Determining the Effects of COVID-19 on the Sport Participation Ecosystem

by

Lance Warwick

A Thesis
presented to
University of Guelph

In partial fulfilment of requirements
for the degree of
Master of Science

in

Tourism and Hospitality

Guelph, Ontario, Canada

ABSTRACT

DETERMINING THE EFFECTS OF COVID-19 ON THE SPORT PARTICIPATION ECOSYSTEM

Lance Warwick — Major Advisor (s)

University of Guelph, 2021 — Dr. Norm O'Reilly

The impact of the global pandemic caused by SARS-CoV-2 (commonly referred to as COVID-19) has been immense, and the effects on society are still emerging. This research attempts to understand the wide-ranging impacts on sport participants and their physical activity. By integrating the Theory of Sport Capital and the Determinants of Sport Participation, this research uses interviews with sport organizations, sport participants, and data collected from a popular physical activity tracking app to determine the current impacts and potential future trends in the recovery of the sport participation ecosystem from COVID-19. This research found that sport participants have resiliency in their physical activity and that the impacts of the pandemic on engaged sport participants was low. However, interviews with sport organizations revealed that they are facing significant capacity constraints and ongoing uncertainty due, in part, to the pandemic. Conceptually, this research provides support for the Theory of Sport Capital and demonstrates that it can be combined with the Determinants of Sport Participation to understand sport participation. Future research should investigate how the pandemic has impacted individuals who have been traditionally excluded from sport and how the sport ecosystem can better develop long-term participation in sport.

Keywords: Sport Organizations, Non-Profit Sport, Physical Activity, Sport Capital

ACKNOWLEDGEMENTS

Given that this thesis explores the phenomena of sport, it is fitting that it would not have been completed without the help and support of a huge team of individuals. I would like to take this opportunity to thank those involved, and I would like to highlight some of the people who helped to get me to the finish line.

I would first like to thank my committee members, Drs. Heather Lawrence-Benedict, Dave Patterson and Jamie Burr for their support and guidance throughout this process. Your willingness to provide insightful feedback and give me the encouragement to push my work to the best possible level was invaluable in getting me to this point.

I would also like to extend a huge thank you to Dr. Sarah Moore. Your support, encouragement, and guidance as I reached the final phases of my work were hugely important and I am not sure this thesis would have been completed without your help. I learned so much from your involvement in my thesis and I can't thank you enough.

My thanks also go out to two organizations that assisted me in the data collection process, without whom there would be no thesis to write. To Katie, Tala, Leigh, and the rest of ParticipACTION, I really appreciate your willingness to help me throughout this process. To Marco and the rest of Jumpstart, I appreciate your enthusiastic response to my research and the work that you put into helping me achieve my research goals.

To my family for providing me support throughout every step of this journey, always supporting me and helping to keep me sane throughout this crazy year.

To Renée, thank you for being beside me throughout this process, from the highs to the lows, to everything in between. There is no one I would have rather had by my side during this time.

Thanks also to the DIVERGENT Lab, who helped show me what good research looks like and who always provided a sense of belonging, along with a healthy dose of laughter and connection throughout the longest days of the pandemic.

Finally, my most significant thanks goes to Dr. O'Reilly, who provided so much support, encouragement, and guidance throughout this whole process. If I were to list every way you helped me throughout my master's, this acknowledgement section would be longer than the thesis that follows (which is saying something!). I have learned so much through this process and have been inspired to continue down this path of becoming the best academic I can be. If anyone told me at the start of my final year of undergrad that this is the path I would be on I would never have believed it, but the fact that I am here is a testament to your belief and support in me which I will never forget.

To everyone who was involved in helping me through this intense, enjoyable, frustrating, enlightening, and totally invaluable experience, thank you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1. Introduction

Physical inactivity is a global issue, with public health implications so dire that researchers have declared physical inactivity to be a global pandemic as far back as 2012 (Kohl et al., 2012). The rates of physical activity (PA) which triggered this level of concern have remained fundamentally unchanged in the ensuing years (Althoff et al., 2017; Sallis et al., 2016). This crisis has impacted the global population, and Canada is not exempt. Research shows that only 16% of adults aged 18 to 79 meet the recommended weekly levels of moderate-to-vigorous physical activity (MVPA) (ParticipACTION, 2019). Additionally, only 39% of children aged 3 to 17 meet their recommended level of MVPA (ParticipACTION, 2018). Researchers, public health officials and various non-governmental and charitable organizations have been attempting to improve rates of MVPA through various interventions, but there remain significant challenges. Most notably, these interventions struggle to "scale up" or become generalizable (Reis et al., 2016).

Technological shifts throughout the past 10-15 years, in the form of the uptake of mobile smart phones and wearable fitness tracking devices, have opened the door to new types of interventions with increased reach. Indeed, multiple studies have been conducted to investigate the efficacy of mobile smartphone-based interventions on various aspects of physical health (see Gal, May, van Overmeeren, Simons, & Monninkhof, 2018; Muntaner, Vidal-Conti, & Palou, 2016; Stephens & Allen, 2013; Yang & Van Stee, 2019). These four distinct reviews found that mobile health initiatives had significant results, although Yang & Van Stee (2019) found that the there were mixed results on the magnitude of the interventions' efficacy. Beyond using mobile phone technology to implement interventions, researchers have also used mobile phone data to examine real-world trends. This has been seen extensively throughout the pandemic, both to look

at movement rates (Zhou et al., 2020) and to look at the epidemiological uses for mobile phone technology (Oliver et al., 2020).

The decline in physical activity rates is mirrored in a decline in sport participation rates. Sport participation is relatively high among youth (ParticipACTION, 2018) but is known to drop off significantly in adolescence and into adulthood (Balish, McLaren, Rainham, & Blanchard, 2014). To date, limited research has been conducted on sport participation-based interventions seeking to raise the rate of participation, especially amongst adults. This is curious, as when investigating the Compendium of Physical Activity (Ainsworth et al., 2011) which details the Metabolic Equivalents (METs) of various physical activities, sport activities almost universally achieve a MET of sufficient intensity to constitute MVPA.

To the extent that sport has institutional support from governments the world over, along with mega events, budgets and expertise devoted to facilitating sport, it seems that there is a dual mandate amongst sport organizations (particularly national, provincial, and regional sport organizations) of both "growing" sport and also having to focus on developing high-performance athletes, whether for the Olympics or other professional sport leagues or organizations. This dual mandate is evidenced by the ways in which government supports sport. For example, on the "Role of Sport Canada" page of the Government of Canada website (Canada.ca), three funding frameworks are detailed: the "Athlete Assistance Program" (which provides direct funding to high performance athletes), the "Sport Support Program" (which provides funding "to strengthen our national sport system and benefit our athletes and coaches"), and the "Hosting Program" (which provides funding to assist in the hosting of sporting events). Furthermore, in their

description of the "Objectives of the Canadian Sport Policy", Sport Canada describes five main goals:

- "Introduction to sport: Canadians have the fundamental skills, knowledge and attitudes to participate in organized and unorganized sport.
- Recreational sport: Canadians have the opportunity to participate in sport for fun, health, social interaction and relaxation.
- Competitive sport: Canadians have the opportunity to systematically improve and measure their performance against others in competition in a safe and ethical manner.
- High performance sport: Canadians are systematically achieving world-class results at the highest levels of international competition through fair and ethical means.
- Sport for development: Sport is used as a tool for social and economic development, and the promotion of positive values at home and abroad" (Sport Canada, 2017).

Given that there is a "pandemic" associated with physical inactivity, and that sport can provide an effective outlet for physical activity, it is therefore important to understand the way in which sport organizations operate to increase physical activity rates. Research conducted by Eime et al. (2015, p. 10) shows organized sport contributed significantly to "health-enhancing leisure-time physical activity". The significant contribution of sport to physical activity rates of a given population suggests that sport organizations should be a central component of research into physical activity. This leads to the purpose of this research, which is to investigate the way in which the COVID-19 pandemic has affected sport participants and sport organizations. Much of the public health restrictions put in place in Canada (such as "lockdowns" and restrictions on

both indoor and outdoor gatherings) has the potential to impact both participants access to sport, and sport organizations' delivery of programming, given that many sports rely on access to facilities outside the home, and (especially so in the case of team sport) congregations of people.

While there has been initial research on the impact of the pandemic on sport participants, it has mostly focused on qualitative research in the context of youth sport, and this current study fills a gap in the research by including quantitative analysis. For example, Elliott et al. (2021) developed four thematic frames from interviews of youth sport participants and their parents in Australia; Teare & Taks (2021) hypothesized three impacts of the pandemic on youth sports participants and three areas in which organizations need to innovate in order to meet the changing demands of sport participants. Schnitzer et al. (2020) investigated sport participation in Tyrol, Austria, at the beginning of the pandemic and found that overall sport participation fell during lockdown periods, but that in less active groups sport participation increased. Schnitzer et al. (2020) suggested that further research needed to be conducted in order to understand the future impacts of the pandemic on sport participants and organizations.

This research takes a mixed-methods approach in investigating the impact of the pandemic on sport participants and sport organizations. To understand the impact on participants and given the success of using mobile phone data in other research contexts related to the pandemic, data from a mobile app (hereon referred to as the "App") developed by a major Canadian physical activity promotion organization (the non-profit "ParticipACTION") was utilized to gauge the actual impact on moderate-to-vigorous physical activity. Additionally, responses from a survey conducted of App users were analyzed to assess any themes in how the pandemic was impacting their participation and their overall level of physical activity. The next portion of the research focused on the impact of sport organizations. Interviews were conducted with senior

management and presidents/CEOs of sport organizations to understand how the pandemic affected their ability to provide programs and services to participants. By combining the device-based data of the App, the subjective lived experiences of participants through survey responses, and the impact on sport organizations, this research aims to provide a complete picture of the sport participation ecosystems' reaction to the COVID-19 pandemic along with an understanding of what the future effects of the pandemic will have on sport participants and sport organizations.

Chapter 2. Literature Review

To support the research goal of investigating the impact of the COVID-19 pandemic on sport participants and organizations, there are key concepts such as how physical activity contributes to overall health, how sport provides physical activity, the barriers to sport, and the early impacts of the pandemic which need to be discussed and analysed. To frame the work, definitions of both physical activity and sport are discussed. The current trends of population level physical activity and sport participation are detailed, with a focus on the trends in Canada. The barriers to sport participation are also discussed with a development of groups of barriers to better understand the reasons why certain individuals may not be able to access sport. The initial impact of the COVID-19 pandemic and the related research is also discussed, along with the development of research questions specifically related to the potential impact on sport. Finally, a research framework is developed to help understand the ways in which the pandemic may affect the participation in sport of Canadians.

2.1. Physical Activity Definition

"Physical Activity" (PA) is a broad concept which is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" (Caspersen, Powell, Christenson, 1985, p. 126). This broad concept can be categorized in different ways, including through the states in daily life (sleeping, at work, during leisure time); by the intensity (light, moderate, or heavy); or by whether the activity is willful or compulsory (Caspersen et al., 1985). The energy required for an activity is commonly measured and expressed in kilocalories (kcal) (Caspersen et al., 1985) or oxygen cost (expressed as millilitres per kg per minute) (Ainsworth et al., 2011). However, these measurements have been simplified by researchers in the form of the

"Metabolic Equivalent of Task" (MET). MET is defined as "as the ratio of the work metabolic rate to a standard resting metabolic rate (RMR) of 1.0 kcal*kg $^{-1}$*h^{-1}. One MET is considered the RMR or the energy cost of a person at rest" (Ainsworth et al., 2011). Alternatively, one MET is equivalent to the oxygen cost of a person at rest, which is 3.5ml/kg/min (Ainsworth et al., 2011). Table 1 shows the ranges for various exertion levels as defined by Ainsworth et al. (2011).

Table 1. MET Definitions

MET Range	**Type/Intensity**
1.0-1.5 METs	Sedentary Behaviour
1.6-2.9 METs	Light-Intensity
3-5.9 METs	Moderate-Intensity
>6 METs	Vigorous-Intensity

Physical activity, including light intensity, can have positive physiological benefits such as reduced mortality and reduced cardiometabolic risk factors (Amagasa et al., 2018), but that increasing intensity to the moderate-to-vigorous-physical-activity (MVPA) level has been shown to increase those benefits (Powell, Paluch, & Blair, 2011; Saint-Maurice, Troiano, Berrigan, Kraus, & Matthews, 2018). Based on the MET thresholds shown in Table 1 (which are used by Ainsworth et al. (2011) and originally sourced from the Department of Health and Human Services "2008 Physical Activity Guidelines for Americans"), this includes any activity in which a person is expending greater than 3 METs during said activity. In its report titled "Global Recommendations on Physical Activity for Health" (2010), the World Health Organization uses MVPA as its recommended intensity of physical activity across all age groups. For ages 5 to 17, the recommended level is 60 minutes of MVPA per day; for ages 18-64, the recommended level

is between 150 and 300 minutes per week; for ages 65+, the recommended level is 150 minutes of moderate activity per week (World Health Organization, 2010).

Please note that the remainder of this paper will use the term "Physical Activity" to refer to activities which fall under MVPA. The list of activities which fall under this term is vast, and the best and most up-to-date categorization of the MET rates of various activities can be found on the webpage "The Compendium of Physical Activities Tracking Guide" published by the Healthy Lifestyles Research Centre at Arizona State University. Further, for the purposes of this study and as supported in the literature (Wankel & Berger, 1990), it is important to note that sport participation and physical activity are not interchangeable.

2.2. Sedentary Behaviours

Despite residing in Table 1 with moderate and vigorous activity, sedentary behaviours and physical inactivity are different (Thivel et al., 2018). However, as suggested by Thivel et al. (2018), many researchers confuse sedentary behaviour as physical inactivity. Thus, while the goal of public health guidelines may be to reduce sedentary activities and increase physical activity, a person may still engage in many sedentary activities and still be physically active. In the case of an office worker, for example, they may sit at a desk in front of a screen for eight hours, but upon leaving work three times a week they go straight to their hockey game and get a surplus of their recommended MVPA. It is important to distinguish what the primary goals of the researchers are. Researchers and practitioners intending to increase MVPA will possibly break up periods of sedentary behaviour by nature of the activity, but reducing time spent sedentary does not necessarily result in MVPA. In Table 1 above, so-called "Light Intensity" behaviour is considered enough to be not sedentary but does not provide the same benefits as MVPA (Saint-

Maurice, Troiano, Berrigan, Kraus, & Matthews, 2018). When considering the efficacy of programs to increase physical activity, it is important to note that while encouraging light-intensity behaviours is still a positive outcome in terms of reducing sedentary behaviours, it is not enough to get the health benefits ascribed to MVPA, which is the goal of most PA programs.

2.3. Definition of Sport

Sport has been considered a subset of PA, not distinct phenomena in most PA research. (Khan et al., 2012). There is ongoing discussion about the definition of "sport". Many different proposed definitions abound; indeed, sport can be a rather ambiguous term. In fact, early scholars have decried attempts to define "sport" all together (McBride, 1975), not because it is not important but because the phrase is used in such a wide variety of applications that they deem it impossible to define. However, some organizations do not have the luxury of debating the philosophical nature of words and as such require an operationalized definition to frame their studies. For instance, Sport Canada has defined "sport" in the following way:

> "An activity that involves two or more participants engaged for the purpose of competition. Sport involves formal rules and procedures, requires tactics and strategies, specialized neuromuscular skills, and a high degree of difficulty and effort. The competitive nature of sport implies the development of trained coaching personnel. It does not include activities in which the performance of a motorized vehicle is the primary determinant of the competitive outcome." (Sport Participation 2010, 2013, p. 13)

This definition is very technical and rigid in that sport "requires tactics and strategies, specialized neuromuscular skills, and a high degree of difficulty and effort". This would seem to preclude the recreational versions of sport (for example, would "beer league" hockey be

excluded from this definition of sport, given that many participants may not be exerting a "high degree" of effort?). It also explicitly excludes motorsport from the definition of sport, despite not explicitly mentioning any other type of sport as being ineligible. This appears to be inconsistent, if the goal is to rule out activities where equipment is a key determinant of outcomes, given that many activities (such as horseback riding, cycling, and golf) would be impossible without equipment, and therefore the quality (or lack thereof) of equipment can play a key role in outcomes.

Interestingly, in the Statistics Canada survey from which the Sport Participation 2010 report is built, the question to survey respondents is phrased thusly:

> "Many Canadians participate in sport in one way or another. For the following questions sport is identified as activities which involve training or competition with some level of physical intensity or organization. Leisure activities such as dance, fitness, fishing, or hiking, are not considered sport." (Sport Participation 2010, 2013, p. 93)

In this instance, we come across another example of the fact that sport is often defined by what it is not, as opposed to what it is. This definition is much more open in terms of the activities considered sport than the definition proposed by Sport Canada, and assumes that the survey respondent has some internalized, societal definition of sport.

Other scholars have defined sport in relation to physical activity to create a separation. Kilpatrick, Hebert, & Bartholomew (2005) define sport as "physical activity governed by formal or informal rules that involve competition against an opponent or oneself" (p. 89). This definition provides for the vast nature of sport, given that it does not always occur within the rigorous bounds of organized competition. This separation of physical activity and sport has been

supported in various studies (Berger, O'Reilly, Parent, Séguin, & Hernandez, 2008; Kilpatrick et al., 2005).

One area that is not often discussed when defining sports is that there is, generally, a defined structure for sport in many countries through national, provincial/state, and regional sporting organizations. These organizations are responsible for both high-performance/Olympic level sport but also, especially in the case of regional sport organizations, the development, and grassroots levels as well. Currently, there are 58 nationally funded sport organizations in Canada ("National Sport Organizations - Canada.ca," n.d.) such as Hockey Canada, Canada Soccer, and Climbing Escalade Canada (rock climbing). These organizations are responsible for the governance of their given sport at the national level; they work with respective provincial level organizations (in the case of Hockey Canada, they would work with, for example, the Ontario Hockey Association and BC Hockey). These organizations provide the structure through which many participants engage with when engaging in sport. There also exists numerous organizations which work to facilitate participation in sport amongst underserved populations (Whitley, Forneris, & Barker, 2015). The benefit of the Kilpatrick et al. (2005) definition is that it includes all potential contexts for sport participation, whether in a highly structured environment (i.e. "traditional" league structures governed by RSOs, PSOs, or NSOs; non-profit organizations engaging underserviced groups; or purely recreational, loosely organized sport).

