because of it now”, and “I worry about taxes now.” A few comments noted that the Games had highlighted the barriers faced by survey respondents “I realised figure skating is too expensive for me to join”, and “I realise I suck at sport!”

More common than negative comments in 2013 were comments noting the Games had not affected them “Nothing to do with me”, “I wasn’t in Canada then”, “What does that have to do with my life?”, “Why on earth would the Olympics have anything to do with me?” and “Why would it affect a small town like this?”

In addition to adolescents’ qualitative comments, quantitative analysis of the forced-choice options showed that in 2013, 15.3% of BC adolescents reported at least one positive legacy of the 2010 Games (increased employment, PA, or sports opportunities). This included 10.8% who reported one legacy, 3.5% who reported two, and 1.1% who reported all three positive legacies. Results were similar during the Games’ pregnancy period except the percentage of adolescents who reported three positive legacies was slightly higher in 2008 (1.4% vs. 1.1% in 2013), and the percentage reporting two positive legacies was lower (2.8% vs. 3.5% in 2013). In both survey years, males were more likely to report positively on the Games impact than females (Figure 4.1. for 2008 results). For example, in 2013 18.1% of males reported at least one positive legacy of the Games, compared to 12.7% of females.

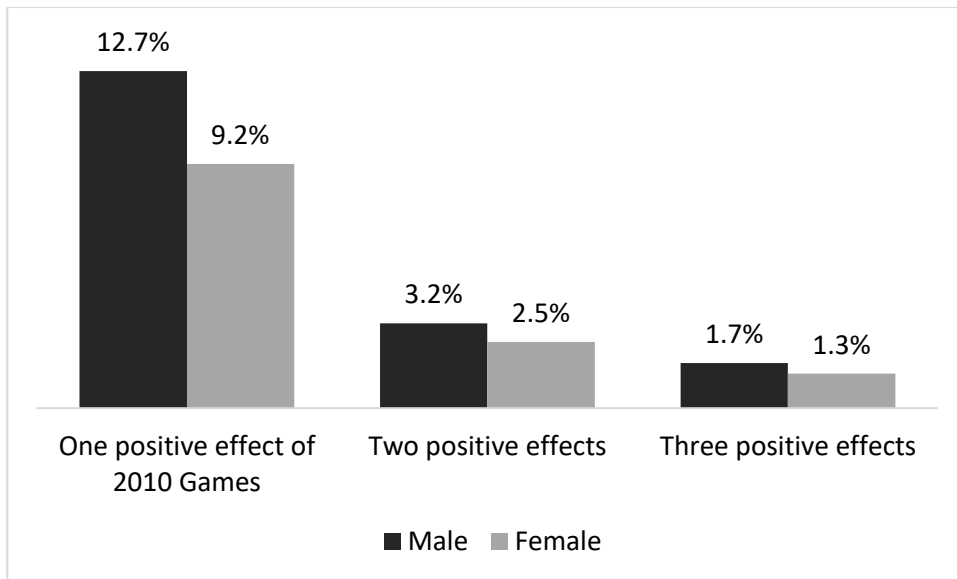
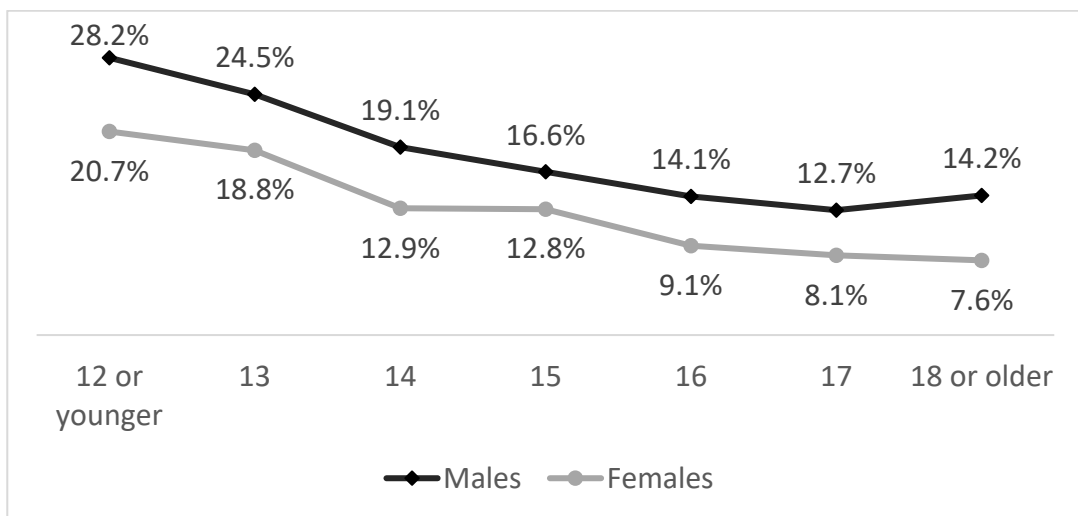


Figure 4.1. Adolescents who reported positive effect(s) of the 2010 Games during pregnancy period (2008 BC AHS)

Pre and post the 2010 Games, younger adolescents were more likely than older ones to report at least one positive legacy of the Games (Figure 4.2 for 2013 results).

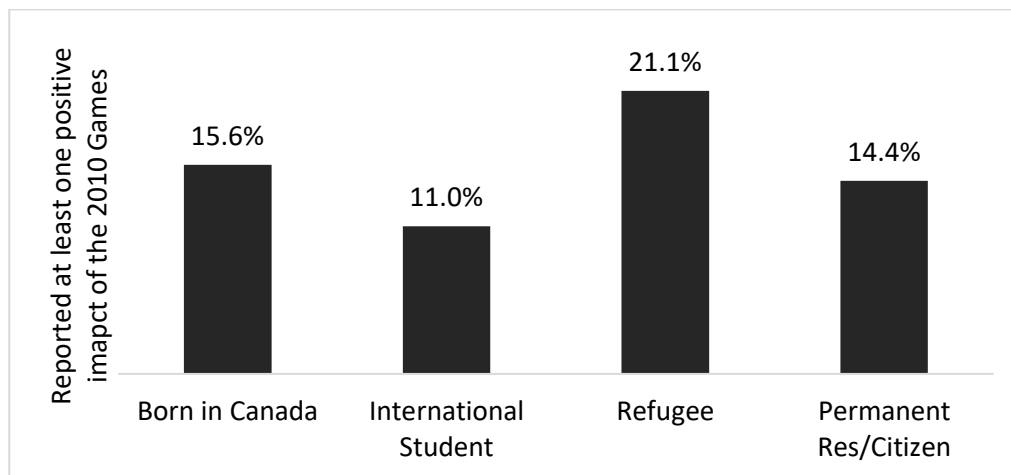


Note: Percentage estimate for males aged 17 years was not statistically different to those aged 16, 18 or 19.

Figure 4.2. Adolescents reporting at least one positive legacy of the 2010 Games by age (2013 BC AHS)

In 2008, 13.0% of adolescents born in Canada reported at least one positive effect of the Games, compared to 10.3% of those born abroad. The pattern was repeated in

2013, with adolescents born in Canada more likely to report a positive impact of the Games (15.6% vs. 13.9% of those born abroad). When considered by immigration status, international students were less likely than Canadian-born adolescents to report positively on the Games, although adolescents who had arrived in Canada as refugees were more likely (Figure 4.3).



Note. The difference between born in Canada and permanent resident/citizen was not significant.

Figure 4.3. Reported positively on the impact of the 2010 Games by immigration status (2013 BC AHS)

In both survey years, the most commonly reported positive legacy of the Games was increased PA participation (Table 4.1), and this rose over time (9.1% in 2008 to 12.6% in 2013). Increased access to sports opportunities (6.0%) and increased employment opportunities (5.8%) were reported at similar rates in 2008. However, reporting the Games had increased their access to sports opportunities remained consistent (6.4%) but access to Games related employment opportunities decreased to 2.0% in 2013 (Table 4.1).

In 2008, males were more likely than females to report they were more physically active and had more sports opportunities as a result of the upcoming Games and were also more likely to provide a qualitative response (Table 4.2). These differences continued in 2013, when males were also more likely to report increased employment opportunities (Table 4.2). Pre and post the 2010 Games, females were more likely to

report they had not thought about the Games, and in 2013 were more likely to say the Games had negatively affected their participation in PA (Table 4.2).

Table 4.2

Gender Differences in Reported Legacies of the 2010 Games (BC AHS)

	2008		2013	
	Males	Females	Males	Females
I am more physically active	11.0%	7.3%	15.0%	10.4%
I am less physically active	0.7%	1.0%	0.7%	1.1%
I have more sports opportunities	7.0%	5.1%	7.6%	5.3%
I have less sports opportunities	0.6%	0.5%	0.3%	0.3%
I have more job opportunities	6.1%	5.6%	2.3%	1.4%
I have less job opportunities	0.6%	0.4%	0.3%	0.3%
Haven't thought about it	39.4%	48.0%	34.6%	50.2%
No effect	45.0%	45.6%	50.3%	49.7%
Other	2.3%	1.9%	5.3%	4.3%

Note. Bolded percentages were significantly different to females within year at $p < .01$.

In 2008 and 2013, the mean age of male and female adolescents who reported positive impacts of the Games on their PA and sports opportunities was lower than those who did not report these effects of the Games (Table 4.3 and 4.4). In 2008, the mean age of those reporting increased job opportunities was higher than those who did not report this impact on their employment (Table 4.3).

In both survey years, the mean age of those who reported they had not thought about the Games was lower, and the age of those who reported no effect or wrote in a comment was higher than those who did not report these effects (Tables 4.3 and 4.4).

Table 4.3

Mean Ages of Adolescents Reporting Impacts of 2010 Games (2008 BC AHS)

	Males				Females			
	Mean age who endorsed item	Mean age who did not endorse item	t	p value	Mean age who endorsed item	Mean age who did not endorse item	t	p value
I am more physically active	14.37	15.07	12.737	<.001	14.19	15.09	13.775	<.001
I am less physically active	14.82	15.00	0.770	.441	14.81	15.02	1.063	.288
I have more sports opportunities	14.64	15.02	5.352	<.001	14.42	15.05	8.454	<.001
I have less sports opportunities	15.07	15.00	-0.35	.727	14.85	15.02	0.671	.502
I have more job opportunities	15.61	14.96	-9.286	<.001	15.70	14.98	-10.22	<.001
I have less job opportunities	15.51	14.99	-2.464	.014	14.76	15.02	0.892	.373
Haven't thought about it	14.86	15.09	6.515	<.001	14.87	15.02	0.892	<.001
No effect	15.18	14.85	-9.787	<.001	15.22	14.85	10.700	<.001
Other	15.57	14.98	-5.559	<.001	15.26	15.02	-2.018	.044

Table 4.4

Mean Ages of Adolescents Reporting Impacts of 2010 Games (2013 BC AHS)

	Males				Females			
	Mean age who endorsed item	Mean age who did not endorse item	t	p value	Mean age who endorsed item	Mean age who did not endorse item	t	p value
I am more physically active	14.46	15.07	12.069	<.001	14.31	15.04	13.696	<.001
I am less physically active	14.80	14.97	0.961	0.337	14.80	14.97	0.961	.337
I have more sports opportunities	14.30	15.00	10.175	<.001	14.30	15.00	10.175	<.001
I have less sports opportunities	14.32	14.97	2.106	.035	14.32	14.97	2.106	.035
I have more job opportunities	14.90	14.97	0.540	.590	14.90	14.97	0.540	.590
I have less job opportunities	15.42	14.96	-1.467	.143	15.42	14.96	-1.467	.143
Haven't thought about it	14.90	15.03	3.985	<.001	14.90	15.03	3.985	<.001
No effect	15.24	14.70	17.256	<.001	15.42	14.70	-17.26	<.001
Other	15.55	14.94	-8.921	<.001	15.20	14.96	-2.848	.004

Note. Bolded means are significantly different from age of those who did not endorse the item.

4.1.1 Increased employment

In 2008, there were no gender differences in adolescents reporting the 2010 Games increased their employment opportunities. However, five years later, males were more likely than females to report this positive legacy of the Games (2.3% vs. 1.4%).

Pre and post the 2010 Games, older adolescents were more likely than younger adolescents to report they had benefitted from increased employment opportunities (e.g. Figure 4.4).

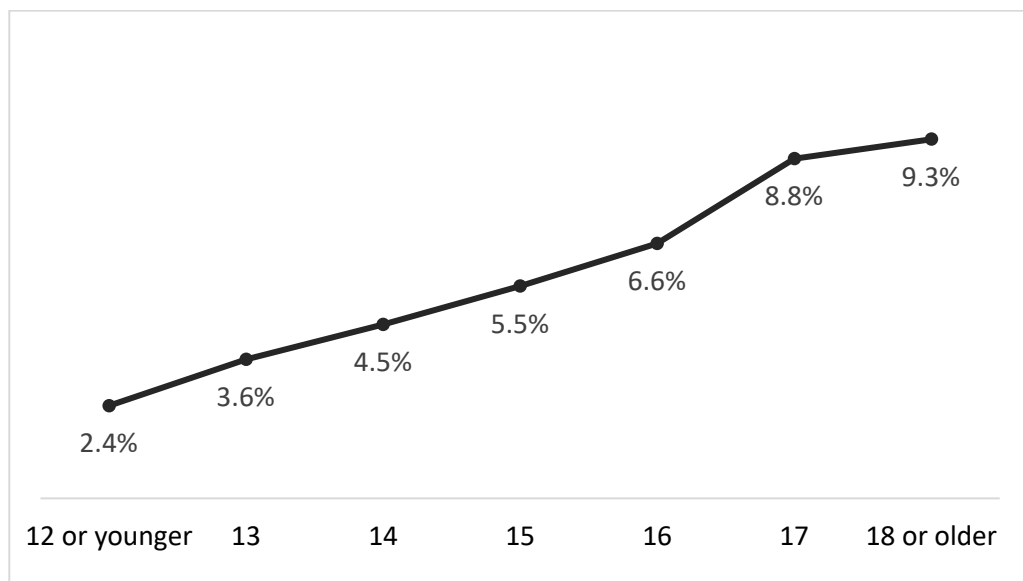


Figure 4.4. Adolescents reporting 2010 Games increased their employment opportunities (2008)

In both survey years, adolescents who reported increased employment opportunities as a result of BC hosting the 2010 Games were more likely to have worked at a paid job in the past 12 months (Figure 4.5).

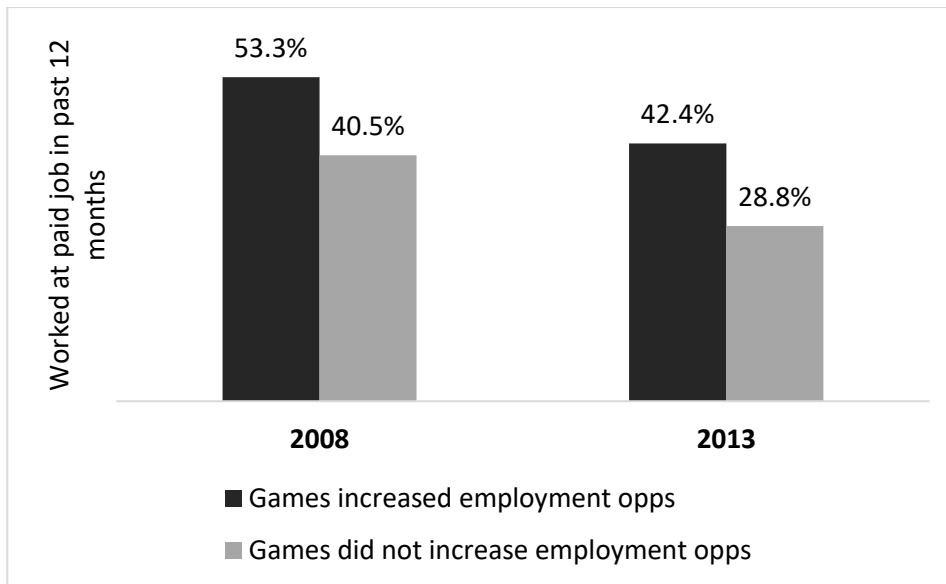
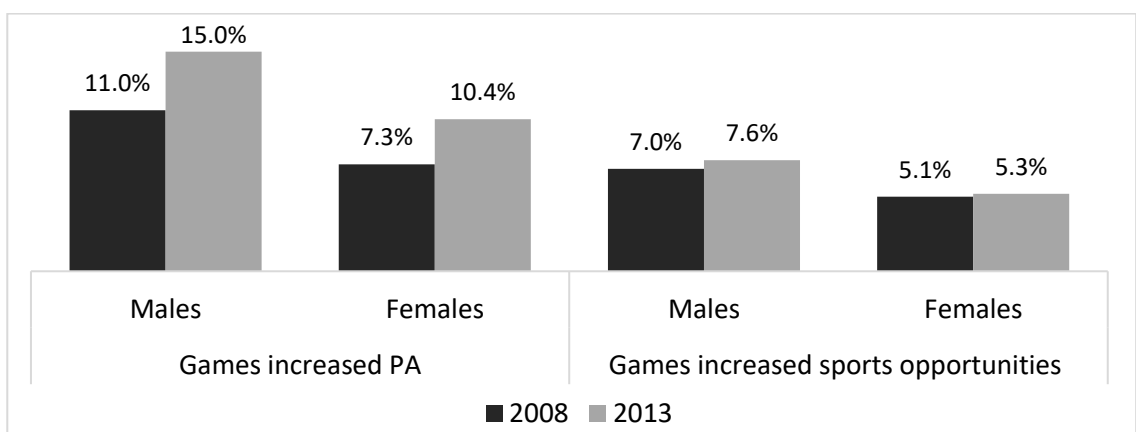


Figure 4.5. Adolescents who worked at a paid job in the past 12 months (BC AHS)

4.1.2. Increased PA and sports opportunities

Between 2008 and 2013, there was an increase in males and females reporting the Games had increased their PA, but there was no such increase in reporting increased access to sports opportunities (Figure 4.6). Pre and post the event, males were more likely than females to report the Games had positively impacted their PA and access to sports opportunities (Figure 4.6).



Note: The difference between 2008 and 2013 was not statistically significant for males or females for increased access to sports opportunities.

Figure 4.6. Adolescents reporting the 2010 Games increased their PA or access sports opportunities (BC AHS)

Unlike the pattern for employment, younger adolescents were more likely than older ones to report that the Games had positively impacted their PA participation (Figure 4.7). They were also more likely than older ones to report increased sports opportunities. For example, in 2008, 17.0% of males aged 13 reported being more physically active as a result of the Games (vs. 7.1% of 17-year-olds), and 8.9% reported they had greater access to sports opportunities (vs. 5.7% of 17-year-olds). For females, 12.5% reported the Games had increased their PA (vs. 3.8% of 17-year-olds), and 7.5% reported increased sports opportunities (vs. 3.0% of 17-years-olds).

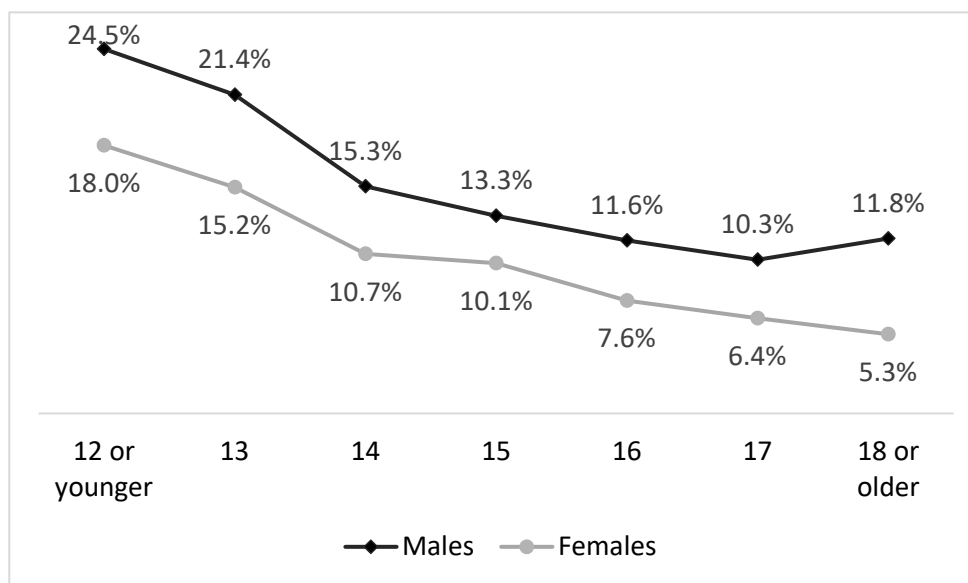


Figure 4.7. Adolescents reporting increased PA as a result of 2010 Games by gender (2013 BC AHS)

Around a third of those who reported the Games had increased their PA also reported they had greater access to sports opportunities (35.4% in 2008 and 31.9% in 2013, with no gender differences in either year). However, among those who reported that the Games had increased their access to sports opportunities, 53.5% in 2008 and 62.9% in 2013 reported a Games related increase in their PA.

4.1.3 Participation in weekly PA 2003-2013

Adolescents' regular participation in extracurricular organised sports (i.e., sports with a coach), informal sports (sports without a coach) and exercise classes (including dance and yoga) were considered over the decade after the 2010 Games were awarded to

Vancouver. Data for participation in extracurricular extreme sports was also available for 2013.

At baseline (2003), males and females were equally likely to have played organised sports at least weekly in the previous 12 months. By 2008, males were more likely to play organised sports than females, and this gender difference continued through 2013 (Figure 4.8).

Males' participation in weekly organised sports rose following the awarding of the Games to Vancouver (from 2003 to 2008), and although there was a slight decline in participation between 2008 and 2013, participation rates remained above the 2003 level (Figure 4.8). For females, there was a similar increase in participation between 2003 and 2008. However, this was not maintained and by 2013 organised sports participation dropped below the rates of a decade earlier (Figure 4.8).

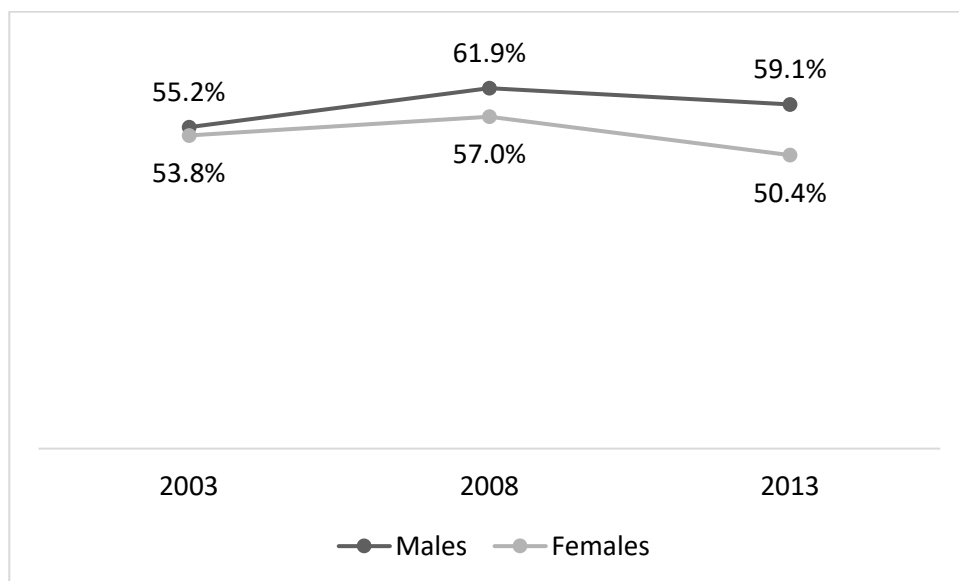
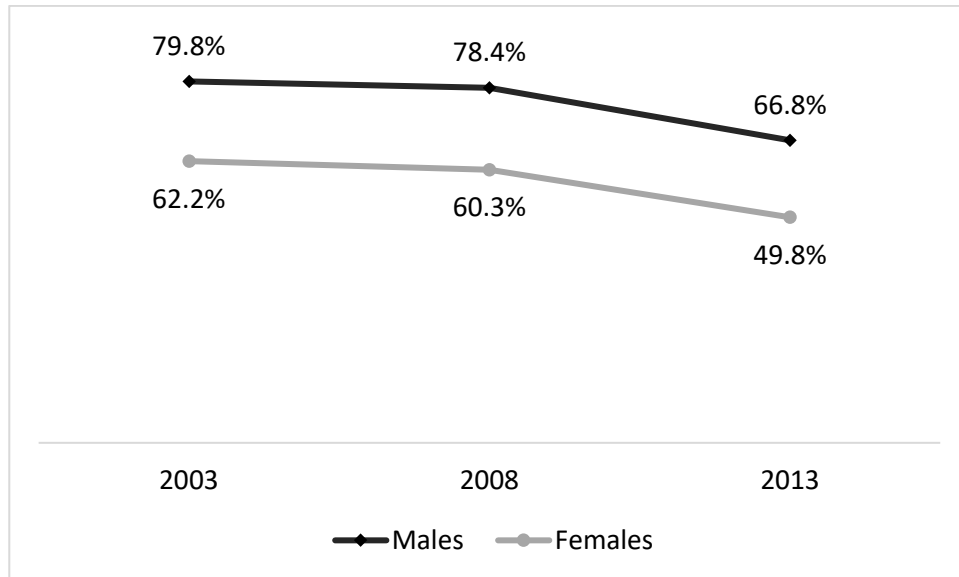


Figure 4.8. Trends in weekly participation in organised sports in past 12 months (BC AHS)

Unlike organised sports there were gender differences in participation in informal sports and exercise classes in 2003, which were also present in 2008 and 2013 (Figure 4.9 and 4.10).

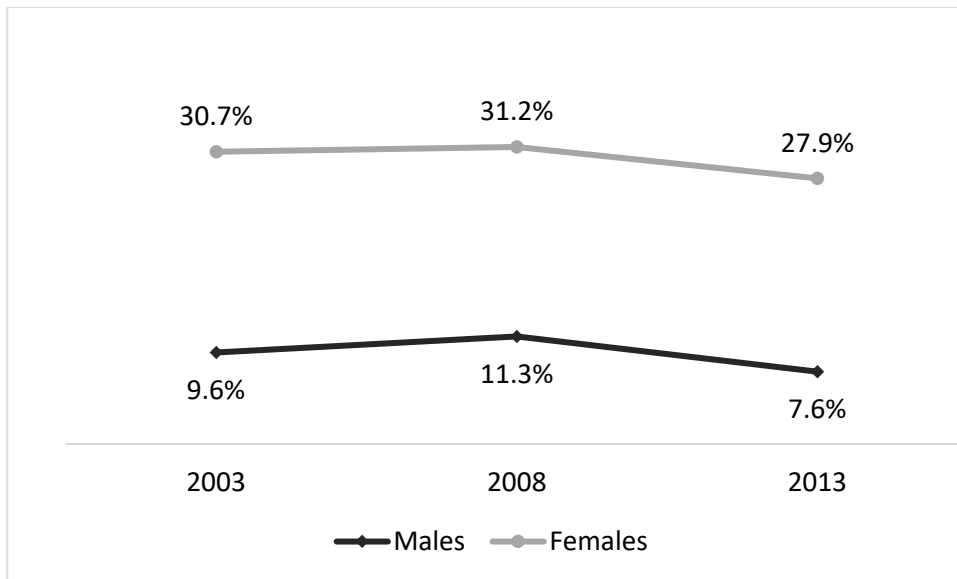
For both genders there was a non-significant decline in informal sports participation between 2003 and 2008 (p 's > .01) and a statistically significant decline in participation between 2008 and 2013 (Figure 4.9).



Note. Decrease in participation between 2003 and 2008 was not statistically significant for males or females.

Figure 4.9. Trend in weekly participation in informal sports in past 12 months (BC AHS)

For males, participation in weekly exercise classes increased between 2003 and 2008, before decreasing below the 2003 level in 2013. For females, participation rates remained stable between 2003 and 2008 before also dropping in 2013 (Figure 4.10).



Note. Changes in females participating in exercise classes between 2003 and 2008 were not statistically significant

Figure 4.10. Trend in weekly participation in exercise classes in past 12 months (BC AHS)

4.1.4 Perception of the Games' impact and engagement in weekly PA

Pre and post the Games, males and females who reported they had become more physically active as a result of BC hosting the Games were more likely to have engaged in each of the types of weekly PA they were asked about, compared to adolescents who did not indicate increased physical activity because of the Games (Table 4.5).

Table 4.5

Perception of 2010 Games impact on PA and Engagement in Weekly PA (BC AHS)

Participated at least weekly in past year	Males (2008)			Females (2008)		
	Games increased PA	Games did not increase PA	Chi square	Games increased PA	Games did not increase PA	Chi square
Organised sports	75.4%	60.2%	123.6	75.4%	55.4%	123.6
Informal sports	87.0%	77.4%	69.5	77.0%	59.0%	69.5
Exercise classes	20.6%	10.0%	143.2	41.8%	30.3%	143.2
Participated at least weekly in past year	Males (2013)			Females (2013)		
	Games increased PA	Games did not increase PA	Chi square	Games increased PA	Games did not increase PA	Chi square
Organised sports	73.0%	56.8%	190.9	69.6%	48.1%	248.9
Informal sports	76.6%	64.9%	107.2	67.0%	47.8%	197.5
Exercise classes	10.0%	7.0%	32.8	35.4%	27.1%	45.4
Extreme sports	21.6%	15.6%	35.8	9.3%	4.5%	65.7

Note. Bolded percentage indicates difference between Games increased PA and Games did not increase PA is statistically significant at $p < .001$.

Note. Participation in extreme sports was not included on the 2008 BC AHS.

Similarly, male and female adolescents who reported they had greater access to sports opportunities as a result of the 2010 Games were more likely to have engaged in weekly organised, informal and extreme sports than those who did not report the Games impacted their sports opportunities. However, whilst reporting the Games increased their sports opportunities was a predictor of engagement in exercise classes for both genders in 2008, it was no longer associated with regular exercise class participation for males by 2013 (Table 4.6).

Crosstabulations (Tables 4.5 and 4.6) showed an association between weekly engagement in sports and exercise, and reporting the Games had a positive impact on PA and access to sports opportunities. However, as age is known to affect participation in PA, adjusted logistic regression analyses were conducted, controlling for age. Findings were similar after controlling for age, with positive perceptions of the Games (in terms of greater PA and sports opportunities) linked to increased weekly PA during the pregnancy period of the Games and three years after the Games (Table 4.7).

Table 4.6.

Perception of 2010 Games Impact on Sports Opportunities and Engagement in Weekly PA (BC AHS)

Participated at least weekly in past year	Males (2008)			Females (2008)		
	Games increased sports opps	Games did not increase sports opps	Chi-square	Games increased sports opps	Games did not increase sports opps	Chi-square
Organised sports	78.9%	60.6%	122.1	82.1%	55.5%	198.6
Informal sports	90.0%	71.6%	79.0	77.7%	58.1%	96.5
Exercise classes	16.8%	10.7%	32.013	40.90%	30.6%	33.8
Participated at least weekly in past year	Males (2013)			Females (2013)		
	Games increased sports opps	Games did not increase sports opps	Chi-square	Games increased sports opps	Games did not increase sports opps	Chi-square
Organised sports	78.8%	57.6%	181.2	76.7%	48.9%	223.5
Informal sports	78.5%	65.7%	77.0	67.4%	48.8%	101.4
Exercise classes	9.9%	7.4%	8.4	36.2%	27.5%	26.9
Extreme sports	23.2%	16.8%	28.1	12.4%	4.6%	92.0

Note. Bolded percentage indicates difference between Games increased sports opportunities and Games did not increase sports opportunities is statistically significant at least $p < .01$ (Exercise classes for males $p < .01$ in 2013, all other analyses $p < .001$).

Table 4.7

AORs for Perceptions of Increased Physical Activity as a Result of the 2010 Games as a Predictor of Weekly Engagement in PA (BC AHS)

	Males		Females	
	2008	2013	2008	2013
Organised sports	1.881 (1.565-2.261)	1.957 (1.745-2.195)	2.209 (1.766-2.762)	2.165 (1.908-2.458)
Informal sports	1.892 (1.492-2.399)	1.782 (1.575-2.016)	2.237 (1.801-2.779)	2.213 (1.957-2.503)
Exercise classes	2.145 (1.746-2.634)	1.543 (1.294-1.840)	1.564 (1.292-1.893)	1.443 (1.275-1.633)
Extreme sports	N/A	1.393 (1.226-1.583)	N/A	2.026 (1.648-2.489)

Note. Bolded Adjusted Odds Ratios (AOR) indicate that perceptions the Games increased PA predicted engagement in weekly PA at $p < .001$.

Similarly, after controlling for age, reporting that the Games had increased access to sports opportunities predicted weekly participation in sports for males and females in 2008 and 2013. Reporting the 2010 Games had increased access to sporting opportunities predicted engagement in exercise classes for both genders in 2008, and for females in 2013 (Table 4.8).

Table 4.8

AOR for Perceptions of Increased Access to Sports Opportunities as a Result of the 2010 Games as a Predictor of Weekly Engagement in PA (BC AHS)

	Males		Females	
	2008	2013	2008	2013
Organised sports	2.380 (1.870-3.028)	2.694 (2.295-3.163)	3.359 (2.521-4.475)	3.022 (2.489-3.670)
Informal sports	2.588 (1.888-3.548)	1.878 (1.576-2.237)	2.272 (1.763-2.926)	2.134 (1.799-2.531)
Exercise classes	1.618 (1.285-2.139)	1.303 (1.026-1.654)	1.489 (1.192-1.862)	1.436 (1.214-1.699)
Extreme sports	N/A	1.496 (1.273-1.758)	N/A	.910 (.872-.948)

Note. Bolded AORs indicate that perceptions the Games increased access to sports opportunities predicted engagement in weekly PA at $p < .001$.

As reporting the Games increased PA and access to sports opportunities both predicted weekly PA involvement, the two were placed together in a regression model, with age as a covariate, to consider if one was a stronger predictor of weekly participation than the other.

When considered together, reporting the Games increased PA continued to predict participation in weekly organised, informal and extreme sports, and exercise classes. Reporting increased sports opportunities also continued to predict participation in organised, informal and extreme sports, but no longer predicted participation in exercise classes for males or females in either survey year (Tables 4.9 and 4.10).

Table 4.9

Perception of the 2010 Games as a Predictor of Weekly Sports and PA Participation (2008 BC AHS)

Males (2008)	AOR (with 99% CI)	adj F	t	p value
Organised sports				
Increased PA due to 2010 Games	1.564 (1.291-1.895)	36.105	6.009	<i>p</i> <.001
Increased sports opportunities due to 2010 Games	1.968 (1.529-2.532)	47.997	6.928	<i>p</i> <.001
Age	.882 (.853-.914)	91.613	-9.571	<i>p</i> <.001
Informal sports				
Increased PA due to 2010 Games	1.561 (1.220-1.996)	21.788	4.668	<i>p</i> <.001
Increased sports opportunities due to 2010 Games	2.144 (1.547-2.970)	36.431	6.036	<i>p</i> <.001
Age	.941 (.906-.976)	17.987	-4.241	<i>p</i> <.001
Exercise classes				
Increased PA due to 2010 Games	2.075 (1.642-2.623)	64.170	8.044	<i>p</i> <.001
Increased sports opportunities due to 2010 Games	1.113 (.802-1.54)	.715	.846	<i>p</i> =.398
Age	.904(.858-.952)	25.115	-5.011	<i>p</i> <.001

Table 4.9 continued...