2.4. Health Benefits of Sport

While the previous section has investigated the distinction of sport from physical activity, the overall goal of many organizations and practitioners – informed by research - is to reduce the level of global physical inactivity. As such, this section will examine how participation in sport

provides many of the same benefits as physical activity and more. Studies have found that, while not perfect, practicing a sport can lead to the same or similar benefits as physical activity (Leek et al., 2011; ParticipACTION, 2018). A brief analysis of the 2011 Compendium (Ainsworth et al., 2011) shows that of the activities labelled as "sport", 116 of 128 met the 3 MET threshold for MVPA. As sport is generally made up of the components of physical activity (i.e., running, lifting, throwing, etc.), this is not surprising. It has also been found, in the Canadian context, that youth get much of their MVPA from sport participation (ParticipACTION, 2018). Outside of Canada, it has been consistently shown that youth in a variety of contexts get a majority of their MVPA through sport participation, and that those who participate in sports get more MVPA than those who do not, which suggests that sport encompasses a large portion of what we see as MVPA (Marques, Ekelund, & Sardinha, 2016; Pfeiffer et al., 2006; Silva et al., 2010; Telford et al., 2016; Wickel & Eisenmann, 2007).

One aspect of sport that differentiates it from physical activity is the social and mental health benefits. In terms of mental health, recent reviews have shown that participants in sport have stronger social support, self-esteem, and larger social networks, regardless of the type of sport participated in, although team sports appear to be better at improving long-term outcomes (Andersen, Ottesen, & Thing, 2019). Studies have shown that many people participate in sport not just for the physical activity benefits, but for the hedonic rewards and social aspects of sport (Berg, Warner, & Das, 2015). To put it simply, participation in sport has been shown to make people happier (Ruseski, Humphreys, Hallman, Wicker, & Breuer, 2014). The psychological benefits of sport participation are well researched in youth and young adults (Neely & Holt, 2014; Richman & Shaffer, 2000; Taliaferro, Rienzo, Miller, Pigg, & Dodd, 2008), however, as with the physical benefits, more research is required for the psychological impact of sports on

adults (Andersen, Ottesen, & Thing, 2019). It has been hypothesized that the same benefits present for youth are available to older adults (Baker, Fraser-Thomas, Dionigi, & Horton, 2010), but additional research is required to understand this relationship. These additional benefits of sport lends itself to the argument that sport itself is a valuable public health tool beyond simply increasing MVPA rates.

2.5. Global State of Physical Activity

Since 2012, The Lancet has published a reoccurring series on global physical activity. In the first series, they estimated that 5.3 million deaths per year were due to physical inactivity, putting it on the same level of risk factors for chronic disease as tobacco and obesity (Kohl et al., 2012). Worldwide, it is estimated that approximately 23.3% of adults and 20% of adolescents are inactive (Sallis et al., 2016). This has led researchers to declare that physical inactivity is a global pandemic (Althoff et al., 2017; Kohl et al., 2012). Complicating the challenge of understanding global physical activity is the fact that most research is done using self-reported surveys and that there are significant challenges associated with relying on that data (Sallis et al., 2016). Recent research has developed the use of accelerometer data for objectively understanding physical activity rates (Wijndaele et al., 2015). However, Sallis et al., (2016) found that recent studies using accelerometery could not be compared to the traditional self-reporting mechanisms. Recent research has been investigating the use of accelerometer-based data in large scale studies to hopefully narrow the gap in comparability between self-reported and objectively measured data (Doherty et al., 2017; Migueles et al., 2017; Trost, 2020).

The consequences of the global inactivity crisis are dire. Researchers have estimated that the direct economic costs of the physical activity crisis are equivalent $53.8 billion USD[1] per year as of 2013, along with $13.7 billion in productivity losses (Ding et al., 2016). To limit the descriptions of costs of physical inactivity to economic measures makes them rather impersonal. When looking at the individual level, the implications of physical inactivity are also glaring. A meta-analysis by Arem et al., (2015), indicated that those who met the recommended weekly level of MVPA had a 31% lower risk of all-cause mortality than those who did not. More recently, a large-scale review by Kivimäki et al., (2019) found that in a sample of 404,840 people, physical inactivity was strongly linked to incident diabetes, coronary heart disease, and stroke. The resulting costs, both at the individual and societal level, lends credence to the declaration that physical inactivity is a global pandemic.

2.6. Physical Activity Trends in Selected Populations

Physical activity trends are not identical across various subsets of the population. As previously discussed, it has been estimated that physical inactivity is much higher among adolescents than among adults (Sallis et al., 2016). However, that is not the only distinction, as Sallis et al. also found that in 137 of the 146 countries analysed, that men were more active than women. An analysis of World Health Organization (WHO) data by Brown, Mielke, & Kolbe-Alexander (2016) showed that men participated in leisure time physical activity (physical activity performed recreationally; excluding activities such as active commutes) at an average of 25.3 minutes per day, as compared to 13.7 minutes for women. This physical activity gender gap

[1] Note that the study conducted by Ding et al. (2016) reports the figure in International Dollars, which is equivalent to the purchasing power of $1 in the United States.

has been explored in various contexts and is consistently found to exist regardless of country or socioeconomic status (Althoff et al., 2017; Guthold, Stevens, Riley, & Bull, 2018). Research on the benefits of physical activity for women has consistently shown that women across demographics and across lifespans receive as much if not more benefit from increasing PA than men (Choi et al., 2013; Dinkel et al., 2020; Hu et al., 1999; LaMonte et al., 2017). While it is important to raise the physical activity of all members of society, it is crucial to acknowledge that there are significant gaps in who is physically active to start with.

Socioeconomic status is another key differentiator in levels of physical activity. Many studies have shown that economically disadvantaged populations average less physical activity than more privileged ones (Boone-Heinonen et al., 2011; Estabrooks, Lee, & Gyurcsik, 2003; Ford et al., 1991; Sallis et al., 2018). This has held true across various contexts, including amongst adolescents (Stalsberg & Pedersen, 2010), and has been seen at the nation level, with higher income countries exhibiting higher physical activity rates (Sallis et al., 2016).

There are complex interactions between race, gender, and socioeconomic status, which show that the physical inactivity pandemic is not an "equal opportunity" concern. Research has shown that the physical activity crisis has disproportionately impacted those with lower socioeconomic status (Althoff et al., 2017). The relationships between the various factors of physical activity have been explored, with it being found that access to facilities was higher in areas with higher median incomes and lower in areas with higher percentage of minorities. In terms of sport, at the youth level it has been found that socioeconomic status and gender intersect in a way that leaves girls with a lower socioeconomic status with the lowest access to sport (Dollman & Lewis, 2010).

One final area of research in physical activity is related to children and adolescents. Long-term follow up studies have shown that physical activity in childhood and adolescence strongly predicts physical activity in adulthood (Kuh & Cooper, 1992; Telama, Yang, Hirvensalo, & Raitakari, 2006). Couple this with the previously discussed crisis of inactivity in children and adolescents, and the much higher level of MVPA suggested for youth, and the resulting issues are significant and concerning. Again, adolescent sport participation and socioeconomic status interact and have been shown to influence physical activity in adulthood (Tammelin, Näyhä, Laitinen, Rintamäki, & Järvelin, 2003).

2.7. Physical (In)Activity in Canada

While global rates and descriptions of the physical inactivity crisis are illustrative and provide important context, given the focus of this research, it is worth investigating the specific nature of the crisis in Canada. The Canadian Physical Activity Guidelines (CPAG) are in line with the World Health Organization recommendations regarding MVPA at both the adult (18-64) and youth (5-18) age groups. The realities of physical activity levels in Canada are stark. Only 16% of adults ages 18-79 meet the recommended weekly levels of MVPA (ParticipACTION, 2018). Additionally, only 39% of children ages 3-17 meet their recommended level of MVPA (ParticipACTION, 2018). In terms of economic costs, the total (including direct and indirect) economic costs related to physical inactivity in Canada was estimated at $6.8 billion CAD in 2012 (Janssen, 2012). Canada is not immune to the discussed gender gap in physical activity (Coen, Subedi, & Rosenberg, 2016). The urban and rural divide in physical activity has also been addressed in the Canadian context, with suggestions that rural populations in Canada are more active than in other nations (Plotnikoff, Mayhew, Birkett, Loucaides, & Fodor, 2004; Witcher,

Holt, Spence, & Cousins, 2007). Youth participation has been investigated in the context of disadvantaged youth (O'Loughlin, Paradis, Kishchuk, Barnett, & Renaud, 1999), new Canadians (Taylor & Doherty, 2005), and gender (Bengoechea, Sabiston, Ahmed, & Farnoush, 2010).

This overwhelming level of evidence shows that while Canada may be ahead in some physical activity indicators, the costs, consequences, and disparities in physical activity globally are still major issues in Canada. Some key areas for future research identified by ParticipACTION in their 2019 report are to further investigate (i) the physical activity levels of distinct population groups; (ii) the impact of different types of physical activities; and (iii) the characteristics of physically inactive people (ParticipACTION, 2019). Further research on physical activity is crucial to the health of Canadians.

2.8. Sport Participation Trends

Sport participation has generally followed the trend of decreasing physical activity overall. The Sport Participation 2010 (2013) report found that sport participation rates are declining across all age groups. As of 2016, only 26.7% of Canadians aged 15+ regularly participated in sport (Statistics Canada, 2016). Approximately 75% of children and youth participate in organized sport in Canada (ParticipACTION, 2018). This, however, indicates that there is a large attrition rate between youth and adults. Much research has been done regarding youth sport attrition (why youth stop participating in sport), although it is generally limited to Western contexts (Balish, McLaren, Rainham, & Blanchard, 2014). When analyzing attrition rates from adolescence into adulthood, many studies are limited in scope.

In terms of interventions seeking to increase lifetime physical activity, there is research that looks at the efficacy of school-based physical education courses on lifetime active

behaviours, with Green (2014) and MacNamara et al. (2011) suggesting that school-based PE is one of the key drivers of lifetime sport and physical activity participation through the development of key sport and movement competencies. There are some studies that specifically attempt to track the lifetime sport participation cycle. These studies seek to understand the antecedents of adult sport participation by understanding how people interact with sports throughout their lifespan. Some studies have shown strong support for the influence of early sport experiences on continuing sport participation (Harada, 2016; Langley & Knight, 1999), while others are more skeptical (Vanreusel et al., 1997). One interesting finding which needs to be further explored is the "cycle" of sport participation. It has been hypothesised that adult sport participation follows "cycles" of participation, with periods of engagement followed by periods of non-engagement, and that the longer said periods of non-engagement the less likely they are to continue the cycle (Engel & Nagel, 2011). This raises interesting questions on when sport participation interventions should be staged to change individuals' levels of engagement with sport.

2.9. Barriers to Sport Participation

To understand why people may not engage with sport, it is important to understand the barriers faced by many to participate in sport. Much research has been done in this area. As with much of the other research on sport participation, published studies can be segmented based on various characteristics, for example focusing on age (Berger et al., 2008; Jenkin, Eime, Westerbeek, O'Sullivan, & Van Uffelen, 2017) or focusing on specific countries (Beyleveldt, Burnett, & Hollander, 2004; Breuer, Hallmann, & Wicker, 2011; Farrell & Shields, 2002). Many of these studies identify common barriers to sport participation. The goal of this section is to

identify themes in the literature to develop constructs that will mediate the relationship between intention to engage in sport and engaging in sport. Groupings will be introduced to better incorporate the studied reality of sport engagement barriers.

2.9.1. Relative Cost

The first grouping of barriers to sport participation is related to a concept called "relative cost". The cost of engaging is a well-studied phenomenon in sport across many contexts. For example, cost has a negative impact on sport participation for youth (Holt, Kingsley, Tink, & Scherer, 2011; Somerset & Hoare, 2018), amongst people with disabilities (Newitt, Barnett, & Crowe, 2016; Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004) and amongst low-income adults (Steenhuis, Nooy, Moes, & Schuit, 2009). It is important to understand that this barrier group is relative cost. Studies have shown that those with higher incomes participate in sport more (Humphreys & Ruseski, 2015) and this barrier is thus modified based on how expensive participation is to the individual paying for the participation. For example, for a household with two parents making a combined income of $200,000, the cost of children's hockey equipment, relatively speaking, is much lower than for a single parent making $75,000. The other aspect of this grouping is that it is comprehensive. Any monetary cost is included, whether that is coaching, travel fees, equipment fees or league fees. Understanding relative cost goes a long way towards explaining why relatively low-cost sports such as soccer are much more widely participated in than specialized (and expensive) sports such as skiing, and why those more expensive sports tend to attract a different socio-economic demographic.

2.9.2. Time Barriers

As with cost, time frequently comes up in various contexts as a reason why various groups do not participate in sport. Time has been cited as a barrier amongst middle aged women (Sit, Kerr, & Wong, 2008), German sport participants (Pawlowski, Breuer, Wicker, & Poupaux, 2009), and children (Somerset & Hoare, 2018). Time is another universal barrier that affects everyone differently. Many factors fall under time, such as travel times to facilities, length of time of the activity, for children, if there is more than one child, the issue is compounded. Another factor to consider is the fact that scheduling may be an issue for those that do not work the traditional Monday-Friday, 9-5 schedule, as many events are typically either evening or weekend focused.

2.9.3. Accessibility Barriers

While accessibility issues are mostly used in the concept of disabled athletes (Jaarsma, Dijkstra, Geertzen, & Dekker, 2014), in the case of sport participation, accessibility can mean simply access to facilities (O'Reilly, Berger, Hernandez, Parent, & Séguin, 2015) or access to coaches (Coakley & White, 2016). Accessibility can mean different things to different people; a non-wheelchair friendly facility may make no difference to an able-bodied person but could prevent a disabled person from participating all together (French & Hainsworth, 2010). A facility that is not on a bus route in a city may make no difference to a wealthy participant who has access to a car but could prevent lower-income people from accessing the service, as exemplified by a quote from research conducted by Holt et al. (2011, pg. 494):

> "but given that I [cannot drive due to medical reasons] and my wife's in school so she's not really there to drive us, getting out there and back on the bus would shoot three hours.

Right? … Like here it's a good 40 minutes one way, then an hour lesson and then 40 minutes back."

The lack of access to representative coaching may not make a difference to a cisgender white male but could be a massive barrier to a person of colour or other members of minority groups (Reade, Rodgers, & Norman, 2009). The lack of female-focused programming has no effect on male participants but can prevent females from participating (Lim & Dixon, 2018).

2.9.4. Other Factors

There are other factors and contextual differences to barriers that are not covered above. For example, new residents of a country will face the other barriers described above, but may also have different conceptions of the social norms and opportunity surrounding participation in sport (Sawrikar & Muir, 2010). Some of these barriers are less apparent but no less limiting, such as the research that indicate that those who are overweight or obese find it difficult to access physical activity resources (Ball, Crawford, & Owen, 2000). One limitation of the physical activity and sport ecosystem is the lack of diverse communication and community targeting, with research suggesting that the traditionally communicated benefits of physical activity (such as individual health and well-being) may not translate to collectivist social groups (Joseph, Ainsworth, Keller, & Dodgson, 2015).

Table 2. Barriers to PA Classifications

Barrier Classification	Examples	Relevant Research
Relative Cost	League fees, equipment fees, travel costs	Somerset & Hoare, 2018; Newitt, Barnett, & Crowe, 2016; Humphreys & Ruseski, 2015
Time	Travel distances, work schedule/amount, length of activity	Sit, Kerr, & Wong, 2008; Pawlowski, Breuer, Wicker, & Poupaux, 2009
Accessibility	Availability of public transport, availability of facilities/coaches, wheelchair-friendly facilities, representation in coaching	Jaarsma, Dijkstra, Geertzen, & Dekker, 2014; O'Reilly, Berger, Hernandez, Parent, & Séguin, 2015; French & Hainsworth, 2010
Other Factors	New residents, influence of pre-existing health conditions, lack of inclusive communication of PA benefits	Sawrikar & Muir, 2010; Ball, Crawford, & Owen, 2000; Joseph, Ainsworth, Keller, & Dodgson, 2015

2.10. Understanding Sport's Role in Physical Activity

In the previous section, the relevant characteristics of sport have been discussed. The trends of sport participation, the barriers to sport participation, and the benefits of sport participation have all been discussed and supported by relevant literature. This section aims to conceptualize the place of sport in the discussion of PA interventions and sport's role in the promotion of healthy active lifestyles. In the literature, sport is often presented with physical activity when discussing the impacts or interventions of both. Recent research has suggested that there is a need to investigate in which ways sport differs from physical activity (Eime et al., 2016). However, much of the research into sport participation, in terms of the discussed trends, barriers and benefits are very similar. The central hypothesis of this chapter is that when researchers, policy makers and practitioners look to increase MVPA, that their first and most

important goal should be ramping up capacity and capability for various sports to accept and encourage more participants.

2.10.1. Sport and METs

Recall that regarding metabolic equivalent thresholds (METs), values over 3 are considered to be "Moderate to Vigorous Physical Activity" (MVPA), which is the accepted level of activity which provides health benefits, and which is used in public health guidelines. Indeed, as noted in Chapter 2, many studies which attempt to increase PA are looking to reduce sedentary behaviours. In the Ainsworth et al., (2011) compendium of physical activities, sport (section 15) contains 125 examples of sporting activities and their equivalent METs. Of the 125 sport activities, only five do not reach the 3.0 MET threshold for MVPA. They are: "Tai Chi, qi gong, sitting, light effort (1.5 METs)"; "Horse cart, driving, standing, or sitting (1.8 METs)"; "Billiards (2.5 METs)"; "Darts, wall or lawn (2.5 METs)"; and "Football or baseball, playing catch (2.5 METs) (Ainsworth et al., 2011). This means that there are over 100 sporting activities which reach or exceed the threshold for MVPA. Even in cases where the line between sport and physical activity is ambiguous, the sporting form of the activity is related to higher MET output. For example, bicycling to work at <10mph is associated with 4.0 METs, whereas bicycle racing ranges from 10-15.8 METs depending on effort level. This is crucial, given that recent research has shown that light intensity activity does not provide the same benefit as MVPA (Saint-Maurice, Troiano, Berrigan, Kraus, & Matthews, 2018). The fact that sports dominate the type of activities which achieve MVPA-level METs, and even more so the vigorous activity level METs, suggest that sport, in its many forms, is an incredibly powerful tool in getting individuals' recommended level of MVPA.

2.10.2. Sport vs PA Benefits

There are differences in the benefits provided by sport and general physical activity. As noted in the previous section, light PA does not provide the same benefits as MVPA, and so interventions such as standing desks are excluded from this comparison. The most recent Physical Activity Guidelines for Americans suggest that adults need 150-300 minutes of moderate PA and/or 75-150 minutes of vigorous PA (or a combination) per week (Piercy et al., 2018). So, in terms of pure physical benefits, sport and PA cannot be separated.