Females (2008)	AOR (with 99% CI)	adjF	t	p value
<u>Organised sports</u>				
Increased PA due to 2010 Games	1.648 (1.297-2.092)	29.067	5.391	<i>p</i> <.001
Increased sports opportunities due to 2010 Games	2.680 (1.983-3.620)	71.420	8.451	<i>p</i> <.001
Age	.830 (.803- .854)	222.874	-14.929	<i>p</i> <.001
<u>Informal sports</u>				
Increased PA due to 2010 Games	1.883 (1.494-2.373)	49.780	7.055	<i>p</i> <.001
Increased sports opportunities due to 2010 Games	1.723 (1.316-2.256)	27.149	5.210	<i>p</i> <.001
Age	.932(.906- .960)	39.380	-6.275	<i>p</i> <.001
<u>Exercise classes</u>				
Increased PA due to 2010 Games	1.456 (1.173-1.807)	20.057	4.478	<i>p</i> <.001
Increased sports opportunities due to 2010 Games	1.226 (.952 -1.580)	4.302	2.074	<i>P</i> =.038
Age	.919 (.889-.950)	43.419	-6.589	<i>p</i> <.001

Note. Bolded AOR indicates Games increased PA predicted engagement in weekly PA at *p*<.001.

Table 4.10

Perception of the 2010 Games as a Predictor of Weekly Sports and PA Participation (2013 BC AHS)

Males (2013)	AOR (with 99% CI)	Adj F	t	p value
Organised sports				
Increased PA due to 2010 Games	1.608 (1.370-1.888)	58.535	7.651	<i>p</i> <.001
Increased sports opportunities due to 2010 Games	2.143 (1.713-2.681)	76.985	8.774	<i>p</i> <.001
Age	.869 (.841-.898)	121.717	-11.032	<i>p</i> <.001
Informal sports				
Increased PA due to 2010 Games	1.6012 (1.342-1.921)	47.613	6.900	<i>p</i> <.001
Increased sports opportunities due to 2010 Games	1.492 (1.160-1.919)	16.827	4.102	<i>p</i> <.001
Age	1.028 (.998-1.060)	5.637	2.374	<i>p</i> =.018
Exercise classes				
Increased PA due to 2010 Games	1.527 (1.182-1.974)	18.192	4.265	<i>p</i> <.001
Increased sports opportunities due to 2010 Games	1.040 (.734-1.474)	.084	.289	<i>p</i> =.772
Age	1.010 (.699 – 1.382)	.211	.459	<i>p</i> =.642
Extreme sports				
Increased PA due to 2010 Games	1.280 (1.063-1.541)	11.731	3.425	<i>p</i> =.001
Increased sports opportunities due to 2010 Games	1.317 (1.042-1.665)	9.199	3.033	<i>p</i> =.002
Age	.979 (.942-1.016)	2.186	-1.479	<i>p</i> =.139
Females (2013)				
Organised sports				
Increased PA due to 2010 Games	1.748 (1.461-2.092)	64.378	8.024	<i>p</i> <.001
Increased sports opportunities due to 2010 Games	2.266 (1.723-2.979)	59.448	7.710	<i>p</i> <.001
Age	.817 (.787-.841)	259.694	-16.115	<i>p</i> <.001

Table 4.10 continued...

<u>Informal sports</u>				
Increased PA due to 2010 Games	1.976 (1.659-2.354)	101.035	10.052	$p<.001$
Increased sports opportunities due to 2010 Games	1.499 (1.172-1.918)	17.981	4.240	$p<.001$
Age	1.014 (.987-1.041)	1.727	1.314	$p=.189$
<u>Exercise classes</u>				
Increased PA due to 2010 Games	1.362 (1.138-1.547)	19.736	4.442	$p<.001$
Increased sports opportunities due to 2010 Games	1.211 (.949-1.547)	4.093	2.023	$p=.043$
Age	.957 (.927-.987)	13.617	-3.690	$p<.001$
<u>Extreme sports</u>				
Increased PA due to 2010 Games	1.549 (1.116-2.149)	11.866	3.445	$p=.001$
Increased sports opportunities due to 2010 Games	2.113 (1.413-3.159)	22.989	4.795	$p<.001$
Age	.918 (.868-.970)	16.082	-4.010	$p<.001$

4.1.5 Stakeholders' reflections on tangible benefits of the 2010 Games

Most of the stakeholders who were interviewed for this study had expertise which related to sports participation. They felt the results which showed some BC AHS participants credited the Games with increasing their PA provided clear evidence of a demonstration effect occurring for BC adolescents.

"There is a direct correlation between young people watching their professional sports idols, regardless of the sports, and wanting to go out and participate."
Senior administrator, Vancouver Whitecaps FC.

"This [the results] is Bandura's self-efficacy. I don't see how it couldn't be."
2010 Canadian Olympic health support team member

However, all these stakeholders also commented that insufficient planning and resources went into trying to create a tangible long-term legacy of sports and PA participation. For example, three stakeholders involved in adolescent ice hockey noted

that opportunities to capitalise on the presence of a demonstration effect were lost within the sport, and speculated that the percentages who reported increased PA and access to sports opportunities would likely have been higher, and included greater diversity, if clubs and venues had been better prepared.

“Hockey Canada should have had a plan for afterwards. They could have made local heroes of the winners, taken them into schools, got them doing things with kids, especially the [ethnic] minority kids who need to see they [ethnic minority athletes] can be involved and do well, but there was none of that.” Senior administrator, Surrey Minor Hockey.

“We were completely unprepared. Especially with all the girls suddenly wanting to be the next Hayley [Wickenheiser]. We just weren’t set up.” Senior administrator, BC Hockey.

None of the stakeholders who felt the BC AHS and sports club membership data indicated that a demonstration effect had occurred felt that the opportunity to watch elite athletes in isolation was sufficient to engage adolescents in PA at the population level. All stated that adolescents reporting increased PA and sports opportunities likely also benefitted from improved infrastructure which occurred as a result of the Games.

“The transit developments meant places like Whistler and the Oval were suddenly more accessible. Even schools were doing a couple of trips a year up to Whistler - that never would have happened before.” Youth service provider.

“I would say it is the facilities and the programming that came out of 2010 that are responsible for any legacies we see.” Senior administrator, BC government.

Stakeholders not directly involved in sports also felt that the infrastructure developments associated with the Games left a tangible legacy of increased PA.

“With the Olympic Village development, there was a deliberate effort to create an active community. It was a huge success ... I do think it has changed how we build here for the better. It helped us to figure out a layout where people can interact with each other and with nature, and where adolescents can connect in healthier ways.” Project manager, Olympic Village construction.

The discrepancies in tangible benefits, particularly in relation to sports and PA, between males and females and younger and older adolescents did not surprise any of the stakeholders.

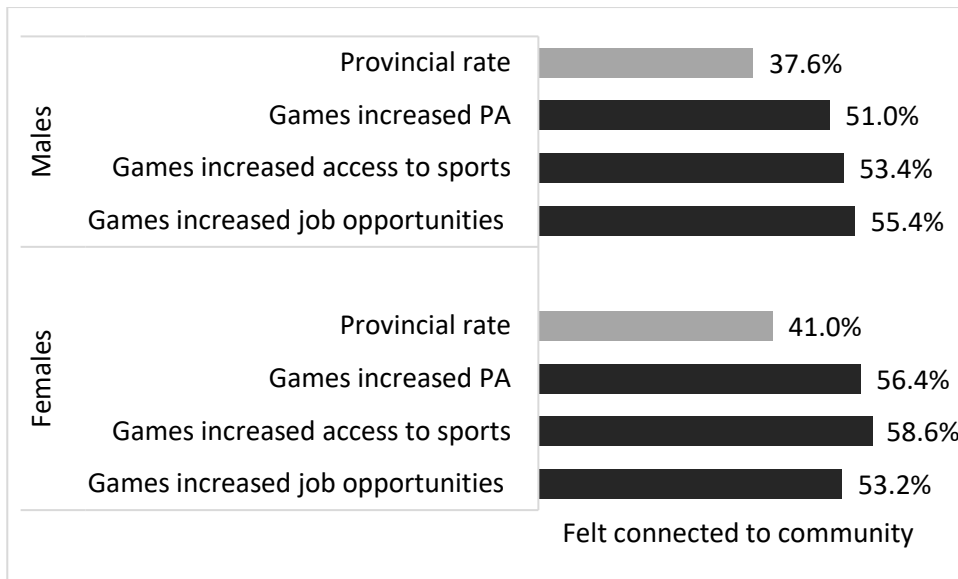
“It’s a bit of a generalisation but ... 16 to 18-year-old girls are not watching sport! They might be completely into playing soccer but they don’t even watch the World Cup when it is on. Boys will be watching much more... so they are more influenced by something like the Olympics. If you can get girls to watch they get into it but you have to find different ways to engage them, because they don’t go looking for it.” Junior sports coach.

“Girls are put off by the focus on male sports. The Olympics are about the only place you see female athletes on TV but [every four years] it’s too late by then, they’ve lost interest.” Senior administrator, BC government.

4.2 Intangible benefits of the 2010 Games

Research Question 2: *Were there intangible benefits of a positive perception of the Games, such as increased community connectedness?*

In 2013, 39.3% of BC adolescents (37.6% males vs. 41.0% females) reported feeling ‘quite a bit’ or ‘very much’ connected to their community. Males and females who reported the Games had increased their PA, access to sports opportunities and/or employment opportunities were more likely to feel connected to their community than their peers who did not report positively on the Game impacts in these areas. They also had higher levels of connectedness than the provincial rate (Figure 4.11).



Note. Differences between provincial rate and reporting positively on the Games were statistically significant at $p < .01$.

Figure 4.11. Adolescents who felt 'quite a bit' or 'very much' connected to their community (2013 BC AHS)

As reporting that the Games increased employment opportunities was associated with adolescents being more likely to have held paid employment in the past year, adjusted logistic regressions were conducted to ascertain if reporting increased job opportunities would remain an independent predictor of community connectedness when considered with employment and age (Table 4.11).

For both genders, reporting that the Games had increased their employment opportunities was an independent predictor of community connectedness, and for males was a stronger predictor of community connectedness than being employed in the past year (Table 4.11).

Table 4.11

Adolescents Who Felt 'Quite a bit' or 'Very much' Connected to Their Community in Relation to Employment and Perception of Games' Impact on Employment (2013 BC AHS)

	Males			
	AOR (99% CI)	Adj F	t	p value
Employed in past 12 months	1.217 (1.089-1.360)	20.820	4.563	<i>p</i> <.001
Games increased job opportunities	2.019 (1.460-2.793)	31.255	5.591	<i>p</i> <.001
Age	.871(.845-.898)	136.913	-11.701	<i>p</i> <.001
	Females			
	AOR (99% CI)	Adj F	t	p value
Employed in past 12 months	1.308 (1.172-1.460)	40.052	6.329	<i>p</i> <.001
Games increased job opportunities	1.594 (1.093-2.323)	10.276	3.190	<i>p</i> = .001
Age	.866 (.839-.894)	134.949	-11.617	<i>p</i> <.001

Note. Bolded AOR indicates Games increased PA predicted engagement in weekly PA at *p*<.001.

Similarly, gender specific logistic regressions (controlling for age) were conducted to assess if increased PA and/or increased access to sports opportunities predicted community connectedness independently of participating in weekly PA. Age was negatively linked to community connectedness, whereas increased PA and increased access to sports opportunities predicted community connectedness independent of each other and of weekly engagement in PA (Table 4.12).

Table 4.12

Adolescents Who Felt ‘Quite a bit’ or ‘Very much’ Connected to Their Community in Relation to Weekly PA Involvement and Perception of Games Impact on PA and Sports Opportunities (BC AHS)

	Males			
	AOR (99% CI)	Adj F	t	p value
Engaged in weekly PA	1.648 (1.426-1.898)	80.776	8.988	<i>p</i> <.001
Games increased PA	1.529 (1.321-1.771)	55.945	7.480	<i>p</i> <.001
Games increased access to sports opportunities	1.499 (1.222-1.838)	26.199	5.118	
Age	.898 (.872-.925)	87.600	-9.359	<i>p</i> <.001
	Females			
	AOR (99% CI)	Adj F	t	p value
Engaged in weekly PA	1.702 (1.505-1.926)	123.972	11.134	<i>p</i> <.001
Games increased PA	1.556 (1.316-1.841)	46.274	6.803	<i>P</i> <.001
Games increased access to sports opportunities	1.485 (1.170-1.885)	18.281	4.276	<i>P</i> <.001
Age	.910 (.882- .939)	59.916	-7.741	<i>p</i> <.001

Note. Bolded AOR indicates variable predicted community connectedness at *p*<.001.

4.2.1 Stakeholders’ reflections on intangible benefits of the 2010 Games

The study’s qualitative and quantitative findings of an association between the hosting of the Games and community connectedness were supported by stakeholders. All of them spoke positively about the sense of *communitas* and connectedness that was generated by the Games, and the feeling that Vancouver was experiencing a ‘once in a lifetime’ event. Five of the stakeholders who had knowledge of communities outside of the Lower Mainland also stated that events like the torch relay were effective in creating a sense of excitement and community in those towns.

“There was such excitement in the small towns around the torch relay that it really did feel like everyone could be involved and be a part of a community around the Olympics.” Junior sports coach (and Olympic torchbearer)

“Even the most anti-Olympic kids before the Games who were protesting...and complaining, got swept up in it and came away with a sense of community and that they had experienced something special.” Junior sports coach.

Senior administrators at the three venues which had benefitted from investment associated with the Games spoke about how each venue had developed a deliberate strategy which aimed to build on the sense of community created during the Games.

“We’ve made a conscious effort to use this facility to create community connectedness and a deeper sense of belonging by hosting community events, concerts, anything that can bring people together through a focal point.” Manager, legacy recreational facility.

Eight of the stakeholders noted that a sense of pride had been generated at the community, provincial and/or national level which had continued long after the Games ended and had left a lasting positive impact on the province.

“We had immigrant kids tell us they felt Canadian for the first time. [Ice] Hockey is so Canadian and they got into it through the Games. The kids felt connected to their community and then wanted to get involved and that brought the parents together through the kids. You see them at the rink now and they have a community...They needed that catalyst to bring them out.” Senior administrator, Richmond Minor Hockey.

“As Canadians we don’t have a high profile in most sports and there aren’t a lot of Canadians to cheer for at world events , so it is hard to create a legacy of winning in the way that countries like the US can that have the population and the infrastructure, but I think the Games really did make kids and adults think of ourselves differently and feel united and connected in ways we could be proud of and wanted to maintain.” Junior sports coach

4.3 Negative legacies of the 2010 Games

Research Question 3: *To what extent and in what time and space did adolescents report negative unplanned legacies of the Games, such as decreased access to housing, employment or services?*

This question is addressed in greater detail in Chapter Five as relatively few BC adolescents reported negative effects of the 2010 Games at the population level, pre or post the Games (Table 4.1). In 2013, 0.9% reported they were less physically active, 0.3% had reduced access to sports opportunities and 0.3% reported decreased employment opportunities. These percentages were similar to five years earlier, as was the overall percentage who reported any negative legacies (1.3%).

There were no gender differences in reporting the Games had negatively impacted employment or sports opportunities in either survey year, but post Games, females were more likely to report they were less physically active as a result of the Games being hosted in BC (1.1% vs. 0.7% of males).

Adolescents who reported the Games had negatively impacted them in one area did not necessarily view its impact negatively in other areas. For example, in 2008, 18.9% of adolescents who indicated the Games had decreased their employment opportunities reported that it had also increased their PA, compared to 9.1% in the overall population.

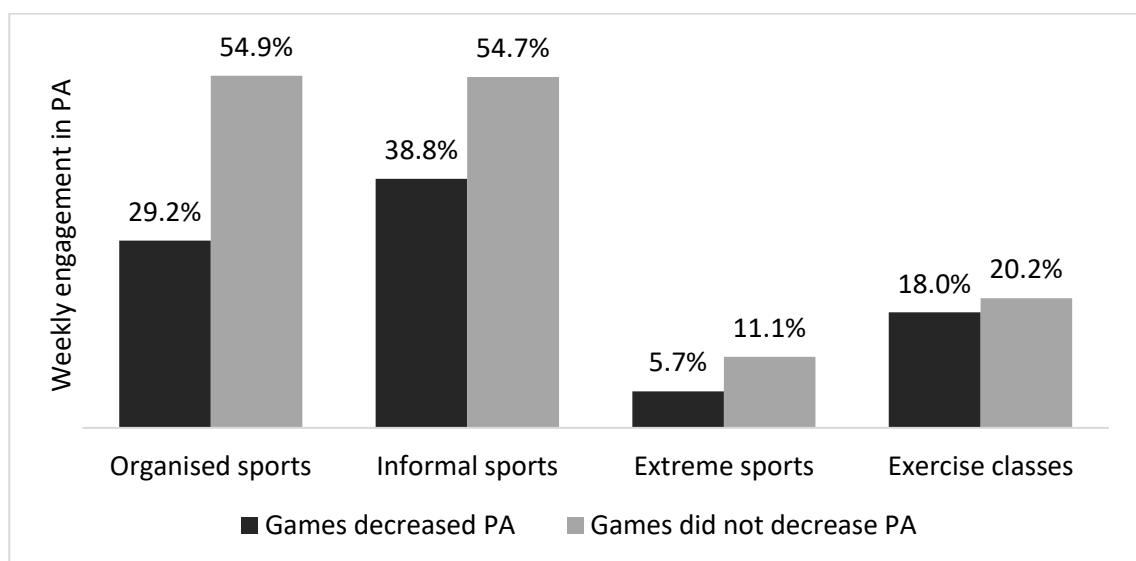
Research Question 3a: *Was reporting a negative legacy of the Games associated with other tangible or intangible experiences?*

Pre- and post the 2010 Games, adolescents who reported the Games had negatively impacted their employment opportunities were employed at similar rates to their peers who were not negatively impacted.

In 2008, there were no significant differences between adolescents reporting the Games had negatively impacted their access to sports opportunities and their participation in weekly organised sports, informal sports or exercise classes. Results were similar in 2013 except reporting reduced access to sports opportunities was associated with lower levels of weekly engagement in organised sports (38.8%* vs. 54.7%).

Adolescents in 2008 who reported they were less physically active as a result of the Games were less likely to play weekly organised sports (42.8% vs. 59.3% who did not report a negative impact on their PA) or informal sports (42.4% vs. 69.2%). In 2013, reporting the Games had negatively impacted PA was associated with lower levels of engagement in weekly sports (Figure 4.12).

Pre and post the 2010 Games, there was no relation between reporting a negative impact on PA and weekly participation in exercise classes for males or females.



Note. The difference for exercise classes was not statistically significant.

Figure 4.12. Weekly sports participation among adolescents who reported the Games decreased their PA (in comparison to those who did not report this negative impact; 2013 BC AHS)

Adolescents who reported the Games had negatively impacted them were less likely to feel connected to their community. For example, 37.0% of females who reported the Games had resulted in them being less physically active reported feeling connected to their community, compared to 56.4% of those who reported it had increased their PA. However, there were no significant differences between those reporting negatively on the Games and the overall provincial rate of community connectedness.

4.3.1 Stakeholders' reflections on negative legacies of the 2010 Games

Stakeholders were not surprised that so few adolescents reported negative impacts on their PA and sports involvement at the population level. However, one articulated that the results provided further evidence of a demonstration effect, suggesting those who did report a negative impact on their PA and sports involvement were likely to be adolescents who could not see themselves reflected in the athletes they saw competing in the Games.

“How can an event in Vancouver affect a kid in Fort St John? They might watch it and go ‘great’ but how does that change anything? Again it’s Bandura, it has to be relevant to them to mean something. Otherwise it can leave them feeling ‘what’s the point?’” Health and wellness support, Canadian Olympic team.

Sports coaches and administrators all stated that a demonstration effect was only likely to have occurred among adolescents who could afford to participate, and they were unanimous in commenting that the cost of Winter sports had become increasingly prohibitive and exclusive since the Games.

4.4 Spatial impact of the 2010 Games

Research Question 4: *Was there a spatial impact of the Games (i.e., was the impact of the Games different in host communities, in comparison to non-host BC communities)?*

The regions of Vancouver, North Shore and Richmond (host regions) were collectively compared against BC’s other thirteen regions (non-host regions) to investigate any spatial impact of the Games. There were no differences between host and non-host regions in adolescents reporting negative effects of the Games on their employment opportunities, PA involvement, or access to sports opportunities. However, adolescents in the host regions were more likely than those in non-host regions to report increased employment opportunities in 2008 (8.2% vs. 5.2%) and greater access to sports opportunities in 2013 (Figure 4.13).

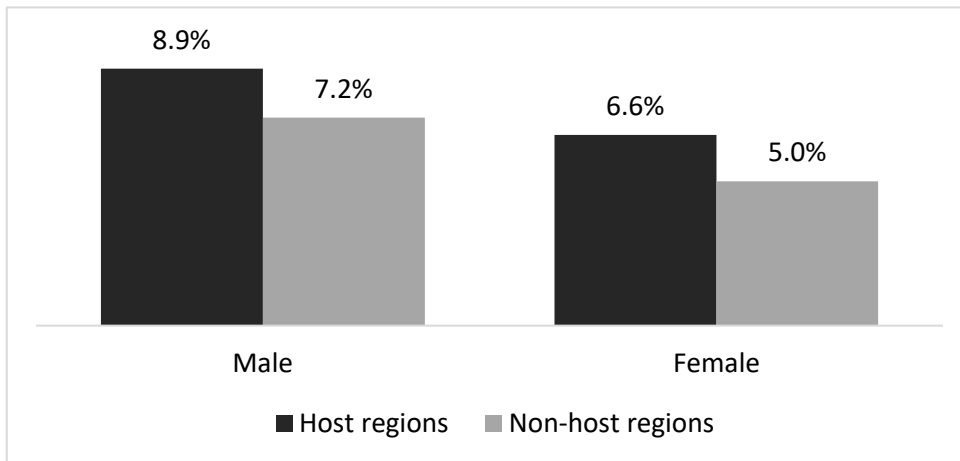
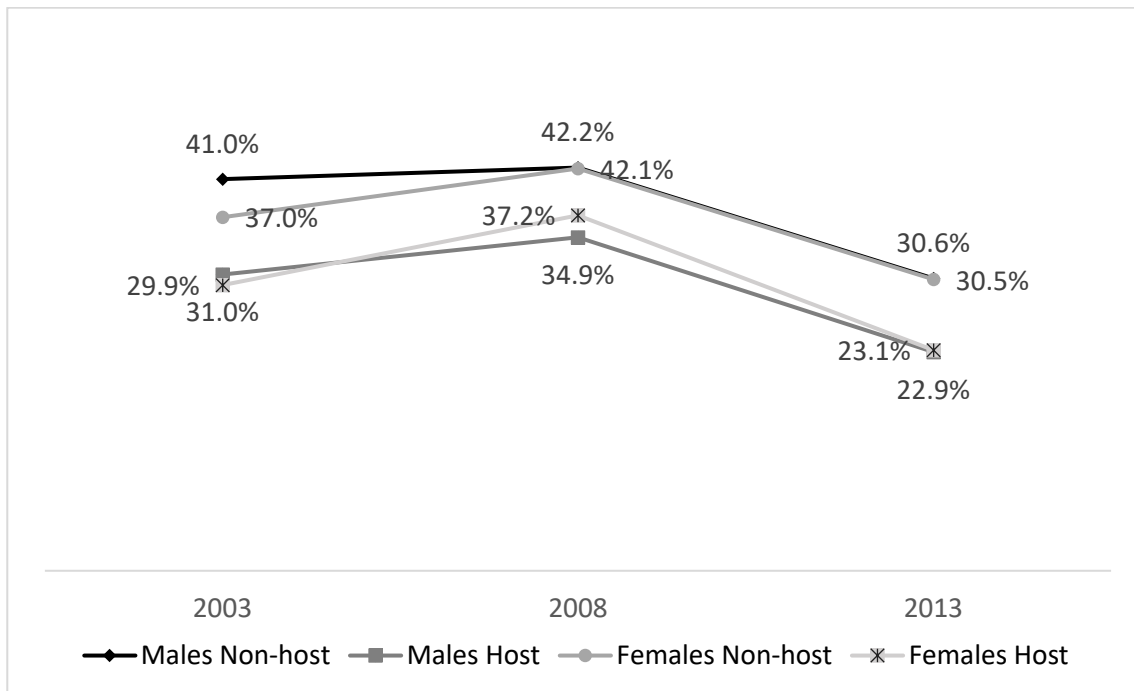


Figure 4.13. Adolescents reporting increased access to sports opportunities as a result of the 2010 Games (2013 BC AHS)

As noted earlier, the percentage of BC males and females employed in the previous 12 months rose between 2003 and 2008 before falling below the 2003 rate in 2013. The pattern was similar for adolescents in the host and non-host regions, except those in host region were less likely to have been employed at each time point (Figure 4.14).



Note. At each time point males and females in non-host regions were more likely to be employed than those in host regions. The differences between males and females within host regions and within non-host regions were not statistically significant at every time point.

Figure 4.14. Trends in adolescents employed in previous 12 months (BC AHS)

However, when the three host regions were considered separately, North Shore adolescents were employed at a similar rate to their peers in non-host regions in 2003 and 2013, and at higher rates in 2008. Adolescents in Vancouver and Richmond had lower employment rates than those in non-host regions, in 2003 and 2013, except during the build up to the Games (2008) when Richmond females recorded similar rates of employment to females in non-host regions (Table 4.13).

Table 4.13

Adolescents in Paid Employment in the Past 12 months by Region (BC AHS)

	Males				Females			
	Non-host	North Shore	Vancouver	Richmond	Non-host	North Shore	Vancouver	Richmond
2003	41.0%	41.7%	23.7%	30.7%	37.3%	39.9%	23.0%	31.1%
2008	42.2%	46.1%	27.3%	33.5%	42.1%	48.9%	29.6%	39.1%
2013	30.6%	32.6%	17.2%	21.6%	30.5%	33.0%	18.0%	21.4%

Note. Bolded percentage is significantly different to non-host at $p < .01$.

In 2008, adolescents in each individual host region were more likely to report the Games had positively impacted their employment opportunities, compared to adolescents in non-host regions (Figure 4.15). There were no such regional differences in 2013.

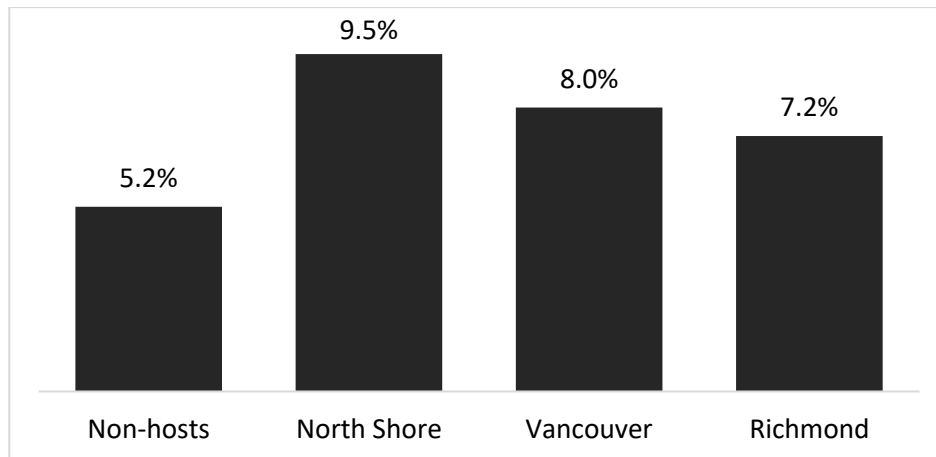


Figure 4.15. Adolescents reporting 2010 Games increased employment opportunities in host and non-host regions (2008 BC AHS).

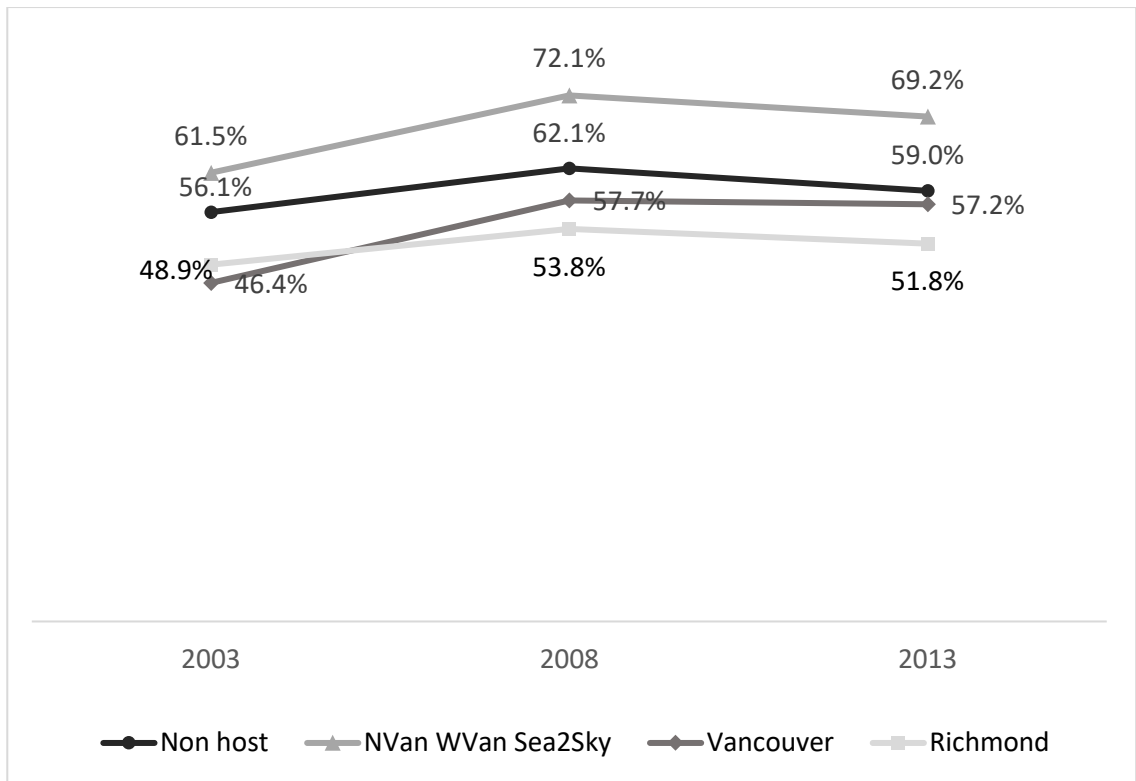
In 2008, reporting a positive effect of the 2010 Games on PA and/or sports opportunities was similar among adolescents within each of the three host communities, and in comparison, to the non-host regions. However, in 2013, adolescents in Richmond were more likely than those in Vancouver, North Shore and non-host communities to report increased sports opportunities (10.2% vs. 7.0% in North Shore, 7.1% in Vancouver and 6.1% in non-host communities).

However, gendered analysis showed there were no significant differences between males in Richmond and those in the other host and non-host regions, but females in Richmond were more likely than those in North Shore to report the Games had increased their PA (12.6% vs 8.6%) and were more likely than those in Vancouver (10.6% vs 4.9%), North Shore (vs. 6.4%) and the non-host regions (vs. 5.0%) to report the Games had increased their sports opportunities.

As North Shore is geographically the largest of the three host regions (covering 5,000 KM, and comprised of six school districts), the next analyses considered those North Shore School Districts nearest to the Games venues (North Vancouver, West Vancouver and Sea to Sky) and those further from the Games venues (Sunshine Coast, Powell River and Central Coast). Adolescents in the three school districts nearest the Games venues were more likely to report increased employment opportunities in 2013 (10.2% vs. 6.7% in North Shore school districts further from the Games sites, and 5.8% provincially). They were also more likely to report a positive impact of the Games on their access to sports opportunities (8.0% vs. 4.4% in North Shore School Districts further from the venues in 2008; and 7.7% vs. 3.9% in 2013). There was no difference in reporting the Games increased PA within the North Shore region for either survey year.

The potential of an epicentre effect appeared stronger for reporting increased access to sports opportunities when the North Shore school districts which were closest to the Games epicentre were separated from those further away. Hofstetter, Hovell and Sallis (1990) have reported that positive perceptions about the convenience of facilities and neighbourhood safety influence intention to be physically active. Therefore, the final analysis compared Richmond, Vancouver and the three closest North Shore school districts of North Vancouver, West Vancouver and Sea to Sky to the rest of the province (non-hosts), to determine if there were any differences in PA participation between the host and non-host regions and if so, if that disparity had changed between 2003 and 2013.

The prevalence and trends in weekly PA involvement for each of the four regions (Non-hosts; North Vancouver, West Vancouver, and Sea to Sky; Vancouver; and Richmond) were calculated. Between 2003 and 2013, males' participation in organised sports increased in each region except Richmond (Figure 4.16), but remained stable in the host regions for females and decreased for females in the non-host regions (Figure 4.17).



Note: Not all changes in participation were significant at every time point.

Figure 4.16. Trends in males' participation in weekly organised sports in host and non-host regions (BC AHS)

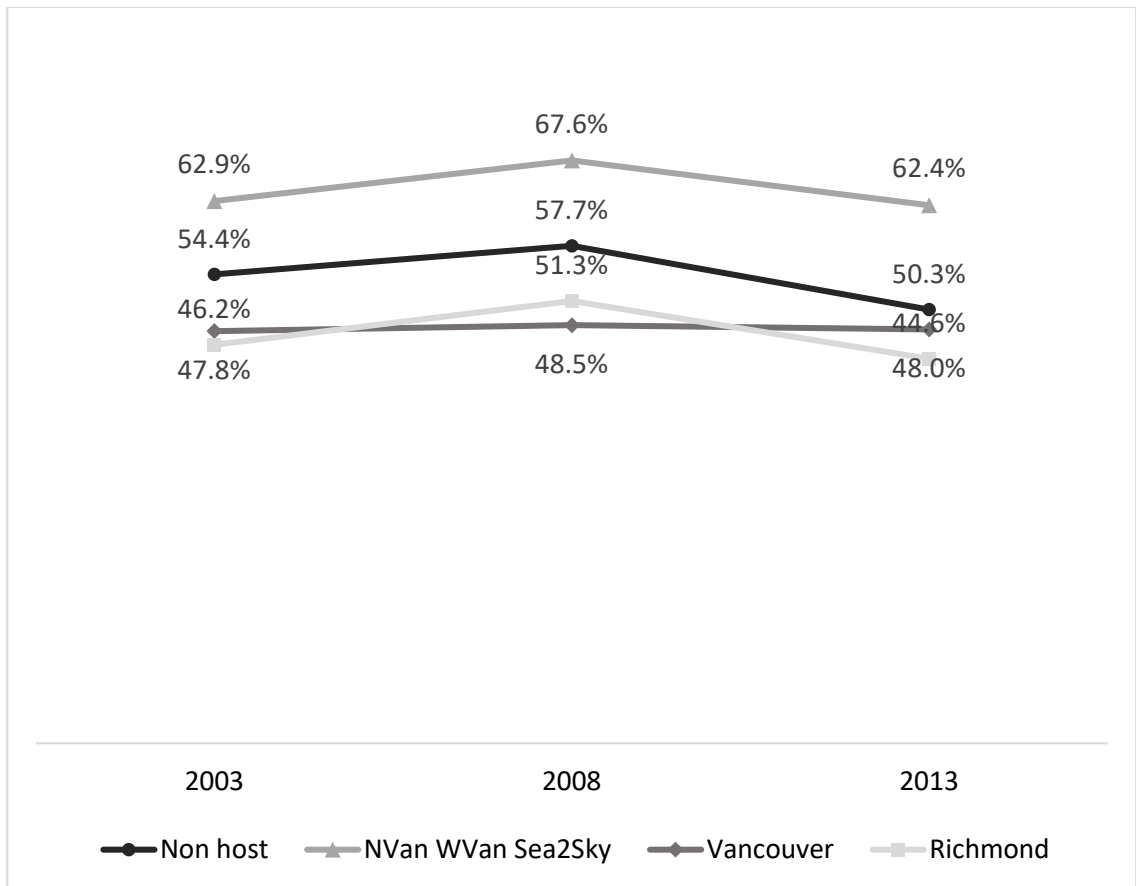


Figure 4.17. Trends in females' participation in weekly organised sports in host and non-host regions (BC AHS)

Between 2003 and 2013, participation in informal sports decreased for both genders in all regions of the province, except among males in Vancouver (Table 4.14).

Participation in exercise classes also decreased for males and females in the non-host communities and for males in Richmond but did not decrease for females in Richmond or for either gender in the other two host regions.

Table 4.14

Trends in Sports and PA Participation by Region (BC AHS)

Organised sports	2003	2008	2013	Odds ratio	
<i>Male</i>				2003-2013	2008-2013
Non-host	56.1%	62.1%	59.0%	1.116 (1.045-1.192)	.873 (.815-.934)
N Van,W Van,Sea2Sky	61.5%	72.1%	69.2%	1.422 (1.127-1.793)	.867 (.676-1.111)
Vancouver	46.4%	57.7%	57.2%	1.540 (1.309-1.812)	.987 (.782-1.247)
Richmond	48.9%	53.8%	51.8%	1.095 (.869-1.381)	.899 (.701-1.152)
<i>Female</i>					
Non-host	54.4%	57.7%	50.3%	.848 (.790-.910)	.722 (.975-.772)
N Van,W Van,Sea2Sky	62.9%	67.6%	62.4%	.994 (.773-1.280)	.814 (.622-1.064)
Vancouver	47.8%	48.5%	48.0%	1.006 (.883-1.216)	.961 (.775- 1.192)
Richmond	46.2%	51.3%	44.6%	.949 (.749- 1.203)	.733 (.578-.930)
Informal sports	2003	2008	2013	Odds ratio	
<i>Male</i>				2003-2013	2008-2013
Non-host	80.6%	80.0%	67.5%	.495 (.450-.539)	.518 (.483-.556)
N Van,W Van,Sea2Sky	81.5%	80.1%	70.3%	.538 (.436-.663)	.590 (.462-.753)
Vancouver	73.9%	66.9%	64.1%	.634 (.531-.756)	.888 (.716-1.102)
Richmond	75.4%	70.2%	55.8%	.402(.331-.481)	.525 (.417-.660)
<i>Female</i>					
Non-host	64.1%	62.8%	50.3%	.563 (.524-.606)	.591 (.557-.627)
N Van,W Van,Sea2Sky	60.6%	58.1%	57.5%	.882(.711-2.094)	.985 (.785-1.237)
Vancouver	51.8%	47.6%	44.2%	.732 (.622-.860)	.858 (.716-1.029)
Richmond	50.9%	47.3%	44.6%	.778 (.656-.922)	.888 (.740-1.066)
Exercise classes	2003	2008	2013	Odds ratio	
<i>Male</i>				2003-2013	2008-2013
Non-host	9.8%	10.8%	7.2%	.708 (.700-.884)	.638 (.573-.711)
N Van,W Van,Sea2Sky	7.8%	10.5%	9.8%	1.280 (.923-1.775)	.931 (.656-1.320)
Vancouver	9.7%	15.3%	9.8%	1.005 (.780-1.294)	.608 (.440-.840)
Richmond	9.0%	14.0%	5.4%	.576 (.402-.823)	.350 (.241-.506)
<i>Female</i>					
Non-host	31.2%	32.1%	28.4%	.872 (.809-.939)	.831 (.777-.888)
N Van,W Van,Sea2Sky	26.0%	27.6%	22.0%	.866 (.703-1.066)	.903 (.731-1.116)
Vancouver	26.1%	24.0%	24.1%	.886 (.727-1.080)	.993 (.792-1.245)
Richmond	25.6%	27.8%	24.3%	.935 (.744-1.176)	.819 (.659-1.017)

Note. Data were weighted and age adjusted. Odds ratios in bold indicate $p < .05$.

Prior to the announcement that BC would host the 2010 Games, adolescents in North Vancouver, West Vancouver, and Sea to Sky were more likely to participate in weekly organised sports than their peers in non-host communities. In contrast, adolescents in Vancouver and Richmond were less likely than their peers to participate in weekly organised and informal sports. Females in Richmond also participated in exercise classes at lower rates (Table 4.14).

4.4.1 Changes in disparities over time

Results from gap analyses indicated that the disparity in organised sports participation between hosts and non-hosts narrowed for males in Vancouver and females in Richmond, and widened for males in North Vancouver, West Vancouver and Sea to Sky (Tables 4.15 and 4.16).

The disparities in weekly informal sports widened for males and females in North Vancouver, West Vancouver and Sea to Sky and for males in Richmond, and narrowed for males and females in Vancouver, and females in Richmond.

There were no changes in exercise class disparities between females in host and non-host regions but for males the gap between participation rates in Vancouver and the non-host communities narrowed and in North Vancouver, West Vancouver and Sea to Sky there was a discrepancy in participation rates in 2013 which was not present before the Games were awarded to Vancouver.

Table 4.15

*Odds ratios and 95% CI for Sports/PA Participation by Year (2003-2013):
Comparisons by Region*

		Organised sports		
Males	2003	2008	2013	
Non-host	Reference	Reference	Reference	
N Van, W Van, Sea2Sky	1.252 (1.101-1.423)	1.594 (1.366-1.861)	1.586 (1.299-1.937)	
Vancouver	.675 (.603-.755)	.825 (.674-.1.009)	.933 (.815-1.067)	
Richmond	.762 (.661-.878)	.724 (.612-.855)	.750 (.619-.908)	
Females	2003	2008	2013	
Non-host	Reference	Reference	Reference	
N Van, W Van, Sea2Sky	1.474 (1.253-1.733)	1.528 (1.277-1.827)	1.718 (1.405-2.102)	
Vancouver	.780 (.682-.892)	.696(.590-.821)	.926 (.797-1.076)	
Richmond	.726 (.627-.842)	.793 (.687-.916)	.813 (.670-.987)	
		Informal sports		
Males	2003	2008	2013	
Non-host	Reference	Reference	Reference	
N Van, W Van, Sea2Sky	1.057(.899-1.245)	1.009(.829-1.225)	1.135 (.968-1.330)	
Vancouver	.680 (.597-.775)	.504 (.425-.598)	.862 (.744-.999)	
Richmond	.748 (.648-.864)	.597 (.497-.717)	.602 (.517 -.701)	
Females	2003	2008	2013	
Non-host	Reference	Reference	Reference	
N Van, W Van, Sea2Sky	.870 (.749-1.010)	.814 (.695-.952)	1.347 (1.132-1.603)	
Vancouver	.607 (.539-.684)	.542 (.472-.621)	.786(.692-.909)	
Richmond	.584 (.512-.667)	.538 (.467-.620)	.801 (.706-.909)	
		Exercise classes		
Males	2003	2008	2013	
Non-host	Reference	Reference	Reference	
N Van, W Van, Sea2Sky	.781 (.631-.965)	.968 (.762-1.231)	1.400 (1.062-1.844)	
Vancouver	.995 (.810-1.222)	1.482 (1.120-1.960)	1.405 (1.161-1.702)	
Richmond	.923(.757-1.126)	1.371 (1.115-1.685)	.748 (.543-1.031)	
Females	2003	2008	2013	
Non-host	Reference	Reference	Reference	
N Van, W Van, Sea2Sky	1.215 (1.047-1.410)	1.110 (.955-1.290)	1.202 (1.024-1.410)	
Vancouver	.786 (.683-.905)	.669 (.561-.798)	.798 (.682-.934)	
Richmond	.763 (.643-.905)	.827 (.711-.962)	.815 (.689-.965)	

Note. 'Reference' refers to comparison group (non-host regions).

Table 4.16

Trends in Sports and PA Participation: Interaction Between Region and Year (Odds Ratio and 95% CI)

	Males	Females
Organised sports		
Non-host vs. year 2013	Reference	Reference
N Van, W Van, Sea2Sky 2013 vs. 2003	1.269 (1.001-1.610)	1.170 (.903-1.516)
N Van, W Van, Sea2Sky 2013 vs. 2008	.993 (.771-1.279)	1.125 (.858-1.475)
Vancouver 2013 vs. 2003	1.381 (1.159-1.645)	1.187 (.971-1.452)
Vancouver 2013 vs. 2008	1.133 (.859-1.440)	1.331 (1.063-1.667)
Richmond 2013 vs. 2003	.985 (.776-1.249)	1.119 (.877-1.428)
Richmond 2013 vs. 2008	1.034 (.802-1.333)	1.022 (.802-1.303)
Informal sports		
Non-host vs. year 2013	Reference	Reference
N Van, W Van, Sea2Sky vs. 2003	1.086 (.868-1.360)	1.568 (1.243-1.977)
N Van, W Van, Sea2Sky vs. 2008	1.137 (.884-1.464)	1.675 (1.321-2.122)
Vancouver vs. 2003	1.274 (1.046-1.551)	1.301 (1.092-1.552)
Vancouver vs. 2008	1.719 (1.370-2.156)	1.457 (1.206-1.759)
Richmond vs. 2003	.809 (.656-.998)	1.381 (1.148-1.660)
Richmond vs. 2008	1.009 (.795-1.283)	1.500 (1.238-1.816)
Exercise classes		
Non-host vs. year 2013	Reference	Reference
N Van, W Van, Sea2Sky vs. 2003	1.269 (1.001-1.610)	.993 (.798-1.235)
N Van, W Van, Sea2Sky vs. 2008	.993 (.771-1.279)	1.085 (.871-1.352)
Vancouver vs. 2003	1.381 (1.159-1.645)	1.017 (.823-1.255)
Vancouver vs. 2008	1.113 (.889- 1.444)	1.196 (.944-1.513)
Richmond vs. 2003	.985 (.776-1.249)	1.072 (.844-1.361)
Richmond vs. 2008	1.034 (.802-1.333)	.990 (.790-1.242)

Note. 'Reference' refers to comparison group (non-host regions).

4.4.2 Stakeholders' reflections on the presence of an epicentre effect

Stakeholders involved in sports generally saw the changes in the gap in sport and PA participation between host and non-host communities as further evidence of the presence of a demonstration effect. Several stated that BC's geographical distances meant it was unrealistic to expect the Games to have impacted adolescents outside of the Lower Mainland. For them, the BC AHS results confirmed their belief that those who had experienced the Games in their city were the ones who would show increased PA participation.

However, several stakeholders noted other factors beyond a demonstration effect. They most commonly suggested that the gap which already existed between the Lower Mainland and many other parts of the province, in terms of affluence and access to resources, further widened following the infrastructure investments which occurred as a result of the Games.

“It is so expensive to live in Whistler that ‘yes’ kids got the chance to watch the Games up close, but also their parents have the money to put them into whatever sport they want. So yes, Whistler kids are bucking the national trend [in declining sports involvement] but I am not sure the Olympics should claim credit for that. It’s more about privilege and opportunity.” Senior administrator, BC government.

4.5 Changes over time in sports club membership

Research Question 5: *Were there sustained changes over time in BC sports club membership for any of the sports which were featured in the 2010 Winter Olympic and Paralympic Games?*

Membership data were limited or unavailable for all sports included in the 2010 Games, except alpine skiing and ice hockey. A summary of available data is presented below and further details provided in Appendix 4.

Table 4.17

Summary of Available Sports Club Membership Data for Winter Olympic Sports

Sport	2002/03-2012/13 data
Alpine skiing	Comprehensive data available. Membership increased for males and females between 2002/3 and 2012/13. Lowest membership in 2009/10 (season 2010 Games held).
Biathlon	No data available before 2010-11. Membership increased from 2010-11 onwards for males and females aged 12-19.
Curling	No data available before 2007-08 or by gender. Membership increased between 2007-08 and 2012-13 for youth aged 12-19.
Figure skating	No data available specifically for youth or by gender. Membership increased between 2002-03 and 2012-13. Highest membership recorded in 2009-10 season.
Ice hockey	Comprehensive data available. Membership increased for males and females between 2002/3 and 2012/13. Largest growth during pregnancy period of Games.
Speed skating	No data available specifically for youth or by gender. Membership increased between 2002-03 and 2012-13. Highest membership recorded in 2006-07.

Among adolescents aged 12-19, Alpine Skiing club membership increased 9.25% over the decade between 2002-03 (the season before the Games were awarded to Vancouver) and 2012-13 (an increase from 649 youth members to 709). Overall, participation rates were lowest in the season the Games took place (2009-10), but rose again following the Games and remained above 2003/04 participation rates in subsequent seasons (See Figure 4.18).

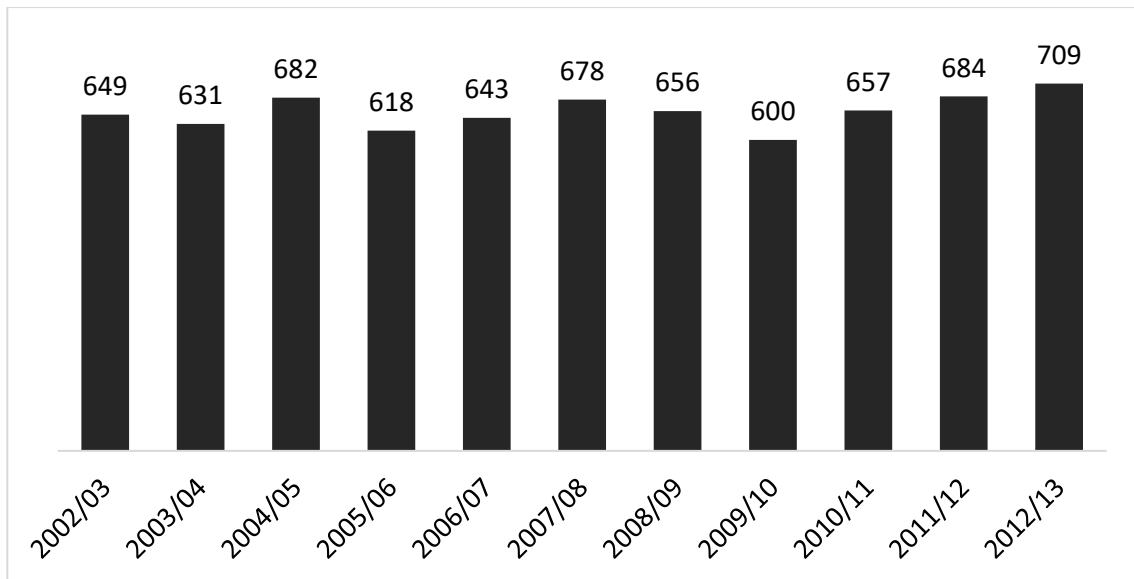


Figure 4.18 Alpine skiing club membership among youth aged 12-19

Over the decade 2002/03 – 2012/13, females were generally more likely to be members of alpine skiing clubs than males. For both genders, membership fluctuated in the build up to the Games, decreased during the season the Games took place, and increased year on year in the seasons following the Games (Figure 4.19).

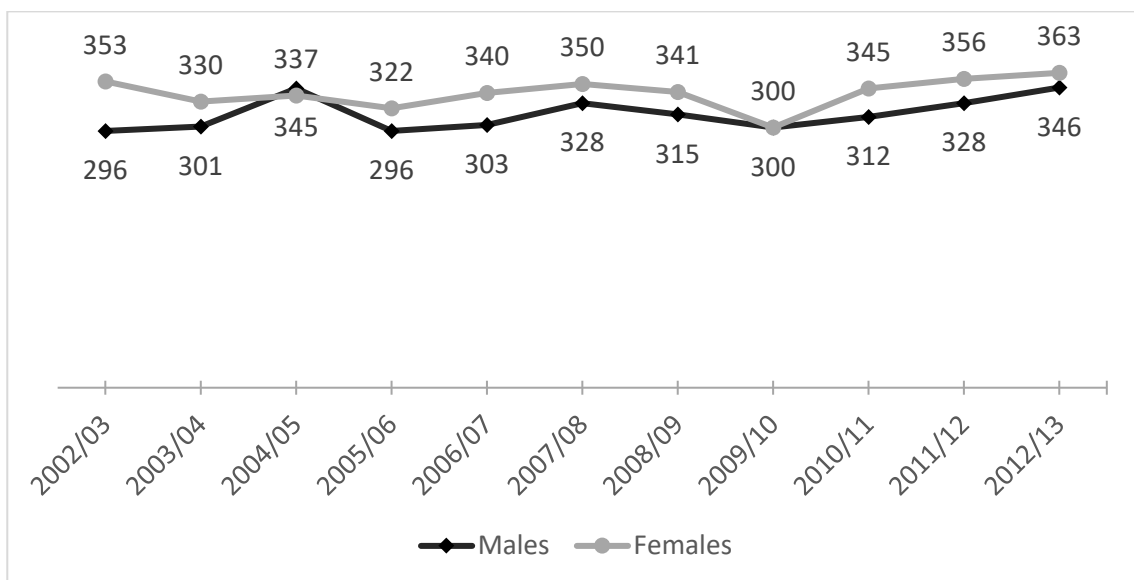


Figure 4.19. Alpine skiing club membership by gender among youth aged 12-19

There was also an increase in membership of ice hockey clubs. The number of males aged 12-19 who participated in minor and junior leagues rose between 2002/03 and

2007/08 (from 11,529 to 18,681). In each season after 2007/08, participation decreased slightly but remained above 17,000 through until 2012-13, meaning participation rates were higher in 2012-13 than when the Games were awarded to Vancouver.

In each season between 2002/3 and 2012/13, females were less likely than males to join an ice hockey club. However, membership rose for both genders, and in 2012/13, there were more than twice as many females registered with BC ice hockey clubs, as in 2002/03 (Figure 4.20).

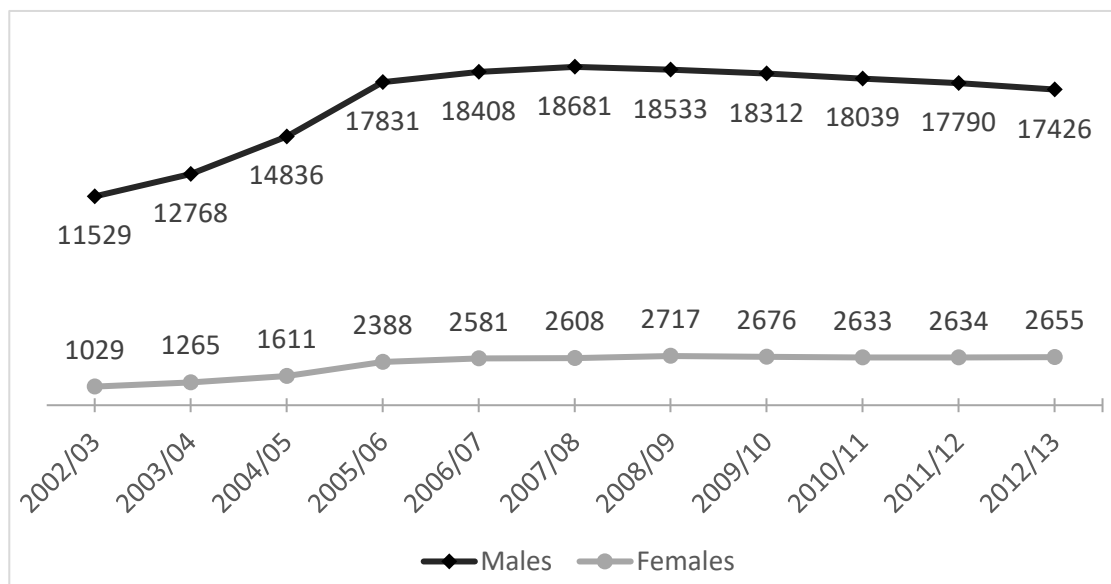


Figure 4.20. 2002/03-2012/13 Ice hockey club membership in BC by gender among adolescents aged 12-19

In each season between 2002/03 and 2012/13, younger youth were more likely than older ones to be a member of an ice hockey club, with the highest number of male and female participants in the 12-13 age group. For each age group, membership increased following the 2003 announcement that Vancouver would host the 2010 Games, and remained above 2002-03 participation rates through 2012/13 (Figures 4.21 and 4.22). The sharpest increases in participation occurred during the pregnancy period of the Games (2003/04-2008/09; Figures 4.21 and 4.22).

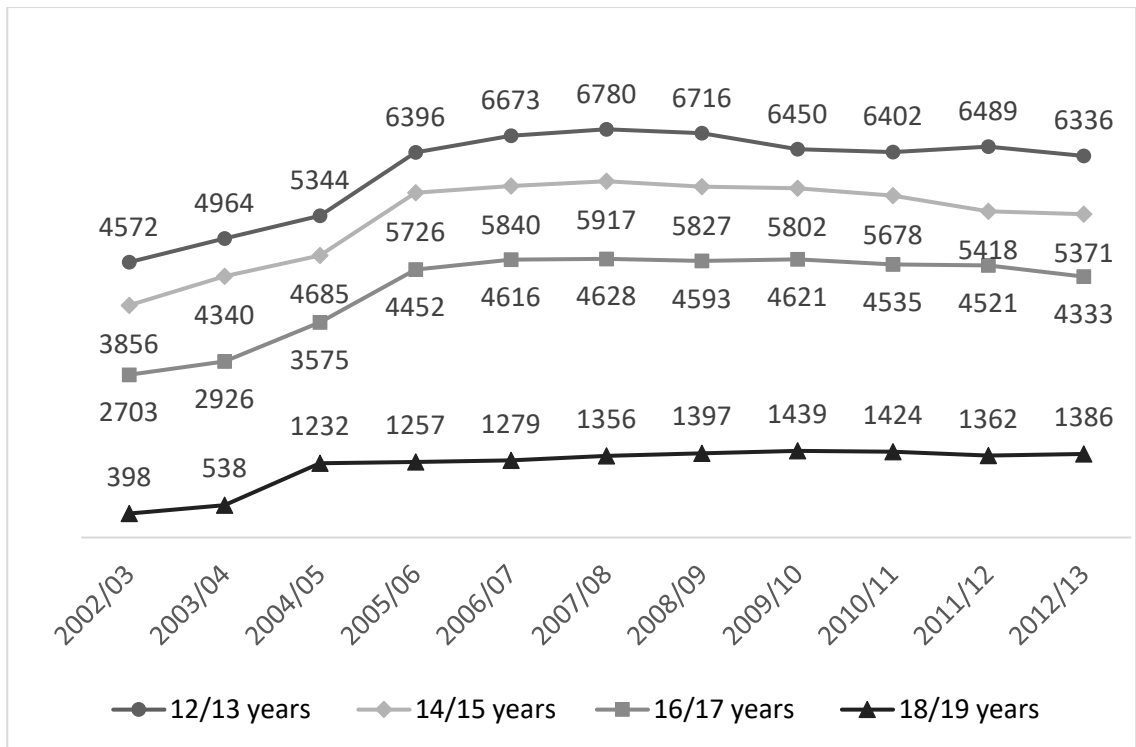


Figure 4.21. Males (aged 12-19) ice hockey club membership 2002/03-2012/13

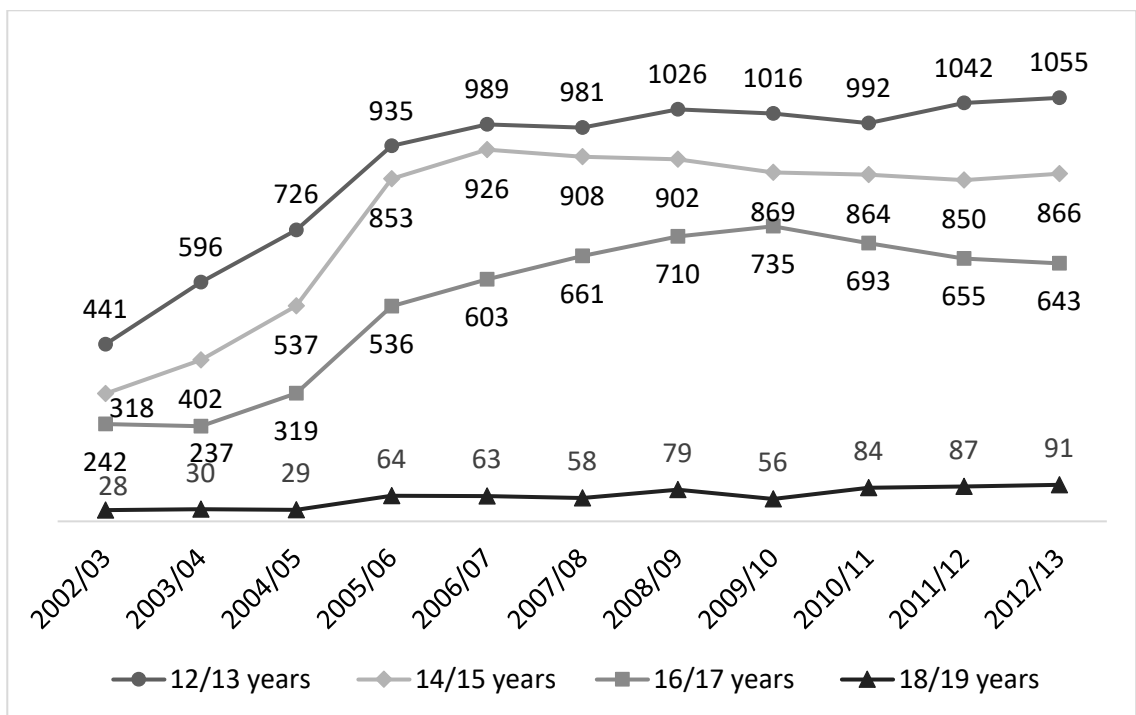


Figure 4.22. Females (aged 12-19) ice hockey club membership 2002/03-2012/13

4.5.1 Stakeholders' reflections on sports club membership

As noted earlier, stakeholders who were involved as coaches and administrators in amateur winter sports clubs commented that the BC AHS results confirmed that opportunities were lost to capitalise on the interest the Games generated. Similar comments were noted when stakeholders reviewed the sports club membership results. Three also stated that the Games had led to an over emphasis on elite performance and the creation of elite academies within junior ice hockey. This in turn had led to less skilled players becoming disillusioned, and to less affluent families being unable to support their children's participation. These stakeholders also commented that had data been included beyond the decade under consideration in this study, it would likely have shown a decline in participation.

"We kept that 'Own the Podium' mentality and spoilt it for kids who wanted to join the game and who were new and not very good. We kept creaming the top players from each team into these new elite academies and that meant the others were totally lost...they soon lose interest when they keep losing every week, can't learn anything from their team mates and know they aren't good."
Senior administrator, Surrey Minor Hockey.

Several stakeholders commented that the results reflected the influx of funding received by clubs in the build up to the Games, and the impact that occurred when pre-Games funding was no longer available and promised legacy funding did not materialise.

Venue administrators also noted that after the Games, winter sports venues had to focus on the most popular sports programmes to be financially viable. This meant that minority sports often lost out. For example, one venue removed a curling rink and replaced it with an ice hockey rink as this generated considerably more revenue.

"The focus was to 'Own the podium'. It was very cut throat. There was a lot of money and then after the Games there was nothing. It was all gone. The national coaching programs were cut and it all fell away. Now it is very disjointed and sport specific. So some sports are doing better than others. We made it hard for adolescents wanting to get involved in a lot of the Winter sports." Health and wellness support, Canadian Olympic team.

4.6 Discussion of population level results

This study is the first to have considered the impact of a mega sporting event from an adolescent's perspective, pre and post the event. Analysis in this chapter considered tangible and intangible benefits, negative effects and the time and space in which any legacies of the 2010 Games occurred.

This chapter answered five specific research questions about the legacies of the 2010 Winter Olympic and Paralympic Games on adolescent health at the population level. The findings are summarised and discussed below.

Research Question 1: *To what extent was the 2010 Winter Olympics associated with planned, positive, tangible benefits for different subpopulations of adolescents in BC, either during the pregnancy period or after the Games?*

Results Summary:

Qualitative responses on the BC AHS showed adolescents in 2013 were more likely to report positive legacies of the Games than their peers in 2008.

Quantitative analysis of the BC AHS showed:

- Approximately 1 in 6 BC adolescents reported a positive legacy of the 2010 Games during the pregnancy period and three years after the Games (with increased PA the most common legacy).
- Adolescents who arrived in Canada as refugees were more likely than Canadian born adolescents to report at least one positive legacy of the Games.
- Males and younger adolescents were the most likely to report increased PA and sports opportunities, whereas older adolescents were the most likely to report increased employment legacies.
- Reporting the Games increased employment opportunities was associated with adolescents having a paid job in the past year.

- Reporting the Games positively impacted PA and access to sports opportunities was associated with engagement in weekly organised, informal, and extreme sports; and exercise classes.
- Reporting the Games increased PA was not necessarily associated with having increased access to sports opportunities. However, over half of those reporting increased sports opportunities as a result of the Games reported being more physically active.
- Between 2003 and 2013, weekly extracurricular organised sports participation increased during the pregnancy period of the Games but whilst it remained above 2003 levels for males, it dropped below this level for females in 2013. Participation in informal sports decreased over the decade and participation in exercise classes rose then decreased for males, and remained stable for females. Participation was higher among adolescents who reported the Games had increased their PA and access to sports opportunities.
- Reporting the Games had a positive impact on PA and access to sports opportunities increased the likelihood that adolescents would be engaged in weekly sports and exercise, even after controlling for age.
- When perceptions of the Games increasing PA and access to sports opportunities were considered together, both continued to predict participation in weekly organised sports, informal sports and extreme sports. Perceptions of increased PA due to the Games remained a strong predictor of weekly exercise classes, whilst increased access to sports opportunities no longer predicted engagement in exercise classes.

Stakeholder consultations confirmed that tangible legacies of the Games occurred for adolescents, and suggested that a combination of a demonstration effect and infrastructure developments were responsible for those legacies.

A justification for investing public funds into the hosting of the 2010 Games was that it would increase grass roots sports participation (VanWynsberghe, 2013). Although, findings from the BC AHS did not support the BC government's pre-Games pledge that

the 2010 Games would increase PA by 20% at the population level, the adolescent sports club membership data and BC AHS results did show there may be some ability to leverage such an event to create a lasting PA legacy for adolescents.

Girginov (2011) believes that a meaningful PA participation legacy needs to be included in the developmental design for the Games and needs to reflect the unique needs and strengths of the host community to be sustainable. Including data about weekly participation in informal and individualised sports and PA ensured activities such as skateboarding, hiking, road running, dance and yoga were captured, as these are often missed in discussions of event related outcomes (Koorts, Mattocks, Ness, Deere & Blair, 2011; Harris et al., 2017). This was particularly important given so many rural and remote communities in BC lack organised sports facilities, and because there were differences in participation and trend patterns among the different types of PA.

Future studies should also consider ways that sports clubs and other forms of organised and informal sports can welcome diversity, and reach out to those traditionally excluded. Initially, the BC AHS results did not support findings from other studies (e.g., Waitt, 2001; Waitt, 2003; Mitra, 2014) that adolescents born outside of Canada would be more likely to report positively on the Games impacts. However, when further analysis was conducted this reflected the high percentage of international students who completed the survey while temporarily attending school in BC (and who likely were not in BC during the 2010 Games). Adolescents who had arrived in Canada as refugees were more likely than Canadian born adolescents to report positive impacts of the Games. Given the poorer health and well-being experienced by refugees in Canada, and findings from other studies of the benefits of sports participation programmes for refugee youth (e.g., Coalter, 2012), it is important that future mega sporting events such as the 2026 FIFA World Cup seek to ensure these adolescents have opportunities to fully participate and benefit from any related legacies.

The thematic analysis of the qualitative data offered support for Frawley & Cush's (2011) suggestion that younger people may be more likely than adults to be inspired to

take up organised sport as a result of a mega sporting event. This was further supported by the finding of an association between positive perceptions of the Games' impact on PA and sports opportunities, and weekly sports participation among BC's adolescent population.

Qualitative evidence from open-ended survey responses from a minority of adolescents in host and non-host communities suggested that a psychological mechanism of being inspired by the Games led to changes in behaviour. This was corroborated through stakeholder consultations and correlational analysis which showed those who reported being inspired by the Games to become more physically active were more likely to have played sport or exercised on at least a weekly basis in the past year.

PCM was one of the psychological theories under consideration in this study. It can offer an explanation of the findings of increased membership in sports clubs and participation in sports and exercise where this occurred. Applying the PCM would suggest that the Games served as a vehicle to introduce some interested adolescents to new sports opportunities, as they moved through the four stages of awareness, attraction, attachment and allegiance. There were qualitative examples from adolescents who completed the BC AHS at each of the four different stages of PCM including quotes such as *"I learned about biathlon – it's so cool!"* (awareness) *"I want to be the next Sydney Crosby"* (attraction), *"I am much more into my figure skating now."* (attachment) and *"I am going to the next Olympics with my team."* (allegiance).

It is likely that through the 2010 Games and '2010 Legacies Now' events young people in BC became aware of minority Winter Olympic sports, which is the first stage in moving towards participation. However, as only around 1 in 6 BC adolescents reported the Games had positively affected them, any such effect was limited, especially for females who were generally less likely than males to report positive legacies of the Games.

Stakeholders consulted for this study noted that socioeconomic factors likely played a role in whether adolescents who became aware of these sports were inspired into participation. For example, one noted:

“Free tickets are great and should happen more often than it does. For some kids it changed their lives but it can only help kick start a kid to get involved if that kid has support from their family, or whoever, to take it to the next step and join a club or something.” Junior sports coach.