Physical benefits are not the only benefits that come from sport or PA. Included in the Physical Activity Guidelines for Americans are the benefits to PA, which include improved cognition, reduced risk of dementia, improved mental health including reduced anxiety and reduced risk of depression (Piercy et al., 2018). So, for a baseline, PA, if it is MVPA, provides mental health benefits. A key differential, however, is the form in which sport takes. A systematic review by Eime et al., (2013) found that there were key benefits associated with participation in sport that were not present in general PA. Three results stand out: sport, as compared to PA, was found to provide better mental health outcomes than activities which achieved MVPA but were not sport; participation in team sport resulted in improved mental health than other PA activities, even when controlled for level of PA, which the authors hypothesize is related to the social aspect of team sport; and finally, that competitive and recreational sport provided different benefits in the form of intrinsic versus extrinsic satisfaction. What this suggests is that interventions, whether they be from researchers, governments or practitioners in industry are overlooking these advantages when promoting or investigating "physical activity" over, or indifferently treating, sport.

2.10.3. Institutional Difference of Sport and PA

Finally, when examining sport and physical activity, the institutions supporting sport and the institutions supporting physical activity need to be compared. Physical activity, and more specifically MVPA, is a concept which is promoted primarily by health agencies and is taught in school through physical education classes. Health promotion and the school system are two formidably sized public institutions with considerable budgets. However, PA is only one small part of their considerable mandates. When looking at sport, however, the resources deployed are evident, given that many governments have ministries or agencies devoted specifically to sport, with sport organizations existing at national, regional, and local levels.

2.11. Theoretical Perspectives on Physical Activity and Sport

There is a vast literature which aims to identify the theoretical underpinnings of behaviour, and more literature still that attempts to utilize those theories to underpin interventions designed to change behaviour. A 2015 review investigating theories used in social and behavioural sciences suggested that the three most frequently used were the Transtheoretical Model of Change (TTM), the Theory of Reasoned Action/Theory of Planned Behaviour (TRA/TPB) and Social Cognitive Theory (SCT), with the next most significant being the Information-Motivation-Behavioural-Skills Model (IMB) (Davis, Campbell, Hildon, Hobbs, & Michie, 2015). While more use does not necessarily represent a better theory, it does suggest that researchers are confident in the respective theories' ability to assist with the understanding of various phenomena. The two most frequently used, the TRA/TPB and the TTM (Davis et al., 2015), will be discussed below, with focuses on their developments, uses in physical activity research and common criticisms. Beyond physical activity, the literature on sport has included

the development of some theories which seek to explain how individuals engage in sport (Rowe, 2015; Wicker et al., 2012). The two models detailed later in this section are the "Sport Capital" model and the "Sport Demand" model. These theories will be detailed below. Additionally, a comparison will be made between the theories widely applied in physical activity research and those that have been applied to sport, with the goal of identifying which models are most useful for understanding the impact of COVID-19 on behaviours.

2.11.1. Theory of Reasoned Action and Theory of Planned Behaviour

The Theory of Reasoned Action (TRA) is a theoretical model which suggests that behaviour is driven by behavioural intention, which is in turn driven by attitudes toward the behaviour and subjective norms surrounding the behaviour. Originally developed by Martin Fishbein and Icek Ajzen, the TRA has been applied to everything from consumer behaviour (Shimp & Kavas, 1984) to health behaviour (Ajzen, Albarracin, & Hornik, 2007). While the TRA is still in use today (e.g., Hagger, Polet, & Lintunen, 2018), it was extended by Ajzen in 1985 to include Perceived Behavioral Control, a measure of how well one thinks they can engage in a behaviour (Ajzen, 1985). This new model was called the Theory of Planned Behaviour. Unlike the TTM, the behaviour is the outcome in these models.

The TPB has been utilized in numerous ways within physical activity literature. Indeed, a recent meta-analysis showed that the TPB was able to strongly predict physical activity intention (44.3% of variance explained) and behaviour (19.3% of variance explained) (McEachan, Conner, Taylor, & Lawton, 2011). It has been tested at the individual level, with results showing that it had the potential to predict various physical activity behaviours (Hobbs, Dixon, Johnston, & Howie, 2013). When used in interventions directly, there are mixed results with regards to the

efficacy of TPB-informed interventions. For instance, Darker et al. (2010) tested a TPB-inspired intervention on increasing walking amongst the general population and found that while the intervention was successful, the belief that a change in beliefs is necessary to change behaviour is not supported. Similarly, Plotnikoff et al. (2010) developed an intervention based on the TPB to increase physical activity amongst those with Type 1 and Type 2 diabetes and found that the TPB variables predicted 19% and 23% of variance in observed PA respectively. Additionally, they found that at a 6-month follow-up, the TPB explained 13% and 8% of the variance in PA (Plotnikoff et al., 2010).

Despite having been tested extensively, there is still doubt as to whether the TPB is an acceptable theory for modeling behaviour. In a 2014 editorial, Sniehotta, Presseau, & Araújo-Soares argue that the TPB has outlived its usefulness for explaining changes to behaviour. They have multiple criticisms of the theory, but before fully examining them, it is useful to understand a recent trend in TPB research. Various researchers have been "extending" the TPB by adding factors that explain one of the three TPB constructs. This is evidenced clearly in the following two articles. Presseau, Sniehotta, Francis & Gebhardt (2010) extended the TPB by including the concept of an "intergoal", which is a goal held by an individual that either helps motivate a behaviour or acts against it in a form of resource constraint. Similarly, Wang & Zhang (2016) extended the TPB by adding the concepts of self-efficacy and past experiences as variables which impacted intention and behaviour. Now, in the editorial, Sniehotta and colleagues argue that these extensions mean that researchers do not believe that the TPB is effective and explaining behaviour. In fact, they are quite harsh:

> "Extended-TPB' models do a disservice to the novel ideas that such extensions test and provide unnecessary support to a model that in aggregate has been extended well-beyond

recognition. What is needed is theoretical development testing new falsifiable hypotheses to explain behavioural phenomena to better help people change their behaviour and to help those who design and deliver interventions to help people to do so." (Sniehotta et al., 2014, p. 4)

The authors also argue about the validity of the theory, pointing to various studies which refute various aspects of the TPB. One important critique they make of the TPB is that it is not empirically falsifiable. They argue that "conditions suggesting that individuals are more likely to engage in behaviours that they enjoy less, feel incapable of doing or do not intend to do seems implausible and would cast doubt on the data more than on the underlying theory" (Sniehotta, Presseau, & Araújo-Soares, 2014, p. 2). The implication of this being that it reduces the impact of TPB designed interventions, because the underlying premises cannot be questioned.

The creator of the TPB, Ajzen, responded to these assertations (Ajzen, 2015). In the response, Ajzen highlighted multiple items with which he disagreed. First, he argues that while not necessarily well represented in the popular graphical depictions of the model, the original design of the model explicitly included feedback loops from behaviour which modified attitudes toward a said behaviour. The next point that the author raises, which is useful for this review, is the fact that when various extensions to the model are made, they often interact with the core constructs of the theory and enhance the predictive ability of the model. The author argues that this is a feature of the fact that many studies only include a few factors for each core construct, which, they argue, is not enough to measure such complex items. By "extending" the theory, they are effectively testing the model in greater detail, not "doing it a disservice". In what is perhaps the most relevant point for this review is the author's discussion of the use of the TPB in interventions. The author first states that while the TPB is not a theory of behavioural change, it

is useful for understanding the issues regarding behaviour and subsequently modifying those issues. Ajzen further argues that many studies that conduct interventions based on the TPB do not do the necessary work of understanding what the issue is regarding the behaviour before designing the intervention. For example, if one is trying to promote registration in a recreational ice hockey league, a researcher must understand whether it is social norms, attitudes or perceived behavioural control that is dampening registration before designing the intervention.

Events occurring between assessment of intentions and observation of behaviour can produce changes in intentions and unanticipated obstacles can prevent people from carrying out their intentions (Ajzen, 2011). What is more, the beliefs that are accessible in the real situation in which a behaviour is performed can differ from the beliefs that are accessible in the hypothetical situation in which the TPB constructs are typically assessed (Ajzen, 2012; Ajzen & Sexton, 1999). This could account for failure to act on previously expressed intentions if, for example, favourable beliefs about exercising after work are readily accessible in the morning, but unfavourable beliefs are accessible after a long day's work (Ajzen, 2015). The TPB has been used in sport participation previously, for example by Quinton, (2020), where the TPB was used to predict the sport participation of first-year university students. In Quinton (2020) the TPB was found to predict 42% of sport participation. Alexandris & Stodolska (2004) investigated the TPB in the context of residents of a Greek city (Thessaloniki) and found that the TPB could predict 54% of the variation in intention to participate in sport, although the intention/behaviour gap was not explored in the study.

2.11.2. The Transtheoretical Model

The Transtheoretical Model of Change (sometimes known as the Transtheoretical Model of Behaviour Change) is a model which describes the engagement of an individual with a given behaviour. Originally developed in a therapeutic health context (Prochaska & Di Clemente, 1982), the Transtheoretical Model of Change (TTM) has since been adapted to a variety of applications. The TTM describes behavioural change as having distinct "stages" which a person moves through during engagements (Prochaska & Di Clemente, 1982). These stages are pre-contemplation, contemplation, preparation, action, and maintenance. As individuals become more engaged, they move up the scale ultimately towards maintenance. This process is not strictly linear (meaning that individuals can travel both towards the maintenance stage and away from it), as it has been shown that individuals can regress to previous stages if they do not make it to the maintenance stage, and then can continue either moving up or moving down the scale (Marshall & Biddle, 2001) (see Figure 1 for a graphical representation of the TTM).

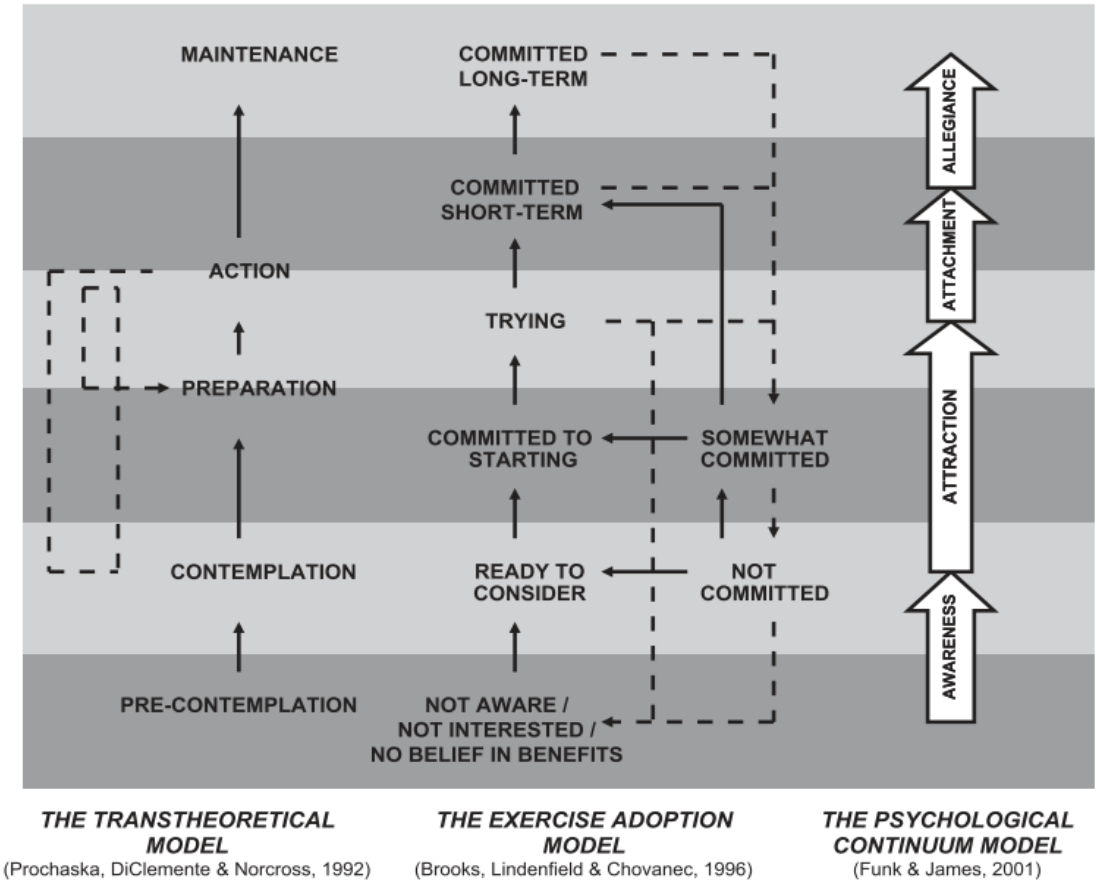

Figure 1. TTM and Adjacent Theories (Weed et al., 2015)

Having been developed in a therapeutic health context, the TTM is also consistently used in the physical activity and sport domain. In a meta-analysis, Marshall & Biddle (2001) found 71 articles using the TTM in a physical activity context. They found that while there was support for different groups having different levels of physical activity, there were key issues with the theory in this context. The authors found that there was insufficient data to support the conclusion that behaviour change occurred in quantitatively different ways along or across a spectrum; there was a need for standardized measurement; and that the processes of change were not supported in the physical activity context (Marshall & Biddle, 2001). More recent reviews of the TTM in relation to physical activity interventions have concluded that there is insufficient standardization in the

definition and classification of what factors define each "stage" to support the theory's effectiveness with regards to physical activity (Hutchison, Breckon, & Johnston, 2009). One key differentiator of the TTM from other theories applied to behaviour is that it describes behaviour as a process of engagement, whereas other theories see the behaviour as an outcome (Hutchinson et al., 2009).

2.11.3. Sporting Capital

Both the TRA/TPB and the TTM attempt to explain why and how a behaviour is occurring. One thing that both theories suffer from is a lack of defined temporal limits around each construct. For example, in the TPB it is not explained how changes to one factor in the model will affect the behavioural outcome in the short or long term. Indeed, Ajzen himself suggests that:

> "It stands to reason that, as time passes, an increasing number of intervening events can change people's behavioural, normative or control beliefs, modify attitudes, subjective norms, or perceptions of control, thus generating revised intentions. Changes of this kind will tend to reduce the predictive validity of intentions that were assessed before the changes took place." Ajzen, 2011, pg. 1115)

While the TPB and the TTM are incredibly valuable models in predicting intention, there remains an issue with the intention-behaviour gap. A meta-analysis conducted by Rhodes & Dickau (2012) suggested that the relationship between behaviour and intention within theoretical frameworks such as the TPB and TTM was potentially so weak as to be of little "meaningful/practical value" (Rhodes & Dickau, 2012, pg. 724). When looking at the

relationship between changes in intention and changes in behaviour, Rhodes & Dickau (2012) state:

> "…meaningful changes in intention appear to result in trivial changes in behavior which challenges the utility of the intention–behavior connection postulated by several of the theoretical frameworks used in contemporary exercise psychology." (Rhodes & Dickau, 2012, pg. 726)

This is where the theory of "Sport Capital", developed by Rowe (2015), becomes applicable to the current study. The theory of sporting capital posits that every individual has a level of "capital" associated with their proclivity to participate in sport. "Sporting Capital" is roughly analogous to the concept of human capital (see Rowe (2015) for a more in-depth discussion of the relationship between sporting capital and human capital). Importantly, the difference between the theory of sporting capital and the behaviour theories above is that sporting capital does not explain an individual's behaviour through intention; instead, it seeks to explain the probability that an individual will engage in the behaviour *at some point*. Rowe (2015) states that:

> "Although sporting capital can appreciate and depreciate, it is, by its nature, more durable than participation, which is characterized by high levels of flux. The theory proposes that people with high levels of sporting capital are more resilient to the potential negative impact on participation of external barriers associated with changes in life circumstances and, should they drop out, are more likely to return to sport than their peers with low levels of sporting capital." (Rowe, 2015, pg. 46)

A useful way to view an individual's "sporting capital" is to think of the impact of an exogenous shock, such as a job loss which impacts the ability to afford to participate in sport. An

individual with significant "sporting capital" would be expected to return to participation as soon as the impact of the exogenous event wears off. However, the individual with lower sport capital is less likely to return. So, while participation is variable, the likelihood of returning to sport does not change.

The theory of sporting capital (TSC) suggests that there are three distinct factors which make up sporting capital, namely the physiological domain (consisting of physical health and physical competency/literacy), the psychological domain (consisting of self-confidence, self-efficacy, and identity), and the social domain (consisting of social connectedness, family/friends' involvement in sport). Table 3 breaks down the relevant domains and factors.

Table 3. Domains and Factors of the Theory of Sport Capital

Domain	**Relevant Factors**
Physiological	Perceived Physical Literacy Perceived Physical Health
Psychological	Physical Self-Worth/Self-Esteem Perceived Competence Self Efficacy Personal Identity
Social	Family Member Participation in Sport Friend Participation in Sport Social Norms

These domains and factors combine to give an individual their overall level of sport capital. Based on their scores across the relevant factors, an individual could be classified as having low, medium, or high sporting capital. The higher their capital, the more likely they are to engage in sport. Figure 2 visualizes the Theory of Sporting Capital as developed by Rowe (2015).

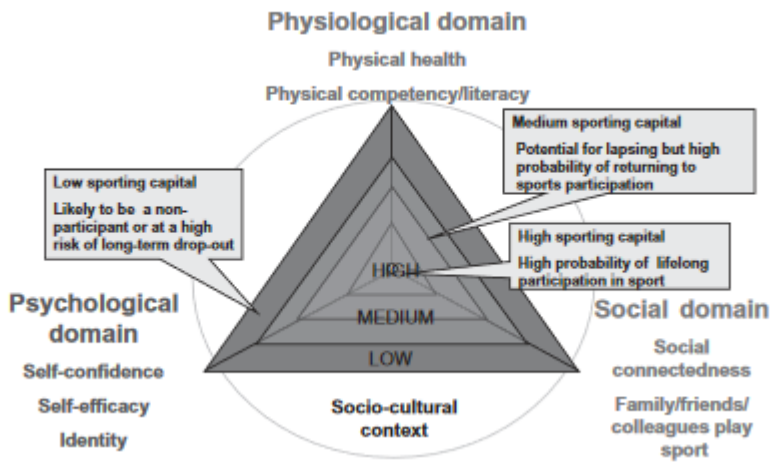

Figure 2. Theory of Sporting Capital (Rowe, 2015).

To inform a discussion of the impact of COVID-19 on sport and physical activity of sport participants, Rowe (2015) suggests that those with high sport capital will be more resilient towards the effects "negative barriers" when it comes to their sport participation. This theoretical model was both developed and tested by Rowe (2015). When testing the model, everyone who had responded to the "Active People Survey" (a survey commissioned by Sport England) was given an index score from 1-10 with one being the lowest level of capital and ten being the highest level of capital. It was found that the point at which an individual was more likely to participate currently or in the future in sport was between levels 7 and 8, with an individual at level 7 having a 49.7% chance of participating in sport (see Figure 3).