For those inspired to increase their PA as a result of the Games, moving into the attraction stage of the PCM can also be influenced by factors such as gender, age, ethnicity, and barriers such as cost, and availability (Funk & James, 2001).

For some adolescents (particularly females and older adolescents), these and other barriers—such as geographical distance from the epicentre of the Games as suggested by some stakeholders consulted for this study—may have contributed to them not moving beyond awareness of the 2010 Winter Olympic sports. For others, watching the 2010 Games and/or participating in one of the associated events attracted them to one or more of the sports they experienced (Figure 4.23).

Some adolescents would not move beyond the attraction stage, such as if they lived in communities which lacked access to the sport they were interested in. Others could progress to developing an attachment to that sport. In communities where infrastructure already existed or was developed for the Games, adolescents may have had the opportunity to pursue their growing allegiance to the sport by joining an organised sports club. They may then have become further committed to the sport and received sufficient rewards from membership that they continued to participate (Beaton, et al, 2011; Figure 4.23). This may explain how all sports which had membership records available, retained membership levels above those recorded in the 2002-03 baseline season, and the change in PA participation disparity seen between adolescents in host and non-host communities.

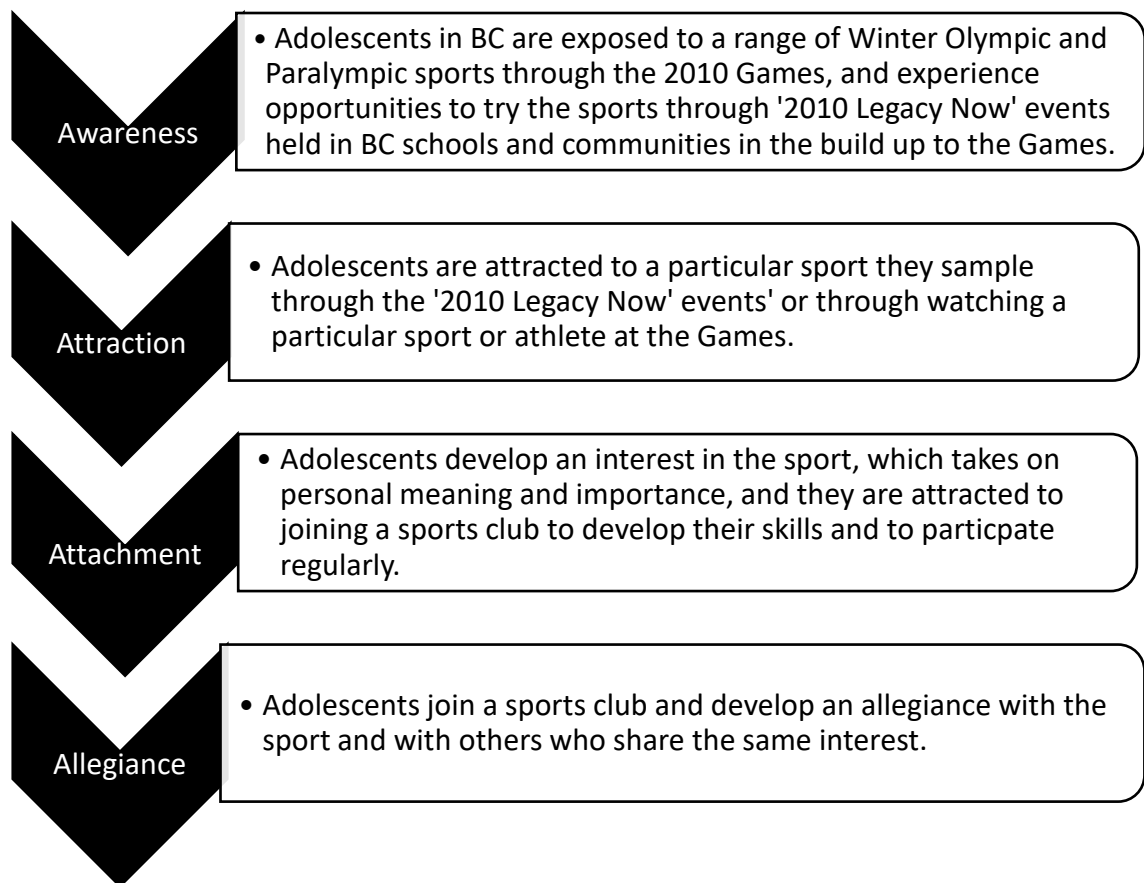


Figure 4.23. PCM applied to this case study of the 2010 Winter Olympic and Paralympic Games

Although PCM offers a psychological mechanism for explaining the higher levels of participation in sports and PA among those who reported the 2010 Games increased their PA and access to sports opportunities, there is no way of knowing if this was the process which occurred for adolescents in BC. Other staged models, such as Trans Theoretical Model (TTM), could also be applied to these findings, and offer a similar trajectory which adolescents might pass through before becoming fully committed to changing their sports and exercise behaviour. TTM also includes a pre-contemplation stage which would also take account of the significant percentage of BC adolescents who did not engage in regular sports and exercise and for whom the Games had no impact.

There were a number of online and school-based programmes targeted at BC adolescents in the build up to the Games, but no such programming occurred after the

Games (VanWynsberghe, 2014). The findings of a relationship between a positive perception of the Games and higher levels of regular PA participation in 2013 (supported by open-ended survey responses) is therefore an important one, given the population level declines in weekly PA engagement. It suggests that the lack of attention to leveraging the Games after the event may have been misguided. This suggestion was also supported by stakeholders who noted missed opportunities to capitalise on the interest the event generated post-Games.

The 2010 Games were associated with tangible benefits (increased engagement in PA, greater access to sports opportunities, and increased employment opportunities) for around 1 in 6 BC adolescents during the pregnancy period of the Games (2008) and three years after the Games closing ceremony (2013). Additionally, whilst the percentage reporting the Games had increased their employment opportunities decreased following the Games, those reporting increased access to sports opportunities remained stable and those reporting the Games had motivated them to increase their PA rose. These mixed findings did not support Preuss' (2015) blanket assertion that mega sporting event legacies reduce over time, and suggests the need for future studies to consider individual legacies of the Games separately. Findings of gender and age differences in reported legacies of the Games highlight the need for any future study to account for various potential contributing factors in its design. Poverty should be one of the factors considered, as this study was not able to include a satisfactory measure of SES, yet stakeholder consultations suggest it may have played an important role in the results.

It had been anticipated that the increased availability of construction and security jobs during preparations for the Games would ensure males would be more likely than females to report increased employment opportunities in 2008, during the pregnancy period of the Games (Kennelly, 2017). However, whilst a gender difference among adolescents who reported increased employment opportunities existed in 2013, there was no such difference in 2008. This is likely because school-age male adolescents were not old enough, qualified enough or available enough to be considered for the additional employment opportunities in construction and security which were

available during preparations for the Games. The results also appear to confirm other studies' findings that most mega event related jobs are taken by qualified adults and leave few long-term employment legacies (e.g. Horne, 2007; Minneat, 2012).

In 2008 and 2013, older adolescents were more likely to report the Games had increased their employment opportunities than younger ones. This finding likely reflects the fact that younger adolescents were less likely to be looking for employment, as other BC studies have shown that older adolescents are more likely to be working than younger ones (Smith et al., 2014). An employment legacy of the Games may therefore have been more pronounced than reported here if more sophisticated analyses had been conducted, particularly among older adolescents.

BC AHS employment trends over the decade after the Games were awarded to Vancouver showed that the percentage of males and females employed in the previous 12 months rose between 2003 and 2008 before falling below the 2003 rate in 2013. This may mean that the three time-points for BC AHS data collection did not capture the point at which most event-related employment would likely have been available to adolescents (i.e., 2009 and 2010). Additionally, it is unclear what impact the global recession had on adolescent employment opportunities, and how this affected the BC AHS results.

Social Control Theory might suggest that the finding of any link between reporting the Games increased employment opportunities and adolescents being employed is a positive legacy of the Games, as it assumes employment supports healthy development. However, it appears that this legacy was mostly time limited, occurred for a small percentage of adolescents and was more likely to be experienced by older adolescents, males and those within geographical proximity of the 2010 Games. A greater understanding of adolescent employment, and more targeted job opportunities would need to be created to leverage a mega sporting event to achieve a wider employment legacy for adolescents.

Of importance was the finding that male and female adolescents who reported positive effects of the Games on their PA and access to sports opportunities were more likely to be engaged in weekly sports and exercise (even after controlling for age), as this increased the credibility of the self-reported impact of the Games. However, a more sophisticated mixed methods research design which collects longitudinal data will be necessary to build on these findings and contribute to a better understanding of causation (Mutter & Pawlowski, 2014).

Previous studies have found a relationship between adolescents' current affective state and their judgements of events (Diaconu-Gherasim & Măirean, 2017). It could therefore be claimed that those feeling positive on the day they completed the BC AHS in 2008 and 2013 were more likely to report positively on the Games' outcomes. However, self-efficacy theorists argue that positive perceptions of actions in relation to health outcomes can and often will lead to increased activity and the adoption of a healthier lifestyle. Therefore, if a mega sporting event such as the 2010 Games was associated with a perception among young people that it had improved their outcomes and health behaviours; this could in itself have led to the positive behaviour changes which seemed to be present in the BC AHS data (Schwarzer & Renner, 2000).

Research Question 2: *Were there intangible benefits of a positive perception of the Games, such as increased community connectedness?*

Results summary:

In 2013, male and female adolescents who reported positively on the impact of the 2010 Games were more likely to feel connected to their community, in comparison to those who did not report positively on the Games' impact.

Reporting the Games had positively impacted their employment opportunities remained an independent predictor of community connectedness, when considered in an age-adjusted model with being employed.

Reporting the Games had positively impacted their PA and sports opportunities remained independent predictors of community connectedness, when considered in an age-adjusted model with weekly PA engagement.

Stakeholder consultations identified some of the strategies which were employed to create a lasting legacy of community connectedness following the Games.

The current study aimed to investigate if adolescents reported any intangible benefits of the 2010 Games. Neither the 2008 nor 2013 BC AHS asked adolescents directly if they had experienced any such benefits as a result of the Games. However, the 2013 survey did ask participants if they felt a sense of connection to their community.

Social control theory states that employment and engagement in organised sports provides adolescents with opportunities to create ties with healthy peers and positive adult role models in their community (Thompson et al., 1982). Support for this theory and of a connection between adolescents' sense of community connectedness, and their engagement in sports and employment has been found in other studies (Smith et al, 2014).

The current study also found that perception of the Games positive impact on employment opportunities, PA and access to sports opportunities were all independent predictors of community connectedness, and for males a perception that the Games created more employment opportunities was actually a stronger predictor of community connectedness than having being employed in the past year. This appears to support other research which has shown that perception of community assets and resources may be a stronger predictor of community connectedness than the actual resources which are available (Adams & Sherar, 2018).

Van Winkle and Woosnam (2014) considered the impact of perceptions of festivals and events on community connectedness, and found that adults with a more positive perception of the event were at increased likelihood of feeling connected to their community. Other studies with adults have shown that younger adults, and those who identify with a large-scale sporting event are the most likely to report such an event has increased their community connectedness (Fredline & Faulkner, 2001). Results of the current study suggest this is also the case for adolescents.

Stakeholder consultations offered some insight into how the 2010 Games may have increased community connectedness; for example, by engaging immigrant adolescents and their families in ice hockey programmes, and through ongoing community events programmes at legacy facilities. However, as the current study is the first to look at this, further investigation would be required before this link could be more broadly asserted.

Intangible benefits of the Games beyond community connections—such as increased national and provincial pride, enhanced skill and knowledge, and promotion of a healthy lifestyle (Homma & Masumoto, 2013)—were not measured in the forced-choice survey items on the BC AHS, nor were the impacts of tangible benefits of the Games, such as infrastructure development of spaces to connect with other community members and build a sense of community connectedness. However, the most common qualitative responses about the impact of the 2010 Games on the 2013

survey noted increases in PA and positive changes in lifestyle, and referenced a sense of community and national pride which had been created for adolescents.

Stakeholders who were interviewed for this study also reported that the Games had created a sense of community across BC, and several noted deliberate strategies which had been employed to create a sense of belonging and community including the torch relay and free community events. One also noted that the construction of the Olympic Village in Vancouver had been designed to leave a legacy of opportunities for residents and those passing through to engage in healthy activities and build social connections.

Previous studies have shown that individuals who were highly connected to their community might be predisposed to view a mega sporting event as creating benefits for the local community (Garbacz, et al., 2016). Therefore, although the qualitative and quantitative data appear to show a link between the impacts of hosting the 2010 Games and an increased sense of connection to community, the quantitative results from the BC AHS are associations, and the directions of the relationship should be considered. It is possible that pre-established community connectedness impacted how adolescents viewed the impact of the Games.

Research Question 3: *To what extent and in what time and space did adolescents report negative unplanned legacies of the Games, such as decreased access to housing, employment or services?*

a) Was reporting a negative legacy of the Games associated with other tangible or intangible experiences?

Results summary:

Pre and post the 2010 Games, less than 1% of male or female adolescents reported each of the negative outcomes of the Games (reduced PA, access to sports opportunities or employment opportunities).

The only gender difference occurred in 2013 when females were more likely than males to report they were less physically active as a result of the Games.

Adolescents who reported the Games had negatively impacted them in one area did not necessarily view its impact negatively in other areas.

Few stakeholders noted negative legacies of the Games for adolescents at the population level.

Reporting a negative impact of the Games was not generally associated with other negative experiences. However, adolescents who reported the Games had negatively impacted their PA and their access to sports opportunities were less likely than their peers to have engaged in regular organised sports over the past year.

Adolescents have a tendency to underestimate the probability of negative consequences of events (Chapin & Coleman, 2012). This may partially explain the very low rates of negative perceptions of the Games' impact reported in both 2008 and 2013. However, other studies of mega events have found that younger residents are the least likely to experience negative consequences of the events and the most likely to experience positive ones (Ritchie et al., 2009).

Studies with adults have shown that negative perceptions of the Games are more likely to occur following a mega sporting event than before or during the event. However, this did not appear to be the case among BC adolescents, as the only changes in response rates were positive, with those reporting the Games increased their PA rising from 9.1% in 2008 to 12.6% in 2013.

The very low numbers of youth who endorsed the items asking about negative impacts of the Games may have resulted in non-significant findings due to a lack of statistical power to detect differences between adolescents reporting negatively on the Games' impacts and those not negatively affected. A larger sample of negatively impacted adolescents would be necessary before more robust conclusions could be drawn.

Additionally, as with many studies of children and adolescents which rely on self-report data, the current study did not account for SES. The 2003, 2008 and 2013 BC AHS all included different previously validated measures of SES, yet each provided inconsistent results and supported previous findings that adolescents experience difficulties in conceptualizing and providing an accurate assessment of their SES (Svedberg, Nygren, Staland-Nyman, & Nyholm, 2016). Developing a “youth friendly” measure of SES would be important for future studies of the impact of mega sporting events as stakeholders in this study suggested that lower SES contributed to adolescents experiencing negative legacies.

Future studies should consider the impact of the Games in different areas of an adolescent’s life. Adolescents in this study who reported the Games had negatively impacted them in one area, did not necessarily report other negative impacts and some also reported positive effects. For example, reporting negatively on the Games impact did not appear to be associated with reduced community connectedness. Similarly, specifically reporting reduced job opportunities was not associated with a reduced likelihood of being employed in the past year.

As noted previously, the small number of students reporting negative consequences of the Games may have led to low statistical power and to a Type II error (i.e., finding no difference between those reporting negative consequences of the Games and their peers, when a difference actually existed; Faber & Fonseca, 2014). It would therefore be important for future studies to include a qualitative component which could gather information about the experiences of the small minority of youth who may experience negative consequences of a mega sporting event, and ensure the experiences of different subpopulations is captured.

One statistically significant finding was that adolescents who reported the Games had reduced their PA were less likely to engage in weekly organised sports than their peers who did not report the Games had negatively impacted them in this way. Self-efficacy theory states that people who observe others enjoy the rewards of athletic success are

inspired to attempt to emulate it, only if they believe they have the skills to achieve what they are seeing (Bandura, 1997). This suggests that any positive impact of the Games would only be observed among those who believed they had similar abilities as the Olympic athletes they observed. Adolescents who could not envision themselves achieving athletic success may have been dissuaded from trying to engage in sports and exercise altogether because they knew they would not attain the level of competence they had witnessed (e.g., Carter & Leone, 2013).

Females were more likely than males to report a negative impact of the Games on their PA. In BC, females are less likely to participate in PA and specifically organised sports than males (Smith et al., 2014). They may therefore have been most likely to view Olympic success as personally unattainable. Future studies should include a qualitative component to tease out the impact of watching elite athletic success on younger and older female adolescents.

Research Question 4: *Was there a spatial impact of the Games (i.e., was the impact of the Games different in host communities, in comparison to non-host BC communities)?*

Results summary:

There were no differences between adolescents in host and non-host regions in reporting negative legacies of the 2010 Games but there were some differences in reporting positive legacies, especially when North Shore was divided into communities nearest and farthest from the Games sites (with the communities closer to the epicentre of the Games reporting more positive results for employment and access to sports opportunities).

Adolescents in the North Shore epicentre communities of West Vancouver, North Vancouver and Sea to Sky participated in organised sports and informal sports at higher rates than their peers in non-host regions in 2003 and the gap widened for males in organised sports and for both genders in informal sports, over the following decade. Also, no difference existed in exercise class participation between

adolescents in the North Shore epicentre communities and non-host regions at baseline (2003) but was present a decade later (post Games).

Adolescents in Vancouver and Richmond participated in organised and informal sports at lower rates than their peers in non-host communities at baseline (2003) and females participated in exercise classes at lower rates, but the gap narrowed in organised sports (males in Vancouver and females in Richmond), informal sports (males and females in Vancouver and females in Richmond) and exercise classes (males in Vancouver).

Stakeholder consultations appeared to offer support for the presence of an epicentre effect in BC.

Some spatial impacts of the Games were detected in adolescent employment during the pregnancy period of the Games (when mega event related employment opportunities are most likely to occur; Hagn & Maennig, 2008). In comparison to adolescents in non-host regions, those in host regions were more likely to report the Games had increased their employment opportunities in 2008. Additionally, the percentage of adolescents who had been in paid employment in the past year was higher in North Shore (males and females), and Richmond (females only) in comparison to adolescents in the non-host regions in 2008, but not in 2003 or 2013.

Although not previously evidenced, it has been theorised that school-age adolescents living near Games sites may be likely to benefit from any employment legacy of a mega sporting event because they tend to work in part-time retail and service industry jobs which are the types of jobs typically created as a result of hosting a mega sporting event (Kingston & Rose, 2015). This may explain the difference in employment rates between North Shore and Richmond, and the non-host communities in the build up to the Games.

The relatively low percentages reporting employment benefits, even in host communities suggest that school age adolescents are not a major beneficiary of any

Games related employment opportunities which are created. However, it is possible that by 2013, adolescents may have been unaware if their employment was related to the Games. For example, if they worked in a hotel which was built for the Games but was no longer associated with the event.

Attributing changes in PA participation at the population level over the decade under study is challenging, as it is difficult to distinguish between the contribution of the 2010 Games and the contribution of other factors (Habicht et al. 1999). Behaviour Settings Theory states that an adolescent's built environment and available infrastructures can reduce or increase the likelihood they will engage in PA and employment, or feel connected to community. Considering the presence of an epicentre effect was therefore a key element in the process of reducing uncertainty over how much, if any, the event contributed to any apparent impacts on adolescents PA, and through which mechanism or combination of mechanism.

One of the most tangible benefits associated with a mega sporting event is access to improved or newly developed infrastructure legacies such as new sport facilities, and improved transportation systems (Homma & Masumoto, 2013). Potwarka and McCarville (2010) theorised that those nearest to the centre of a mega event are most likely to be impacted by the event because they are the ones who benefit directly from the improved access to sport infrastructure post-event, and from the sense of community euphoria that the host region experiences. Previous studies have also shown that the availability of sport infrastructure influences participation in PA (Huang & Humphreys, 2012). This appears to be supported by adolescents in the host regions being more likely to report increased access to sports opportunities, in comparison to their peers in other parts of the province, and by the change in disparities in PA participation between adolescents in host and non-host regions.

The Richmond Oval was built especially for the Games, and was served by the new light rail line opened to correspond with the event, and which connected the Oval with downtown Vancouver and Richmond. Following the conclusion of the Games, the Oval

was converted into a community sports and recreation centre offering a range of sports, including adaptive sports, such as wheelchair track and wheelchair rugby. The Oval has seen year on year increases in membership since it opened and offers over 140 different sports (Richmond Olympic Oval Annual Report, 2015). Initial cross-tabulation analyses showed the decline in weekly organised sports participation for males and females between 2003 and 2013 in non-host regions was not seen for either gender in Richmond. This is a particularly important finding as in 2003 Richmond (along with Vancouver) had among the lowest adolescent PA participation rate in BC (Stewart, Peled, Poon, Cullen, Kovaleva, Smith & McCreary Centre Society, 2014).

More complex analyses (the Gap Analysis technique developed for use in SPSS Complex Samples by Homma et al., 2016) identified further evidence of a spatial impact or epicentre effect occurring, with a significant positive impact on the gap in PA participation between adolescents living in host regions close to the Olympic sites and those in non-host regions. The narrowing of the gap in some types of PA between Vancouver and Richmond adolescents and those in non-host regions was a key finding given the two regions are home to the most diverse populations in BC and have the province's highest percentages of immigrants - a population known to have lower rates of PA participation than Canadian born adolescents (Smith et al., 2011). Stakeholder consultations confirmed that some male and female adolescents, and specifically immigrant adolescents in Richmond, have benefitted from increased access to sports opportunities through the addition of the Oval and other community facilities.

It has been suggested that a demonstration effect is most likely to occur when the athletes being observed are demographically similar to the observer and their achievements appear attainable (Lockwood & Kunda, 1999; Potwarka & Leatherdale, 2015). In addition to Canadian athletes' successes in Vancouver and Richmond, East Asian male and female athletes also experienced success at the 2010 Games. East Asian is the most common heritage of adolescents in Richmond and Vancouver. For example, in 2013, 47% of Vancouver adolescents and 50% of Richmond adolescents were of East Asian descent (Peled, Stewart, Poon, Kovaleva, Cullen, Smith, & McCreary

Centre Society, 2014; Stewart et al., 2014). Therefore, a demonstration effect may have occurred for East Asian and immigrant adolescents who observed East Asian athletes competing and succeeding, as well as Canadian born athletes. Future studies should consider immigration status and ethnicity when exploring the existence of a demonstrating effect.

In a study such as this one, it is not possible to establish causation and the role of a demonstration effect in comparison to the effects of infrastructure development and changes to the built or social environment. It is possible that as the impact of a demonstration effect fades the impact of infrastructure development increases. It has been suggested that the effects of structural improvements from the hosting of a mega sporting event can take a generation to affect the health of the local population (Wellings et al., 2011). It will therefore be important to continue to monitor differences in PA participation between adolescents in host and non-host communities in future cycles of the BC AHS.

It will also be important to further explore the finding of no difference in reports of increased PA as a result of the Games between host and non-host communities. Many non-host communities did not directly benefit from infrastructure legacies, which suggest a demonstration effect may play a larger part in population level increases in PA than other theoretical explanations under consideration, such as Behaviour Settings Theory. Additionally, BC AHS data showed that among adolescents who reported they had been inspired by the Games to increase their PA, almost two-thirds did not report increased access to sports opportunities. This suggests that for a significant proportion of young people, the Games' impact on their PA did not result from sporting infrastructure developments. It also supports Weed and colleagues' (2015) claim that a demonstration effect is a potential legacy of a mega sporting event which needs to be leveraged as part of a systematic plan to achieve sustainable outcomes through a mega sporting event. Stakeholder consultations offered support for this perspective, and of the need to more fully understand the relationship between being inspired by an event and access to opportunities to participate in sport and PA which are created through that event.

Research Question 5: *Were there sustained changes over time in BC sports club membership for any of the sports which were featured in the 2010 Winter Olympic and Paralympic Games?*

Results summary:

Few sports club membership records were available, but available data showed an increase in Winter Olympic sports membership between 2002/3 and 2012/13.

Declining engagement in sports in general has been associated with declining enrollment in sports clubs (Weimar, Wicker & Prinz, 2015). The finding of a sustained increase in sports club membership in alpine skiing and ice hockey between 2003 and 2013 was in contrast to population level data from the BC AHS which showed a decrease in female adolescents' engagement in organised and informal sports, and in males' engagement in informal sports and exercise classes during this time period.

A meta-analysis investigating the effects of mega sporting events suggested that any increase in sports club membership would only occur during the pregnancy period of the Games, or around the time of the Games (Weed et al., 2015). This was not consistent with the findings of this study, and may reflect the fact that the studies on which this assertion was based focused on adult sport participation and were conducted over shorter time periods than the current study, suggesting further longitudinal studies of adolescent sports club membership may be warranted.

The presence of a tangible increase in adolescent sports club membership could not be definitively established beyond ice hockey and alpine skiing, as these were the only sports with comprehensive participation data available by age and gender. However, findings that three years after the Games' closing ceremony adolescent ice hockey and alpine skiing sports club membership was higher than before the 2010 Games were awarded to Vancouver offers some support for previous suggestions that a demonstration effect from watching elite level international sporting success can

influence membership of sports clubs, to a sufficient extent that it halts otherwise declining trends in membership (Harris, et al., 2017; Weimar et al., 2015).

Stakeholders argued that the increases in ice hockey club membership for males and females was linked to Canada's sporting success at the Games as the men's and women's Olympic teams both won gold, and both Paralympic teams reached the semi-finals. However, if a demonstration effect did occur, achieving medal success may not have been the primary driving force, as alpine skiing also saw an increase in club membership, despite being a sport in which Canada did not win a medal.

Alpine skiing did benefit from infrastructure investment with two new purpose-built venues, and adolescents were exposed to the sport through various school and community programmes during the pregnancy period of the Games, suggesting that it is important to consider broader mechanisms than just a demonstration effect. Were these findings to be supported with more robust data, the conclusion that these factors were instrumental in the increase in participation would be similar to that reached by Weed and colleagues (2015) for the 2012 London Olympics, and Frawley & Cush (2011) for the 2003 Rugby World Cup.

Chalip (2006) suggested that a demonstration effect will only occur from hosting a mega sporting event if that event is accompanied by opportunities for people to try the sports, have positive social interactions, and feel a sense of celebration connected to the event. This may explain the increase in ice hockey and alpine skiing membership. It may also go some way to explaining why most adolescents who reported the Games inspired them to increase their PA did not report increased access to sports opportunities, as they had the opportunity to participate in school programmes and feel a sense of celebration, even if they did not benefit from infrastructure developments. However, stakeholders who took part in consultations raised concerns that opportunities to fully capitalise on a demonstration effect were lost due to the lack of attention paid to school and community programming post-Games, and an increased emphasis on developing elite athletes.

It is also possible that the increase in membership was attributable to other factors or a combination of factors. For example, during the decade of this study there was Games and non-Games related infrastructure investment in BC, the 2006 Turin Winter Olympics took place, the 2010 Canadian ice hockey player Sidney Crosby became a superstar in the National Hockey League, South Africa hosted the Football World Cup, and there were numerous annual large-scale and mass participation sporting events, any one of which could have increased adolescents' interest in joining a sports club.

Regardless of the reason for the increase in sports club membership, it has been argued that such membership has benefits beyond sports and PA participation because of the structure and sense of community a club can offer (e.g., Eime, Harvey, Brown, & Payne, 2010; Frawley & Van den Hoven, 2015). Yet many Winter Olympic sports clubs have costs currently beyond what BC's poorer families can afford, and this would need to be addressed before adolescents could truly benefit.

The results for the two Winter Olympic sports of ice hockey and alpine skiing were encouraging. However, as with other studies (e.g. Frawley & Cush, 2011; Weimar, et al, 2015) it could not be established how frequently adolescents participated in the sports club of which they were a member or if the membership increases reflected adolescents switching activities, becoming more serious about a sport they already engaged in or coming new to sport. If the results reflected an increase in activity re-engagement or in activity switching, rather than attracting new participants into sport, this would still be a positive legacy of the Games, as this renewed/new interest can lead to continued participation into adulthood (Tammelin, Nayha, Hills, & Jarvelin, 2003).

The apparent rise in club membership of minority winter sports, such as alpine skiing (and with limited data quality also curling and biathlon), suggests that in a time of rising sedentary behaviour and reduced participation in more mainstream Canadian sports, future events could capitalise on the interest multi-sport events can generate. It also suggests it would be beneficial to create opportunities to participate in new and

different sports and exercise which were not previously available (such as through the purpose-built sliding centre at Whistler).

Alpine skiing had its lowest adolescent participation rate in 2009-10, the season the Games took place, followed by a subsequent increase in participation. This was also the case among younger males in ice hockey clubs. These findings reflect similar findings for males in Germany, and suggest that there may be a potential lagged effect on sports club membership among adolescents, who may first engage with a sport in more informal ways before taking the step of joining a club (Weimar et al., 2015). However, suggestions from the thematic analysis of BC AHS data indicate that this may also have been at least partially related to facilities being renovated and elite teams training and competing at venues which would otherwise have been available for community use. Findings from the thematic analysis support those of a previous qualitative study conducted in BC during the 2009/10 and 2010/11 seasons, which also found that some winter sports experienced decreased participation during the Olympic season, which was attributed to reduced facility access as a result of the clubs being upgraded and used as Olympic training facilities (Ogilve, 2012).

Ice hockey was already the most popular, widely available and well-funded of the Winter Olympic and Paralympic sports in Canada. It has a strong infrastructure with a range of competitive leagues and recreational opportunities for adolescents to engage in. Of all the Olympic sports, it was best placed to capitalise on the Games as it had the capacity to promote club membership widely, and for adolescents to find a club in their community. For example, there are eight ice rinks within the City of Vancouver alone (City of Vancouver, 2018). In contrast, sports such as bobsleigh, luge, and ski jumping are limited to one or two clubs across the province, and to one track built at Whistler for the Games (a two-to-three-hour drive north of Vancouver with very limited and expensive public transportation).

However, stakeholder interviews suggest that ice hockey and other Winter sports clubs were ill prepared for the level of interest linked to the Games, and lacked the capacity to fully capitalise. This supports the findings of other studies that amateur

sports clubs are often unable to entice new members during a time when there is a temporary surge in interest in their sport, and supports suggestions that to capitalise on future mega events, clubs need the capacity to advertise and offer introductory programmes for new participants (Pappous & Hayday, 2015).

Future studies should link sports club membership data to other data about adolescent formal and informal sports participation, to better understand the mechanism through which sports membership occurs so clubs can be better prepared to respond to any upsurge in interest, and event organisers can consider ways to minimise the impact on sports club members during any renovations or disruptions.

Although this study was not able to directly link self-report data to sports club membership records, it was noteworthy to see the rise in participation in organised sports between 2003-2008 and increase in sports club membership over the same five-year period. This appears to support previous calls to capitalise on the Games' 'pregnancy period' rather than waiting for the actual event to inspire people to become more active (Weed et al., 2009).

The mixed methods approach of qualitative and quantitative survey data combined with sports club membership data and stakeholder reflections has made a significant contribution to our knowledge of the impact of mega sporting events on adolescents. The results have shown some inconsistencies with other studies which should be further explored. For example, based on other studies it would be anticipated that there would be a decrease in positive perceptions of the 2010 Games and an increase in negative ones after the event. However, such assumptions have been based primarily on cross-sectional data from adults (e.g., Gursoy, Chi, Ai & Chen, 2011; Kim et al., 2006), and it is therefore important for future studies to ensure adolescents are included.

The unique picture which has emerged for adolescents at the population level, and particularly within host communities, suggests that mega sporting events may have a role to play in improving health outcomes and supporting healthy development. The

data suggest any positive effects are stronger for certain sub groups, and this will be further explored in Chapter 5.

5 RESULTS - VULNERABLE POPULATIONS

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Having considered population level results in Chapter 4, this chapter focuses on homeless adolescents, adolescents at risk of incarceration and adolescents with a physical disability, to ascertain the impact of a mega sporting event on these three vulnerable subpopulations. Four of the five research questions asked in Chapter 4 are asked of each subpopulation. The chapter also considers how the results can be applied to ensure future mega sporting events are leveraged to support healthy adolescent development (Research Question Six).

This chapter uses data from the cross-sectional self-report BC AHS and HSIYS. All analyses for homeless adolescents were completed using the HSIYS. Participants were aged 12-18 (N=762 in 2006 and 681 in 2014). Gender distribution was similar to the BC AHS (51.4% female in 2014 HSIYS), and the mean age was higher (e.g., 16.83 years in 2014 HSIY vs. 14.95 years in 2013 BC AHS). Unlike the BC AHS, the HSIYS did not ask participants directly about the effect of the Games on their sports and PA involvement,

although both surveys asked about the Games' impact on employment opportunities, and the HSIYS also asked about its impact on housing and services.

2010 Games host communities Richmond and North Shore did not participate in the HSIYS in 2006, and Richmond did not participate in 2014. Only 72 North Shore adolescents completed the survey in 2014. Of these, an insufficient number reported any positive or negative effects of the Games to allow for community specific analysis. However, it was possible to consider North Shore and Vancouver together as host communities in 2014 (n= 198), and to look specifically at Vancouver in both waves of the survey (n=212 in 2006 and n=126 in 2014).

Data from the 2013 BC AHS was analysed to consider the impact of the 2010 Games on adolescents at risk of incarceration (n= 2,241). The impact on adolescents with a disability was explored using data from the 2003 (n=340), 2008 (n=431) and 2013 BC AHS (n=357). Common themes and findings unique to each population are explored in the discussion section of this chapter.

5.1 Homeless adolescents

***Research Question 1:** To what extent was the 2010 Winter Olympics associated with planned, positive, tangible benefits for different subpopulations of adolescents in BC, either during the pregnancy period or after the Games?*

In 2006, 17.4% of homeless adolescents reported experiencing at least one positive impact of the upcoming 2010 Games (increased access to housing, services or employment opportunities). This decreased to 8.8% in 2014. In 2014, homeless adolescents were specifically less likely to report the Games had increased their access to housing and employment (Table 5.1).

Table 5.1.

Self-Reported Impact of 2010 Games on Homeless Adolescents (HSIYS)

Impact of 2010 Games	2006 HSIYS	2014 HSIYS	Chi-square
More access to housing	8.5%	5.4%	4.87
Less access to housing	11.1%	8.3%	2.56
More access to services	3.8%	2.3%	2.15
Less access to services	7.0%	4.0%	4.88
More job prospects	9.6%	NR	33.70
Less job prospects	5.2%	4.8%	0.10
No effect	42.2%	47.0%	2.71
Haven't thought about it	35.2%	41.8%	5.36
Other	4.3%	NR	9.82

Note. Bolded percentages indicate a statistically significant difference to comparison group at $p < .05$.

NR= Not releasable due to risk of deductive disclosure.

In 2006, 24.9% of homeless males reported at least one tangible benefit of the Games, compared to 10.6% of females. They were more likely than females to report the Games had increased their access to housing (12.9% vs. 4.7%) and their job prospects (14.2% vs. 5.6%). Adolescents aged 16 and older were also more likely to report the Games increased their housing access (9.9% vs. 4.2%), and job prospects (11.4% vs. 3.0% of under 16's). There were no such gender or age differences in 2014.

In 2006 (but not 2014), homeless adolescents who credited the Games with increasing their job prospects were more likely to have been employed in the past month (49.2% vs. 28.6% who did not report this positive impact of the Games), even after controlling for age and gender (AOR=1.924 [95% CI 1.101 -3.363]).

Pre and post the 2010 Games, there were no significant associations among youth who indicated the Games had increased their access to services and their self-reported use of services.

Positive perceptions of the 2010 Games' impact on their housing, job opportunities and access to services were not associated with participation in PA. One exception was that adolescents who reported positively on the Games' impact were more likely to have played informal sports recently in 2006 (53.6% vs. 40.4% of adolescents who did not report a positive impact of the Games, AOR=1.54, 95% CI [1.004 - 2.38]).

In 2006, 4.3% of homeless adolescents provided a qualitative response about the impact of the Games, including less than 1% who offered a positive comment. Those comments noted hoping to have the opportunity to attend the Games and looking forward to the sporting competition. Post Games, only a couple of adolescents offered a positive comment on the Games impact. These noted increased awareness of different sports, being inspired to become active, and enjoying the festival atmosphere of the Games.

Research Question 2: Were there intangible benefits of a positive perception of the Games, such as increased community connectedness?

In 2014, homeless adolescents who reported a positive impact of the Games were more likely to report feeling 'quite a bit' or 'very much' connected to the community (55.6% vs. 30.7% who reported no effect of the Games; AOR=2.828, 95% CI [1.495-5.349]). The 2006 HSIYS did not include an item about community connectedness.

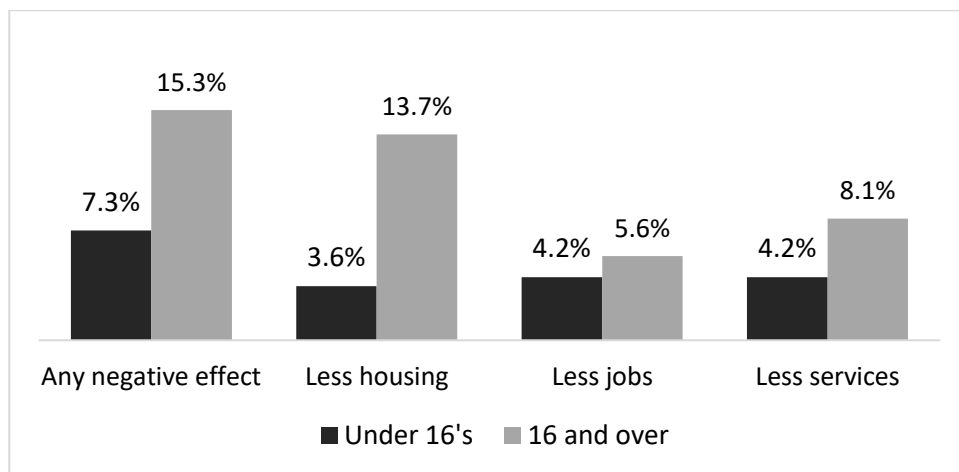
Research Question 3: To what extent and in what time and space did adolescents report negative unplanned legacies of the Games, such as decreased access to housing, employment or services?

a) Was reporting a negative legacy of the Games associated with other tangible or intangible experiences?

In 2006, homeless adolescents were more likely to report a positive impact of the Games than a negative one. This was not the case in 2014, although there was an overall decrease in reporting any negative impact of the 2010 Games (from 13.3% in 2006 to 9.4% in 2014).

Despite the overall decrease in perceived negative impacts, there was no decrease in reporting reduced access to housing, which was the most commonly reported effect of the Games at both time points (Table 5.1). The percentage reporting reduced access to employment also remained consistent, while the percentage reporting decreased access to services dropped (Table 5.1).

There were no gender differences in reports of negative effects of the Games, and no age differences in 2014. However, in 2006, older adolescents were more likely than younger ones to report a negative impact of the Games (Figure 5.1).



Note: The difference between younger and older youth was not significant for reduced employment opportunities (fewer jobs)

Figure 5.1. Age differences in negative impacts of the 2010 Games (2006 HSIYS)

A thematic analysis of the qualitative responses about the Games effects showed that the comments were generally negative. In 2006, most referenced an increased police presence and aggressive policing methods. Other negative comments referenced gentrification, a rise in prices and the environmental impact of the Games. The majority of negative comments were from adolescents surveyed in the host community of Vancouver. Post-Games (2014), less than 10 HSIYS participants provided a qualitative response. The negative comments referenced an increased police presence, increased transit costs and inflated housing prices.

Pre-Games, homeless adolescents who reported that the Games had decreased their access to housing were more likely to be staying in the most precarious situations (e.g., in a squat, in a car, on the street) than their peers who did not report that the Games had decreased access to housing (19.5% vs. 5.8%). There was no such relation in 2014.

The HSIYS did not ask directly about perception of the Games' impact on police contact or community connectedness. However, homeless adolescents who reported at least one negative impact of the Games (i.e., reduced access to services, employment or housing) were more likely than those who did not report such negative effects to have had contact with the police in the past year (76.1% vs. 60.0% who did not report negatively of the Games in 2014). Adolescents who reported the Games had negatively affected them reported similar rates of community connectedness as those who reported no effect of the Games.

Research Question 4: *Was there a spatial impact of the Games (i.e., was the impact of the Games different in host communities, in comparison to non-host BC communities)? ['Hosts' in this section refers to Vancouver in 2006 and Vancouver/North Shore in 2014 unless otherwise noted. In 2014, results were similar for Vancouver and Vancouver/North Shore unless noted.]*

In 2006, homeless adolescents in Vancouver were slightly older than those in non-host communities (16.65 vs. 16.23 years, $p < .001$). There was no such age difference in 2014. There were no gender differences between adolescents in host and non-host communities in either year. Additionally, in 2006, homeless adolescents in Vancouver were more likely than those in non-host communities to report the Games had positively or negatively impacted them, and were less likely to report they had not thought about it or it had not affected them (Table 5.2).

Table 5.2

Effect of the 2010 Games - Host community (Vancouver) vs. Non-Host Communities (2006 HSIYS)

Impact of 2010 Games	Host community	Non-host communities
More access to housing	3.6%	6.0%
Less access to housing	15.8%	5.5%
More access to services	2.2%	2.4%
Less access to services	7.2%	2.9%
More job prospects	1.4%	1.6%
Less job prospects	7.2%	3.9%
No effect	46.8%	47.1%
Haven't thought about it	36.0%	44.0%
Any positive effect	7.2%	9.4%
Any negative effect	16.5%	6.8%

Note. Bolded percentages indicate a statistically significant difference to comparison group at $p < .01$.

In 2014, homeless adolescents in the host communities (Vancouver and North Shore) reported positive impacts, and no effects of the 2010 Games at similar rates to their peers in non-host communities, but were more likely to report negative effects, and specifically to report decreased access to housing and services. Adolescents in Vancouver were also less likely to report they had not thought about the Games (44.0% vs. 31.6%).

There was an increase between 2006 and 2014 in Vancouver adolescents reporting that the Games had no effect on them (from 26.5% to 45.6%), and a decrease in the percentage reporting negative consequences (32.1% vs. 17.7%). However, the percentage reporting specifically that the Games had decreased their access to housing remained consistent.

In 2006, there were some gender differences in Vancouver which were not present in non-host communities, as 40.5% of Vancouver females reported at least one negative consequence of the Games compared to 24.4% of males. Specifically, Vancouver females were around twice as likely to report the upcoming Games had decreased their access to housing (36.5% vs 18.6% males) and employment (20.3% vs. 9.6%).

Consistent with the picture for the whole sample in 2014, homeless youth in the host communities who reported the Games had negatively affected them were more likely than those who did not report such negative effects to have had contact with the police in the past year. In Vancouver, they were also more likely to report the police had run checks on them (19.4% vs. 6.2% of Vancouver youth who did not feel the Games had negatively affected them).

5.1.1 Stakeholders' reflections on results among homeless adolescents

Although sports coaches, administrators and venue operators reported they had little knowledge of how the Games had impacted homeless adolescents, there was an assumption that these youth had likely missed out on positive legacies which were created. Stakeholders involved in event related activities acknowledged that little had been done to ensure more vulnerable populations were included in any tangible benefits. Other stakeholders noted the results of this study reflected their experience that it was the more vulnerable populations who had missed out on legacies when the Games had been negatively impacted by the global recession, including the cancelling of social housing for homeless families in the Olympic Village.

“When the recession hit, all the extras got cancelled and they were cutting to the bare bones. The Olympics was good in that all the development would have stopped if there hadn't been this deadline with the world watching, but what did stop was the extra builds that would benefit those at-risk kids and the poor families.” Project manager, Olympic Village construction.

“The promised upgrades to the rec centres got cancelled in some of the poorer areas and the homeless young people we work with could never afford to access the types of sports and activities that they put in when they did the upgrades anyway.” Youth service provider.

A lack of a positive legacy of employment opportunities for homeless adolescents was cited as a missed opportunity of the Games by a couple of stakeholders, with one stating:

“The biggest missed opportunity has to have been around youth employment. Kids with barriers could have really been helped by the event. The organizers should have partnered with not-for-profits to offer training, support and tools so that [youth] could get some work experience around the Olympics, and then get some skills to move out of homelessness and into job afterwards, but that never happened. So, any jobs that were there had zero impact on these kids.” Youth service provider.

However, a youth service provider did also note that the 2010 Games was associated with an increase in housing stock, specifically for homeless adolescents.

“The biggest legacy of the Games for homeless young people was the youth housing at [names 2 large-scale purpose-built youth housing developments in Vancouver]. We never would have got those without the Olympics. It was initially meant to be temporary housing just so they had somewhere to put kids to get them off the streets and out of the way during the Olympics but without the Olympics there would be no youth housing today.” Youth service provider.

The intangible benefits of communitas noted by stakeholders at the population level were also seen among homeless adolescents. The building of the new light rail line was partially credited with a longer-term increase in community connectedness by two stakeholders who felt that improved transit had allowed adolescents who were homeless in downtown Vancouver to maintain connections with their family or former community. Several stakeholders also suggested that access to free tickets to attend events had helped create community connectedness for vulnerable populations of adolescents such as those who were homeless during the Games.

“We got lots of free tickets for [homeless] kids. I know there was a lot of abuse of that and the tickets didn’t get to a lot of the kids and families they were supposed to but we made sure staff took the kids and it was a great experience for them...They really felt part of it.” Youth service provider.

Negative legacies of the Games reported by adolescents who completed the HSIY were confirmed by stakeholders, particularly in relation to housing and police harassment.

“An unintended really negative consequence of the Olympics has been the loss of rental accommodation all along the Canada Line [the light rail line built for the Games]. So many people have been displaced.” Youth service provider

“There was a lot more police harassment of [homeless] kids in the buildup [to the Games] and when the tourists came.” Youth service provider

Several stakeholders noted they were not surprised at the association between a negative perception of the Games and increased police contact among homeless adolescents. These stakeholders had personally observed increased police harassment, and aggressive enforcement of policies about begging, congregating, and sleeping rough by the City of Vancouver in the build up to the Games.

“There were lots of meetings but no collaboration and no sense of how to involve these kids. They [Event organisers and the police] just wanted to get ahead of youth and make sure no one spoilt it for the tourists by begging or stealing.” Youth service provider.

5.2 Adolescents at risk of incarceration

The same research questions posed for homeless adolescents were asked for adolescents at risk of incarceration who completed the 2013 BC AHS.

Research Question 1: *To what extent was the 2010 Winter Olympics associated with planned, positive, tangible benefits for different subpopulations of adolescents in BC, either during the pregnancy period or after the Games?*

Among adolescents at risk of incarceration, few provided a qualitative comment about the Games, and most comments were negative or described no effects of the Games. However, 17 youth reported being inspired to participate in sport and PA (e.g. ‘I started playing basketball’, ‘Now I am working hard to get in the Olympics’, ‘I have more hope to be on the podium one day.’). Other tangible impacts included ‘I got a job for the Olympics’ and ‘I live in the Olympic Village now.’

In 2013, adolescents at risk of incarceration were less likely to report any positive impacts of the 2010 Games (increased PA, greater access to sports opportunities or increased employment opportunities), in comparison to their peers with fewer risk factors (12.7% vs. 15.5%), and were specifically less likely to report increased PA and greater access to sports opportunities (Table 5.3).

Table 5.3

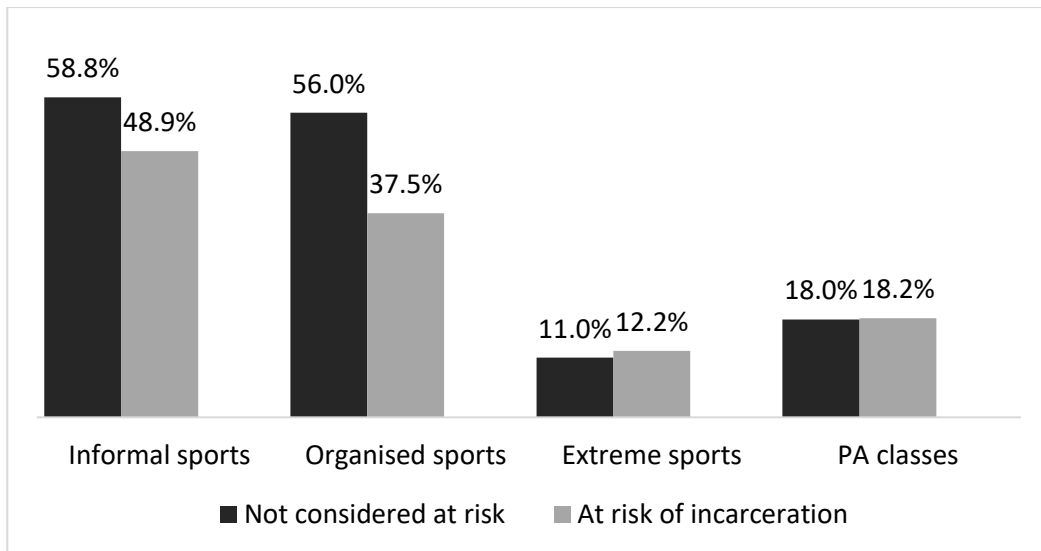
Self-reported effects of 2010 Games on adolescents at risk of incarceration (2013 BC AHS)

	Youth at risk of incarceration	Youth not considered at risk
I am more physically active	9.3%	12.9%
I am less physically active	2.6%	0.8%
I have more sports opportunities	4.8%	6.6%
I have less sports opportunities	1.1%	0.3%
I have more job opportunities	1.8%	2.0%
I have less job opportunities	1.1%	0.3%
Haven't thought about it	37.7%	43.0%
No effect	57.2%	49.3%
Other	0.4%	4.4%

Note. Bolded percentages indicate a statistically significant difference to comparison group at $p < .01$.

Among adolescents not considered at risk for incarceration, there were gender differences in reports of the Games' impact on increased PA, access to sports opportunities and employment opportunities. The only gender difference in positive perceptions among those at risk of incarceration was males were more likely to report increased PA (12.2% vs. 7.4%).

In comparison to their peers, male and female adolescents at risk of incarceration were less likely to be engaged in weekly organised sports and informal sports, and females were also less likely to be participating in weekly exercise classes (Figure 5.2).



Note: The difference between adolescents at risk of incarceration and those not considered at risk was not statistically significant for extreme sports or PA classes

Figure 5.2. Comparison of weekly PA participation – adolescents at risk of incarceration vs. not considered at risk (2013 BC AHS)

However, adolescents at risk of incarceration who reported the Games had increased their PA were more likely to have participated in organised sports, informal sports and exercise classes on a weekly basis over the past year, compared to their peers who did not report this positive impact of the Games (Table 5.4). Those who reported increased sports opportunities were more likely to have participated in organised and extreme sports (Table 5.4).

Table 5.4

Participation in Weekly PA Among Youth At Risk of Incarceration in Relation to Self-Reported Impact of Games on PA and Access to Sports Opportunities (2013 BC AHS)

	Games increased PA	Games did not increase PA	AOR (99% CI) ^a	t	Adj F	p value
Organised sports	56.2%	35.6%	1.725 (1.108-2.685)	3.182	10.125	p=.002
Informal sports	64.2%	47.6%	1.799 (1.120-2.889)	3.200	10.238	p=.001
Extreme sports	25.5%	10.9%	1.682 (.948-2.982)	2.343	8.307	p=.019
Exercise classes	27.4%	17.3%	1.950 (1.159-3.281)	3.312	10.972	p=.001
	Games increased sports opportunities	Games did not increase sports opportunities	AOR (99% CI) ^a	t	Adj F	p value
Organised sports	69.8%	35.9%	3.300 (1.729-6.296)	4.769	22.746	p<.001
Informal sports	64.1%	48.4%	1.521 (.794-2.913)	1.666	2.776	p=.096
Extreme sports	34.2%	11.1%	3.215 (1.600-6.458)	4.321	5.485	p<.001
Exercise classes	23.9%	17.9%	1.301 (.598-2.832)	.873	.762	p=.382

^a Controlling for age and gender in logistic regressions.

Note. Bolded percentages indicate a statistically significant differences to comparison group at p<.01. Bolded AOR is statistically significant at the p value indicated.

In comparison to population participation rates, participation in organised sports and informal sports was lower among males and females at risk of incarceration, and for females in exercise classes (Table 5.5). However, males and females at risk of incarceration who reported increased PA or increased sports opportunities as a result of the Games participated in organised sports, informal sports and exercise classes at similar or higher rates than adolescents in the province as a whole (Table 5.5).

Table 5.5

Participation in Weekly PA of Adolescents at Risk of Incarceration by Impact of 2010 Games on PA and Sports Opportunities in Comparison to Provincial Participation Rates (2013 BC AHS)

	BC participati on rate	Participation rate - at risk of incarceration	Reported increased PA - at risk of incarceration	Reported increased sports opps - at risk of incarceration
Males				
Organised sports	59.1%	43.9%	59.2%*	71.1%*
Informal sports	66.8%	60.2%	65.2%	69.5%*
Extreme sports	17.5%	20.8%	33.8%*	42.2%*
Exercise classes	7.6%	10.3%	14.7%	14.5%*
Females				
Organised sports	50.4%	33.4%	53.0%*	68.5%*
Informal sports	49.8%	41.6%	63.1%*	58.5%*
Extreme sports	5.0%	6.6%	16.7%	25.9%*
Exercise classes	27.9%	23.3%	41.0%*	33.9%*

*Standard error was higher than anticipated but still within a releasable range

Note. Bolded percentages were significantly different to the provincial rate at $p < .01$.

Reporting positively on the Games' impact was not associated with a reduced likelihood of being detained in a custody centre in the past 12 months or of being involved in antisocial or illegal behaviour such as carrying a weapon to school, engaging in illegal gambling, being the perpetrator of in person or online bullying, getting in a fight, or getting into trouble with the police while intoxicated.

Research Question 2: *Were there intangible benefits of a positive perception of the Games, such as increased community connectedness for youth at risk of incarceration?*

Six adolescents at risk of incarceration reported qualitatively that the Games had positively impacted their community connectedness and community pride. Adolescents at risk of incarceration were less likely to feel connected to their community than their peers. For example, 24.3% felt 'quite a bit' or 'very' connected to their community (vs. 40.5% without multiple risk factors for incarceration), and 35.3% felt 'not at all' or 'very little' connection to their community (vs. 17.9%).

However, adolescents at risk of incarceration who reported the Games had positively impacted them were more likely to feel connected to their community than those who felt it had negatively impacted them (Figure 5.3).

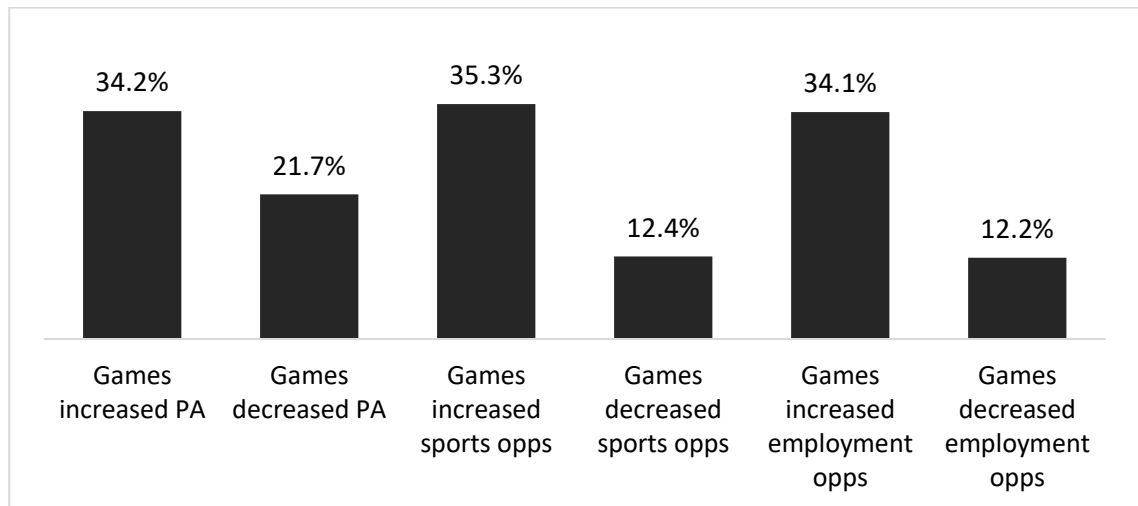


Figure 5.3. Adolescents at risk of incarceration who reported feeling quite a bit/very much connected to their community (BC AHS 2013)

Reporting the Games increased PA and access to sports opportunities remained independent predictors of community connectedness after controlling for age and gender, but increased employment opportunities no longer predicted community connectedness (Table 5.6). For this population, being employed in the past year was also not an independent predictor of community connectedness (AOR .957, [99% CI .698 – 1.312], $p=.719$).

Table 5.6

Reporting Positive Impact of the Games as Predictor of Community Connectedness (2013 BC AHS)

	AOR (with 99% CI) ^a	t	AdjF	P value
Games increased PA	1.722 (1.159-3.045)	3.181	10.119	$p=.002$
Games increased sports opportunities	1.879 (1.159-3.045)	2.564	6.574	$p=.011$
Games increased employment opportunities	1.773 (.866-3.632)	1.567	2.457	$p=.117$

^a Controlling for age and gender in logistic regressions.

As population level results showed that engagement in weekly PA was a predictor of community connectedness, additional analyses were conducted to ascertain if the pattern was the same for adolescents at risk of incarceration. Age and gender adjusted logistic regressions showed that engaging in organised, informal or extreme sports were predictors of feeling ‘quite a bit’ or ‘very’ connected to community but weekly participation in exercise classes was not (Table 5.7).

Table 5.7

Participation in Weekly Sports and PA as a Predictor of Community Connectedness (2013 BC AHS)

	AOR (with 99% CI) ^a	t	Adj F	p value
Organised sports	1.384 (1.043-1.838)	2.962	8.771	p=.003
Informal sports	1.354 (1.019-1.799)	2.752	7.575	p=.006
Extreme sports	1.705 (1.131-2.596)	3.359	11.280	p=.001
Exercise classes	1.141 (.790-1.649)	.927	.859	p=.354

^a Controlling for age and gender in logistic regression.

Reporting the Games had increased PA and playing organised sports on a regular basis both predicted community connectedness among youth at risk of incarceration. These were then entered together in a regression, along with age and gender, to assess if one variable predicted community connectedness over and above the other. Both continued to independently predict community connectedness (Table 5.8). These results were repeated when increased PA as a result of the 2010 Games was considered as a co-variate with informal sports and with extreme sports (Table 5.8).

Table 5.8

Participation in Weekly Sports and PA and Positive Perception of the 2010 Games' Impact on PA as Independent Predictors of Community Connectedness (2013 BC AHS)

	AOR (with 99% CI) ^a	t	AdjF	p value
Weekly participation in organised sports	1.332 (.999-1.776)	2.574	6.627	p=.010
Games increased PA	1.611 (1.032 – 2.515)	2.762	7.627	p=.006
Weekly participation in informal sports	1.300 (1.043-1.622)	2.322	7.417	p=.020
Games increased PA	1.604 (1.025-2.510)	2.723	5.391	p=.007
Weekly participation in extreme sports	1.629 (1.039-2.556)	2.810	7.831	p=.002
Games increased PA	1.667 (1.099-2.530)	3.166	10.017	p=.005

^a Controlling for age and gender in logistic regression.

These analyses were repeated, examining increased access to sports opportunities as a result of the Games and weekly participation in PA, in relation to community connectedness. Perceived greater access to sports opportunities due to the Games no longer predicted community connectedness when considered with weekly organised sports participation, age and gender as co-variables (AOR 1.640, 99% CI .858-3.134, p=.049). Nor was it still predictive of community connectedness when considered with weekly informal sports participation (AOR 1.812; 99%CI .958-3.425, p=.016), or weekly extreme sports participation (AOR 1.691, 99% CI .881-3.248, p=.038).

The three strongest predictors of community connectedness were reporting increased PA as a result of the Games, and engaging in organised or extreme sports on a weekly basis. These predictors were therefore placed together in a model (with age and gender). Reporting increased PA as a result of the Games and weekly participation in

extreme sports remained as independent predictors of community connectedness (Table 5.9).

Table 5.9.

Participation in Weekly Organised and Extreme Sports and Positive Perception of the 2010 Games Impact on PA as Independent Predictors of Community Connectedness (2013 BC AHS)

	AOR (with 99% CI) ^a	t	Adj F	p value
Weekly participation in organised sports	1.264 (.940-1.701)	2.041	4.167	p=.042
Weekly participation in extreme sports	1.609 (1.049-2.467)	2.869	8.232	p=.004
Games increased PA	1.573 (1.001-2.471)	2.588	6.698	p=.010

^a Controlling for age and gender in logistic regression.

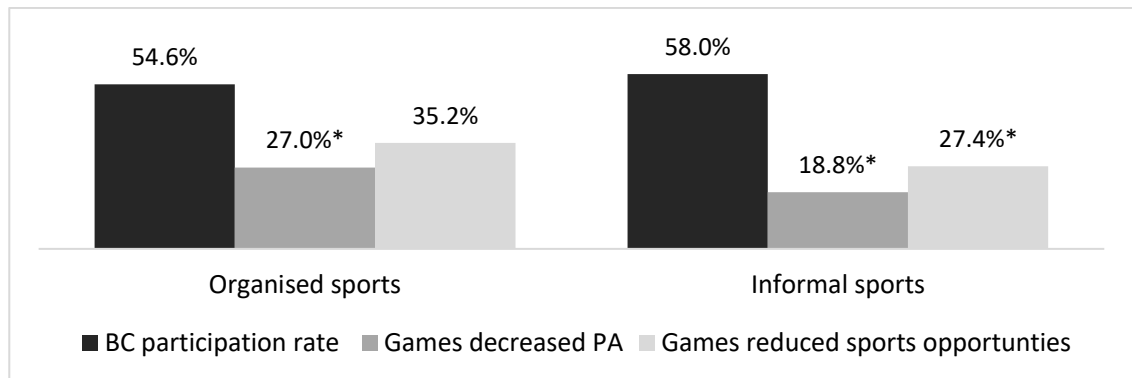
Research Question 3: *To what extent and in what time and space did adolescents report negative unplanned legacies of the Games, such as decreased access to housing, employment or services?*

a) Was reporting a negative legacy of the Games associated with other tangible or intangible experiences?

Adolescents at risk of incarceration were more likely than their peers to report qualitative and quantitative negative consequences of the 2010 Games, included reduced PA, reduced access to sports opportunities, and reduced employment opportunities (Table 5.3). Qualitative responses also referenced frustration with the crowds, the expenditure, increased prices, and availability of drugs.

Adolescents at risk of incarceration who reported the Games had a negative impact on their PA or sports opportunities participated in organised sports and informal sports at rates below the provincial average (Figure 5.4), which was not the case for those who

reported positively on the Games' impact on their PA and sports opportunities (Table 5.4).



*Standard error was higher than anticipated but within the releasable range.

Figure 5.4. Sports and exercise participation among adolescents at risk of incarceration in comparison to provincial participation rates (2013 BC AHS)

Having a positive perception of the Games was not associated with reduced engagement in illegal and antisocial behaviours in the past 12 months. However, adolescents who reported negatively on the Games' impact were more likely to have engaged in these behaviours (Table 5.10). For example, adolescents who reported the Games had reduced their PA were more likely to have carried a weapon to school (34.0%* vs. 14.6% who did not report negatively), been held in a custody centre (13.7% vs. 2.7%), engaged in illegal gambling (46.3%* vs. 18.3%), engaged in in-person or online bullying (61.5%* vs. 41.3%), and been in a physical fight while intoxicated (26.2%* vs. 9.3%). The patterns for reduced access to sports and employment opportunities were similar.

Table 5.10

Engagement in Illegal and Antisocial Behaviours in Past 12 months Among Adolescents At Risk of Incarceration (2013 BC AHS)

Illegal/antisocial behaviour	Experienced at least one negative impact	No negative impacts	AOR (99% CI) ^a	Adj F	P value
Held in a custody centre	14.9%	2.5%	6.989 (2.769-17.643)	29.381	<.001
Always carry weapon to school	40.6%	14.2%	4.143 (2.093-8.203)	28.848	<.001
Illegal gambling	47.5%	17.9%	4.327 (2.308-8.110)	36.217	<.001
Bullied another youth in person or online	60.6%	41.1%	2.063 (1.072-3.970)	8.150	<i>p</i> =.004
Got into physical fight while intoxicated	27.9%	9.1%	3.309 (1.509-7.256)	15.480	<.001

^a Controlling for age and gender in logistic regressions.

Note. Bolded percentage estimates are statistically significant at $p < .01$. Bolded AOR is statistically significant at the p value indicated.

Around a third (32%) of adolescents at risk of incarceration who reported positive impacts of the Games also reported feeling 'quite a bit' or 'very much' connected to their community, whereas only around 1 in 5 (19.7%) of those with negative perceptions of the Games reported this level of community connectedness.

Research Question 4: Was there a spatial impact of the Games for youth at risk of incarceration (i.e., was the impact of the Games different in host communities, in comparison to non-host BC communities)?

Among adolescents at risk of incarceration, no differences in reported effects of the Games were found between those in host and non-host regions or when the three host communities were compared separately to the rest of the province.

5.2.1 Stakeholders' reflections on results among adolescents at risk of incarceration

Adolescents at risk of incarceration were included as a subgroup in this study because they are largely ignored by mega event organisers. Reflecting their lack of visibility as a vulnerable population, none of the stakeholders were aware of any efforts to include this group of adolescents in Games related initiatives or legacy planning, although one did note agencies working with justice involved adolescents had received free tickets to Olympic events.

A youth service provider observed that homeless youth who were justice involved were particularly targeted by police and municipal bylaw enforcement officers in the build up to the Games, and many of these adolescents were arrested or left Vancouver for fear of being arrested during the build up to the Games. That same stakeholder did note that there appeared to be an intangible benefit of *communitas* among homeless adolescents at risk of incarceration, and this was echoed by a junior sports coach.

"I was a torchbearer down Commercial Drive [in Vancouver] and it was really scary with all the protests and barricades going on...[But] those anarchist kids who were protesting the Games and making barricades and rioting suddenly

changed when the Games started and they loved it and got totally into the community festivals. They felt like they belonged to something.” Junior sports coach.

5.3 Adolescents with a physical disability

Data were available from all three waves of the BC AHS for adolescents with a debilitating physical disability. These adolescents comprised 1.1% of the BC AHS sample in 2003, 1.5% in 2008 and 1.3% in 2013.

Research Question 1: *To what extent was the 2010 Winter Olympics associated with planned, positive, tangible benefits for different subpopulations of adolescents in BC, either during the pregnancy period or after the Games?*

Among adolescents with a physical disability 4.9% in 2008 and 7.1% in 2013 provided a qualitative response. In 2008, the majority were negative and only one reported a positive impact on their sports participation. In 2013, responses were more likely to be positive or indifferent than negative, and included two who reported the Games has inspired them to want to play competitive sports, one who had enjoyed being involved in the torch relay for the Games and one who had sung at the Paralympics.

In 2008, 16.2% of adolescents with a physical disability reported at least one positive legacy of the Games, which was similar to the rate among those without this type of disability. However, whilst adolescents without a physical disability reporting positive legacies remained constant, the percentage among those with a physical disability halved (from 16.2% to 8.1%).

There were few differences between adolescents with and without a physical disability in specific effects of the 2010 Games. However, those without a disability were more likely to have not thought about it (2008), and to report the Games increased their PA (2013; Table 5.11).

Table 5.11

Comparison of Effects of 2010 Games – Adolescents With a Debilitating Physical Disability vs. Those Without (BC AHS)

	2008		2013	
	Physical Disability	No physical disability	Physical Disability	No physical disability
I am more physically active	11.2%	8.9%	6.3%	12.7%
I am less physically active	2.4%	0.8%	NR	0.9%
I have more sports opportunities	6.1%	6.0%	4.5%	6.4%
I have less sports opportunities	NR	0.5%	NR	0.3%
I have more job opportunities	5.2%	5.9%	1.7%	1.9%
I have less job opportunities	NR	0.5%	NR	0.3%
Haven't thought about it	35.7%	44.1%	45.7%	42.7%
No effect	47.1%	45.5%	57.4%	49.7%
Other	4.7%	2.0%	7.1%	4.7%

Note. Bolded percentages were significantly different to adolescents without a physical disability at $p < .01$.

In both survey years, the most common legacy of the 2010 Games reported by adolescents with a physical disability was increased PA. However, this decreased over time, as did reporting increased job opportunities. There was an increase in those reporting the Games had no effect on them and that they had not thought about it (Table 5.12).