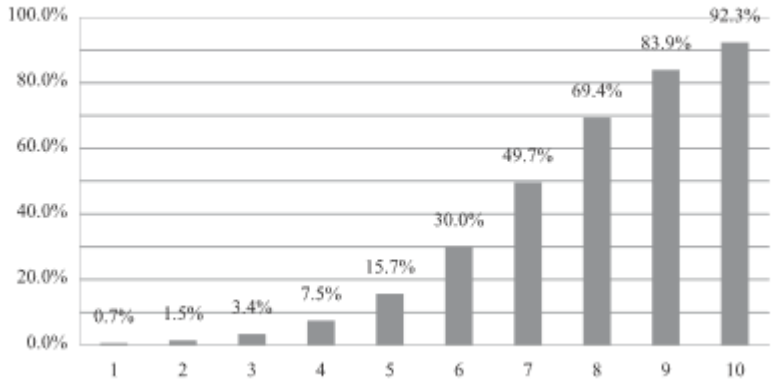

Figure 3. Probability of an individual participating in sport (Rowe, 2015)

Rowe (2015) also determined the distribution of sport capital amongst survey respondents. Of note, the majority of respondents sat at or below a six on the sporting capital, suggesting that the majority of the population is more likely to not be participating in sport than to be participating in sport, as it is at levels 7 and above that a person becomes more likely to be participating than not participating in sport. This is consistent with the trends in sport participation examined in section 2.8.

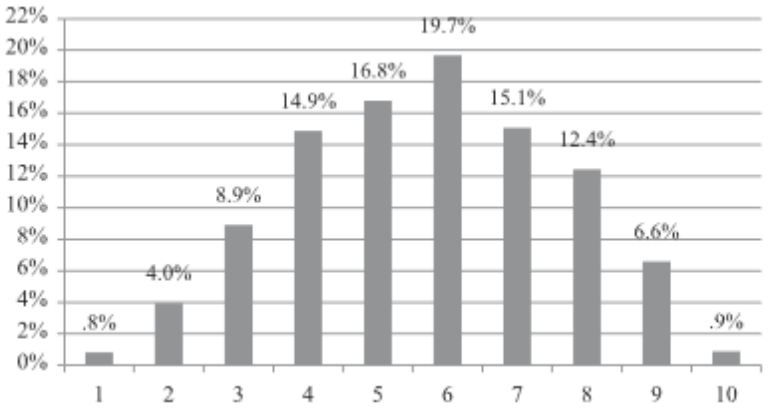

Figure 4. Distribution of Sporting Capital Index Scores (Rowe, 2015)

An interesting aspect of the sporting capital model is that it explicitly references the impact of external factors on sport participation:

> "However, for any individual, the decision to participate will be mediated by the available opportunities and the barriers and constraints that impact on those opportunities, whether personal, e.g., in the family; social, e.g., in the community; environmental, e.g., in terms of suitable places to play; or economic, e.g., in terms of affordability. The theory proposes that everything else being equal, in terms of the opportunities available and the constraints and barriers faced, two people with identical levels of sporting capital will have the same probability of participating. However, differences in personal and local circumstances can change that relative probability." (Rowe, 2015, pg. 47)

This is where the sport capital model differentiates itself. By allowing for the existence of barriers, the model can be used to understand the realities of individuals in different circumstances. As discussed in section 2.9, there is significant research into the barriers that prevent people from participating in sport. The TSC allows for an understanding of the likelihood that a person will participate in sport at some point but acknowledges that external factors (such as barriers) will influence whether a person is participating at any given time. Therefore, to understand the impact of the COVID-19 pandemic on sport participation, the changes to and impacts on the established barriers should be examined as well. Given that barriers are external to the TSC, to understand barriers another model must also be used to factor in the influences of the COVID-19 pandemic on sport participation.

2.11.4 Micro-and-Macro Level Determinants of Sport Participation

Various authors have looked at the phenomena of sport participation through an economic lens. Wicker et al. (2012) investigated the micro and macro level determinants of sport participation, which includes a summary of the barriers presented in section 2.9. In their model development, they specified micro level determinants (which can be roughly described as attributes of the individual) and macro level determinants (which can be roughly described as the attributes of their surroundings).

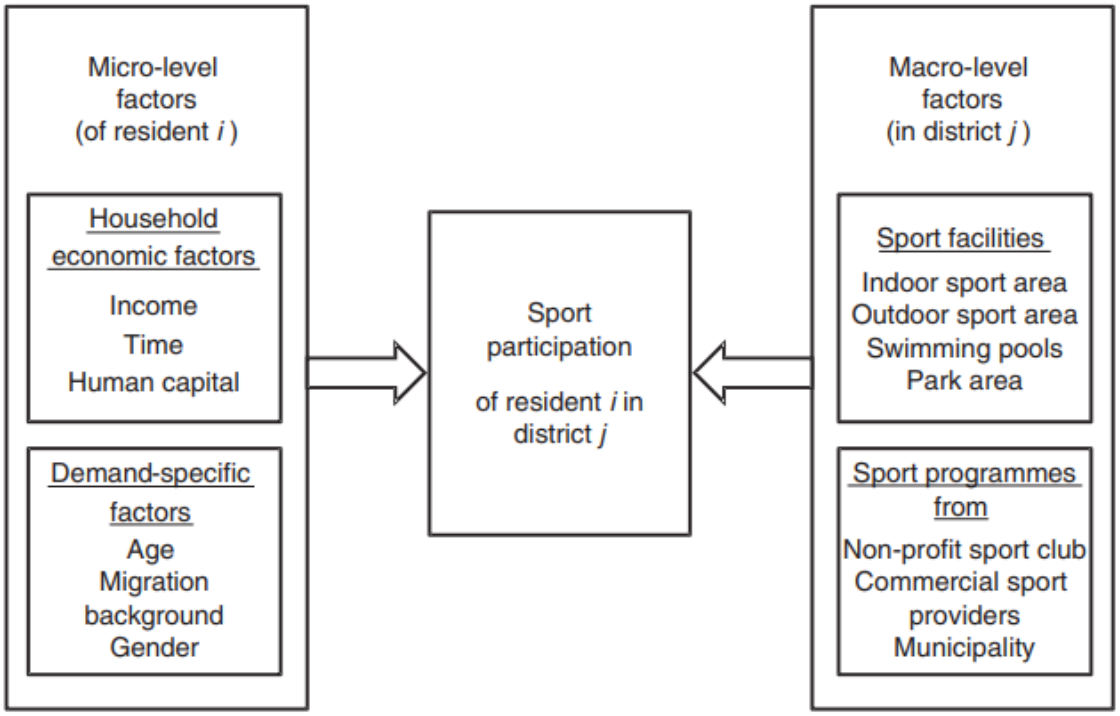

Figure 5. Micro and Macro Level Determinants of Sport Participation (Wicker et al., 2012)

In their research, Wicker et al. provide strong evidence of the influence of macro level factors on sport participation. A division used in their research provides interesting implications for the Canadian sport ecosystem. They found that their mix of micro and macro level factors

were more strongly predictive of sport participation in non-profit clubs than in all forms of sport. Given that much of Canadian participatory sport is administered by non-profit clubs (in line with their respective Provincial and National sporting organizations), it can be inferenced that this model provides a good fit in estimating the demand of sport in Canada. In fact, in Wicker et al. (2012), results of their survey of the population of Munich show that 19.5% participate in a sport in a non-profit club context. The most recent data available from Statistics Canada suggest that, as of 2005, 18% of Canadians participate in sport in the non-profit club context (Ifedi, 2005).

Of note in the Wicker et al. (2012) model is the fact that they include, within their micro-level factors, the idea of human capital. In their paper, human capital is defined in relation to educational attainment: "In addition to income and time, the economic situation is determined by a third factor, human capital. Usually, people with a higher educational level are more likely to practise sport as they know about the positive effects of sport participation." (Wicker et al., 2012, pg. 54). While it may be the case, this limited view of human capital makes a relatively simplistic argument. It may also be argued that the same would be true of knowledge surrounding physical activity; it may also be argued that an individual with an undergraduate degree in accounting would not necessarily have more knowledge about the benefits of sport than an electrician with a keen interest in beach volleyball.

2.12. Sport Participation Demand and COVID-19

Clearly, the COVID-19 pandemic has had drastic impacts on all aspects of life. Early on in the pandemic, severe restrictions (such as lockdowns, bans on gatherings, closure of facilities) were put in place to help curb the spread of the virus. These restrictions resulted in the closure of sporting facilities and many sporting programs, especially at the recreational level. Initial

research suggests that there have been significant effects because of the pandemic on individual's sport participation. While the research on this topic is in its infancy, several initial observations have been made. A study of adults in Tyrol, Austria, found that participation in sport increased amongst those who were not regular participants in sport increased their participation in sport after a significant lockdown (Schnitzer et al., 2020). This finding fits within what can be expected within the Sport Participation Demand Framework in that those with already high sport capital (those regular participants pre-restrictions) were not likely to change their participation despite a reduction of barriers; for those with relatively low sport capital, a reduction in barriers (or more accurately an increase in leisure time available due to circumstances such as working from home). Researchers in Germany found that approximately a third of the population reduced their leisure time sport and exercise (LTSE), while a third maintained or increased their LTSE (Mutz & Gerke, 2021). The researchers suggest that there was a distinction between the two groups, which provides potential support for the impact of sport capital. Research has also looked at the impact of the pandemic on youth sport. Elliot et al. (2021) investigated the impact of the pandemic on youth sports in Australia, finding that there would be additional challenges in returning to "normal"; this is of particular importance within the concept of sport capital as it is built through experiences in sport, and if the pandemic impacts these early developments of sport capital, there will be ripple effects throughout a person's life. Researchers also worry about the potential of a "lost generation" (Drummond, Elliott, Drummond, & Prichard, 2020).

2.13. Hypothesis Development

Given that the rollout of the vaccine is currently underway, there is optimism that the effects of the pandemic will recede, and the question will be how life returns (or does not return) to normal. There remain many questions about how the recovery will or will not include various groups of individuals, and how it will affect organizations. The effect of the pandemic on sport is top of mind for sport sociology; an article by Evans et al. (2020) presents questions that they suggest sport researchers should focus on during the recovery to the pandemic:

1. What role will sport, exercise and physical activity play in the future?
2. Will the organizational structure of sport change in response to the pandemic?
3. Will the inequalities highlighted by the pandemic begin to be addressed?

As discussed above, research has already begun into these topics. Recently published research by Teare & Taks (2021) investigates how the pandemic has changed youth sport preferences and trends in Canada. They suggest that there is a potential that participation in sport will move towards less organized forms of sport; they suggest that there will be an increased focus on the health benefits (both mental and physical) of sport participation; and that there will be a shift in the value placed on certain aspects of participation. They also suggest that innovation within sport organizations will be key to improving outcomes after the pandemic has concluded. Research from Choi & Bum (2020) suggests that an increased fear of sickness (which is moderated by age, as age played a significant factor in negative outcomes related to COVID-19) will play a significant role in individual's decision on whether or not to return to sport.

Much of the expected effects of the pandemic can be reconciled with the Theory of Sport Capital (TSC) and the Micro/Macro level determinants of sport participation. Many of the recent studies above have investigated how the pandemic will influence the various aspects of either the

TSC or Micro/Macro level determinants of sport participation, although without explicitly using either of the frameworks. Additionally, much of the previous research on the COVID-19 pandemic has focused on youth sport, and while crucial, ignores adult sport participation. This research seeks to take a more holistic view of sport participation by looking at sport participants and sport organizations representing a diverse demographic set. This research will also focus on points two and three from Evans et al. (2020). Thus, using both the TSC and the Micro/Macro level determinants of sport participation, we arrive at the following research questions to be addressed in this thesis:

RQ1: How has the COVID-19 pandemic affected individuals' sport capital?

RQ2: How has the COVID-19 pandemic affected micro-level factors related to sport participation?

RQ3: How has the COVID-19 pandemic affected macro-level factors related to sport participation?

There is also the question of how sport participation and physical activity were affected during the pandemic, and relatedly, how sport participants were affected as compared to non-sport participants during the pandemic, which to date has not been investigated in the Canadian context. This leads to an additional research question of interest:

RQ4a: How has the actual rate of sport participation changed as a result of the pandemic?

RQ4b: How do sport participants differ from non-sport participants in relation to the effects of the pandemic on their physical activity?

Finally, in line with the Evans et al. (2020) recommendations for sport research emerging from the pandemic, we are interested in how sport organizations are responding to the changes brought about by the pandemic. Given that sport organizations are a factor in the Macro level determinants of sport participation (Wicker et al., 2012), this paper will specifically look at the capacity of sport organizations in relation to provide programming to participants. To accomplish this, the multi-dimensional framework of capacity in community sport organizations (Doherty, Misener, & Cuskelly, 2014) will be utilized to understand how the COVID-19 pandemic may have impacted sport organizations. The five capacity dimensions of sport organizations in Doherty et al. (2014) are detailed in Figure 6.

Capacity dimension	Critical elements
Human resources	Enthusiasm
	Human capital
	Common focus
	Sufficient volunteers
	Volunteer continuity
	Volunteer succession
	Development and support
Finance	Stable revenues
	Stable expenses
	Alternate sources of revenue
	Fiscal responsibility
Infrastructure	Formalization
	Communication
	Facilities
Planning and development	Strategic planning
	Creative planning
	Plan implementation
External relationships	Personal connection
	Engagement with partners
	Balanced relationships
	Dependable relationships
	Bureaucratic partners

Figure 6. Dimensions of Community Sport Organization Capacity

In Teare & Taks (2021), one of the potential themes in the recovery from the pandemic is the willingness and implementation of innovation in sport organizations. With regards to sport organizations, the Doherty et al. (2014) and Teare & Taks (2021) research leads to two additional research questions:

RQ5a: How has the COVID-19 pandemic impacted the capacity of community sport organizations?

RQ5b: How do community sport organizations see the role of innovation in the recovery of from the COVID-19 pandemic?

2.13. Developing a Research Framework

Two theoretical frameworks for looking at sport participation emerge from the literature review. The micro and macro level determinants of sport participation brought forth by Wicker et al. (2012) takes a much broader approach to sport participation, while the sporting capital model (Rowe, 2015) focuses more on an individual's internal sporting resources. However, despite taking different approaches in their look at sport participation, both Rowe (2015) and Wicker et al. (2012) have left room for the other's theoretical bases. In Rowe (2015), there is specific acknowledgement that external factors will play a significant role as to whether an individual will participate in sport across the various levels of sporting capital. In the Wicker et al. (2012) framework, there is a specific factor in the micro level determinants of sport participation relating to "human capital". While human capital is defined in terms of educational attainment in Wicker et al. (2012), it is reasonable to assume that, in relation to sport

participation, it is possible to substitute in Rowe's theoretical framework of sporting capital into Wicker et al.'s micro and macro level determinants of sport.

To build this research framework, let us explicitly look at how the impact of the pandemic can be mapped onto the TSC and Micro/Macro level determinants of sport participation. Beginning with the TSC, there are three domains which make up sporting capital, the psychological domain, the social domain, and the physiological domain. A recent review on the mental health impacts conducted by Vindegaard & Benros (2020) found that the public had an overall decrease in psychological wellbeing as a result of the pandemic. Research has also suggested that due to the restrictions associated with the pandemic, individuals feel they have both lost out on social connections and are also worried about feeling comfortable in social situations in the future (Williams, Armitage, Tampe, & Dienes, 2020). Considering that Rowe (2015) suggests that having a network of friends and family who participate in sport, and that pandemic restrictions on gatherings and social distancing have resulted in the closures of sport programs, it is expected that the pandemic may have significant effects on sport capital. This is represented by Figure 7 below.

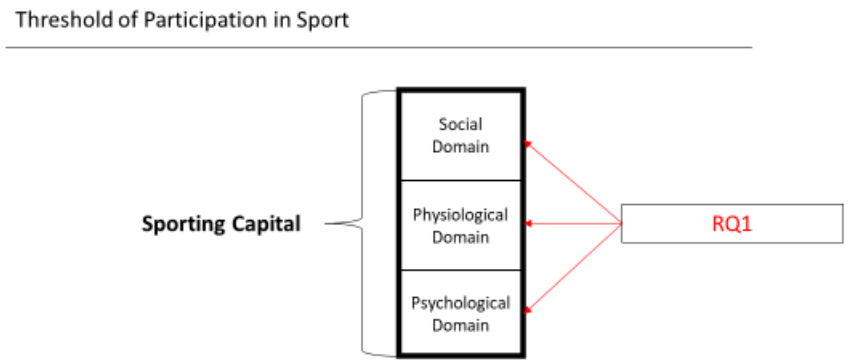

Figure 7. RQ1

In Figure 7, participation in sport is represented as a threshold; if an individual crosses the threshold, then they are participating in sport. Rowe (2015) found that even at the highest levels of sport capital, an individual had a 92.3% chance of participating in sport (see Figure 3). It then stands to reason that sport capital alone is not enough to have a person participate in sport. However, the level of sporting capital can be graphically represented by the size of the bar containing sport capital. See Figure 8 below.

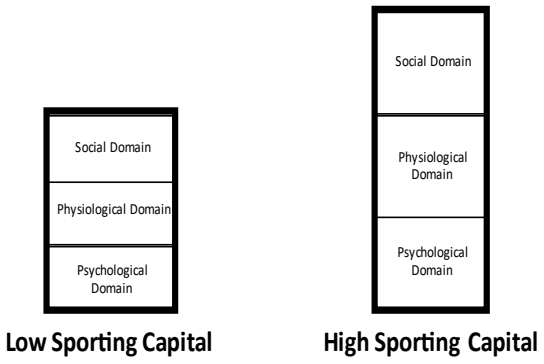

Figure 8. Relative Levels of Sport Capital

As depicted in Figure 8, sport capital alone is not enough for an individual to reach the threshold of participation. This is where the Micro/Macro level determinants of sport participation get included into the framework. In the Wicker et al., (2012) model, the micro-level determinants of sport participation include both household economic factors and demand-specific factors. The demand specific factors (age, migration background, gender) are unlikely to have changed because of the COVID-19 pandemic, however the household economic factors (income and time) have already been shown to have changed. For instance, Almeida et al. (2021) found that household income in the EU fell an average of 4.3% due to the pandemic. In terms of time, research has suggested that measures associated with the pandemic (such as work-from-home policies) increased the leisure time available to individuals. In investigating whether these trends have (or will have) any affect on sport participation, the micro-level determinants of sport

are included in the research framework. RQ 2 is related to the micro-level determinants of sport participation and is shown in the framework in Figure 9 below.

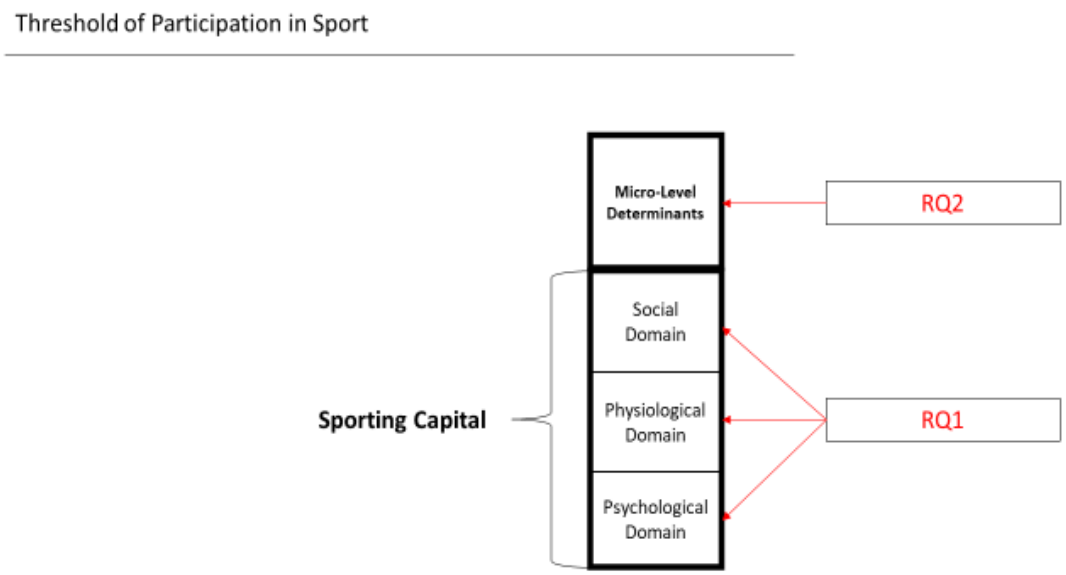

Figure 9. Sport Capital and Micro-Level Determinants of Sport Participation

In a similar fashion to sport capital, micro-level determinants can be represented the same way in that an increase in the determinants (time and income) increase the likelihood of participation. Both Wicker et al. (2012) and Humphreys & Ruseski (2011) investigated the impacts of both leisure time and income and found that leisure time was significantly related to sport participation while the evidence of income increasing participation was mixed. For the purposes of this framework, an increase in leisure time and an increase in income should result in a larger bar representing micro-level determinants, moving the individual towards the sport participation threshold.

The next aspect of the framework is the macro-level sport participation determinants established by Wicker et al. (2012). These consist of sport facilities and sport programmes. Research questions three and five look at the macro-level determinants of sport participation. Wicker et al. (2012) and O'Reilly et al. (2015) have investigated the role of facilities and sport organizations on sport participation and found that proximity to and availability of facilities, and provision of programs from sport organizations are significantly related to sport participation. Again, considering that many of the pandemic restrictions (indoor gathering restrictions and social distancing measures) have meant that sport organizations are not able to run programming and sport facilities are not accessible, there is the potential that there has been an impact on these macro-level factors. The macro-level factors are visually represented in the framework in Figure 10. The macro-level determinants again have the dimension of size, with a relatively larger bar indicating more access of the participant to facilities and programming.

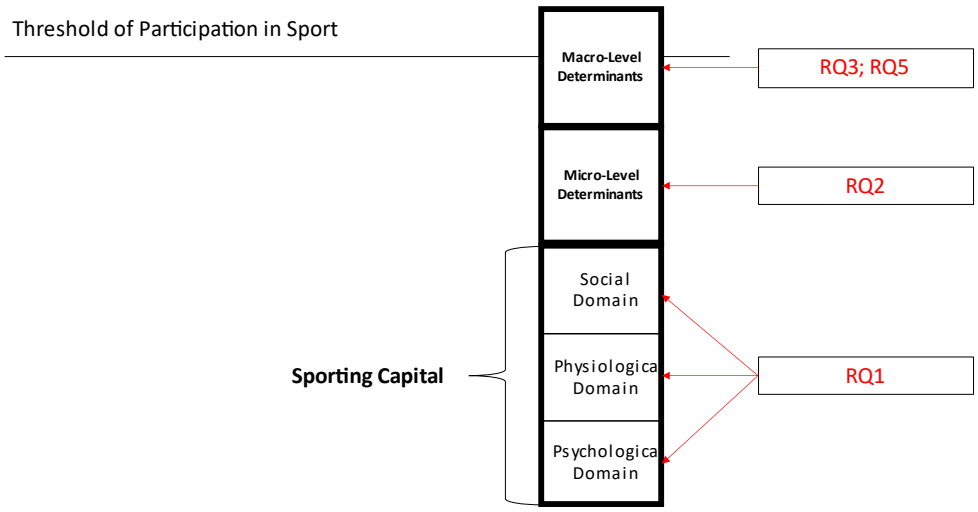

Figure 10. Sport Capital, Micro and Macro Level Determinants of Sport

The final aspect of the framework to be discussed is the sport participation threshold and how it relates to sport capital and the determinants of sport participation. The idea of the threshold is that an individual must reach that level to participate in sport; the way that an individual arrives at the threshold will be a unique combination of sport capital, micro-level determinants and macro-level determinants. For example, let us consider two hypothetical individuals. Individual A was a recreational sport participant as a youth, had friends who participate in sport, but did not come from a "sporty" family. Individual B was a competitive athlete as a child, has multiple friends who play sport, and a family which is very active. Their relative sport capital is displayed in Figure 11 below.

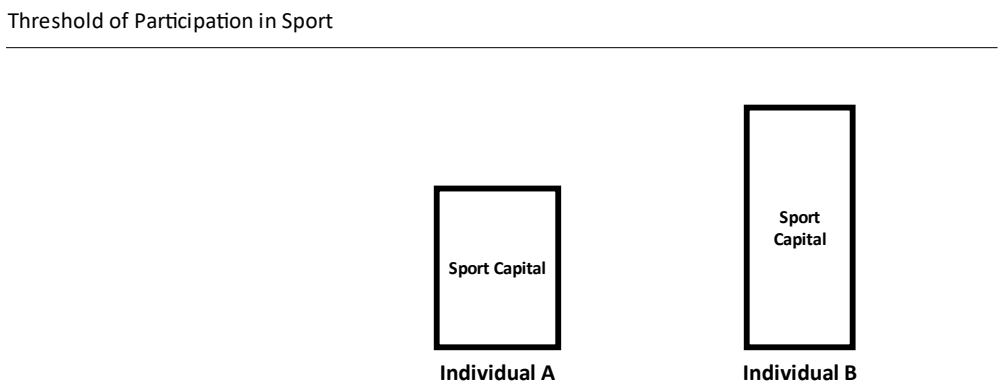

Figure 11. Sport Capital Comparison

In terms of the micro-level determinants, individual A is a senior lecturer at the local university and makes a significant salary while retaining a significant amount of leisure time. In contrast, individual B works at a sport non-profit and works significant hours without much

renumeration. Thus, we arrive at this stage (see Figure 12) when considering micro-level determinants of sport participation:

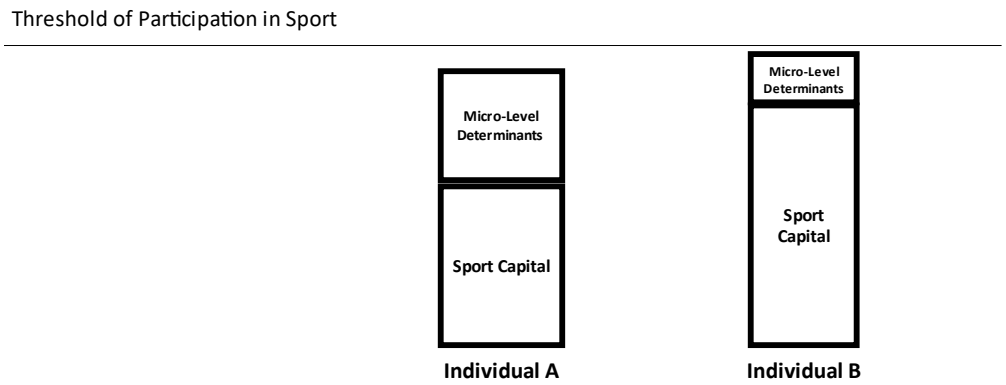

Figure 12. Comparison of Sport Capital and Micro-Level Determinants

As shown in Figure 12, despite having micro-level determinants suggesting increased sport participation as compared to individual B, the sport capital amassed by individual B means they are more likely to be participating in sport at this point. Next, let us consider macro-level factors. If both individuals live in a city where access to facilities is common and there are multiple sport organizations, then we result in the following (see Figure 13):

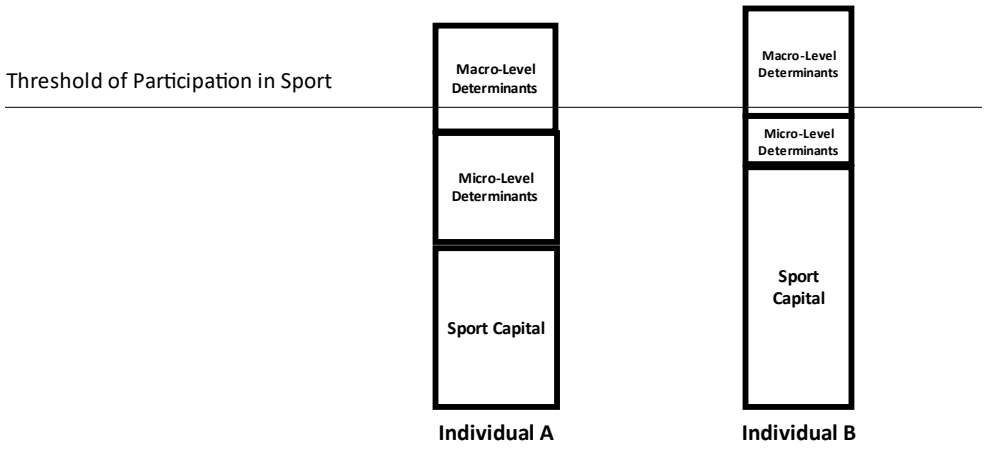

Figure 13. Comparison of Sport Capital, Micro and Macro Level Determinants

We can now consider how this framework predicts how individuals will respond to various situations that have the potential to affect their participation in sport. Say, for example, individual A's university goes through an insolvency process and their position is terminated, resulting in lost income. Meanwhile, individual B makes the decision to move from the city to a more rural area because they can now work from home. Based on the framework, we would expect that individual A has a higher likelihood of dropping out of participation while individual B has enough sport capital to maintain a high probability of participation despite a lower level of support from macro-level determinants.

The final research question to be plotted on the framework is RQ4. As the impacts of the pandemic were not felt equally across Canada (public health is primarily the role of provincial governments in Canada, which resulted in different policies and restrictions) there remains questions around how participation in sport in Canada has actually changed as a result of the

pandemic. Moore et al. (2020) found that in Canadian youth physical activity had declined and sedentary behaviours had increased because of the pandemic. However, researchers have yet to look at whether those who participate in sport are different from those that do not participate when it comes to the impact of the pandemic on their physical activity. Therefore, this research seeks to identify both the impacts on sport participation and whether sport participants' physical activity was impacted differently that those who do not participate in sport. This research question is depicted graphically in Figure 14.

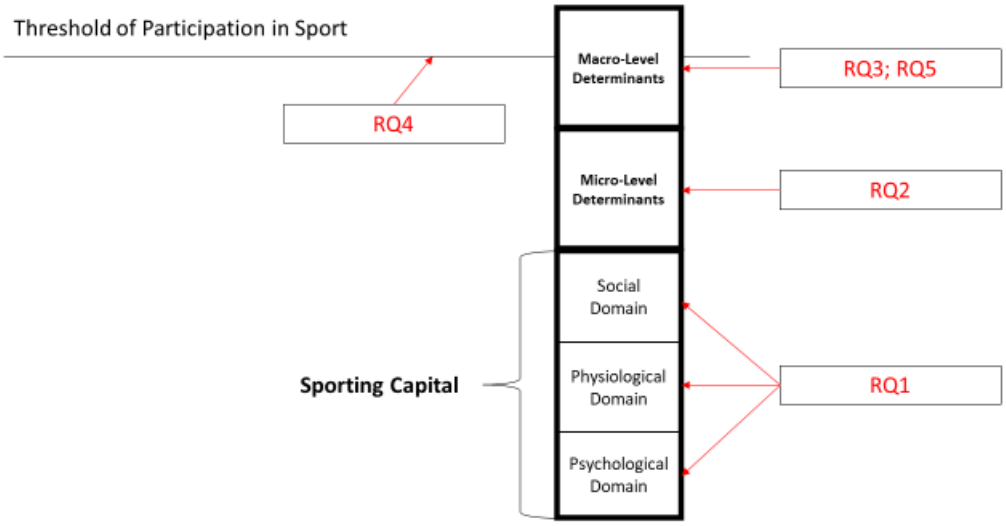

Figure 14. Research Framework

This proposed framework depicted in Figure 14 amalgamates both the sport capital theory and the micro and macro determinants of sport participation and plots the five research questions in relation to the proposed framework. Each element (Sport Capital, Micro-Level Factors, and Macro-Level Factors) builds on or adds to each other to get an individual to the sport participation threshold. In the theory of sport capital, an individual's capital is less changeable

than their current sport participation. The inclusion of the micro and macro level determinants allows for an examination of how an individual may react to a given situation. This framework gives clearer instruction to practitioners when it comes to addressing a lack of sport participation than either framework on its own. Sport capital is relatively less changeable and accrues because of a given individual's life experience. The micro and macro level factors range in their relative level of flux, but also exist on a spectrum from more fixed (gender) to more flexible (income). This framework is built in a way as to allow researchers to make predictions of the effects of the pandemic by considering which processes are most important for individual sport participation.

Chapter 3. Methodology

3.1. Study Population

The goal of this research was to develop a broad understanding of the sport participation ecosystem in a post-pandemic world. A mixed-methods approach was used to study the research questions. Mixed-method research is defined as:

> "… an approach to research in which the investigator collects, analyzes, and interprets both quantitative and qualitative data (closed- and open-ended information), integrates or combines the two approaches in various ways, and frames the study within a specific type of design or procedure. Sometimes the researcher makes specific their philosophical assumptions, and often, they include a theory that guides the quantitative or qualitative strand of their research or both. Also, both strands need to be conducted using rigorous methods of data collection and analysis." (Creswell, 2015, pg. 4)

This research is similar to research conducted by Bogolyubov (2019) which incorporates quantitative analysis of a so-called "big data" set and qualitative semi-structured interviews to explore a phenomenon (in the case of Bogolyubov (2019), this was national identity and social media). Mixed methods research is commonly used to contextualize the depth and richness of data generated by qualitative methods with the generalizability of large data sets (McBride, MacMillan, George, & Steiner, 2019).

To look at the individual aspects of sport participation, two data sets were used. The first was data collected via a mobile phone-based app published by ParticipACTION, a national physical activity promotion organization, which allows users to track their physical activity. ParticipACTION has a research group that authorizes the use of data from the App for analysis

pending review from an advisory board. The authorization letter is Appendix 4. This data set contained the data for approximately 6,000 users. This sample size is quite large when considering the samples of related studies (e.g., Lesser & Nienhuis (2020); Teare & Taks (2020); Spence et al. (2021); Moore et al. (2020)). The discussions on the suitability of the sample regarding whether the sample is representative of Canadians will be discussed in the results. Additionally, a survey was conducted electronically by ParticipACTION which included questions related to sport participation (specifically looking at micro-level effects) (n = 4,104). Again, this sample size is well above previous studies investigating the impact of COVID-19. The App data was used to address RQ4 while the survey data was used to assess RQ1, RQ2, and RQ3.

To identify the impacts on sport organizations (the macro-level), two sets of interviews were conducted. In the first, a leading executive from a physical activity promotion organization were interviewed to ascertain the impact that innovation and new technology will have moving forward as organizations recover from the COVID-19 pandemic. The following set of interviews (n =8) were undertaken with representatives from sport organizations across Canada who had applied for pandemic relief funding from a Canadian charitable organization. The organizations interviewed represented a broad cross section of the sport organizations across the Canadian sport participation ecosystem. These interviews were used to address RQ5.

3.2. Data Collection

3.2.1. App Data

The App data was collected from the App provider. The App data consisted of a full set of data collected from a sequence of weeks (just over 100 weeks of data). Due to the magnitude of

cleaning needed to be done to analyze the data, a decision was made to reduce the dataset to two 13-week periods corresponding to March, April, and May of 2019 and March, April, and May of 2020 to investigate the effects of the lockdowns imposed in that period of 2020. The App collects data from the users, either automatically or via self-reporting. Self-reporting is known to differ significantly from objective measures (Liu et al., 2016; Prince et al., 2008;), although arguments have been made that by combining objective and self-reported measures there is the opportunity to provide a more holistic picture of physical activity (Howitt et al., 2016). However, because the activity could not be validated, all analysis conducted used either the device-based measurements or the self-reported data, they were never mixed.

When cleaning the data, all users with greater than 960 minutes per week of MVPA were removed from the sample, consistent with other physical activity measurement tools such as the International Physical Activity Questionnaire (IPAQ Research Committee, 2015).

Finally, in terms of cleaning the data, there were only two types of users who were retained in the final data set. There were full-data users, who used the App consistently (had valid, non-zero physical activity data) across all thirteen weeks of both the Year 1 (2019) and Year 2 (2020) data sets. The other set of users that was included in the final data set were "dropouts", who were active (had valid, non-zero physical activity data) in at least two weeks who were then subsequently inactive for four consecutive weeks within the 13 week period (either Year 1 or Year 2).

3.2.2. ParticipACTION Survey

The ParticipACTION survey was administered by the organization through their mailing list and conducted electronically through the ParticipACTION App. The survey was primarily focused on assessing the outcomes related to a program that the organization had been running,

however, researchers were given an opportunity to include other questions related to physical activity. The data was collected through online survey by ParticipACTION in the Autumn of 2020, and anonymized results were shared with researchers.

3.2.3. Expert Interview

To answer the research questions related to innovation in sport and physical activity organizations, an in-depth, semi-structured interview was conducted with an expert in the field. Expert interviews are frequently used when researchers are seeking answers from industry practitioners (Dorussen, Lenz, & Blavoukos, 2005). One of the key considerations for research involving expert interviews is whether the information from the experts is reliable (Dorussen et al., 2005). This expert has extensive experience in the field and has been at the forefront of their organization for many years, so reliability is quite likely.