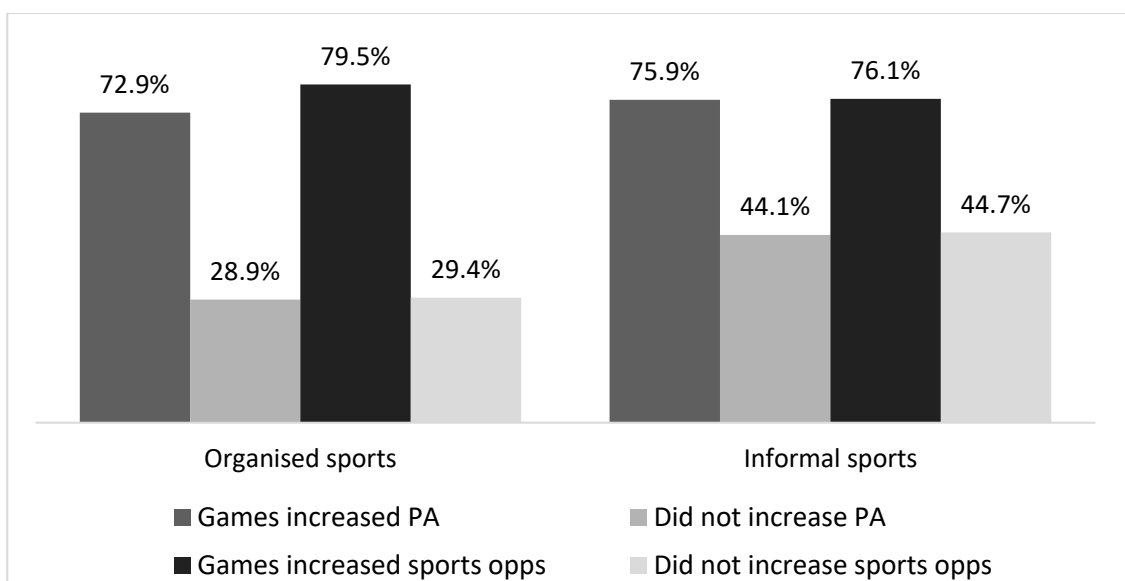
Table 5.12

Self-Reported Impact of the 2010 Games Among Adolescents With a Physical Disability (BC AHS)

	2008	2013
I am more physically active	11.2%	6.3%
I am less physically active	2.4%	2.6%
I have more sports opportunities	6.1%	4.5%
I have less sports opportunities	NR	NR
I have more job opportunities	5.2%	1.7%
I have less job opportunities	NR	NR
Haven't thought about it	35.7%	45.7%
No effect	47.1%	57.4%
Other	4.7%	7.1%

Note. Bolded percentages were significantly different to 2008 at $p < .05$.

In 2008, adolescents with a physical disability were no more likely to engage in weekly sports or exercise if they reported the Games had positively impacted their PA or their sports opportunities, than if they did not report either of these Games' impacts. However, in 2013 those who reported the Games had increased their PA and sports opportunities were more likely to have played organised and informal sports on a weekly basis over the past year (Figure 5.5).



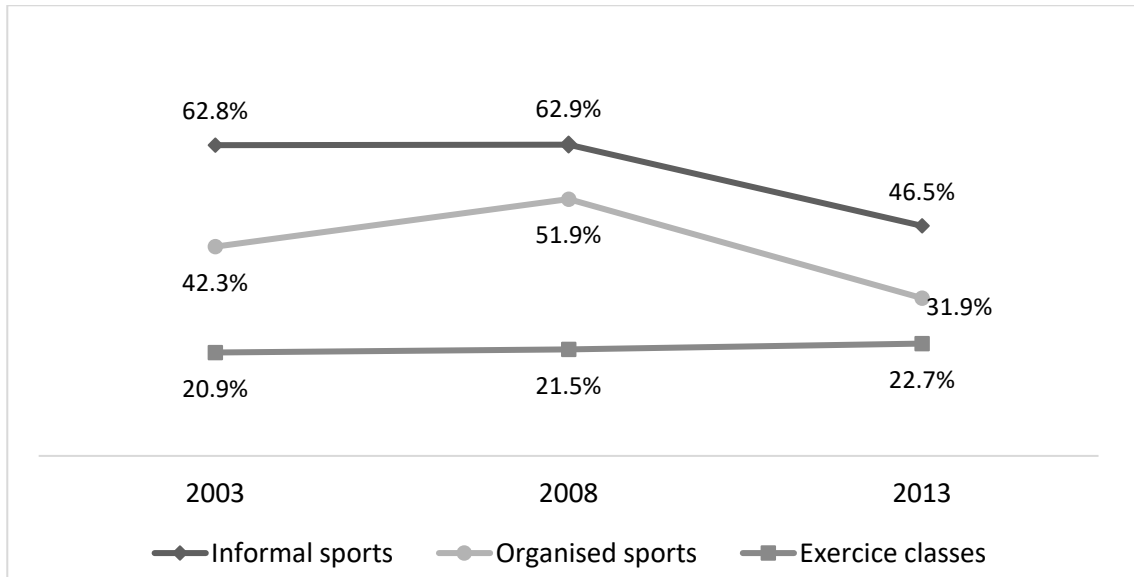
*SE was higher than anticipated but still within a releasable range.

Figure 5.5. Participation in weekly sports in past 12 months among adolescents with a physical disability by 2010 Games impact on PA and access to sports opportunities (2013 BC AHS)

In 2003, 37.9% of adolescent with a physical disability worked at a paid job in the past year, and this did not change significantly in the build up to the Games or following the Games. Cell sizes were too small to calculate any association between reporting the Games increased job opportunities and employment in the past 12 months in 2013, but in 2008 75.3%* of adolescents with a physical disability who reported the Games had increased their employment prospects held a paid job in the past year, compared to 43.7% of adolescents who did not report the Games increased their job opportunities.

Between 2003 and 2013 participation in weekly exercise classes remained consistent among adolescents with a physical disability (Figure 5.6), with females more likely to participate than males in each survey year (e.g., 28.9% vs. 13.8% in 2013). For informal sports, participation rates were similar in 2003 and 2008 before decreasing in 2013 (Figure 5.6), with the only gender difference seen in 2008 when 72.8% of males with a physical disability played informal sports, compared to 53.2% females.

There was an increase in weekly organised sports participation between 2003 and 2008 before participation rates dropped below the 2003 rate in 2013 (Figure 5.6). There were no gender differences at any time point.



Note: For informal sports, differences between 2003 and 2008 were not statistically significant. For exercise classes, no differences in percentage estimates were statistically significant.

Figure 5.6. Trends in weekly PA participation among adolescents with a physical disability (BC AHS)

In each of the three survey years, adolescents with a disability participated in weekly extracurricular exercise classes at similar rates to their peers without a disability. In 2003 and 2008, they also participated in informal sports at similar rates to their peers, but were less likely to participate in 2013 (46.5% vs. 58.3%). At each time point, adolescents with a physical disability were less likely to participate in organised sports than their peers without a disability (Figure 5.7).

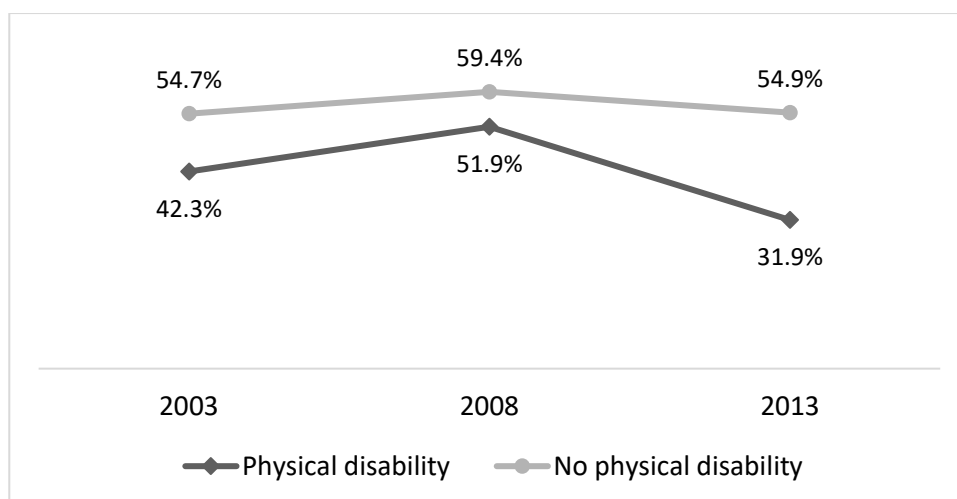


Figure 5.7. Trends in weekly organised sports participation among adolescents with and without a physical disability

Gap analysis was conducted to ascertain if the apparent narrowing and then widening of the gap between adolescents with and without a physical disability in organised sports participation was statistically significant (Table 5.13).

Table 5.13

Trends in Organised Sports Participation Disparities Between Adolescents With and Without a Physical Disability (BC AHS)

	AOR ^a	95% CI	p value
(Intercept)	1.446	1.051-1.988	.023
Physical disability	1.569	1.180-2.086	.002
No physical disability	1.000		
2013	.579	.399-.840	.004
2008	1.346	.935-.935	.110
2003	1.000		
Physical disability – 2013	1.682	1.160 – 2.440	.006
Physical disability – 2008	.902	.628 – 1.294	.574
Physical disability – 2003	1.000		
No physical disability – 2013	1.000		
No physical disability – 2008	1.000		
No physical disability – 2003	1.000		
Age	.961	.950 - .972	.000

^aControlling for age and gender in logistic regressions.

The adjusted odds ratio (AOR 1.569) showed there was a change in the disparity in organised sports participation after the Games were awarded to Vancouver in 2003 (Table 5.13). However, the apparent narrowing of the gap between adolescents with and without a disability between 2003 and 2008 was not statistically significant after controlling for age (AOR .902), but the widening of the gap in participation seen in 2013 was significant (AOR 1.682, Table 5.13).

Research Question 2: Were there intangible benefits of a positive perception of the Games, such as increased community connectedness?

No adolescents with a physical disability provided a qualitative comment about the Games' impact on community connectedness in 2008. In 2013, three reported that their sense of community connectedness had increased.

Quantitative responses showed that in 2013, adolescents with a physical disability were less likely to report feeling 'quite a bit' or 'very much' connected to their community, in comparison to those without a physical disability (26.7% vs. 39.6%). Among adolescents with a physical disability, those who reported at least one positive impact of the Games were three times more likely to feel 'quite a bit' or 'very much' connected to their community (66% vs. 22.9% who did not report any positive effects).

Research Question 3: To what extent and in what time and space did adolescents report negative unplanned legacies of the Games, such as decreased access to housing, employment or services?

a) Was reporting a negative legacy of the Games associated with other tangible or intangible experiences?

Only a couple of adolescents with a physical disability qualitatively described a negative legacy of the Games, pre or post the event. Those comments referenced the cost.

In 2008, 2.4% of BC adolescents with a physical disability reported experiencing at least one negative legacy of the 2010 Games, which was comparable to adolescents without a disability. However, in 2013, adolescent with a physical disability were more likely than their non-disabled peers to report at least one negative legacy (3.4% vs 1.2).

In each wave of the survey, adolescents with a physical disability were around twice as likely as their peers without such a disability to have been discriminated against because of the way they looked. For adolescents without a physical disability, discrimination rates remained constant between 2003 and 2013, but increased for those with a disability from 36.4% in 2003 to 46.6% in 2013.

Adolescents with a physical disability experienced barriers to participation in sports and recreational activities at higher rates than their non-disabled peers (Figure 5.8). However, due to the small numbers of adolescents with a physical disability who reported positive or negative legacies of the Games and experienced barriers to participation, no associations with perception of the Games could be explored.

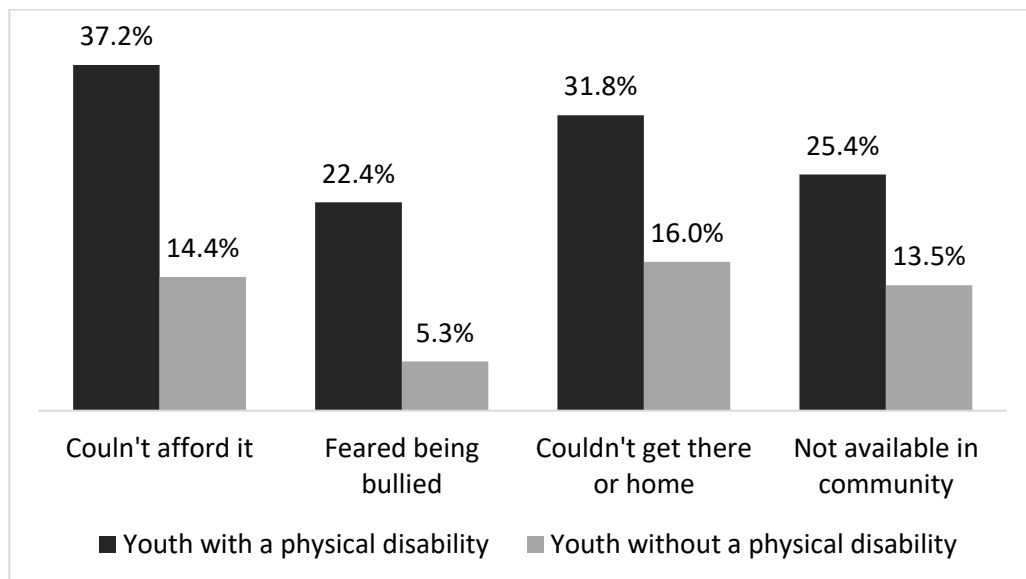


Figure 5.8. Barriers to extracurricular sports and recreation participation (2013 BC AHS)

Research Question 4: *Was there a spatial impact of the Games for youth with a physical disability (i.e., was the impact of the Games different in host communities, in comparison to non-host BC communities)?*

Due to the small numbers of adolescents with a physical disability within the host region who endorsed survey items about positive or negative effects of the Games, it was not possible to compare host vs. non-host regions. One exception was that in 2008, 23.3% of adolescent with a physical disability in the host regions reported at least one positive legacy of the 2010 Games, compared to 14.6% in the non-host regions.

Across survey years, there was no significant difference in weekly participation in organised sports, informal sports and exercises classes between adolescents with a physical disability in host and non-host regions. Additionally, adolescents with a physical disability in the host regions generally reported similar barriers to participating in sports and recreational activities as their peers in the non-host regions, except those in the host regions were more likely to report they did not participate because they could not afford to (53.8% vs. 33.7% in 2013).

In 2013, adolescents in the host regions experienced discrimination because of the way they looked at similar rates to their disabled peers elsewhere in the province. In the host regions, 46.1% of adolescents with a physical disability had experienced this type of discrimination, which was similar to the rate prior to the Games, and higher than among youth without a physical disability (46.1% vs. 16.6%).

5.3.1 Stakeholders' reflections on results among adolescents with a disability

Stakeholders involved in able bodied and para-sports confirmed there were tangible benefits associated with the Games for adolescents with a disability in both the host regions and provincially. As with the population level results, a demonstration effect

was partially credited with increasing sports and PA participation among some adolescents with a disability.

“[The Paralympics] definitely raised the profile [of sledge hockey]. Afterwards we got lots of kids who had been injured and had walked away from sports, seeing something they could get involved in and wanting to play sledge hockey which none of them knew anything about beforehand... It did a lot for those kids. It woke them up. Senior administrator, Surrey Minor Hockey.

The widening of the gap in sports participation between adolescents with and without a disability identified in this study was viewed as disappointing by stakeholders, particularly those involved in the Paralympic movement, but was corroborated by those involved in community level sports:

“The drop off [in participation among youth with a disability] afterwards is exactly what we saw. There was lots of investment in disability sports and a real buzz around it, then the money went and you just couldn’t keep it up.” Manager, legacy sports facility.

“We can’t train the coaches anymore without the funding so it is hard to recruit, and without coaches you can’t offer any specialised programmes.” Senior administrator, Paralympic.

Several stakeholders noted that they were not surprised that adolescents with a disability who participated in the BC AHS were reporting increased discrimination and affordability barriers, and felt the Games had done little to address these. However, one stakeholder connected to the Paralympic organising committee disagreed and felt that the Games had raised awareness among people with a disability about their rights. He felt the BC AHS results did not reflect an increase in discrimination but rather a greater awareness of discrimination and barriers to participation among adolescents with a disability.

Most stakeholders commented that the accessibility improvements to public transportation were likely the biggest legacy of the Games for adolescents with a disability, although none were aware of data which confirmed their views.

5.4 Discussion of vulnerable populations results

Preuss (2016) posed a series of questions about the impact of a mega sporting event which included asking how particular stakeholders are affected; when they are affected, how long any effect lasts and how constant any effect is over time. Although results in this chapter did not fully answer these questions, the self-report survey data provided by three vulnerable adolescent subpopulations, and reflections of various stakeholders, did offer important insights and build on the population level results presented in Chapter 4.

The commonalities and differing experiences of three unique populations—one who were expected to benefit from the hosting of the 2010 Games (adolescents with a physical disability), one who it was anticipated might experience negative as well as positive impacts (homeless adolescents), and one group on whom the expected impact has not previously been considered (youth at risk of incarceration)—offer important information for future event organisers seeking to engage with different adolescent subpopulations. They also increase our knowledge about who was affected by the Games, how it affected them, and the length and consistency of any legacies. The findings also clearly support Girginov and Hills' (2008) call for inclusivity of vulnerable populations in mega-event planning.

Despite limitations with the sample size among the smaller subpopulations, item changes on the BC AHS and HSIYS which affected trend analyses, and of cross-sectional self-report data in general, the findings of how the Games appeared to benefit and/or exclude vulnerable population offer some timely considerations for future mega events planners, to ensure their needs are not ignored or assumed to be similar to those of adults, or their more advantaged peers.

It is well established that the use of self-report data is a reasonably reliable method of obtaining information from this age group (Hardie-Murphy, Rowe, Belton & Woods, 2015). Therefore, a significant strength of this study was the use of pre- and post-Games survey items which asked vulnerable populations of adolescents and their

peers directly about the effect of the Games. Analysis of the BC AHS and HSIYS clearly identified adolescents' perceptions of the Games' legacies (pre and post the event), and allowed for the consideration of associations linked to those perceptions. The findings for each subpopulation increase our insight into 'who' was impacted by the Games, and as with the population level results, highlight the importance of considering age, gender and other social determinants of health when planning to leverage a mega sporting event to address disparities and leave a positive legacy. For example, homeless females were less likely to report any positive impacts of the Games and were more likely to report negative effects, such as reduced access to housing and reduced employment opportunities. Yet, as with results at the population level, when homeless females were able to report they had experienced positive impacts of the Games it was associated with potential benefits.

A limitation of this study is that it remains unclear through what mechanism young people experienced Games related legacies. Although various psychological, environmental and social mechanisms were considered, and stakeholders reported a demonstration effect occurred for some adolescents with a disability, a number of factors which could have impacted the results are unknown. For example, homeless adolescents are traditionally periodically homeless rather than chronically homeless (Moore, n.d.). It is therefore unknown if the adolescents who participated in the 2014 survey were homeless at the time the Games took place or if their responses were based on later experiences, and therefore in what context and through which mechanism or combination of mechanism any Games effect took place.

The lack of accurate measures of SES in the BC AHS and HSIYS meant that this could not be factored into the analyses of vulnerable populations. This is a limitation, as it is not known how that would have impacted the results. For example, it is likely that adolescents with a physical disability from affluent families were more likely to be in a position to benefit from any Games legacies than those dealing with the intersectionality of having a disability and living in poverty. Stakeholder consultations also suggested that SES impacted the vulnerable population results, as it did results at the population level:

“The Games created the Oval which was great for those who can afford it but it has put sport beyond what poorer families can afford. They have pay parking [at the Oval]. It can easily cost \$2,000 a year for a kid to play hockey, and then they get taxed with the parking each time they play. There is just no way for them to be able stomach that.” Senior administrator, Surrey Minor Hockey.

“Sports like sledge hockey can be so expensive with all the equipment and the travel so even with new facilities a lot of kids with a disability are from families who have no way for them to get involved.” Manager, Legacy venue.

It is possible that the study’s findings of tangible and intangible consequences of the Games may in reality be what Preuss (2015) would classify as ‘incorrectly perceived legacies’ or ‘placebo legacies’. For example, adolescents may have attributed the Games with reducing their access to employment but a lack of job opportunities in their community may have had nothing to do with the event. However, even if survey participants incorrectly believed that the Games were a contributing factor, this belief of the effects should not be dismissed or downplayed (Preuss, 2015).

Findings highlighted the extent of the impact of the Games on vulnerable adolescents. For example, four years before the Games and four years afterwards, less than half of homeless adolescents (in host and non-host communities) reported that the Games had not affected them. Similarly, three years after the closing ceremony, adolescents at risk of incarceration were less likely than their peers to report the Games had not affected them. Additionally, some negative legacies experienced before the Games continued to be experienced by vulnerable populations of adolescents five (BC AHS) and eight years (HSIYS) later, and did not decrease as would have been anticipated based on other studies and the population level results.

This is an important finding for Canada. In 1991, the country agreed to implement and abide by the declaration of the UN Convention on the Rights of the Child which includes the right for young people under the age of 18 to have a say in decisions that affect them. It also explicitly states that children should not be treated unfairly because of their gender, disability, family income or other demographic characteristics (UNICEF, 2013). Results such as the gender differences in positive and negative

legacies of the Games and the widening disparity in organised sports participation between those with and without a physical disability suggest a need to ensure future events such as the 2026 FIFA World Cup in Canada recognise young people as stakeholders in the planning process. They have the right to a say in how events are leveraged, and to ensure they are not harmed and can benefit from any positive legacies which are planned.

The implications of specific findings are discussed below, as is the research question *What are the implications of the findings for leveraging future mega events to support healthy adolescent development?*

Research Question 1: *To what extent was the 2010 Winter Olympics associated with planned, positive, tangible benefits for different subpopulations of adolescents in BC, either during the pregnancy period or after the Games?*

Results summary:

Post-Games, vulnerable populations were less likely to report positive benefits of the Games than their peers. Homeless adolescents were also less likely to report positive legacies during the pregnancy period of the Games.

Unlike population level results, positive legacies of the Games decreased over time for adolescents who were homeless or had a physical disability.

Males and older adolescent were the most likely to report positive legacies of the Games.

Adolescents at risk of incarceration generally had lower rates of participation in sports and exercise classes than their peers. However, those who reported positive impacts of the Games participated at similar (organised sports, informal sport and exercise classes) or higher rates (extreme sports) than the provincial average.

Reporting positively on the Games' impact on PA or sports opportunities appeared to have little impact on weekly PA participation for adolescents with a physical disability in 2008, but in 2013 was associated with higher rates of participation in organised, informal and extreme sports and reporting the Games had increased their PA was also associated with participation in exercise classes.

The disparity in organised sports participation between adolescents with and without a physical disability widened between 2003 and 2013.

Stakeholder consultations identified tangible benefits of the Games for vulnerable adolescents which included housing, improved transportation, and to a lesser extent access to sports opportunities.

One of the six key propositions of Preuss' legacy framework was that the value of a legacy is measured by how much it improves quality of life (Preuss, 2016). Up to around 1 in 7 BC adolescents in the vulnerable populations reported positive impacts of the Games, which suggest that mega sporting events can be leveraged to improve outcomes for different groups of young people, including those considered 'hard to reach'.

Vancouver's Olympic bid noted that BC residents with a physical disability and particularly those in host communities would benefit from increased accessible infrastructure and improved attitudes towards people with a disability as a result of the 2010 Games, and the homeless would benefit from increased housing stock (VANOC, 2002). A minority of adolescents with a physical disability reported increased access to sports opportunities, and a minority of homeless adolescents reported improved access to housing. However, a greater percentage of adolescents with a physical disability reported barriers to participation, and a greater percentage of homeless youth reported decreased access to housing.

Unlike results for the BC adolescent population as a whole, there was a decrease in positive perceptions of the Games among homeless adolescents and those with a physical disability following the Games. This was more reflective of studies with adult populations than the BC AHS population level results, as other studies have noted a decline in positive perceptions in host communities following the event (Kim et al, 2006). However, it is worth future studies considering the small percentage of adolescents in the vulnerable populations who reported being positively impacted by the event three and four years after the closing ceremony, to better understand how these sustained positive legacies may impact healthy adolescent development, and how a greater proportion could benefit.

Achieving sustainable sports participation through the hosting of a mega sporting event cannot be achieved unless the rights of different groups are recognised, and inclusivity is increased (Girginov & Hills, 2008). Applying self-efficacy theory and the PCM to this study, it was anticipated that adolescents with a physical disability would have been one of the groups encouraged to take up or increase their PA and particularly their organised sports participation as a result of the visibility of the 2010 Paralympics, and the inclusivity initiatives associated with the Games.

No previous study has linked the hosting of the Paralympics to increased sport and physical activity opportunities for people with disabilities (Misener et al., 2013), although the OGI study of the Games did note that 60% of BC residents believed the 2010 Paralympics had a positive effect in *“encouraging people with disabilities to participate in sports”* and 45% believed that the Games had increased accessible sports opportunities (VanWynsberghe, Bichel et al, 2011, p 17). In the current study, only around 6% of adolescents with a physical disability reported increased access to sports opportunities pre or post the Games, and the percentage who reported increased PA decreased from 11.2% to 6.3% after the Games. Stakeholder consultations offered support to Misener’s (2012) argument that despite the success of the Paralympics, little thought was put into leveraging it to engage people with a disability in PA or to promote winter sports as accessible.

Despite the OGI's optimism, prior studies have suggested that in the build up to the 2010 Games, the gap between marginalised and more mainstream adolescents was increasing in relation to extra-curricular sports participation and access to recreational facilities (Skinner et al., 2008). The findings of the current study show there was a non-significant rise in organised sports participation among adolescents with a physical disability in the build up to the Games (after controlling for age). However, this was not maintained, and the participation gap between adolescents with and without a physical disability widened over the decade under consideration.

Although this is discouraging, it does appear that a mega sporting event can be leveraged to increase participation among a subpopulation of adolescents with a physical disability. Those who reported the Games had positively impacted their PA were almost twice as likely as those who did not report such an effect of the Games to play organised sports on a weekly basis over the past year, and were more than twice as likely to play informal and extreme sports and to take exercise classes. Similarly, those who reported infrastructure legacies of increased sports opportunities were more likely than their peers who did not experience this impact of the Games to be engaged in weekly organised, informal and extreme sports.

These findings offer some encouragement to those involved in disability sports. However, one such stakeholder interviewed for this study suggested that summer Olympics may have a greater impact on adolescents with a physical disability than winter ones because summer sports are more accessible.

"Kids with a disability swim, they don't ski. There are so many financial and other barriers to winter sports that I wonder if we should really focus all our attention on leveraging the summer Games and be a bit more realistic about what we can achieve in winter sports in the current financial climate." Former Paralympian and member of 2010 Paralympics organising committee.

Preuss posits that a legacy of a mega event includes infrastructure and community developments a city did not plan at the time they hosted a mega sporting event but which they later realised were needed through the event (Preuss, 2016). It could also be argued that the positive associations between those adolescents reporting

increased access to sports opportunities and engagement in PA would have been seen among a significantly higher percentage of physically disabled adolescents had the planned, but later cancelled, accessible sports venues developments gone ahead for the Games.

Overall, adolescents at risk of incarceration had lower rates of participation in weekly organised sports than their peers. However, males and females who reported increased PA or increased sports opportunities as a result of the Games participated in organised sports, informal sports and exercise classes at similar or higher rates than adolescents in the province as a whole. Similarly, although the HSIYS did not ask directly about the Games' impact on PA, homeless adolescents who reported being positively impacted by the Games in other areas were more likely to continue taking part in informal sports (such as skateboarding, hiking, cycling) after they became homeless than those who had not been positively impacted. As informal sports are low-cost and low-barrier, further research may be warranted to identify how future mega sporting events can be leveraged to engage vulnerable adolescents, particularly given the compromised health picture experienced by these adolescents and the benefits which have been associated with homeless adolescents engaging in sports and exercise (Adams & Piekarz, 2015; Sherry, 2010).

Risk taking is a key part of adolescent development and is attractive to young people (Sharland, 2006), and particularly those who are justice involved (Smith et al., 2014). The inclusion of extreme and high-risk sports in the 2010 Games may have been appealing to youth at risk of incarceration in a way that may not occur with other mainstream global sporting events (such as the Summer Olympics or FIFA World Cup), and may have been reflected in the higher levels of participation in extreme sports seen among those who reported positively on the Games' impact on their PA and access to sports opportunities.

Extreme sports are particularly appealing to this population because of their subversive counterculture image and inherent danger (Begg et al., 1996; Donnelly, 1981). These sports have been associated with positive psychological benefits

including those achieved by spending time in nature (Brymer & Schweitzer, 2012). Additionally, those who participate in extreme sports such as snowboarding will often take up other extreme sport in the summer such as skateboarding and as a result be physically active year-round (Self, de Vries Henry, Findley & Reily, 2007). Extreme sports have also been noted to improve general well-being and mental health in a way not provided by other sports (Olivier, 2006; Pain and Pain (2005). The finding that adolescents at risk of incarceration who reported the Games increased their PA and sports opportunities participated in extreme sports at more than double the provincial rate should therefore be further explored to consider if a Winter Olympic Games may be uniquely positioned to engage these adolescents.

This finding is also encouraging given the complexity of the relationship between organised sports participation and health risk behaviors. For example, Smith and colleagues (2011) found that high levels of engagement in organised sports was associated with both positive and negative health outcomes for BC adolescents, including increased rates of binge drinking and reduced rates of self-harm and suicidality. Additionally, Coalter (2012) found that PA in and of itself did not reduce offending, therefore an in-depth look at the role of extreme sports within a mega sporting event is warranted.

The IOC claimed that 2,500 full-time and 8,900 temporary or part-time jobs were created through the 2010 Games (International Olympic Committee, 2011). Reflecting population level results, reporting that the Games increased job opportunities was associated with adolescents with a physical disability and homeless adolescents being in paid employment in the pre-Games period. However, no correlations between reporting the Games had increased job opportunities and employment were found among adolescents at risk of incarceration, suggesting this group might face additional barriers to accessing Games related employment not experienced by their peers. Additionally, few adolescents in each sub sample reported increased employment opportunities post-Games, which supports earlier findings that adolescents are unlikely to benefit from any sustained employment opportunities which are created. This also supports stakeholder observations that more needs to be done to create

supported employment opportunities for adolescents with barriers to employment in the build up to the Games, to ensure they develop skills and can move into more mainstream employment opportunities post-Games.

Reflecting the gender differences found at the population level, and supporting Kennelly's (2017) findings among homeless adolescents in Vancouver, it was homeless males who appeared to benefit from any jobs which were created during preparations for the Games. Whilst homeless males were more likely than females to report increased employment opportunities in the build-up to the Games, females were more likely to report the upcoming Games had reduced their employment opportunities.

Research Question 2: *Were there intangible benefits of a positive perception of the Games, such as increased community connectedness among vulnerable adolescents?*

Results summary:

Among all three vulnerable adolescent populations, those who reported positively on the Games' impacts were more likely to feel connected to their community. For example, reporting that the Games had increased their PA increased the likelihood that adolescents at risk of incarceration would feel connected to their community even after controlling for sports and PA participation, gender and age.

It has been theorised that the Olympic Games, more than any other mega sporting event can build intangible social legacies such as an increased sense of community connectedness (e.g., Balduck, et al., 2011). However, prior to the current study there was no evidence that the sense of connectedness created during a mega sporting event could be harnessed over the longer-term and for different populations. Additionally, despite being included in many cities' bids to host the Games, the Games' impact on community connectedness has rarely been evaluated (Bull & Lovell, 2007; Chalip, 2006; Gibson et al., 2014; Phillips & Barns, 2015).

Although few vulnerable adolescents reported qualitatively on the Games increasing their connection to their community, quantitative findings from the BC AHS and HSIYS showed a link between reporting a positive legacy of the Games and feeling connected to their community (independent of their engagement in regular sports and exercise or employment). These findings replicated results at the population level and cannot be fully explained by the theories initially considered for this thesis. For example, Social Control Theory would suggest that engagement in regular supervised extracurricular sports would drive the increase in community connectedness (Barnes, et al., 2007). Yet reporting positively on the Games' impacts was independently associated with community connectedness. Although unexplained, this finding does support other researchers' calls for greater consideration of the sense of *communitas* created by events like the Games and how this can be leveraged for positive outcomes (e.g., Balduck, et al., 2011).

Considering the findings through a Behavioural Settings lens offers support for stakeholders' observations that improved infrastructure—such as Vancouver's investment in a new transit line to coincide with the Games—supported adolescents to feel connected to their community by increasing their ability to stay connected with support networks (e.g., while homeless) or to make and maintain new connections. It could explain why a sense of community was associated with the Games three years after the closing ceremony, especially as large neighbouring cities across the Lower Mainland such as Surrey, Richmond and Burnaby also benefitted from the transit improvements, and constitute approximately 60% of BC's population (Statistics Canada, 2016).

The finding that the Games were associated with increased community connectedness for adolescents across BC (including those outside the Lower Mainland) also support suggestions that actual attendance at events may not be necessary for an event to increase *communitas* (Balduck et al, 2011; Gibson, et al., 2014). This is particularly worthy of consideration in a province as large and diverse as BC, which has significant transportation challenges.

The time laps between when adolescents were surveyed and the hosting of the 2010 Games also raises questions about previous studies' conclusions that any sense of community connectedness derived from a mega sporting event is short lived and unlikely to occur among marginalised populations because they do not engage in mainstream global events (Kennelly & Watts, 2011; Pringle, 2001).

The apparent link between the 2010 Games and community connectedness offers further support for Gibson and colleague's (2014) belief that younger and more disadvantaged groups are the most likely to benefit from the hosting of a mega event. Two of the stakeholders who took part in the consultations noted that (to their surprise) they witnessed the Games increase community connectedness among homeless adolescents at risk of incarceration who had previously been vehemently opposed to the city hosting the Games. This confirms that more work is required to identify ways in which event-related *communitas* can be leveraged to accomplish long-term goals of increasing social inclusion.

VANOCs strategy of engaging disadvantaged young people in the opening and closing ceremonies and of offering free event tickets to youth serving organisations, including those serving adolescents involved in the justice system appeared to have had some success (Economics & Statistics Service, 2011; PLEA Community Services, 2010). A small number of vulnerable adolescents who completed the BC AHS and HSIYS commented on benefiting from the opportunity to attend events, and participate in the opening and closing ceremonies, including an opportunity to learn about other cultures, and feel like they were part of something extraordinary. Stakeholders who were consulted also noted some benefits to the free ticket scheme, when adolescents were supported to attend the events. This suggests such programmes could be more widely implemented to include those traditionally excluded from attending and to be more purposefully leveraged to create community connectedness.

Research Question 3: To what extent and in what time and space did adolescents report negative unplanned legacies of the Games, such as decreased access to housing, employment or services?

a) Was reporting a negative legacy of the Games associated with other tangible or intangible experiences?

Results summary:

Older adolescents and females were more likely to report negative impacts of the Games.

The percentage of homeless adolescents who experienced negative consequences of the Games decreased over time. However, reporting the Games had decreased access to housing remained the most commonly reported positive or negative consequence of the Games.

Adolescents at risk of incarceration were more likely to report negative impacts of the Games than their peers, including reduced PA, reduced access to sports opportunities and reduced job opportunities.

Pre-Games, adolescents with a physical disability reported similar rates of negative impacts as their non-disabled peers, but higher rates post-Games.

Stakeholder consultations confirmed negative consequences for vulnerable populations which included police harassment, reduced access to rental housing, and exclusion from prohibitively expensive legacy facilities.

Reporting negative impacts of the Games was associated with reduced community connectedness and increased likelihood of engagement in illegal and antisocial behaviours among adolescents at risk of incarceration, and with living in the most precarious housing situations and having police contact among homeless adolescents.

Too few adolescents with a physical disability reported a negative legacy of the Games to explore negative associations. However, adolescents with a physical disability experienced increased rates of discrimination between 2003 and 2013, and experienced barriers to participation in sports and recreational activities, particularly in host communities.

It has been suggested that the real legacy of a mega sporting event might be its effect on the social determinants of health rather than on health itself (Wellings et al., 2011). This may be the case for BC's homeless adolescent population as despite assertions in Vancouver's Olympic bid that the Games would positively impact marginalised populations in the host communities (VANOC, 2002), negative consequences of the Games in the areas of decreased access to housing, employment and/or services were experienced by around a third (32.1%) of homeless adolescents in Vancouver in 2006 and around 1 in 6 (16.5%) in host communities in 2014.

A previous study which found the 2010 Games negatively impacted homeless adolescents focused on those staying in close proximity to the Vancouver events (Kennelly & Watts, 2012). The current study was able to consider the Games impact beyond the immediate vicinity of the Games, and confirmed that homeless adolescents are also vulnerable to negative consequences of the Games and specifically to decreased access to housing, services and employment beyond the host communities.

The negative effects of the Games appeared more sustained than the positive ones for vulnerable populations in BC. Post-Games, adolescents with a physical disability and homeless adolescents reported lower rates of positive perceptions of the Games than pre-Games. However, some negative perceptions of the Games' impacts remained at similar levels for homeless adolescents, and increased among adolescents with a physical disability post-Games.

The Games cannot be held entirely responsible for BC's lack of affordable housing (Edelson, 2011). Previous researchers (Minneart, 2012; Pentifallo & VanWynsberghe, 2015) have noted that promises to leverage the Games to increase affordable housing stock did not materialise. This is not completely accurate as a youth service provider interviewed for this study noted that housing units for adolescents were built in Vancouver as a result of the Games.

However, the first 30 units did not become available until 2014 and were described by the service provider as resembling “350 square feet voluntary police cells.” Furthermore, other planned social housing did not materialise. These factors, combined with an inflated housing market, may explain why decreased access to housing was the most commonly reported effect of the Games among homeless adolescents in both survey years, and in host and non-host communities.

This study has corroborated others which have concluded the homeless are particularly vulnerable to negative consequences of a mega sporting event (e.g., Girginov, 2011; Horne, 2007; McCartney, et al., 2010). When the Games were awarded to Vancouver, there was concern that funding would come at the expense of services for homeless youth (Kennelly, 2011). A minority of homeless adolescents did report the Games had reduced their access to services pre and post the event. However, it is unlikely that funds used to improve transit and highways, build Games related housing, sports venues and the Convention Centre, would have gone towards services accessed by homeless adolescents such as housing and health services had Vancouver not been awarded the Games (Edelson, 2011). Regardless of this, adolescents’ perspective—expressed through their qualitative responses—that public money went into a short-term global event rather than addressing pressing local needs shows the urgency for mega event organisers to consider ameliorating potential negative legacies (which include leaving vulnerable populations in status quo).

Preuss (2015) suggested that negative legacies of a mega sporting event are rarely intentional. Regardless of intention, the Games were associated with reduced PA, access to sports opportunities and employment for some vulnerable adolescents. Negative experiences of the Games also appeared to have been correlated with what Kennelly (2017) described as ‘intangible injuries’, such as increased police contact as early as four years before the Games took place. This should be noted and addressed in the planning of future mega events, as well as in future studies of the impact of events on adolescents.

The finding that homeless adolescents who reported the Games had negatively affected their access to housing were at increased risk of living in the most precarious situations (such as on the street or in an abandoned building) was concerning. The decision to reduce the number of below-market rental units available following the renovation of Vancouver's Athlete's Village and the gentrification of other areas of the Lower Mainland along the new transit line appear to have negatively impacted homeless adolescents.

HSIYS participants reported reduced access to services as a result of the Games. However, no association was found between reporting reduced access to services and a lack of available services. However, the survey questions may not have been sensitive enough to capture young people's experiences accessing needed housing and health services.

Reflecting the population level picture, adolescents at risk of incarceration who reported the Games negatively impacted their PA or sports opportunities were less likely to engage in regular PA. However, whilst this only impacted organised sports participation at the population level it also negatively impacted informal sports participation among these vulnerable adolescents, which could suggest that negative aspect of the demonstration effect—i.e., those who do not see as personally attainable the athletic success they observe are put off participating (Hindson et al., 1994). If this were confirmed it could have wider and further reaching implications for already disadvantaged adolescents.

In addition to reduced PA participation, adolescents at risk of incarceration who were negatively impacted by the Games reported lower community connectedness and were at increased risk of engaging in illegal and antisocial behaviours. This is a concerning correlation which requires further exploration, as it is well documented that adolescent engagement in crime is a strong predictor of poorer health in adolescence and increased likelihood of entering the adult justice system (Smith et al., 2013).

Social Control Theorists (e.g. Barnes, et al, 2007; Wong 2005) would have expected to have seen a reduction in criminal behaviour among those who were engaging in weekly sports and exercise. However, this was not seen among this population, and confirms that the relationship between sports participation and adolescent criminal involvement is not well understood (Miller et al., 2007). It can be difficult to separate out sports involvement from the influence of other activities in a young person's life, and like many studies (e.g. Gardner, Roth & Brooks Dunn, 2009; Kort-Butler & Martin, 2015) this one did not explore whether adolescents were also involved in other extracurricular activities or which particular sports they were playing.

The Sydney 2000 Olympics were credited with increasing the speed with which infrastructure and attitudinal changes occurred in the city for the benefit of people with disabilities, but not to the extent that many people had hoped for (Derby 2003). Similarly, Canada still appears to have a long way to go before people with disabilities are fully treated as equals (Lee, 2009). The increase in discrimination experienced by adolescents with a physical disability, the barriers to participation, and the widening gap in organised sports participation all confirmed that insufficient progress is being made. The finding that over half of adolescents with a physical disability in the host regions reported being unable to participate in extracurricular sports and recreation opportunities because of the cost (compared to a third in the rest of the province) raises concerns that accessibility upgrades which were conducted for the Games have placed participation out of the financial reach of many adolescents.

Applying Behaviour Settings Theory and Social Control Theory to these findings highlight the need to consider the built and social environment adolescents are growing up in when planning to leverage a mega sporting event to support healthy adolescent development, as these may significantly impact the likelihood of achieving a positive legacy.

Research Question 4: Was there a spatial impact of the Games (i.e., was the impact of the Games different in host communities, in comparison to non-host BC communities)?

Results summary:

Pre-Games, a greater percentage of homeless adolescents in host communities experienced positive and negative impacts of the 2010 Games than those in non-host communities, but post-Games only experienced higher rates of negative impacts.

Within host communities, there were gender differences in negative experiences of the Games, as females were twice as likely as males to report reduced access to housing and employment.

No evidence of an epicentre effect was found for adolescents at risk of incarceration.

In 2008, adolescents with a physical disability who reported positively on the Games' impact on employment were more likely to have worked at a paid job.

In 2013, adolescents with a physical disability in host regions were more likely to report barriers to participating in extracurricular sports and recreational activities than their peers in non-host regions. They were also more likely to report experiencing discrimination post-Games than at the time the Games were awarded to Vancouver. Stakeholder consultations suggested prohibitive costs of participation at the flagship legacy facility, and a lack of sustained investment in Paralympic sports following the Games may at least partially explain these results.

It was anticipated that if the 2010 Olympics were to impact PA participation among adolescents with a physical disability it would be within the host communities where improvements to infrastructure occurred (Potwarka & Leatherdale, 2015; Waitt 2003; & Weed, 2009). No such link was found in this study - although it did not break down participation in peripheral communities who Karadakis and Kaplanidou (2012) found may also benefit from the infrastructure developments, but were categorised as 'non-host communities' in this study.

There was evidence of a spatial impact of the 2010 Games on homeless adolescents. Compared to their peers across the province, a greater percentage of homeless adolescents in the host community of Vancouver reported positive effects of the Games in the pregnancy period. However, the perception of positive legacies decreased to the extent that there was no such difference between Vancouver and other communities four years after the Games. Meanwhile, the percentage of homeless adolescents with negative perceptions of the Games was higher in Vancouver than in other communities, both before and after the Games.

This contrasts with the population level results which suggested the presence of an epicentre effect for positive legacies but no such effect for negative legacies, and supports Minneart's (2012) call for a mega sporting event to achieve real change for socially excluded groups through a targeted strategy, which recognises the fact that general programmes do not tend to reach those with multiple disadvantage.

The 2010 Games were previously reported to be associated with increased police harassment for homeless adolescents in Vancouver (Kennelly, 2015). This study also found such a quantitative link, which was confirmed by qualitative comments on the HSIYS, and through the stakeholder consultations. No epicentre effect was apparent for adolescents at risk of incarceration. However, there were no questions about police contact on the BC AHS, so it is unknown if responses would have been different in host and non-host communities.

*Note. **Research Question 5:** Were there sustained change's over time in BC sports club membership for any of the sports which were featured in the 2010 Winter Olympic and Paralympic Games? could not be asked of the vulnerable subpopulations as insufficient data were available.*

5.5 Leveraging mega sporting events to support healthy adolescent development

This final section of the two results chapters considers the sixth research question, and discusses the study's findings in the context of future events.

***Research Question 6:** What are the implications of the findings for leveraging future mega events to support healthy adolescent development?*

Perhaps one of the biggest implications of the findings in Chapters 4 and 5 is that hosting a mega sporting event may not be the most effective means of supporting healthy adolescent development at the population and subpopulation level. Similarly, setting grandiose targets such as the BC government's pledge to leverage the 2010 Games to increase PA by 20% are unlikely to be successful, unless more consideration is given to how such an event can be leveraged. However, for a minority of adolescents, including some of the most vulnerable, such events can be associated with positive legacies over an extended time frame.

Unlike assertions from previous studies (e.g. Preuss, 2015), population and subpopulation results showed that event legacies do not necessarily diminish over time for adolescents. Therefore, future organisers should invest in programmes which seek to maintain positive legacies and diminish negative legacies post-Games, as well as pre-Games.

The finding of an epicentre effect for adolescent PA participation, and the narrowing of the gap in participation between adolescents in host communities which typically had very low participation rates and the rest of the province provides further proof that future event organisers should target this age group in their planning. They also support calls to continue to invest in legacy programmes which do not end when the event does.

Specific subpopulations warrant particular attention from future event planners (including refugees and the three vulnerable populations studied in this chapter). These groups traditionally report poorer health in adolescence and into adulthood, yet results show not only can they experience positive legacies of a mega sporting event, but there are also apparent health benefits associated with those legacies.

The finding that the Games increased PA among adolescents who did not benefit from increased access to sports opportunities, and that this was a stronger predictor of engagement in weekly exercise classes than having increased access to sports opportunities was an important one and implies that there is value in investing in creative ways to leverage events to inspire young people to become more active when it is not possible to create improved infrastructure, or when those young people face barriers to accessing sports facilities.

Population and subpopulation qualitative data, supported by quantitative findings and stakeholder reflections, offered evidence of a demonstration effect for a minority of young people, who reported being inspired to take up or increase their PA participation as a result of the 2010 Games. This suggests that future events may want to tailor their leveraging efforts towards increasing opportunities for young people to observe the sporting competition and engage in the festivals that surround them. Were organisers to make such an investment, it appears there would be a greater likelihood that this would result in a more sustained impact on PA than has previously been observed among adults. This recommendation also supports that of Smit and colleagues (2014) who suggest that while a demonstration effect from a mega event is unlikely to increase sports participation at the population level, a PA participation legacy can be leveraged if engagement strategies are employed to capture the interest of a greater proportion of young people.

Given adolescence is a time when individuals can deviate from previous patterns of health risk and health promotion behaviours and establish new ones which can influence them throughout their lifetime (Feinstein, et al., 2006), this suggests an opportunity was missed with Vancouver 2010. As non-voting citizens, adolescents

living in countries which successfully bid to host such events will continue to have these events imposed upon them, and risk being excluded from legacy planning. However, results here suggest the opportunity should be seized to ensure they are engaged and can experience benefits and not harms.

Host cities traditionally aim to increase national pride and patriotism during their events but the positive impact of the Games in communities with high numbers of immigrant adolescents (Richmond and Vancouver) suggest promoting the multicultural nature of the event and celebrating athletes from other countries may also engage and inspire young people in those communities.

The mechanism by which sport participation can be leveraged through festivals associated with large scale events is not yet understood (Misener, Taks, Chalip, & Green, 2015). Studies with adults have found no evidence that that the feeling of *communitas* created during a mega sporting event translated into any longer-term impact on physical activity among a general population (Murphy & Bauman, 2005). Yet, this study found a consistent connection between adolescents reporting positive legacies of the Games and a heightened sense of community connectedness.

The declines in weekly PA engagement recorded at the population and subpopulation levels following the Games, which were not seen during the pregnancy period, suggest that insufficient time and resources were put into creating a sustained participation legacy. As stakeholder consultations suggested, there may be value in organisers, educators and host communities continuing with event-related programming following the event, rather than focusing solely on the build up to the event.

Mega sporting event evaluations have typically relied on sports club membership records and considered legacies only in terms of organised sports participation. The inclusion of data about weekly participation in informal and individualised sports and PA in this study was an important one and shows the value of including such measures in future OGI evaluation studies. Event organisers should also recognise that trends in leisure time PA are moving away from traditional sports, and a continued reliance on

data about these sports will not provide a complete picture of the leveraging potential of that event.

The findings of this study would need further exploration to determine the drivers of community connectedness and ascertain if results truly reflected the Games' impact or if there were other variables involved. However, the results support calls for greater emphasis to be placed on the role that mega events can play in developing social capital and connections, and in supporting adolescents and particularly marginalised adolescents to overcome some of the isolation and disadvantage they face (Chalip, 2006; Gibson et al, 2014; Veitch, 2013).

5.5.1 Stakeholders' reflections on leveraging mega sporting events to support healthy adolescent development

Stakeholders who reviewed the results of this study had many suggestions for how VANOC or future hosts could better capitalise on the Games to create legacies which support healthy adolescent development. These included ensuring at least equal value was given to developing grassroots recreational physical activity participation as was given to elite athletes; ensuring clubs were prepared for a post-Games influx of new and inexperienced players; and supporting schools to offer post-Games Olympic related sports programming to capitalise on the interest generated among those who faced barriers to joining clubs outside of school.

“There was nothing after [the Games] in Canada. There wasn't suddenly a local alpine ski club for kids to join. There needs to be something afterward to keep the momentum going. That should be mandatory.” Junior sports coach.

“[Games hosts should] think about it over the decade afterwards. Don't just invest for the short term but think about kids in five years' time, ten years, what do they need? What will get them out playing? What will it all look like then? Otherwise it is just a really great two-week party.” Senior administrator, Richmond Minor Hockey.

Stakeholders also felt future event organizers should learn from other global sporting events and also take transferable learnings from other areas relevant to the hosting of an Olympic Games such as major housing and transit developments.

“We can learn a lot from Japan. They don’t just host things like the World Cup or the Olympics they change their culture and invest. Like when they knew they were wanting the [FIFA] World Cup they created the J League, invested in women’s soccer as well as men’s, and now they are a soccer culture, so they built that longevity into their plans.” Junior sports coach.

“The [Vancouver] Olympic Village housing development was part of the inspiration for other large-scale housing developments like the one in Toronto which have taken it to the next level of creating healthy communities, and we need to keep playing this forward.” Project manager, Olympic Village construction.

For most stakeholders, along with a lack of legacy planning, their biggest frustration with the 2010 Games appeared to relate to the lack of quality evaluation data associated with the event. Regardless of their relationship to the Games, all stakeholders felt this was an area that needed to be improved for future mega sporting events.

“There should have been an evaluation of what the Olympic Village development did - not only for adolescents but seniors, young families, everyone. There was no evaluation so how can anyone learn from that?” Project manager, Olympic Village construction.

Stakeholders also had a number of suggestions as to how future events could increase positive legacies for vulnerable populations of adolescents, including being deliberate and intentional in designing and delivering accessible programmes and opportunities. Examples included creating free drop-in sports programmes which provide all needed equipment, and offering supported employment and employment training opportunities around the Games.

Although stakeholders were in favor of the policy of giving ‘at-risk’ youth free tickets to events, seven of the stakeholders suggested future events need to take additional

measures to support adolescents to engage with the Games and benefit from any legacies.

“You can’t just give kids free tickets to a place they don’t know, to watch something they don’t know what it is, and expect them to turn up...You need transport, someone to go with them, someone to show them where to go and what to do, all that sort of stuff just to get them in the door...It all needs to be thought through ahead of time.” Junior sports coach.

“If we want to build on 2010, get the more risky kids involved, or even just attract them into sport, we have to make it look different. They hate the structure and the rules. They want to drop in and try stuff. They can’t afford all the uniforms and fees. They don’t want to join a club even if they can. They aren’t ever going to play hockey week in, week out but they will do ‘pick up’ or ‘drop in’ if we get them the gear and the support, and they can try different things....if they get into organised sports great but we have to stop having that as our goal [of mega sporting events] because we won’t meet it.” Senior administrator, BC government.

Being held accountable and ensuring legacy funding is available to offer programming for adolescents with a disability and other vulnerable populations were named by all three legacy venue operators as key to those venues welcoming and offering inclusive programming. Without these, they felt there was little pressure to address barriers to participation experienced by these adolescents.

“We were given millions of tax payers dollars... and we definitely made [the arena] better for disabled spectators but in terms of participation there was zero accountability. Absolutely none. If I was being honest, I would say we are a bit light on legacies. We have tried some sledge hockey but can’t afford to do it on an on-going basis, and no one is making us... There should have been something we signed that said there would be a legacy from all this money that was invested.” Manager, legacy recreation facility

6 CONCLUSION

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This study has shown that the 2010 Winter Olympic and Paralympic Games was associated with a range of positive and negative, planned and unplanned, tangible and intangible legacies which differed by age, gender, location and vulnerability, and changed over time. Despite these variations, across BC a positive perception of the impact of the Games was associated with adolescents engaging in regular physical activity both pre and post the event. Also, vulnerable adolescents who reported positive impacts of the Games experienced some reduction in health disparities with the general population. However, vulnerable subpopulations appeared to be at increased risk of reporting negative and unplanned legacies, and rather than the Games serving as a catalyst to close the gap in organised sports participation between adolescents with and without a physical disability the disparity increased following the Games.

The critical realist approach to this study acknowledges and accepts its limitations. It also accepts that the author's interpretation of the results may differ from those of the reader or another researcher looking at the same data (Shibli, 2015). Through this lens, the final chapter critically reviews the approach which was taken. It also recommends a framework for future studies of mega sporting events, which can build on the lessons

learned from this study. It concludes with a discussion of the study's contribution to knowledge, which it is hoped can be revised and built upon as new knowledge emerges.

6.1 Review of philosophical approach and theoretical framework

This study applied a critical realist philosophical and methodological framework, and was guided by a number of theoretical approaches. Critical realism proved a useful lens through which to view the results. It is an approach which is comfortable with the fact that this study, like all others of the impact of a mega sporting event, did not fully measure the impact of the hosting of a point-in-time event, but moved us closer to understanding the extent to which the hosting of such an event might be able to contribute to a sustained increase in adolescent sports club membership, exercise participation, employment or community connectedness

One of the challenges of taking a critical realist approach is that the author may have strayed beyond scientific knowledge and into interpretation, meaning recommendations were made without sufficient grounds to do so (Hodgeson, 1999; McEvoy & Richards, 2003). However, this study never intended to offer definitive causal statements about the relationships which were explored within the data. Rather it aimed to increase the knowledge base available to researchers, policy makers and practitioners.

Prior to this study, little was known about the impact of a mega sporting event from the perspective of adolescents pre and post that event - largely because nobody had asked them. By considering for whom and when the 2010 Games appeared to support healthy adolescent development, the cross-sectional analyses provided measures of association. It did not provide defining causal factors, rather it proffered potential theoretical explanations and interpretations and moved our current state of knowledge forward by considering the impact of hosting a mega sporting event on over 60,000 adolescents.

The perspective of each of those adolescents will have been influenced not only by their experiences of the Games but will have overlapped or interacted with other experiences, which were not captured. This is not a weakness of the study, as it is useful to establish tendencies and rough trends (Danermark et al., 2002). As such, it is important to consider the strength of any significant correlations which were discovered, as the stronger the statistical associations, replicated across studies, the greater confidence there can be in the relationship (Bauman et al., 2002). The challenge now is to build on the correlations which were found for Vancouver 2010 and see if they are replicated with future events. Only then will we begin to truly understand the findings presented here and to comprehend to what extent the theories which guided this study were incorrect, partially correct, only applicable in certain contexts, or subject to prevailing norms and interpretations (Cruickshank, 2004).

Pawson and Tilley's (1997; cited in Wiltshire, 2018) suggest that the basic task of a study such as this one is to offer an explanation of the underlying mechanism which would explain the findings. There were likely many underlying mechanisms driving the results of this study, and it was not possible to fully understand which of the three broad mechanisms, two psychological theories (demonstration effect and PCM), one social (Social Control Theory) or one environmental (Behaviour Settings) theory which were explored were applicable, or if other competing theoretical explanations should have been applied. For example, PA participation in this age group was likely influenced by personal (biological, psychological, behavioral), social, and physical environmental factors.

Programme theory provided an overarching theoretical framework which could be applied retrospectively. It allowed for the applicable environmental, psychological and social theories to be explored within a single conceptual framework, and for the consideration of the replicability of the results in different settings (Funnell & Rogers, 2011; Rogers, 2008; Weiss, 1997). It also allowed the Games to be considered as part of a sequence rather than as an isolated 'intervention' and acknowledged that

evaluating the impact of a mega sporting event is complex and complicated and needs to incorporate multiple causal mechanisms (Coalter, 2012; Rogers, 2008; Weiss, 1997).

The application of programme theory took the study beyond a simple impact evaluation. A logic model was developed to illustrate the application of the theoretical framework to the intended outcomes. It showed the theory of the anticipated causal relationships between the hosting of the 2010 Games and its potential legacies. The logic model proved useful in focusing the data analysis and discussion on relevant positive/negative, tangible/intangible outcomes, and allowed for the outcome indicators to be linked to the different mechanisms, to measure whether the theory of change worked as initially expected and, if not, to identify where and how it was unsuccessful.

However, Coalter (2012) cautions that taking a programme theory approach may have led to assumptions that the various activities, processes, relationships and experiences that constitute the Games were designed and delivered in such a way as to maximise the possibility of achieving the desired outcomes. The logic model for this study investigated both positive and negative outcomes rather than focusing solely on the Games' desired outcomes, but were the study to be repeated the same logic model would not be used. By articulating the theories of change and theories of action, there may have been a tendency to ignore other possible mechanisms of change, miss key outcomes, and underestimate the role of different relationships.

A better articulated logic model would have been structured to take account of additional legacies and would have differentiated pre- and post-Games outcomes to better capture the length and breadth of those legacies. However, despite its limitations, the logic model provided at least a somewhat useful structure to illustrate the potential legacies of hosting a mega sporting event, and the means through which they might be achieved. The theory of action was also useful in guiding the stakeholder interviews, and the BC AHS and HSIYS analysis.

The model provided one suggested framework to consider the relationship between a mega sporting event and healthy adolescent development. However, a more sophisticated logic model based on programme theory would have better situated the 2010 Games in the context of healthy adolescent development and would have included space to discuss counterarguments.

Within the programme theory framework, this study offered a practical application of Preuss' legacy cube and showed that asking adolescents directly about the impact of the Games before and after the event provides valuable data about who is affected, how that is manifested and when the effect occurs.

Two of Preuss (2016) overarching questions when considering the legacy of a mega sporting event were 'What constitutes an event-related change?' and 'How does a legacy affect a particular stakeholder?' The correlations offered in this study may not have answered these questions. However, the explicit self-report of various populations of adolescents about the impact of the 2010 Games not only directly answered these questions but also offered insight into when a legacy occurs, how long it lasts, and how constant it is over time – areas which Preuss (2016) also highlighted as being important to assess. The inclusion of key stakeholders' perspectives provided additional insight into specific event related changes and how these affected various groups of adolescents.

Preuss (2016) believes that the identification of a legacy depends on the host city's long-term development plan. However, as adolescents (and particularly those experiencing challenges to healthy development) continue to be largely overlooked in municipal and regional development plans, this was not explored within the theoretical framework of the study. Results confirmed that in studies such as this it is likely more useful to consider legacies simply as event related changes, regardless of whether they were intentional or not.

Weed (2019) argues that "*Theorists become self-reinforcing and self-referential devotees, advocates for theory rather than outcomes*" (Hagger & Weed, p. 7). An

omission of the philosophical and theoretical framework applied to this study was that it failed to address who has responsibility for leveraging and sustaining any Games legacies. This needs to be investigated in future studies to determine the accountability and roles of stakeholders throughout the legacy process. Additionally, although it had some strengths, future studies should consider if there is an overarching need for a theoretical framework, or if a concentration on ensuring a comprehensive and conclusive methodology would be time better spent to ensure no outcomes are missed or misinterpreted.

6.2 Review of methodology

This study was designed to evaluate the sustained impact of the 2010 Winter Olympic and Paralympic Games on BC adolescents. Given that it is the first to examine the relationship between a mega sporting event and healthy adolescent development, there were a number of methodological shortcomings, most notably that it was designed after the event, relied on secondary data and was completed in isolation. Its findings and limitations both highlight areas in which future research is necessary, and suggest ways that the current methodology could be improved.

This study used quantitative data collected at different time points for up to eleven years after the event was awarded to Vancouver. This proved insufficient time to truly measure the legacy impact of a mega sporting event. This is also the case for the OGI evaluations which currently collect data over a 12-year period (9 years pre-event and 3 years post-event) for which it has been criticised (VanWynsberge, 2015). Long-term impacts of a mega sporting event can take up to 15 years to appear (Gratton & Preuss, 2008). Future studies should therefore collect data at additional time points and over a longer time period, particularly as the effects of infrastructure changes can take a generation to be realised. Measuring evidence of such long-term effects would be invaluable to conducting a true cost-benefit analysis of hosting a mega sporting event (Wellings et al., 2011).

The application of programme theory to the current study has offered suggestions of possible cause and effects, which may not be present, and which cannot be fully ascertained even with the various qualitative and quantitative data sources available (Weiss, 1997). Despite its shortcomings, the application of programme theory could be helpful to the evaluation of future mega events as it is an approach which considers theoretical underpinnings, describes mechanism which may explain results, and seeks to make useable generalisations which can inform future studies (Coalter, 2012).

It was assumed that the methodology used in this study would generate at least as many questions as it answered, as no single study can accurately and comprehensively identify young people's positive and negative, planned and unplanned, tangible and intangible experience of the impact of a mega sporting event. It was confirmed that further data must be collected and alternative explanations of the findings developed and thoroughly debated (Easton, 2010; Wiltshire, 2018).

VanWynsberghe's (2015) critique of the OGI evaluation framework suggested a standardised framework against which all Olympic Games were measured was necessary to assess the sustained impact of the Games legacy. Yet he acknowledges this ignores the local context and offers no place for qualitative data. This study has addressed some of those gaps with its methodology of considering the three individual host communities separately and also the experience of adolescents in non-host communities, and this disaggregation of data should be continued in future studies.

VanWynsberghe (2015) also suggested comparing results against control communities to establish the effect of an event on its host. However, his claim that the 2010 OGI was an exemplar of this methodology was misleading, and his comparison of BC to oil rich neighbours Alberta and the culturally and climatically different Ontario highlight the challenges of finding communities which are comparable. Similarly, within the province, VanWynsberghe compared Vancouver to the government capital of Victoria, a much smaller city with less sporting infrastructure, a more affordable housing market, a more temperate climate and a different ethnic make up to Vancouver. This study has been able to improve on the methodology by considering the host

communities against all other BC communities, and future studies can benefit from continuing with this approach.

The logic model for this study considered social, environmental and psychological mechanisms which might influence the impact of the 2010 Games on healthy adolescent development, and these have been discussed in Chapters 4 and 5. Although some adolescents (and other stakeholders) have articulated the presence of a demonstration effect, the study has not established which, if any, of the other theoretical mechanisms are most strongly linked to the findings but has also not been able to dismiss these as an explanation of the findings.

It is possible, for example, that the findings of an epicentre effect for PA engagement are influenced by psychological and environmental factors equally or that one of these or other factors are driving the results. It remains unclear from the current study if it is necessary to invest heavily in sporting infrastructure legacies for young people to increase their PA engagement or if this can be achieved in part or wholly through a considerably less expensive psychological mechanism such as the demonstration effect. Further studies should seek to identify what Rogers (2008) refers to as the 'tipping point' which would identify at which point an investment in infrastructure or opportunity to experience athletes competing at an elite level result in PA gains. Findings of gender and age differences in reported legacies of the Games also highlight the need for any future study to account for various potential contributing factors in its design.

Previous research with vulnerable populations has tended to focus on the negative consequences (e.g., Kennelly's 2015 study of the impact of the Games on homeless youth in Vancouver). Findings from the current study of positive perceptions of the Games' impact among adolescents in each of the three subpopulations suggests a more balanced approach is necessary to capture all legacies. This point is particularly important given the associations between vulnerable populations reporting positive benefits of the Games and positive outcomes, such as PA participation.

Regardless of the mechanism involved, among all subpopulations and at the population level, male and female adolescents who reported positive effects of the Games on their PA participation and access to sports opportunities were more likely to be engaged in weekly sports and exercise. Future studies should also seek to collect qualitative and quantitative data about various types of PA participation in combination with data about the self-reported perceived impact of the event under consideration. A more in-depth qualitative component would allow greater attention to be paid to teasing out the differences between having increased access to sports opportunities through infrastructure development and being inspired to change PA behaviour.

Similarly, a methodology which can tease out the relationship between adolescents pre-existing PA involvement and sense of community connectedness and reported impact of the Games would be important. It would also help to determine the direction of the relationships found in the quantitative analysis for this study.

6.2.1. Review of case study methodology

The case study methodology applied to this study followed the four stages recommended by Yin (1994): design the case study, conduct the study, analyse the evidence, and develop the conclusions, recommendations and implications. However, although not a requirement of a case study, designing the study after the fact proved challenging and it is proposed that any future case study be designed ahead of the hosting of a mega sporting event. A case study within a larger case study may also be useful to specifically focus on the role of legacy organisations (such as BC's 2010 Legacies Now) as this would allow for a much deeper analysis of the governance of mega event structures and processes than was possible here.

6.2.2 Limitations of using cross-sectional data

Although some adolescents chose to provide a qualitative response about the Games impact on community connectedness, this study was generally reliant on cross-sectional correlational data to establish a link between the Games and community connectedness. Therefore, in addition to ensuring future studies collected qualitative data, a longitudinal design could explore adolescents' experience of the impact of an event on their connection to community at various time points, including some closer to the actual event. As adolescents were able to provide credible feedback about the tangible benefits of the Games, any future studies which are reliant on cross-sectional data should also include options for adolescents to self-report on intangible benefit.

Despite having data from over 60,000 adolescents, some of the intended analyses could not be conducted due to the very low numbers of adolescents who endorsed some BC AHS items (e.g., items asking about negative impacts of the Games). Additionally, analyses which were performed may not have detected differences which did exist because of a lack of statistical power. Future studies should consider having a larger overall sample, and taking a more targeted approach to ensure a sufficient sample of those experiencing the legacies of interest is achieved. It is also recommended to carefully consider question wording to ensure the intent of the question is fully understood and answerable by this age group. Should future studies insert survey questions about the Games impact on a broader survey, the positioning of the questions within that survey must also be considered, to limit the impact of attrition.

A strong positive of the study was the availability of provincial and community level data. It is likely that pan-Canadian comparisons would have provided additional insights into the breadth of the Games' impact. However, such comparisons were not possible due to the limited number of other Canadian Provinces and Territories that survey adolescents. There is also a limited ability to compare outcomes between surveys which do exist due to divergence in methodology, sample and content, and because no other provincial survey asked adolescents about the impact of the Games.

The cross-sectional datasets available to this study were not specifically designed to address the role of a mega sporting event, and therefore it was challenging to 'prove' any causal links or exclude alternative explanations about the impact of the Games. However, if other more long-term studies of adolescent health can continue to incorporate questions about mega sporting events and collect data at different points in time, it would increase our understanding of adolescents' perceptions of these events and changes in those perceptions over time. Collecting such data across multiple studies would enable event organisers to identify areas of concern and unrealistic expectations which adolescents may have pre-Games which can be addressed. Post-Games data can act as an evaluation of the Games success for this age group. It has been previously recommended that gathering data two to three years after the event when residents have more idea of the cost-benefits of the Games would be a useful addition to the literature (Gursoy et al, 2011). This study was the first to do so from an adolescent's perspective, and future studies can continue to build on this.

The qualitative data provided in response to the open-ended survey item on the BC AHS and HSIYS offered important insight into the direction of any correlations which were found. Future studies could include more directed qualitative questions for adolescents to respond to, in order to capture the full extent of any Games legacies. A mixed methods approach such as the one employed here also helped to offer insight into the direction of quantitative relationships which were found, and this should be enhanced in future studies. The more sources of data which can be incorporated into the study, the greater the chance future studies will have of identifying a causal link between the Games and observed outcomes.

There were limitations in the survey items asking about the impact of the Games which were used in this study, as the stem question asked about the effect of the '2010 Olympics and Paralympics.' Combining these together made it challenging to differentiate the impact of each on different populations. For example, it was not possible to identify if the impact of the Games reported by adolescents with a physical

disability referred to the Olympics, Paralympics or both. These should be separated in future studies.

Whilst countries such as Italy and the UK have comprehensive measures of SES, there has been a lack of such measures in Canada (Chan, Serrano, Chen, Stieb, Jerrett, & Osornio-Vargas, 2015). Neither the BC AHS nor HSIYS were able to adequately capture SES. The development of a Youth Deprivation Index for the 2018 wave of the BC AHS shows promise for any future studies in BC. However, the absence of such a measure for the 2003-2013 waves of the survey mean this was an important omission in the current study.

Finally, one of the most common criticisms levied at studies using cross-sectional data is the misleading attribution of causality. Whilst there is merit in this, Easton (2010) stated that suggesting causality is only a concern if it is done without thought. He suggests that looking at potential causality using a thoughtful in-depth process can increase our understanding of the way things are and how they are influenced. Future studies should therefore not shy away from considering the plausibility of causality within their findings, as even if causality cannot be established it is useful to know there is a link between perception of the Games and various health behaviours and experiences, regardless of the direction of the relationship.

The inclusion of sports club membership data to supplement the self-reported cross-sectional survey data provided a more comprehensive picture of adolescents' participation in sports. The findings of increases in membership during the decade under study also corroborated the findings of other more time-limited studies such as Pappous and Hayday's (2015) study of two summer Olympic sports. It appears to justify the inclusion of this data in future studies of adolescents' PA participation, especially as most studies have focused on adults (Weed et al., 2015). However, future researchers should engage with sports clubs during the design phase of the study to ensure these organisations are collecting useable data.