3.2.4.Sport Organization Interviews

Semi-structured interviews were conducted with representatives of 8 sport organizations which had received funding to assist their operation during the pandemic. These interviews were conducted over a period of two weeks. All interviews were conducted virtually and were transcribed for further analysis. These interviews were conducted in late June of 2021. Sport organizations were recruited through a form of snowball sampling, with the charity responsible for the funding asking those who had applied to the program whether they were willing to participate in a research interview. To maintain confidentiality, the funding organization was not told whether any of the organizations did or did not participate in the research, and no identifiable data was shared with the funding organization. Following Guest et al. (2020)'s

simplified method of analysing saturation, by setting a base number of interviews followed by a run length in which the search for new codes is conducted, aiming for a saturation ration of less than 5% was adopted (see results for an in-depth description of the process followed).

3.3. Measurement Scales

3.3.1. App Data

The variables measured by the App are included in Table 4. Additional variables were created through computation; see results section for details.

Table 4. App Measurement Variables

Variable	Description
User ID	A unique User ID assigned to App users
Province	The province in which the user is located
Age Category	The age category of the User
Gender	The gender of the User
Week	The week of the data aggregated
Master Active	The sum of active (MVPA) minutes for the user for the week (includes both manually tracked and device-based tracked data)
Manual Active	The sum of active (MVPA) minutes for the user for the week (manually inputted only)
Cycling	Time spent cycling for the week
Running	Time spent running for the week
Sport	Time spent on sport for the week
Swimming	Time spent swimming for the week
Non-sport MVPA	Time spent on activities not represented in the above categories

3.3.2. ParticipACTION Survey

The ParticipACTION survey was designed by the research team at ParticipACTION. In addition to the questions developed by that research team, additional questions were included for

the purpose of assessing sport participation and COVID-19 pandemic impacts. These questions were developed by the author to assess the research questions. The questions were designed in three parts. First, questions were included to determine how much an individual participated in sport and how that contributed to their overall physical activity. The second set of questions were related to the common barriers to sport participation and whether they had been impacted by the pandemic. The third section was related to an individual's intention to, and motivation for, returning to sport after the COVID-19 pandemic. Due to limitations in the number of questions that were able to be included by external researchers, the questions were designed to provide a broad view of some of factors identified in previous research around the pandemic and sport, along with the research questions. The questions developed related to sport are included in Table 5. The questions included in the survey that were not sport-specific but that were used for analysis are included in Appendix 2.

Table 5. Sport-Specific Survey Questions

Section	**Questions (Responses)**
Sport Participation and Physical Activity	- Do you use the ParticipACTION App to track your participation in sport? (Yes/No) - How much of your participation in sport do you track? (All, Most, Half, Some, None) - Of both your moderate and vigorous physical activity, what % was related to sport? (%) - How many minutes per week do you participate in sport? (Min) - Please indicate your level of agreement with the following statements. I depend on a local sport club or team for my participation in sport. (5-point Likert style Agree/Disagree)
Barriers and COVID-19 Pandemic	- I have reduced access to sport participation because of COVID-19 restrictions. (5-point Likert style Agree/Disagree) - Because of COVID-19, I can no longer afford to participate in sport. (5-point Likert style Agree/Disagree) - Because of COVID-19, I no longer have time to participate in sport. (5-point Likert style Agree/Disagree)
Return to Sport	- I feel confident in my sport's return to play procedures. (5-point Likert style Agree/Disagree) - I intend to return to participating in sport… (ASAP, Internal, External, Friends and Family, Do not intend to return) - Within the next 6 months, with regards to sport participation, I intend to: (Increase, remain the same, reduce, stop)

3.3.3. Expert Interview

The questions from the interview guide for the expert interview are below. The questions were adapted from Hoeber et al. (2015).

1. How would you describe your organizations attitude toward innovation?
    i. Your personal attitude?
2. When did the idea for the innovation begin to develop?

3. Was the development of the innovation in response to any particular challenge facing the organization?
4. Who were the key stakeholders in the initial development phase?
5. Were there any roadblocks when attempting to implement the idea?
6. What was the initial response of key stakeholders?
    i. External stakeholders?
7. Has the innovation met the expectations set in the initial ideation phase?
8. What role will innovation play in the future of the organization?
9. What role does innovation have in the wider PA promotion sphere?

3.3.4. Sport Organization Interviews

The interview guide for the sport organization interviews is included in Appendix 5. The interview guide was developed and adapted from the work of Doherty et al. (2014), which explored capacity in sport organizations. Additional questions were developed to investigate the impact of the pandemic; these were inspired by the work of Teare & Taks (2021) and Evans et al. (2020). The initial research guide was formulated to assess the themes from the literature (namely capacity and impact of the pandemic). Kallio, Pietilä, Johnson, & Kangasniemi (2016) provide guidelines for developing semi-structured interview questions, which were followed with particular attention focussed on developing questions that were not leading, explored the themes and had adequate follow-up opportunities. Kallio et al. (2016) state that internal testing is acceptable in circumstances where traditional pilot interviews are not possible, and in this case the limited number of participants available meant the decision was made not to run a pilot interview with a potential interview subject.

3.4. Data Analysis

3.4.1. App Data

The App data was analyzed using a variety of different techniques to draw insights from the large data set to inform the research questions. Hicks et al. (2019) developed a method for the exploratory analysis of so-called "Big Data" sets, visualized in Figure 15.

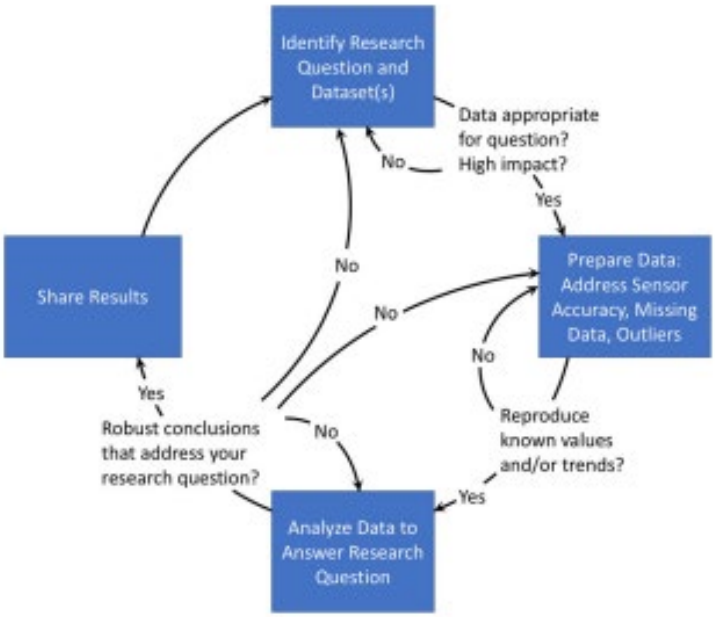

Figure 15. Best Practices for Analysis of Large Datasets (Hicks et al., 2019)

The data analysis took at top-down approach to investigating the data. Cheung & Jak (2016) established a method for analysing large data sets in the "SAM Approach" (Cheung & Jak, 2016, pg. 4). The SAM approach consists of splitting the data ("S"), analyzing the data ("A"), and meta-analyze ("M") the results. In this study, instead of meta-analysis, the result were "merged" to help further the discussion, as in it's original conception the data would be broken into many subsets as opposed to the three data sets used in this study (the split sets of Year 1 and Year 2; and the combined set containing only those who had valid data in both years). Cheung &

Jak (2016) also describe the methods of analysis for the split data sets, and include techniques such as correlations and regression analyses.

By top-down analysis, in all stages of the analysis this study moves from high level, descriptive statistics to frame the data; to correlation matrices to determine what variables were correlated to the given dependent variable (generally items such as overall MVPA, participation in sport, or "dropout"); to regression analyses to determine how much variance in a given DV was explained by the variables correlated to it. The reason that this was done was the fact that all data was secondary, and as such it was uncertain how the variables would work together. Additionally, given the size of the data set many analyses took a significant amount of time to complete, so reduction in variables used for modelling (through the correlation matrix) reduced the impact of the size of the data.

3.4.2.Survey Data

The survey data was entered into the software SPSS for cleaning and analysis. Only complete cases were used in the analysis. Variables such as sport participation were dummy coded in order to include in the model. The survey data was also analyzed in a similar way to the App data, where analysis began at the descriptive level to frame the data, correlation matrices to determine which variables were related to the given dependent variable; and finally models were built using the independent variables that were significantly correlated with the dependent variable to determine how much variability could be explained by the independent variables.

3.4.3. Expert and Sport Organization Interviews

The primary mode of analysis for the qualitative data from the interviews was thematic coding; thematic coding is the process of analyzing qualitative data through the use of coding and grouping to establish themes (Vaismoradi, Turunen, & Bondas, 2013). Thematic analysis is

seen as especially useful in mixed-methods research (Braun & Clarke, 2012). Braun & Clarke (2012) detail six steps for thematic analysis:

1. Familiarize yourself with the data.
2. Generate initial codes.
3. Searching for themes.
4. Reviewing potential themes.
5. Defining and naming themes.
6. Producing the report.

This research closely followed this methodology for the analysis of the interviews conducted. The de-identified transcripts were inputted into the NVivo software to allow for coding. Initial codes were generated and discussed amongst the research team. From that point, themes were generated and discussed amongst the research team. Finally, the themes were named and detailed in the results. An additional step not included in the list above was the identification of key quotes to support the themes generated. This was done to provide richer context with regards to the organization's perspective.

Chapter 4. Results

4.1. Introduction to Study Results

This study utilized a mixed-methods design pulling from two quantitative data sources (the ParticipACTION survey and the ParticipACTION App data) and two qualitative sources (semi-structured interviews with sport organizations and a semi-structured interview with an expert on innovation in physical activity promotion). Each of these data sources provided rich information for analysis, and each data source dealt with different aspects of each research question. For that reason, and to allow for easier understanding, the results section has been divided into four sections corresponding to each data source.

4.2. ParticipACTION Survey

4.2.1. Descriptive Statistics

The ParticipACTION survey was conducted in the Fall of 2020 amongst users of the ParticipACTION App. They surveyed 4,104 respondents. Given the large sample size, the decision was made to remove cases with missing or incomplete data completely. A total of 451 cases were excluded due to missing or incomplete data. Lear et al. (2017) suggest that those achieving 750 minutes per week of MVPA are considered highly active; for that reason, any person reporting more than double that figure (1500 minutes) was excluded from the analysis to combat over-reporting of physical activity. This left a total of 3,568 cleaned and useable responses for analysis.

Due to the data being anonymized before transfer from ParticipACTION to the research team, the only demographic variables included were the country and province of the respondent. The breakdown of the provinces recorded are below in Table 6.

Table 6. Provincial Breakdown of Survey Respondents

Province	**Number of Respondents (% of total)**	**Canadian Population[1]**
Ontario	1,362 (38.2)	14,789,778 (38.7)
British Columbia	691 (19.4)	5,174,724 (13.6)
Alberta	604 (16.9)	4,444,277 (11.6)
Manitoba	196 (5.5)	1,382,904 (3.6)
Saskatchewan	191 (5.4)	1,179,906 (3.1)
Nova Scotia	180 (5.0)	982,326 (2.6)
Quebec	156 (4.3)	8,585,523 (22.5)
Newfoundland	76 (2.1)	520,286 (1.4)
New Brunswick	74 (2.1)	783,721 (2.1)
Prince Edward Island	31 (0.9)	160,536 (0.4)
Yukon	7 (0.2)	42,596 (0.1)
Northwest Territories	3 (0.1)	44,991 (0.1)
Total	**3,568 (100)**	**38,131,104 (100)**

Note: [1] Canadian population data from Q2 2021 (Statistics Canada, Table 17-10-0009-01 Population estimates, quarterly)

Of note is that the survey analyzed was conducted in English, meaning that non-English speaking individuals may have been excluded from the survey. Survey respondents were asked whether they used the ParticipACTION App to track their participation in sport. Of the valid cases used, 1,440 (40.4%) of respondents indicated that they did track their sport participation on the App while 2,128 (59.6%) did not track sport participation using the ParticipACTION App.

4.2.2 Sport Capital and Participation

RQ1 relates to the sporting capital of participants. Due to the inability to contact individuals for interviews, sporting capital was not directly measured. However, Rowe (2015) compiled the theory of sporting capital using secondary data. Initial investigations looked at whether those that track participation in sport were different from those that did not track participation in sport. The first test was an independent sample t-test to determine whether there

was a difference across five questions which are thematically aligned with the theory of sport capital. These questions were asked on a five-point Likert scale. The questions and results are detailed in Table 7 below.

Table 7. Survey Independent T-Test – Sport Capital

Measure	**Sport Participants (n = 1440)**		**Non-Sport Participants (n = 2128)**			
	M	*SD*	*M*	*SD*	*T(df)*	*p*
I receive support to be physically active on a regular basis from friends, family members or other people in my life.	3.63	1.261	3.34	1.323	T(3148) = 6.54	< .001
I am confident in my ability to engage in physical activity.	4.21	.820	3.98	.998	T(3540) = 7.19	< .001
I enjoy being physically active.	4.32	.805	4.11	.919	T(3304) = 7.12	< .001
I have the skills I need to be physically active.	4.28	.884	4.08	1.106	T(3484) = 5.63	< .001
I am physically capable of doing moderate to vigorous physical activity for 150 min across a week if I really had to.	4.32	1.004	4.14	1.150	T(3482) = 4.75	< .001

The results show that those who track their sport participation report significantly higher agreement across five statements that correspond to the three components of sport capital.

Three additional questions were asked to all survey respondents about their ability to afford physical activity (My family and I can afford the costs of me / I can afford the costs of being physically active on a regular basis.), whether they had enough time for physical activity (I have enough time to be physically active on a regular basis.), and whether they had access to facilities

to participate in physical activity (My neighbourhood has several free or low-cost recreation facilities, such as parks, walking trails, bike paths, recreation centres, playgrounds or public swimming pools.). All were measured using a five point Agree/Disagree Likert scale. Again, sport tracking versus non-sport tracking were compared with those tracking sport having significantly more time ($T(3200) = 4.506, p < .001$) and access to facilities ($T(3110) = 4.113, p < .001$) than those that did not track sport participation. There was no significant difference between sport participation tracking users and non-sport tracking users in ability to afford physical activity.

The final independent sample t-test conducted between sport tracking users and non-sport tracking users was on weekly MVPA minutes. Survey respondents were asked how much moderate and vigorous physical activity they had participated in during the past seven days. Responses were recorded in minutes. Sport tracking users ($M = 137.25, SD = 134.63$) reported a significantly higher ($T(3566) = 6.549, p < .001$) amount of physical activity in the past seven days than non-sport tracking users ($M = 108.93, SD = 121.13$).

The correlates of sport tracking within the survey were also tested. The measures mentioned above were used to create a correlation table using SPSS with whether a user tracked sport as the dependent variable (coded as 1 = Tracks sport, 0 = Does not track sport). The results of the correlation matrix are presented in Table 8.

Table 8. Survey Correlation Matrix

Variable	***n***	***M***	***SD***	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Tracks Sport	3568	.40	.491	-								
Family/Friend Support	3540	3.46	1.306	.116*	-							
Self Confidence	3542	4.07	.937	.118*	.341*	-						
Self Enjoyment	3545	4.19	.881	.131*	.324*	.606*	-					
Skills PA	3486	4.16	1.027	.094*	.272*	.590*	.529*	-				
Capability PA	3484	4.21	1.097	.094*	.268*	.546*	.479*	.686*	-			
Time PA	3541	3.81	1.044	.075*	.270*	.437*	.382*	.353*	.317*	-		
Facilities PA	3539	3.75	1.352	.086*	.235*	.392*	.281*	.281*	.254*	.252*	-	
Province Ranked	3568	7.64	4.87	.008	-.002	-.035	-.012	-.023	-.010	-.002	-.017	-
MVPA Minutes	3568	120.36	127.49	.157*	.187*	.189*	.234*	.145*	.173*	.158*	.055*	-.006

Note: * significant at $p < .01$

As shown above, all factors except "Province Ranked" (in which the provinces were ranked from least urban (1) to most urban (12) were significantly correlated with whether someone used the App to track sport. The most strongly correlated factors were Family/Friend support, Self Confidence, and Self Enjoyment.

4.2.3 Investigating Sport Capital

As detailed above, there were 1,440 survey respondents who indicated that they used the App to track their participation in sport. There were specific questions that were only asked to

this group, or those that tracked sport participation. The descriptive statistics for these questions are shown in Table 9.

Table 9. Descriptive Statistics of Sport-Specific Questions

Measure	***n***	***M***	***SD***
How much of your participation in sport do you track?[a]	1492	3.86	1.20
Of both your moderate and vigorous physical activity, what percentage of it was related to sport?[b]	1379	38.00	32.56
How many minutes per week do you participate in sport?[c]	1433	89.48	142.10
I depend on a local sport club or team for my participation in sport[d]	1433	2.45	1.28
I have reduced access to sport participation because of COVID-19 restrictions.[d]	1427	3.59	1.272
Because of COVID-19, I can no longer afford to participate in sport.[d]	1428	2.53	1.14
Because of COVID-19, I no longer have time to participate in sport.[d]	1431	2.35	1.03
I feel confident in my sport's return to play procedures.[d]	1429	3.32	.912
Within the next 6 months, I intend to[e]	1421	3.06	.852

Note: [a] Answered on a five-point Likert scale from none to all
[b] Answered as a percentage
[c] Answered in minutes per week
[d] Answered on a five-point Likert scale from strongly disagree to strongly agree
[e] Answered on a four-point scale from "stop participating in Sport" to "increase participation in sport"

In addressing RQ1, groups were introduced based on three measures that related to the theory of sporting capital: whether an individual felt capable of physical activity (Physiological), whether they enjoy physical activity (Psychological) and whether they felt supported by friends and family in their physical activity (Social). The groups were made using a two-step cluster analysis in SPSS. The two-step cluster analysis yielded five distinct clusters. The centroids for each cluster are reported in Table 10. The cluster analysis provided a silhouette value of 0.6.

Table 10: Sport Capital Cluster Analysis

Cluster "Label"	***n (%)***	**Capability**		**Enjoyment**		**Friends/Family**	
		M	*SD*	*M*	*SD*	*M*	*SD*
1 "All-Stars"	499 (35.8)	4.82	.382	5.00	.000	4.44	.497
2 "Starters"	493 (35.4)	4.31	.463	4.00	.000	4.11	.318
3 "House League"	91 (6.5)	1.11	.948	3.70	1.216	2.81	1.570
4 "Free Agents"	258 (18.5)	4.47	.500	4.35	.479	1.61	.658
5 "Mavericks	53 (3.8)	4.32	.471	1.66	.706	2.62	1.484

Cluster one had very high scores across the three measures indicating a high level of sporting capital, hence they are named the "All Stars". Cluster two also had relatively high levels across all three measures, although not as high as the "All Stars", and so have been given the name of "Starters". Cluster three had very low levels across the three measures and were given the label of "House League". Cluster four had high levels scores in Capability and Enjoyment but low scores in social support and were given the name "Free Agents". Cluster five had high levels of capability but low levels of enjoyment and support and were given the name "Mavericks. The purpose of the cluster analysis was to be able to compare groups with different levels of sport capital.

A one-way ANOVA was conducted to determine whether there were significant differences between the clusters developed from the sport capital measures above. The results of the ANOVA found that there were significant differences across the measures of sport apart from reduced access, which was approaching significance at $p = .085$. Tukey's HSD test was

conducted to explore the differences between groups for each measure. The mean differences are reported in Table 11.

Table 11. Tukey's HSD Results Sport Capital Clusters

	Mean Difference (Total MVPA)				
Cluster	"All Stars"	"Starters"	"House League"	"Free Agents"	"Mavericks"
"All Stars"	-				
"Starters"	22.43	-			
"House League"	68.62*	46.19*	-		
"Free Agents"	32.08*	9.65	-36.54	-	
"Mavericks"	68.94*	46.51	0.31	36.86	-
	Mean Difference (Percentage of MVPA as Sport)				
Cluster	"All Stars"	"Starters"	"House League"	"Free Agents"	"Mavericks"
"All Stars"	-				
"Starters"	6.95*	-			
"House League"	20.46*	13.50*	-		
"Free Agents"	10.53*	3.58	-9.92	-	
"Mavericks"	16.03*	9.07	-4.43	5.50	-
	Mean Difference (Minutes per Week in Sport)				
Cluster	"All Stars"	"Starters"	"House League"	"Free Agents"	"Mavericks"
"All Stars"	-				
"Starters"	46.78*	-			
"House League"	84.05*	37.27	-		
"Free Agents"	50.66*	3.87	-33.39	-	
"Mavericks"	97.07*	50.28	13.01	46.41	-
	Mean Difference (Afford Sport)				
Cluster	"All Stars"	"Starters"	"House League"	"Free Agents"	"Mavericks"
"All Stars"	-				
"Starters"	-.17	-			
"House League"	-.67*	-.497*	-		
"Free Agents"	-.13	.04	-36.54	-	
"Mavericks"	-.352	-.18	.31	-.22	-
	Mean Difference (Time for Sport)				
Cluster	"All Stars"	"Starters"	"House League"	"Free Agents"	"Mavericks"
"All Stars"	-				
"Starters"	-.28*	-			
"House League"	-.71*	-.42*	-		
"Free Agents"	-.27*	.01	.43*	-	
"Mavericks"	-.475*	-.19	.23	-.20	-
	Mean Difference (Post Pandemic Intention)				

Cluster	“All Stars”	“Starters”	“House League”	“Free Agents”	“Mavericks”
“All Stars”	-				
“Starters”	.093	-			
“House League”	.595*	502*	-		
“Free Agents”	.137	.04	-.457*	-	
“Mavericks”	.442*	.35*	-.153	.304	-

A few results stood out from the Tukey HSD analysis. While the one-way ANOVA suggested significant between group differences across almost all measures, the *post-hoc* analysis provided different results indicating that many of the groups did not differ across the sport measures.

Another approach was used to segment the respondents based on Rowe (2015). In the initial explorations of the theory of sporting capital Rowe suggested the weighting of the domains (psychological, physiological, and social) at 36%, 35%, and 29% respectively. Therefore, a composite measure of the three questions used to measure sport capital was created. The scores on each question were multiplied by the respective weighting and to arrive at a weighted “sport capital”. This measure of sport capital was found to be significantly correlated with overall minutes per week spent participating in sport ($r = .219$, $p < .001$).

4.2.4. Impact of COVID-19

Three questions were asked specifically relating to the impact of COVID-19 on the barriers identified in the literature review, namely time, affordability, and access to sport. To ascertain the impact of COVID-19, two nonparametric correlations were done. The first looked at the correlation between the questions about COVID-19 impacting time for sport, affordability of sport, and access to sport on overall time spent participating in sport per week. The impact of COVID on affordability was significantly negatively correlated with sport participation ($r =$

-.057, $p < .05$) as was the impact of COVID on time available for sport ($r = -.092$, $p < .001$). COVID-19's impact on reducing access to sport was positively correlated to time spent participating in sport ($r = .073$, $p < .01$). The correlation was repeated with overall physical activity as reported in minutes of MVPA in the past 7 days. There was no significant correlation between overall MVPA and reduced access to sport, reduced affordability of sport, and reduced time available for sport.

The final analysis done was to investigate whether there was a difference in reporting an impact of COVID-19 on the three barriers by province. A one-way ANOVA was undertaken finding no significant difference between respondents from different provinces on any of the impacts of the pandemic. There was also no significant difference between the provinces in terms of how many minutes per week participated in sport by respondents.

4.3. App Data

The ParticipACTION App dataset was an incredibly large data set that contained over 100 weeks of data from all App users. The first step in the exploration of the data was to create a "pilot" data set to test initial ideas and the feasibility of analyzing the full data set. This pilot data set served a dual purpose, which was to make initial exploration more feasible and to also allow for examination of a key initial exploration area, which was the sport participation behaviours of users before and during the COVID-19 pandemic. To do this, two 12-week data sets were created from the total data set, one consisting of the months of March, April, and May of 2019, and one consisting of the months of March, April, and May of 2020. The variables listed in Table 12, below are the variables retained in the two data sets (from here on labelled as datasets 1a and

1b). A second dataset, dataset 2a, took all users who had data in datasets 1a and 1b to create a pre-COVID and during-COVID comparison.

Table 12. ParticipACTION App Variables

Variable	Description
User ID	A unique User ID assigned to App users
Province	The province in which the user is located
Age Category	The age category of the User
Gender	The gender of the User
Week	The week of the data aggregated
Master Active	The sum of active (MVPA) minutes for the user for the week (includes both manually tracked and device-based tracked data)
Manual Active	The sum of active (MVPA) minutes for the user for the week (manually inputted only)
Cycling	Time spent cycling for the week
Running	Time spent running for the week
Sport	Time spent on sport for the week
Swimming	Time spent swimming for the week
Non-sport MVPA	Time spent on activities not represented in the above categories

For the purposes of coding, the following transformations were done:

- Province was coded from most urban (13) to least urban (1), with data coming from StatsCan (Martel, 2015). In the case of a tie, the province with the higher population was ranked as higher.
- Age Category was coded from youngest (1) to oldest (7)
- Gender was coded as Male (1), Female (2), Other (3)

The number of unique IDs in dataset 1a was 24,079. However, the number of users that were active consistently over that period was smaller. In the analysis, the decision was made to look at two specific groups: those who used the App for the entire 3-month period (March-May of 2019 (Dataset 1a) and 2020 (Dataset 1b)). Table 13 shows the breakdown of how many users had 6+ weeks of useable data.

Table 13. Valid App Users (Dataset 1a)

Valid Weeks	Number of Users
6+	5,369 (22.29% of total sample)
9+	3,504 (14.55% of total sample)
12	1,787 (7.42% of total sample)

The other set of users that we are interested in is those who "drop out". There is an important distinction in the data between inactive users and those who drop out. Because of the way that the App records data, a user may open the App but not log any activity time but would still show up in the data. However, if a user simply does not open the App, they will not appear in the data. The above table is calculated from users who logged at least one minute of physical activity. However, not included may be some users who still open the App (and may consume content) but don't log any activity. Therefore, another analysis was carried out to determine how many users dropped out. To define dropout, any user that was inactive (i.e., did not use the App for four or more consecutive weeks in the 3-month period) was considered to have "dropped out". This analysis showed that of the 24,079 users in Dataset 1a, 3,639 (15%) were considered to have dropped out.

Also calculated was the number of users who recorded participation in either sport, cycling, running, or swimming. Using the same cutoffs as above, the results are below in Table 14.

Table 14. Valid Sport Users (Dataset 1a)

Valid Weeks	Number of Users
6+	925 (3.84% of total sample)
9+	419 (1.74% of total sample)
12	140 (0.58% of total sample)

One aspect of the data that was noticed was that not all users tracked sport for all the weeks they had valid data on the App. Overall, 2,929 users tracked sports for every week that they were active on the App.

These procedures were re-created with Dataset 1b. The total number of users in Dataset 1b was 19,678. The numbers of users with valid weeks are below in Table 15, and sport users are described in Table 16.

Table 15. Valid App Users (Dataset 1b)

Valid Weeks	Number of Users
6+	7,287 (37.03% of total sample)
9+	5,236 (26.61% of total sample)
12	3,514 (17.86% of total sample)

Interestingly, despite the lower overall user base of the App as compared to Dataset 1a, the number of users who were active on the App for the above number of weeks was higher. Additionally, in Dataset 1b, dropout was also higher than in Dataset 1a, with 6,590 (33.49%) of the total user base having "dropped out". This suggests that the users who are not dropping out are staying more consistently engaged as the App evolves.

In respect to users who track their sport participation, datasets 1a and 1b are very similar (Table 16).

Table 16. Valid Sport Users (Dataset 1b)

Valid Weeks	Number of Users
6+	631 (3.20% of total sample)
9+	347 (1.76% of total sample)
12	163 (0.83% of total sample)

The final data cleaning step, as the initial data sets represent the same time periods pre-Covid and post-COVID, was to determine how many matching users are available for a comparison. Between the two data sets, there were 5,741 users who appeared in both.

4.3.1. Dataset 1a

Demographics

The App contains only three demographic variables, to protect the privacy of individuals using the App. These are province in which the user is located at the time of sign up, gender identity of the user, and age range (the groups begin at 5-17 and end at 65+). Below are the results of the descriptive statistics of those three variables.

Province

The users in Dataset 1a were predominantly from the most populous provinces, with Ontario, British Columbia, Alberta, and Quebec representing over 80% of the userbase. The percentages of valid users for each province are roughly equivalent to that of the overall Canadian population as of 2019, according to StatsCan data.

Table 17. Provincial Distribution of App Users (Dataset 1a)

Province	% of App Users	% of Canadian Population (Q2 2019)[1]
Total	5641	37,417,155
Ontario	31.7%	38.7%
Quebec	19.5%	22.6%
British Columbia	15.4%	13.5%
Alberta	13.6%	11.6%
Saskatchewan	4.3%	3.1%
Nova Scotia	3.9%	2.6%
Manitoba	3.8%	3.6%
NWT and Nunavut	2.8%	0.2%
New Brunswick	2.3%	2.1%
Newfoundland	2.2%	1.4%
P.E.I	0.4%	0.4%
Yukon Territories	0.1%	0.1%

Note: [1] Canadian population data from Q2 2021 (Statistics Canada, Table 17-10-0009-01 Population estimates, quarterly)

Age Range

Table 18. Age Distribution of App Users (Dataset 1a)

Age Bracket	**App Users (%)**	**Population (%)[1]**
Total	5641	38,005,238
5-17	0.7	16.4
18-24	5.2	6.5
25-34	17.2	13.9
35-44	24.5	13.4
45-54	25.4	12.7
55-64	19.4	14
65+	7.7	18

Note: [1] Population data from 2020 (Statistics Canada, Table 17-10-0005-01 Population estimates on July 1st, by age and sex)

The majority of App users are between the ages of 35 and 54. Additionally, it is apparent that the App is successful at targeting older Canadians as over 50% of the users were over the age of 45.

Gender

Table 19. Gender Distribution of App Users (Dataset 1a)

Gender	**Percentage of App Users**	**Percentage of Population[1]**
Total	5641	38,005,238
Male	19.1	49.7
Female	80	50.3
Other[2]	0.8	

Note: [1] Population data from 2020 (Statistics Canada, Table 17-10-0005-01 Population estimates on July 1st, by age and sex)
[2] Note that Statistics Canada does not have data on those not identifying as either female or male

4.3.2. Dataset 1b

Province

Dataset 1b (which covers March-May of 2020) has broadly similar trends in users' province as Dataset 1a. The majority of users continued to be from the most populous provinces

(Ontario, British Columbia, Alberta, and Quebec). Again, the App users appear to be broadly representative of Canada as a whole.

Table 20. Provincial Distribution of App Users (Dataset 1b)

Province	% of App Users	% of Canadian Population[1]
Total	10,104	37,979,854
Ontario	33.5%	38.8%
British Columbia	18.2%	13.5%
Quebec	16.1%	22.6%
Alberta	13.5%	11.6%
Manitoba	4.2%	3.6%
Nova Scotia	4.2%	2.6%
Saskatchewan	3.4%	3.1%
New Brunswick	3.1%	2.1%
Newfoundland	2.2%	1.4%
NWT and Nunavut	0.9%	0.2%
P.E.I	0.6%	0.4%
Yukon Territories	0.2%	0.1%

Note: [1] Canadian population data from Q2 2021 (Statistics Canada, Table 17-10-0009-01 Population estimates, quarterly)

Again, while still being broadly representative, there are some insights when comparing to Canada's population. The only provinces in which App users (as a percentage) are lower than the national average is in Ontario and Quebec. While there could be many factors, the competition (Ontario) and language (Quebec) may contribute to this trend.

Age

Table 21. Age Distribution of App Users (Dataset 1b)

Age Bracket	**Percentage of App Users**	**Percentage of Population[1]**
Total	5641	38,005,238
5-17	1.2	16.4
18-24	4.1	6.5
25-34	15.2	13.9
35-44	23.6	13.4
45-54	25.8	12.7
55-64	22.6	14
65+	7.5	18

Note: [1]Population data from 2020 (Statistics Canada, Table 17-10-0005-01 Population estimates on July 1st, by age and sex)

Again, Dataset 1b is very similar to Dataset 1a. The App has a relatively older userbase, with almost 57% of users being over the age of 45, again showing that the App has an ability to target older adults, something that many mobile phone applications struggle to do.

Gender

Table 22. Gender of App Users (Dataset 1a)

Gender	**Percentage of App Users**	**Percentage of Population[1]**
Total	5641	38,005,238
Male	20.4	49.7
Female	78.6	50.3
Other[2]	1.0	

Note: [1] Population data from 2020 (Statistics Canada, Table 17-10-0005-01 Population estimates on July 1st, by age and sex)
[2] Note that Statistics Canada does not have data on those not identifying as either female or male

Finally, in terms of gender, Dataset 1b is very similar to Dataset 1a, with female users making up approximately 4/5 of the entire userbase.

4.3.3. Comparing Highly Engaged Users and "Dropouts"

We have previously defined highly engaged users as those who had activity data throughout the 3-month period of either March-May 2019 (Dataset 1a) or March-May 2020 (Dataset 2a). We also defined "dropouts" as those who went 4 consecutive weeks in either of those two periods without engaging with the App. Our initial exploration centered around a correlation matrix comparing highly engaged users and dropouts. Dropouts were coded as 1 and highly engaged users as 0. At this point in the data analysis, both datasets were combined, with a dummy variable coded for the year (1 for 2019, 2 for 2020) to aid analysis.

One of the difficulties in comparing the dropouts to highly active users is that there is much less data on the dropouts, which is obvious considering that when they are not using the App they are not generating data. So, in looking at this question, the only variables considered were those that would be consistent across both highly engaged users and dropouts.

The first analysis conducted was to run a correlation matrix between the above variables to get a sense of whether a variable would be useful for further analysis. The results of the correlation matrix are presented below in Table 23.

Table 23. Correlation with Dropout

Variable	***n***	**Dropout**
Level of Activity	14408	-.285*
Goal Minutes	14408	-.243*
Province	14408	.002
Age	14408	-.031*
Gender	14408	.067*
Activity per Week	14408	-.559*

Note: *significant at $p < .01$

The largest influences on whether a person will drop out of the App is their average weekly activity level when on the App and their self-reported activity level when they first sign up. Additionally, the goal that a user sets is correlated with their dropout risk, with setting lower

goals resulting in higher dropout risk. For the demographic variables, gender and age were both significantly correlated with age. Of the above variables, only province was not correlated with dropout risk.

To further understand to what extent dropout can be explained by the variables in the above table, a simple linear regression was done with dropout as the dependent variable and the significant correlations (Activity Level, Average Weekly Activity, Goal, Age, and Gender) as detailed above. The results are shown below in Table 24.

Table 24. Predictors of Dropout

Model	**R**	**R^2**	**Adj. R^2**	**SE of Estimate**		
1	.404	.163	.163	.443		
		Unstandardized Coefficients		**Standardized Coefficients**		
Model		***B***	**SE**	***β***	***t***	**Sig**
1	(Constant)	.917	.025		37.07	.000*
	Gender	.033	.009	.028	3.50	.000*
	Activity per Week	.000	.000	-.293	34.16	.000*
	Goal Minutes	.000	.000	-.046	4.27	.000*
	Level of Activity	-.040	.003	-.159	14.49	.000*
	Age	-.005	.003	-.013	1.597	.110

Note: Dependent Variable: Dropout; *significant at $p < .01$

As shown in the above tables, Gender ($\beta = 0.28$, $p < 0.001$), ActivityPerWeek ($B = -0.293$, $p < 0.001$), Goal ($B = -0.46$, $p < 0.001$), and Level of Activity ($B = -0.159$, $p < 0.001$) were significant predictors of dropout.

4.3.4. Impact of COVID-19 on Dropout Rates

While the above analysis uses only the variables produced by users on the App, the dummy "Year" variable can be added to the above model in a hierarchical fashion to determine whether

the COVID-19 pandemic had any effect on dropout rates. The results are presented below in Table 25.

Table 25: Predictors of Dropout (Including Year Variable)

Model	**R**	**R^2**	**Adj. R^2**	**SE of Estimate**		
1	.404	.163	.163	.443		
2	.406	.165	.164	.442		
		Unstandardized Coefficients		**Standardized Coefficients**		
Model		***B***	**SE**	***β***	***t***	**Sig**
1	(Constant)	.917	.025		37.07	.000*
	Gender	.033	.009	.028	3.50	.000*
	Activity per Week	.000	.000	-.293	34.16	.000*
	Goal Minutes	.000	.000	-.046	4.27	.000*
	Level of Activity	-.040	.003	-.159	14.49	.000*
	Age	-.005	.003	-.013	1.597	.110
2	(Constant)	.862	.027		31.806	.000*
	Gender	.033	.009	.028	3.493	.000*
	Activity per Week	.000	.000	-.296	-34.426	.000*
	Goal Minutes	.000	.000	-.047	-4.369	.000*
	Level of Activity	-.041	.003	-.162	-14.750	.000*
	Age	-.005	.003	-.014	-1.711	.087
	Year	.862	.027		31.806	.000*

Note: Dependent Variable: Dropout; ANOVA $F = 422.05$; *Significant at $p < .01$

As shown in the above tables, the inclusion of the Year variable significantly increased the variance explained by the model (Delta $R^2 = 0.002$, $p < 0.001$; B =0.04, $p < 0.001$). The inclusion of Year also resulted in Age becoming significant at the $p < 0.1$ level, suggesting that there is some interaction between the COVID-19 pandemic and Age.