6.2.3 Inclusion of sub-population data

The study identified three vulnerable subpopulations. Indigenous adolescents are overrepresented in marginalised adolescent subpopulations such as those who are homeless and in contact with the justice system (Tourand, Smith, Poon & Saewyc, 2016). They were also the target of several specific Vancouver 2010 initiatives and the Games aimed to be the most inclusive of Indigenous people ever held (Silver, Meletis & Vardi, 2012). Whilst Indigenous youth were included in all analysis conducted for this study, they were not considered as a separate subpopulation. This is an acknowledged but necessary omission of the study and ensures compliance with the Canadian Tri-Council policies regarding research with Aboriginal people and the policies governing non-Indigenous researchers accessing data housed at McCreary Centre Society. Future studies in colonised countries, such as evaluations of the 2026 FIFA World Cup should ensure Indigenous evaluation methodologies are incorporated and Indigenous researchers engaged in the design of data collection tools and interpretation of the findings.

In addition to omitting data for Indigenous adolescents, no other ethnic comparisons were carried out. This may mean that important cultural or ethnic differences were missed, but the approach respected the McCreary Centre Society's policy of only allowing researchers from the ethnic background under study to conduct comparative research. Future studies wishing to consider ethnic differences would benefit from the inclusion of diverse team members and advisors to ensure culturally safe data analysis and that reported results are presented within a culturally appropriate context.

Preuss (2016) states that the value of a legacy is measured by how much it improves quality of life, and a minority of BC adolescents report that it improved their PA, their access to sports opportunities and their employment opportunities. However, many of the targets set by the municipalities, provincial and national government, and VANOC were unmeasurable or not achieved. Additionally, whilst a minority of adolescents reported negative legacies, the reported negative impact of the Games in areas such as access to housing is a cause for alarm. Although it is hard to tease out how much of

this is truly a legacy of the 2010 Games and how much is related to other events which would have occurred regardless of whether BC hosted the Games, the different results seen for different adolescent stakeholder groups further support calls to ensure more marginalised adolescents are included in legacy planning.

A final failing of this study was that the analysis plan covered a wide range of Games related effects but subsequently was not able to explore any of them in great depth. Future studies may want to focus on one specific potential legacy and conduct a more thorough and in-depth analysis of that legacy, and how it might be leveraged.

Despite its limitation, no previous study has included data from such a large sample of adolescents which asked directly about the impact of a mega sporting event (in host and non-host communities), or had the ability to gather such data over an extended time period. The inclusion of the perspectives of adult stakeholder also strengthened the study by providing additional context to the results. The methodology of future studies can take the positive elements of this study and further enhance them.

6.3 Future research design

The current OGI evaluation methodology does not evaluate impact in a systematic and integrated way, and there is no agreed sustainability standard which the event is trying to attain (VanWynsberghe, 2015). The OGI evaluation for Vancouver 2010 included data from only four sources—the Organising Committee for the Olympic Games; secondary data from government agencies; consultants’ reports; and primary data collected through opinion poll. This ensured the study could not measure a number of the potential legacies of the Games articulated in Preuss’ legacy cube (Preuss, 2007), and included in the original evaluation plan.

The impetus for the current study came from claims in the OGI evaluation of the 2010 Games that no data were available on the impact of the event on children and adolescents’ PA and sports involvement, or on increasing accessibility and inclusion for people with a disability (VanWynsberghe, 2013). The absence of this data in the final

OGI report, despite its availability in the province, combined with the absence of data on 51 other measures which were included in the 2007 OGI evaluation plan, highlighted the weaknesses of awarding the OGI evaluation to a single academic team at a local university with few working relationships with other research organisations, or with the community being studied.

Additionally, whilst the 2010 Games intended to leave a legacy of increased adolescent sports and PA participation, it paid minimal attention to other potential legacies, and the OGI evaluation failed to offer a clear picture of any legacies which were achieved for this age group. This was not unique, as Dowse and colleagues (2018) note that currently all mega sporting event evaluation frameworks fail to capture the implications of the event processes for adolescents and how young people can be affected at the individual, family and community level (Dowse et al, 2018).

“[These evaluations] lack the kind of co-ordinated approach required to ensure that risks and opportunities, including those individual to a particular host, are appropriately understood, identified, prioritised and acted upon” (Dowse et al, 2018, p. 105).

The retrospective case study’s methodology used in the current study was undertaken in response to the incompleteness of the OGI evaluation of the 2010 Games, and specifically its lack of attention to outcomes for adolescents. The application of a strong theoretical framework combined with a mixed methods approach and the use of pre and post Games population level cross-sectional data took the study beyond a simple impact evaluation such as the OGI, and enhanced our knowledge of that event on healthy adolescent development.

However, no single study can fully capture young people’s experience of the impact of a mega sporting event, and the current study has confirmed that creating and measuring event legacies for adolescents is complex. Multi-disciplinary and multi-sectoral partnerships and approaches are required to collect and collate relevant data from multiple traditional and non-traditional sources (Ball, 2006).

The next mega sporting event to be held in Canada will be the 2026 FIFA World Cup. It is likely that the Vancouver 2010 OGI's lead evaluator VanWynsberghe's vision for evaluating the event would be to have an independent evaluator appointed from an academic institution to do more of what was done for 2010, but to do it better. However, approaching the evaluation in the same way will lead to the same unsatisfactory outcomes, and an inability to assess the true impact of the event. Although it is too late to design a comprehensive, well-resourced independent research and evaluation framework during the bidding phase for the 2026 event, it is not too late to design a framework which can collect meaningful data and can be implemented by utilising local expertise, networks and relationships and allows for a whole systems approach to evaluating the legacies of that event over a substantial period of time. Such an evaluation must be conducted independently of the host cities and mega event governing bodies to ensure both positive and negative impacts can be captured, and that proposed legacies which are and are not achieved are accurately reported on.

Leopkey and Parent (2015) offer agreement with this assessment, and also suggest that any event evaluation should focus on what can be learned about or improved rather than on precise measurements or outcomes as this is what is required to assist event stakeholders improve on the provision of legacies at the next hosted event. However, whilst Leopkey and Parent (2015) recommend a collaborative, mutually reinforcing Collective Impact approach, they take a draconian view of how this should be achieved, suggesting all stakeholders in the legacy governance system must be held accountable for their actions *“through scrutiny, review/analysis, and discipline [which] can be accomplished through the provision of formal and informal rules, regulations, controls and sanctions”* (p. 22).

A Collective Impact approach to evaluating the impact of a mega sporting event on adolescents would likely be valuable, but such an approach should be based less on discipline and rules, and more on collaboration and partnerships. Although it is too late for the 2026 World Cup to begin an event evaluation during the bidding phase, the immediate implementation of a Collective Impact approach to the evaluation would

allow the event's impact to be measured for significantly longer than the current length of a mega event impact evaluation.

6.3.1 A Collective Impact approach

A Collective Impact approach would retain a critical realist philosophical framework, as critical realism is receptive to collective, interdisciplinary studies and methodological pluralism, in a way that is not possible with other philosophical approaches. It is particularly suited to the evaluation of the impact of a mega event because it does not seek a single explanation of cause and effect but looks more generally at broader multi-faceted causal mechanisms and acknowledges that different contexts and mechanisms can affect outcomes (Wiltshire, 2018).

Collective Impact was initially designed as an approach to address complex social problems, and is based in the belief that to create sustained large-scale solutions to ingrained and complex social problems, organisations need to work together across sectors towards a clearly defined goal, using an agreed upon shared measurement framework (Kania & Kramer, 2011). Applying such an approach to the study of a mega sporting event would acknowledge that no individual researcher or research institution can achieve the same success in recording event impacts and legacies as a highly structured cross-sector coalition (Kania & Kramer, 2013).

The success of a Collective Impact approach stems from the heightened vigilance and accountability that comes from meaningfully engaging multiple partners throughout the process. It is also able to effectively respond to opportunities to include systems, perspectives, and data that would otherwise be missed (Kania & Kramer, 2013).

By marrying emergent solutions with intentional outcomes, Collective Impact has had significant success in addressing deep rooted and complex social problems. The approach is increasingly being employed in Canada and is designed to measure change over the long term (Hanleybrown, Kania & Kramer, 2011). A recent study of 25 Collective Impact initiatives found that measurement of population level outcomes

was possible, even if the initiatives required multiple cross-sectorial players and jurisdictions' involvement (Stachowiack & Gase, 2018). It is thus well suited to a study of the impact of a mega sporting event and for use within Preuss' legacy cube framework.

The application of Preuss's legacy cube (2016) would help all partners to develop a common agenda, conceptualise areas where the Games might impact healthy adolescent development, and determine who should be partners in data collection. For example, schools could be engaged as a key partner in data collection about tangible and intangible benefits, and about any positive and negative legacies experienced by students. Engaging schools in the evaluation would not only improve outcome monitoring but may also encourage them to extend their event related curriculum, and ensure students are aware of the opportunities which may be presented through the hosting of the World Cup or other mega events.

Developing a common agenda is one of the five core conditions of a Collective Impact approach. The other four are shared measurement systems, mutually reinforcing activities, a continuous communication framework, and the support of a backbone organisation (Kania & Kramer, 2011). By applying these five core conditions, an evaluation of the impact of a mega sporting event would move away from the predetermined and prescribed approach suggested by VanWynsberghe (2015). It would also make the current OGI model more accountable and change the way independent researchers approached a study such as this one.

The roles of event stakeholders including different levels of government, national and international organisations, governing bodies and contractors vary over time and may have different challenges and restraints throughout the course of the evaluation of the event legacies. As such, a Collective Impact governance structure would ensure transparency and accountability from all stakeholders involved in the evaluation, including structured time for reflections and discussions of collective performance in respect to desired goals (Leopkey & Parent, 2015). For example, for Vancouver 2010, stakeholders who were involved in a decision-making capacity included the IOC, the

International Paralympic Committee, the Federal and Provincial Government, the host cities, community organisations, partners and sponsor. However, any collaborative committees which were created lacked additional important perspectives and were disbanded soon after the Games, ensuring there was no joint responsibility for sustainability or accountability (Leopkey & Parent, 2015).

Collective Impact was originally designed to address social determinants of health by tackling complex social problems, an area which Welling and colleagues (2011) believe is largely overlooked in mega event literature. A robust meta evaluation of the impact of the infrastructure investments (such as the \$45 million Toronto has committed to spend on facility upgrades for the 2026 FIFA World Cup) has the potential to add substantially to the public health evidence base, where current evidence is weak or incomplete (Wellings et al., 2011).

Such an evaluation will require accurate systematic documentation of both concurrent and contextual factors. It will also require agility, methodological flexibility, and collaboration to capture any unintended and adverse consequences of the event. An integrated process and outcomes, qualitative and quantitative evaluation will therefore be required to capture the multitude of actions taken and their intended and unintended consequences, and what factors impeded and increased progress towards supporting healthy adolescent development goals (Wellings et al., 2011).

A well laid out Collective Impact approach to the study of the impact of a mega event would offer a model of good governance—including modelling cross-sectoral collaboration, accountability, participation, performance, and transparency—which those responsible for the coordination of the actual event, and future events, could learn from. Having the capacity to collect meaningful data from multiple sources would also demonstrate an ability to respond and adapt the measurement framework to ensure the continued collection of meaningful data, even when changes in policy or other external factors impacted the original study framework.

Collective Impact efforts have been found to be most effective when they build from what already exists, and engage established organizations (Hanleybrown et al., 2012). All three Canadian cities which will host 2026 FIFA World Cup games are already engaged in Collective Impact initiatives to reduce poverty (Cabaj, 2012; Pole & Fontan, 2017; Social Planning Toronto & the Alliance for a Poverty Free Toronto, 2013). There is already knowledge of the approach, a commitment within each city for partners to work together, and a confidence that it can be successful. Given the overlap that the World Cup will have with the poverty reduction initiatives already underway in each city, and that much of what the hosting of the World Cup would hope to achieve can be captured in data that are already being collected, it would be possible to create a shared measurement system that was able to tease out where the sporting event was directly responsible for any changes in healthy adolescent development which occurred.

Despite the growing number of successful examples of the use of a Collective Impact approach to measure the impact of initiatives tackling complex social problems, it is unknown if there would be a willingness to work together among academics, community groups, governments and sports governing bodies which would be required for a study such as the one proposed. Without a desire for change to the existing official evaluation framework, a Collective Impact approach would likely struggle to achieve the critical mass of stakeholders required to make it successful. However, given the success of Collective Impact initiatives across North America and their track record of creating an effective evaluation infrastructure that allows stakeholders to work together, the approach could ameliorate many of the challenges of measuring the impact of a mega sporting event experienced by the current study and all other previous studies of the impact of mega-sporting events. In the meantime, the current mixed methods study which incorporates objective and subjective data sources, and includes analysis of survey items developed through a collaboration of community stakeholders is likely the most appropriate available methodology to determine the impact of the 2010 Games on healthy adolescent development.

6.4 Application of Findings

Resnick and colleagues (2012) suggest that evidence-based investments in healthy adolescent development are essential, and failing to do so will have enormous implications for future global health. The findings of this study demonstrate the need to consider the impact a mega sporting event can have on adolescents, including vulnerable subpopulations. The findings also suggest there is value in resourcing positive legacies for an age group who, if they can be engaged, appear more likely to be influenced by such an event than adults, and to be more influenced than has previously been considered.

The results of this study can support research, policy and practice recommendations for future mega sporting events. For example, the findings that adolescents with a physical disability did not benefit to the extent that was intended from the Games, and that legacy facilities were not financed or held accountable to provide participation legacies for adolescents with a disability, can be used to support inclusive and strategic changes in policy and practices at future events. Furthermore, learnings from the implementation of such recommendations will continue the journey to clarifying the causal mechanism which can be influenced to ensure different groups of young people engage in health promoting activities such as PA.

Overall, the findings suggest that for a minority of adolescents, a mega sporting event can be leveraged to increase PA and access to sports opportunities. These adolescents are likely influenced by psychological, social and environmental factors and as such there should be structured and informal mechanisms to bring together experts from these fields along with others (e.g., conservation experts), to maximise the likelihood of creating sustainable health benefits through any future event. For example, the study showed increased access to sports opportunities was not necessarily associated with increases in PA participation. This suggests that before building a new sports venue to be turned over for community use after the event, it is important to identify and address factors which may prohibit adolescents from using that facility—such as neighborhood safety, local family income levels, transit and the presence of

sidewalks—before assuming they will benefit from it. Stakeholder interviews also suggest it would be beneficial to ensure such venues are contractually obligated to be inclusive and accessible for vulnerable populations.

Mega sporting event organising committees are generally disbanded within two years of an event's conclusion, despite it taking several years before positive and negative legacies can be properly evaluated (Leopkey & Parent, 2012; Mangan, 2008). This study confirmed that adolescents were reporting impacts of the Games three and four years after the event, and reinforces the need to revisit the post-event governance structure of mega events, and to include stakeholders who will be active in the host community long after the event has moved on.

This study applied Preuss' legacy framework to the findings. This proved to be a useful lens through which to view the results, as it accounted for all the dimensions in which legacies can occur and did not focus solely on the positive legacies outlined in VANOC's bid for the Games. Future studies should consider replicating the application of this framework not just to future mega event evaluations but also to other proposed initiatives which may impact upon adolescents' health and well-being.

6.5 Contribution to Knowledge

There has been a lack of studies on post-Olympic Games sports participation, and particularly studies which consider any long-term effect of the Games on participation (Weed et al., 2015). The current study is the first to consider the association between a mega sports event and different types of sports and PA for adolescents, and to consider the impact of the Games from an adolescent's perspective, pre and post the event. As such, it has raised awareness of the absence of children and adolescents in the mega sporting event design and delivery processes, and has highlighted the need for their consideration as key stakeholders.

Preuss (2016) states that legacies change in importance over time. It was obvious from this study that pre and post Games, a sizeable proportion of adolescents were

unaffected or unaware of the presence of the Games. However, one of the study's key contributions was raising awareness of the percentage of adolescents who reported being directly impacted by the Games, not only two and three years before they took place when there was heavy investment, media coverage and school curriculum but also five and eight years later when the Games were no longer a government or media focus.

The inclusion of pre- and post-Games data on three unique subpopulations in this study enabled consideration of the long-term legacies of the Games on vulnerable adolescents, and how this might differ from population level results. This is a unique contribution to our knowledge about mega sporting event, particularly as it is the first to have looked specifically at adolescents at-risk of incarceration.

Philosophers, practitioners and evaluators (e.g., VanWynsberghe, 2015) note the value of including multiple data sources and multiple data analysis techniques in an evaluation of a mega sporting event. This study incorporated qualitative and quantitative analysis of three unique data sources—three waves of the BC AHS (2003, 2008 and 2013), two waves of the HSIYS (2006 and 2014), sports club membership data (2003-2013) —and included stakeholder consultations. This is a unique contribution to our knowledge, yet the study's significant limitations suggest that this is not enough and a new collective approach to data gathering and interpretation is required.

The academic work that has been conducted to date in the area of mega events has often struggled to link theory to practise, and there has been a reluctance to evaluate claimed legacies of social inclusion (Cornelissen, 2011). This study's attempt to marry theory to practise and its consideration of the Games impact on community connectedness may have raised more questions than it answered. However, its failings can lead to improved methodologies in the future.

Within a critical realist ontology there are three levels of reality: Empirical reality (where the explanation of events is filtered through human logic, experience and

interpretation, and where meanings and causality are assigned), actual reality (events occur regardless of whether humans experience or interpret them), and real (inherent features that act as causal mechanisms and produce events which are observed at the empirical level; Fletcher, 2016).

This study sought to understand if the Games were a causal mechanism for change among young people in BC. Although the study was limited to testing empirical reality, it may also have stumbled upon actual reality or the real causal mechanism for change that a mega sporting event can play in the lives of adolescents. Even if it has only provided an empirical explanation it has expanded our knowledge, and this can be further developed and explored with mixed method longitudinal studies.

Recommendations made may be fallible but are based on the empirical evidence. Learnings from the implementation of any of the recommendations will continue the journey to identifying the real causal mechanism which can offer adolescents a sustained positive legacy of a mega sporting event.

Girginov and Hills (2009) argued that the IOC's approach to evaluating the impact of the Games is lacking because it relies solely on the tangible effects of the Games, which are measured through metrics such as number of participants and the development of school sports. This study moved beyond such criticism to look at intangible benefit, non-traditional sports and PA participation (such as extreme sports) and to include subpopulations that might otherwise be entirely missed in OGI indicators. The study also went beyond what was possible in the OGI evaluation to consider the processes that linked the hosting of the Games to its intended outcomes and impact, and offered some insight into the mechanisms through which any outcomes may have been achieved. This means the knowledge which is generated can be transferred to future mega events.

This study has provided supporting evidence for Preuss' (2016) claim that legacies may be positive or negative, planned or unplanned, tangible or intangible and must be evaluated in the context of a particular stakeholder group. For example, by showing

that whilst some homeless adolescents were positively affected by the 2010 Games, more were negatively impacted or not touched at all by the Games.

The study included populations who are considered among the most likely to be negatively impacted by a mega sporting event, yet are rarely considered in studies of events' impacts. It has also responded to the criticism of most studies that they focus only on the immediate impact of the event. The findings presented add to our knowledge of the sustained impact of a mega sporting event, and offer evidence that such an event could be leveraged to increase sports and PA participation, and to a lesser extent can provide employment opportunities to at least a minority of adolescents.

It has been stated that the unintended outcomes of mega events are often those that fail to be sufficiently examined (Mackintosh et al., 2016). The impact of a mega sporting event on healthy adolescent development may therefore have been considered an unintended outcome in many cases. This study shows the value of examining such outcomes in detail. It has also responded to the calls of Frawley and Cush (2011) for research that investigates how hosting major sports events impacts sport participation differently for different demographic groups, and Misener and colleagues' (2013) calls for more Paralympic legacy research.

At the conclusion of the literature review (Chapter 2), Table 2.1 laid out the gaps in knowledge this study was seeking to address. It is the author's belief that while not fully filling those gaps, the study's mixed-methods approach and inclusion of qualitative and quantitative data from 60,000 adolescents as well as the perspectives of adult stakeholders has increased our understanding of the potential impact of a mega sporting event (Table 6.1):

Table 6.1

Contribution to Knowledge

Gaps in knowledge the study sought to address (from Table 2.1)	Contribution to knowledge
Lack of population-level survey data which ask directly about the Games' influence on sports and PA participation.	→ This was the first study to effectively use population-level survey data which asked adolescents directly about the impact of a mega sporting event on their PA, access to sports opportunities and employment.
Adolescents' (and specifically those under the age of 15) self-reported perceptions of the Games' impact, collected pre and post the event.	→ The study included perceptions of the Games' impact provided by over 60,000 adolescents aged 12-19.
Knowledge of the impact of a mega sporting event on sport and PA participation beyond organised sports.	→ The study provided data about the impact of a mega sporting event on adolescents' participation on informal sports, extreme sports and exercise classes, as well as organised sports.
The extent and proximity of an epicentre effect for adolescents, and the impact of that event in host and non-host communities.	→ The study found that positive and negative impacts of the Games were more likely to be reported by adolescents in host communities in comparison to non-host communities.
Whether a Winter Olympics can produce a demonstration effect, through what mechanism and how long any effect may last.	→ Adolescents' qualitative self-report and stakeholder consultations appeared to support the presence of a demonstration effect, at least three years after the event.
Gender differences in the impact of a mega sporting event for adolescents.	→ Males were more likely than females to report positively on the Games' impacts but there were sustained population level increases in PA within one host community for females.

Engagement of adolescents with a disability in sport, PA, employment and community, and how a mega sporting event can impact these variables.

→ Adolescents with a disability who reported positively on the Games' impact were more likely to have been employed (2008), to have played organised and informal sports on a weekly basis over the past year (2013), and to have felt connected to their community (2013).

The role that increased availability of sports facilities may play in increasing PA participation, particularly for marginalised adolescents.

→ Increased access to sports opportunities appeared to be associated with increased PA participation, including for adolescents at-risk of incarceration.

Whether engagement in sports, employment and community should always be viewed as a positive outcome for adolescents.

→ The literature review for this study suggests that engagement in sports, employment and community may not always be viewed as a positive outcome for adolescents. However, this was not supported or refuted in the data.

Negative legacies a mega sporting event can have for adolescents in host and non-host communities.

→ For a minority of adolescents at the population level, the Games were associated with reduced access to sports opportunities, employment opportunities and PA. Negative legacies were higher among vulnerable populations, and homeless adolescents experienced reduced access to housing and services.

Despite its limitations, this thesis has achieved its aim of increasing our knowledge about the potential legacies of a mega sporting event. A pragmatic approach towards interpreting the findings ensures the study can be of significant practical and theoretical value. It offers a step forward in bridging the research-to-practice knowledge gap by increasing our knowledge base and setting an agenda for future research, while also informing practice.

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Appendix 1: BC AHS and HSIYS items

Table 1
Recoded BC AHS items

Variable	Description
Positive perception of 2010 Games	Adolescents were asked what effect hosting the 2010 Winter Olympics and Paralympics in BC had on them. Positive response options included in this recode were <i>I am more physically active, I have more sports opportunities</i> and <i>I have more job prospects</i> . Youth who responded positively to any or all of these items were considered to have a positive perception of the Games*.
Negative perception of 2010 Games	Adolescents who responded <i>I am less physically active, I have less sports opportunities</i> and/or <i>I have less job prospects</i> to the question asking about the effect of the Olympics were considered to have a negative perception of the Games*.
Weekly sports and exercise participation	Adolescents were asked about their participation over the past 12 months, outside of school classes, in sport or physical activity without a coach (informal sports); sports or physical activity with a coach (organised sports); dance, yoga or exercise classes with an instructor (exercise classes); and extreme sports. Response options were <i>Never, Less than once a week, 1 to 3 times a week, and 4 or more times a week</i> . These were dichotomised to <i>Less than weekly/At least weekly</i> .
Employed	In each survey year, participants were asked how many hours per week they had worked in a legal job in the past school year (response options ranged from <i>I didn't work at a paid job</i> to <i>20 or more hours a week</i>). This variable was dichotomised to Worked vs. Did not work.
Community connectedness	A single item asked participants how much they felt like a part of their community. Five response options ranged from <i>Very much</i> to <i>Not at all</i> . Those who responded <i>Quite a bit</i> or <i>Very much</i> were considered to be connected to their community.
Adolescents at-risk of incarceration	The six identified factors which put adolescents at increased risk for justice involvement were dichotomised as follows: <ul style="list-style-type: none"> • Parent/guardian did not know what adolescent was doing in their leisure time (Parents rarely/never knew vs. knew sometimes/often/always) • Who adolescents lived with most of the time (Lived with parent/guardian vs. did not live with parent/guardian). • Had ever stayed in a foster home, group home, or on a Youth Agreement (No vs. Yes) • Had been diagnosed with FASD (No vs. Yes).

- Regularly went to bed hungry because they or their parents did not have enough money for food at home (often/always vs. sometimes/rarely/never).
- Had been physically or sexually abused (No vs. Yes). This was computed using the following items: Youth had ever been physically abused (No/Yes), sexually abused (No/Yes), been forced to have sex when they did not want to (No/Yes), and/or sexually active as the younger of an illegal age pairing (assessed by their response to how old their partner was, and how old they were, the first time they had sex).

Having two or more of these six risk factors were computed into a single variable 'adolescents at-risk of incarceration.'

Note. *Adolescents who reported both positively and negatively to a behaviour e.g., reported they were both more and less physically active as a result of the Games were removed from the analyses.

Table 2
Recoded HSIYS measures

Variable	Description
Positive impact of 2010 Games	Adolescents were asked what effect the 2010 Winter Olympics in BC had on them. Positive response options included in this recode were ' <i>more housing</i> ', ' <i>more job opportunities</i> ', and ' <i>more access to services</i> '. Youth who responded positively to any of these items were considered to have a positive perception of the Games' effects.*
Negative impact of 2010 Games	Adolescents who responded ' <i>less housing</i> ', ' <i>less job opportunities</i> ' and/or ' <i>less services</i> ' to the question asking about the effect of the Olympics were considered to report a negative impact of the Games' effects.*
Host community	Participants were asked what community they were currently living in. If they chose the response option ' <i>Vancouver</i> ' in 2006 or ' <i>Vancouver</i> ' or ' <i>North Shore</i> ' in 2014, they were classified as living in a host community.**
Community connectedness	A single item asked how much participants felt like a part of their community. Five response options ranged from ' <i>Very much</i> ' to ' <i>Not at all</i> '. Those who responded ' <i>Quite a bit</i> ' or ' <i>Very much</i> ' were considered to be connected to their community.

Note. *As with the BC AHS, analyses were conducted to determine if adolescents were responding inconsistently on the Game's effects. All survey responses appeared valid and none were removed from the analyses.

**North Shore did not participate in the 2006 survey and Richmond did not participate in either survey year.

Table 3

HSIYS sports and PA survey items and response options

2006	2014
<p><i>Before you were homeless did you do any of the following (Mark all that apply)?</i></p> <ul style="list-style-type: none"> ○ <i>Sports or physical activity without a coach or instructor</i> ○ <i>Sports with a coach or instructor</i> ○ <i>Dance, yoga or exercise classes</i> 	<p><i>Before you were homeless did you do any of the following (Mark all that apply)?</i></p> <ul style="list-style-type: none"> ○ <i>Sports or physical activity without a coach or instructor</i> ○ <i>Sports with a coach or instructor</i> ○ <i>Dance, yoga or exercise classes</i> ○ <i>Extreme sports</i>
<p><i>Before you were homeless did you do any of the following extreme sports (Mark all that apply)?</i></p> <ul style="list-style-type: none"> ○ <i>I didn't do extreme sports</i> ○ <i>Backcountry skiing/snowboarding</i> ○ <i>High-speed motorized sport (e.g. motor-cross)</i> ○ <i>Cliff or bridge jumping</i> ○ <i>White water activities (e.g. tubing, canyoning, rafting, etc.)</i> ○ <i>Downhill mountain biking</i> ○ <i>Other, specify: _____</i> 	
<p><i>In the past 30 days did you do any of the following (Mark all that apply)?</i></p> <ul style="list-style-type: none"> ○ <i>Sports or physical activity without a coach or instructor</i> ○ <i>Sports with a coach or instructor</i> ○ <i>Dance, yoga or exercise classes</i> 	<p><i>Since you became homeless did you do any of the following (Mark all that apply)?</i></p> <ul style="list-style-type: none"> ○ <i>Sports or physical activity without a coach or instructor</i> ○ <i>Sports with a coach or instructor</i> ○ <i>Dance, yoga or exercise classes</i> ○ <i>Extreme sports</i>

Appendix 2. Risk factor for serving a custodial sentence (2013 BC AHS)

Risk factor for serving a custodial sentence	Youth with risk factor who had spent time in a custody centre (compared to youth without the risk factor)	Odds ratio (adjusted for age and gender)
Parent/ guardian rarely/never knew what youth did in their free time	3.0% vs. 0.6%	4.745 (95% CI 2.736-8.229) $p<.0001$
Did not live with parents	4.2% vs. 0.6%	7.785 (95% CI 4.334-13.986) $p<.0001$
History of physical and/or sexual abuse	2.4% vs. 0.5%	4.662 (95% CI 2.664-8.020), $p<.0001$
Often/always went to bed hungry because of poverty	12.9% vs. 0.7%	21.358 (95% CI 13.543-33.683), $p<.0001$
Diagnosed with FASD	16.6% vs. 0.8%	1.179 (95% CI 1.053-1.319) $p<.0001$
History of government care (foster home, group home and/or Youth Agreement)	14.4% vs. 0.3%	54.562 (95% CI 37.513-79.359) $p<.0001$

Note. Bolded percentages were significantly different at $p<.01$. Bolded AOR is statistically significant at the p value indicated. *Note.* AOR>1-associated with higher odds of outcome and AOR<1 associated with lower odds of outcome

Appendix 3 Interview script for stakeholder interviews

[Introduce and explain case study, share brief summary of results]

1. Please describe your role in relation to the Vancouver 2010 Olympics and Paralympic Games.
2. Did you observe any impacts of the 2010 Games on adolescent health? If so, please give details?
3. The governments aim to leverage the Games to achieve a 20% increase in sports participation did not appear to be achieved at the population level. What are your thoughts on this?
4. Results of the study showed that adolescents who viewed the 2010 Games' impact positively were more likely to engage in regular sport and PA than those who viewed it negatively or were not affected by the Games. In your experience, is it likely that it was already active adolescents who reported the Games increased their PA and sports opportunities or was it inactive adolescents who became PA?
5. Although limited data were available, sports club membership appeared to increase following the awarding of the Games to Vancouver. What do you think the reason for this was?
6. Across BC, organised extracurricular sports participation rose during the build up to the Games, then dropped after the Games, and for females dropped below the 2003 level. What do you think explains this? How might the pre-Games increase have been sustained?
7. The Games appeared to affect different sub groups differently (e.g. younger youth and males generally appeared more positively effected). What should be done with this knowledge?
8. Reporting negative impact of the 2010 Games was associated with a lower likelihood of playing sports and engaging in PA. What could be done to address this?
9. There was a correlation between reporting being positively impacted by the Games and higher levels of feeling connected to the community. What might explain this? How could future events capitalise on this?
10. Vulnerable youth generally reported more negative impacts of the Games, but those who were able to report positive impacts experienced some reduction in health disparities with the general population. How could future events be leveraged to improve outcomes for vulnerable populations?
11. The Games was intended to help reduce the disparity in organised sports participation between adolescents with a physical disability and their peers. However, the disparity appeared to increase. What are your thoughts on this?
12. Adolescents in host communities generally appeared to experience more positive and negative effects of the Games. Do you have any thoughts on how the positives could have been expanded and/or the negative legacies reduced?
13. Students in North Shore have traditionally been more active and those in Vancouver and Richmond less active than the provincial average. The gap widening

gap between youth in North Shore communities close to the Games sites and the rest of the province, and narrowed between Vancouver and Richmond and the province. What do you think the reasons for this were?

14. Qualitative findings showed some adolescents were inspired by watching the Games to take up a sport or PA or increase their participation in a particular sport. How can more youth be engaged in this way?
15. Are you aware of other legacies of the 2010 Games for adolescents not captured in this study?
16. The study hypothesised that any 2010 legacies for adolescents would be influenced through psychological, behavioural and environmental mechanisms, and by factors such as increased access to sports opportunities, infrastructure developments and opportunities to see elite athletes perform. To what extent would you agree with these explanations?
17. In your experience, did the Games results in increased availability of sports programmes or opportunities for PA or employment for youth?
18. How could future mega sporting events be designed and leveraged to increase the likelihood of contributing to improvements in adolescent health?
19. If BC were to host another mega sporting event, what should be done differently?
20. This study used secondary data and was conducted after the fact. How could future events be more effectively evaluated for their impact on adolescent health?

Appendix 4: Additional sports club membership data

Biathlon

The provincial governing body for BC's 13 biathlon clubs did not keep membership records until 2010. The available data showed an increase in male and female adolescent membership between 2010 and 2013 (Table 1). Although beyond the scope of this study, obtained data showed participation rates in this minority sport continued to increase in the seasons following the 2012/13 season.

Table 1
Biathlon sports club membership youth aged 12-19

	2010/11	2011/12	2012/13
Males	39	50	72
Females	23	24	29
Total	72	74	101

Curling

The only data which could be obtained on curling sports club membership were compiled from annual reports available between 2007 and 2013. The provincial data showed an increase from 17,000 youth participants in 2007-08 to 20,683 in 2009-10, and over 24,000 in 2012-13 (Curl BC annual reports, 2007-08, 2009-10, 2012-13). No age or gender breakdowns were available.

Figure skating

Figure skating club membership data are not recorded by age level, and BC data are not separated from data from the Yukon Territory (Table 2). Overall participation figures show that membership dropped in the season after the Games were awarded to Vancouver (2003-04) but then increased year on year through the pregnancy period of the Games, before decreasing in the three seasons after the Games. Despite this decrease, membership in 2012-13 was 3.4% higher than a decade earlier.

Table 2

BC and Yukon Figure skating club membership (junior and adult combined) 2002/03 - 2012/13

02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13
16,662	16,417	18,312	18,412	18,932	18,961	18,895	19,548	18,895	18,550	17,232

Source: Starr, 2015.

Speed skating (short track and speedskating)

BC Speed Skating did not keep administrative records by age or gender for the time period of this study. Total membership (children, youth and adults) rose in the years after the Games were announced and remained above the 2002-03 level, with the

highest participation rates being observed in the 2005/06 season (873) and the season immediately following the Games (2010/11; 863 members; Table 3).

Table 3

Overall participation in speedskating (children aged 6 and older, through to adults) 2002/03-2012/13

02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13
730	778	841	798	873	826	811	746	863	767	825

Paralympic sports

No data were available for Paralympic sports except Para-Nordic which began keeping records in 2010, and had less than 10 male and female youth aged 12-19 participated on a regular basis in the following three seasons.