4.3.5. Influence of Sport on Dropout Rates

A feature of the App is that users can manually input records of their physical activity. When using this function, App users must select a category in which their physical activity falls

into. For the purpose of this analysis, the categories of Cycling, Running, Sport, and Swimming were pulled. Various calculations were done, and the variables that were added to the model were whether a user tracked any activity manually (Y = 1, N = 0), whether a user tracked one of the above categories (Y = 1, N = 0), whether a user tracked Sport or Swimming specifically (Y = 1, N = 0), and finally, what proportion of a user's total active weeks contained a sport. Variables were added in a hierarchical fashion in the order above to determine whether they were able to explain more variance in dropout rates. The results of the models are held in appendix X.

The initial addition to the model, whether a user tracked any activity manually, increased the variance explained by the model (Delta $r^2 = 0.021$, $p < 0.001$) and was a significant explanation of the variance in dropout rates ($B = -0.152$, $p < 0.001$). When the model included both whether a user tracked any manual activity and whether they tracked any sport activity, the predictive power again increased (Delta $r^2 = 0.021$, $p < 0.001$) and tracking any sport activity was a significant explanatory variable of dropout rate ($B = -0.171$, $p < 0.001$).

4.3.6. Profiling Highly Engaged Users

Given that the lack of available variables makes it difficult to compare dropouts to highly engaged users, the next step of the analysis of the App was to look exclusively at the highly engaged users to determine what their characteristics were. Again, the initial exploration of this topic used a correlation matrix to determine what made users more engaged. There are a lot of variables that were used for this analysis. Initially, the users total active minutes over the three months was dependent variable, but as the guidelines for healthy physical activity indicate that most individuals should achieve at least 150 minutes of MVPA per week, the number of weeks above 150 active minutes was designated as the dependent variable. Additionally, the data was

computed to look at both average of week-over-week improvement in MVPA rate, and month-over-month improvement in MVPA rates. Unfortunately, due to the nature of the App, the weekly improvements are messy, in that a user may have zero active minutes if they opened the App and did not record, meaning that the average increase/decrease in the weeks preceding and following would be off. Instead, the month 1 to month 3 change was used as a "smoother" measure of an overall increase or decrease in physical activity. The results of the correlation matrix related to weeks above 150 minutes of MVPA are shown below in Table 26.

Table 26. Weeks above 150 MVPA Minutes Correlation Table

Variable	***n***	**Weeks Above 150**
Level of Activity	4728	.428*
Goal Minutes	4728	.358*
Province	4728	.021
Age	4728	.178*
Gender	4728	-.107*
Activity per Week	4728	.862*

Note: *Significant at $p < .01$

When looking at the weeks above 150 minutes of MVPA, every variable is significantly related except for province. This is consistent with the tests conducted previously with relation to the dropout rate. Again, the variables were used for a linear regression with number of weeks above 150 minutes MVPA as the dependent variable. The result of this regression is presented below in Table 27.

Table 27. Predictors of Weeks above 150 MVPA Minutes

Model	**R**	**R^2**	**Adj. R^2**	**SE of Estimate**		
1	.481	.231	.230	3.512		
		Unstandardized Coefficients		**Standardized Coefficients**		
Model		***B***	**SE**	***β***	***t***	**Sig**
1	(Constant)	2.975	.380		7.832	.000
	Level of Activity	.667	.030	.331	22.082	.000
	Goal Minutes	.012	.001	.176	11.744	.000
	Province	.055	.019	.038	2.963	.003
	Age	.372	.040	.118	9.232	.000
	Gender	-.629	.117	-.069	-5.386	.000

Note: Dependent Variable: Weeks above 150; ANOVA $F = 283.63$

The variables from the correlation are again shown to be significant predictors of the number of weeks that a user achieves 150 minutes of MVPA. Specifically, level of activity, goal minutes, province (ranked from least urban (1) to most urban (12)) and age were all positively related to achieving 150-minute weeks while gender was negatively related.

The other dependent variable looked at within the highly engaged user population was that of the change in activity level from month 1 to month 3 was investigated, first using the entire sample, and then specifically at those who on average, were not achieving 150 minutes of MVPA per week. The initial correlation suggested that, of the variables used, only level of activity (rs = -.036, $p < .001$), goal (rs = -.081, $p < .001$), and activity per week (rs = .030, $p < 0.05$) were significantly correlated to the month 1 to month 3 change in activity. When controlling for individuals who are already "sufficiently active" (who had achieved 150 minutes of MVPA per week every week) only level of activity (rs = -.055, $p < .05$) and average activity per week (rs = .048, $p < .05$) were significant. Goal was approaching significance at rs = -.043, r = .051.

Given the limited variables that are correlated with the three months change in activity, a simple linear regression was run to determine to what extent the limited variables could explain Month 1 to Month 3 change. The regression analysis resulted in an adjusted r^2 of .013, $p < .001$. Level of activity ($B = -.037$, $p < .05$), Goal ($B = -.076$, $p < 0.001$), and activity per week ($B = -.035$, $p < .05$) were all significant predictors of Month 1 to Month 3 change in activity levels. However, due to the relatively poor predictive power of the model, the current variables do not have a large role in the overall change in activity levels.

4.3.7. Impact of COVID-19 on Highly Engaged Users

In a similar fashion to the analysis looking at dropout, it is hypothesized that COVID-19 had a significant effect on individual's ability to achieve the recommended level of MVPA per week. To test this, a hierarchical regression was done, using the previous model developed, and subsequently adding the "Year" variable. The results are presented below in Table 28.

Table 28. Predictors of Weeks Above 150 MVPA Minutes (including Year)

Model	**R**	**R^2**	**Adj. R^2**	**SE of Estimate**	**R^2 Change**	**Sig**
1	.481a	.231	.230	3.512	.231	.000
2	.514b	.264	.263	3.435	.033`	.000
		Unstandardized Coefficients		**Standardized Coefficients**		
Model		***B***	**SE**	***β***	***t***	**Sig**
1	(Constant)	2.975	.380		7.832	.000
	Level of Activity	.667	.030	.331	22.082	.000
	Goal Minutes	.012	.001	.176	11.744	.000
	Province	.055	.019	.038	2.963	.003
	Age	.372	.040	.118	9.232	.000
	Gender	-.629	.117	-.069	-5.386	.000
2	(Constant)	.613	.405		1.512	.131
	Level of Activity	.616	.030	.306	20.694	.000
	Goal Minutes	.015	.001	.210	14.140	.000
	Province	.057	.018	.040	3.169	.002
	Age	.331	.039	.105	8.384	.000
	Gender	-.581	.114	-.064	-5.085	.000
	Year	1.511	.103	.186	14.631	.000

Note: Dependent Variable: Weeks Above 150; ANOVA $F = 282.072$

The "year" variable was a significant predictor of whether a user achieved their 150 minutes of MVPA per week. Interestingly, those in year 2 (March-May 2020) were more likely to achieve 150 minutes of MVPA.

Given the relatively low predictive strength of the overall model for the month one vs. month 3 change in activity minutes, the above procedure was repeated, although the results were relatively small. The delta r^2 of the M1M3 model when adding the "Year" variable was .003 ($p < .001$) and the standardized beta of Year was -.053, $p < .001$. Overall, the model with year included had a r^2 of .015, $p < .001$.

4.3.8. Impact of Sport on Highly Engaged Users

Another aim of this research is to investigate the role that sport has on App outcomes. To this end, the models above were adjusted to include variables related to sport participation. However, it is important to note that in order to track participation in sport, users must open the App and manually input their participation. Therefore, to control for the users who make manual inputs, a dummy variable was coded for users who use the manual function and included in the models.

Building on the models developed in the previous sections, further hierarchical regressions were run on the dependent variables “Weeks Above 150” and “Month 1 to Month 3 increases”. The results of these regressions were included below. Note that each analysis includes three models; the original developed above, a model including the dummy variable of manual tracking, and finally a model including a variable specifically regarding whether a user tracked sport.

Table 29. Predictors of Weeks Above 150

Model	**R**	**R^2**	**Adj. R^2**	**SE of Estimate**	**R^2 Change**	**Sig**
1	.514a	.264	.263	3.435	.264	.000
2	.522b	.272	.271	3.417	.008	.000
3	.531c	.282	.281	3.394	.010	.000
		Unstandardized Coefficients		**Standardized Coefficients**		
Model		***B***	**SE**	***β***	***t***	**Sig**
1	(Constant)	.613	.405		1.512	.131
	Goal Minutes	.015	.001	.210	14.140	.000
	Year	1.511	.103	.186	14.631	.000
	Level of Activity	.616	.030	.306	20.694	.000
	Province	.057	.018	.040	3.169	.002
	Age	.331	.039	.105	8.384	.000
2	(Constant)	.062	.410		.152	.879
	Goal Minutes	.014	.001	.203	13.723	.000
	Year	1.758	.108	.216	16.250	.000
	Level of Activity	.615	.030	.306	20.784	.000
	Province	.055	.018	.038	3.062	.002
	Age	.292	.040	.093	7.376	.000
	Gender	-.673	.114	-.074	-5.890	.000
	Tracked Manually	.846	.116	.097	7.276	.000
3	(Constant)	-.022	.407		-.055	.956
	Goal Minutes	.014	.001	.195	13.269	.000
	Year	1.838	.108	.226	17.031	.000
	Level of Activity	.591	.030	.294	20.007	.000
	Province	.056	.018	.038	3.110	.002
	Age	.308	.039	.098	7.812	.000
	Gender	-.646	.114	-.071	-5.684	.000
	Tracked Manually	.283	.135	.032	2.094	.036
	Tracked Sport	.982	.123	.121	7.999	.000

Note: Dependent Variable: Weeks above 150; ANOVA $F = 231.29$

For the dependent variable "weeks above 150", both tracking manually and tracking sport were significant predictors of a user's weeks above 150 minutes of MVPA. Specifically, manual

activity tracking had a beta of 0.97 ($p < .001$) when included in the model exclusive of looking specifically at sport tracking; when whether a user tracked sport was included in the model (controlling for those who tracked manually), sport had a beta of .121 ($p < .001$).

Including the manually tracked variable and sport tracking variables in the Month 1 to Month 3 change model resulted in small but significant changes. When the manual tracking dummy variable was included, the delta r^2 was .002 ($p < .001$), and manual tracking had a beta of -.043 ($p < .001$). There was no significant change in the model when the variable for tracking sport was included.

4.3.9. Investigating Sport Participation and COVID-19

To this point, both sport participation and COVID-19 have been included in models predicting outcomes of the App (namely "dropout", "weeks above 150", and month 1 to month 3 change). However, the data from the App allows for a more direct examination of how those who track their sport participation differ from those who do not when it comes to the effect of COVID-19. For this analysis, only those who had matching data from the pre-COVID (2019) period and the during-COVID period (2020). By using only the users who had matching pre-COVID and during-COVID data, there was the ability to conduct paired t-tests on the App users. The results of the paired t-test are presented below in Table 30.

Table 30. Paired T-Test between 2019 and 2020

Variable	Mean Difference (Y1-Y2)	*t*	df	Sig
Total Activity	-127.23684	-1.007	873	.314
Activity per Week	-18.27596	-2.042	873	.041
Valid Weeks	.79291	4.257	873	.000
Proportion of Activity – Sport	.04064	4.981	873	.000
Weeks Above 150	.42677	2.260	873	.024
M1M3	.07667	.777	873	.437
Sport Minutes	154.30206	3.978	873	.000
Infrastructure Minutes	72.45423	4.832	873	.000

This analysis looked at 8 distinct variables with a pre- and during-COVID measurement, which were computed using the data tracked by the App. The computed variables are detailed in Appendix 1. The results of the above paired t-test provide significant results for every pairing except for the month 1 to month 3 change and the change in total activity.

4.4 Interview Results Stage 1

The extensiveness and the pervasiveness of physical inactivity has been well documented in the previous sections of this thesis. While the problem has been steadily growing larger over recent decades, there exists a network of organizations that exist to promote physical activity through various interventions.

In attempts to understand how these physical activity and health promotion organizations are trying to influence physical activity rates, a key topic that has emerged is innovation. Research has investigated the phenomena of "social innovation" within non-profits, suggesting that there are three distinct forms: "program based", "process based", and "socially transformative" (Shier & Handy, 2014). This idea of social innovation has recently been applied to sport organizations as well (Jones, Carlton, Hyun, Kanters, & Bocarro, 2020). However, social

innovation is more concerned with the outcome of innovation (i.e. in for-profit organizations, the desired outcome of innovation is profit; whereas in non-profits there exists other motivations for innovation) and less with the process and mechanisms of innovation. In contrast to social innovation, the concept of technological innovation has also been investigated in the sport organizational context (Hoeber & Hoeber, 2016). Hoeber & Hoeber (2016) suggest that innovation in sport organizations has two critical elements: time and determinants. Hoeber & Hoeber (2016) found that across the entire temporal aspect of innovation, that leadership determinants were crucial in an organizations' adoption of new technology. Additionally, they found that organizational capacity in the form of financial resources was also crucial for innovation.

As non-profits in the physical activity and health promotion sector are universally attempting social innovation, this initial research stage intends to examine how innovation (specifically technological innovation) is adopted by a non-profit physical activity organization. A Canadian physical activity and health promotion non-profit released a mobile-phone application after working exclusively through in-person events. This kind of ambitious technological innovation appears rare in the non-profit physical activity sector but may be a way forward in our increasingly digital world. The purpose of this research stage is to identify what will be needed by other organizations as we emerge from the impacts of the pandemic, and how these organizations can re-engage their audiences.

The interview yielded interesting results generally supporting previous literature surrounding innovation in physical activity organizations. As a technological innovation within this setting, there were both benefits from and challenges to implementing the App. Key themes

are discussed below, using the temporal stages from Hoeber & Hoeber (2012) as the groupings for themes. The results are summarized in Table 31 on page 105.

4.4.1. Drivers to Innovate and Implementation

One of the emergent themes from the interview was surrounding the need for a clearer relationship with the current population served by the organization. The interview subject discussed the link between being an "evidenced-based" organization and implementing new technology. Specifically, the subject suggested that the use of mobile app technology allowed the organization to gather more data on its existing user base to better target and enact its strategies. This was tied to facilitating a closer relationship with users:

> "… We saw an opportunity and a need to be able to service and have a direct relationship with individual Canadians. Up until that point, we were very, very population base based and we needed a mechanism to be able to work with and support individuals, and to be able to track that impact."

This desire to connect with individuals was filtered through the lens of a national organization. One of the key drivers for the development of the App was: "… How do we how do we reach individuals on a national scale and have that personal relationship with them; and be able to track our engagement with them and their progress?".

At the organizational level, it was clear that there was an attitude towards embracing innovation at the upper levels of management. "I'm quite content with our commitment to

innovation and the things that we've tried to do to address physical activity and sport participation and new ways".

4.4.2. Understanding of Efficacy

The decision to use an App to address the goals above resulted in successes, but not without challenges appearing. The first success of the App implementation was that the expected reach of the App was exceeded, showing promise for future uses. Additionally, the App has allowed the organization to be more flexible, especially in responding to the COVID-19:

> "I think, quite frankly, COVID just made us realize that we were on the right path, because if we didn't have an app, I think our ability to be a relevant organization this past year would have been in question, like, what would we have done because everything has gone digital, everything (in person) is gone… So I think I think the App has certainly allowed us to continue to be relevant in supporting Canadians with their physical activity throughout (the COVID-19 pandemic)."

The App has also supported the organization's other operations by being a platform not only for engagement but also for promotion.

4.4.3. Organizational Partnerships

An interesting theme that emerged was that of organizational partnerships with others in the physical activity promotion area. Two points around organizational partnerships emerged. The first point was that despite targeting a more personal relationship with users, the organization was cognizant of not impacting organizations at the regional or local level. This point was tied directly to the initial idea that led to the development of the App, which was the

need to connect more directly with users. The App was seen as a way to build the personal relationship without conducting in-person events or programs, which had the risk of cannibalizing the users of other local programming from local physical activity organizations. The second point surrounding organizational partnerships was the benefit that the App provided through a symbiotic relationship that it, as a national organization, had with other regional or local organizations, and how the App facilitated that.

> "And we've worked with sport organizations, any type of organization that has a real strong desire to communicate with Canadians, and we have a vehicle to be able to do that. And so it's a it's a win-win situation, we get some really good quality content and they're able to access a user base that they don't have access to."

4.4.4. Capacity Constraints

The next thematic area was that of the capacity constraints to implementing the App. Again, two distinct points emerged within this area. The first capacity constraint was that of financial challenges. Cost of implementation was a challenge, both initially when working with a third-party supplier, but also when pivoting the App in house. The other capacity constraint was that of organizational knowledge, with the interview subject pointing out:

> "We're not a technology organization, we're a physical activity promotion organization. And, so we, you know, we don't know what we don't know. And so we had lots of great third party vendors. But they're, you know, they're technology companies, they're not physical activity companies… we still needed some in-house technical expertise that be

that could speak that language and to be able to direct and monitor the work of that company. And so we have to increase our staff complement in in the digital side"

These two challenges combined to influence a third organizational constraint, which was internal resistance to the project.

"The App is something that requires a lot of attention, a lot of investment. And I think organizationally, we still have some work to do to build our culture to, to, to embrace that… (The App is) questioned or maybe even resented by some in the organization, who don't really appreciate the full magnitude and potential of the App and see, you know, all of our focus, not all of our focus, but a majority of our focus being put into that".

4.4.5. Future Concerns

The final thematic area from the interview was related to the future of the App. Again, there were two points to consider. The first was how to overcome the financial barriers mentioned above:

"…how do we ensure the sustainability of this App long term beyond government funding, while still making it accessible to all? So, you know, we're looking at different ways to monetize the App that that I'd say that's the biggest challenge…"

While the desire to continue with the App was very high, the balance between sustainability from a financial perspective and accessibility to users. This is a significant difference to for-profit organizations developing similar technology, where monetization is often given precedence over accessibility. However, there exists an opportunity for non-profits to learn

from these for-profit organizations, as user bases continue to grow for Apps like Strava, which has both a free and premium version.

The second point on future use is that of gaining a deeper understanding of its user base. The interview participant stated:

> "The one thing that we're still trying to fine tune is actually servicing the target, the intended target audience. Our target audience has always been to try to get those that are somewhat inactive, to be more active, and not really targeting those that are already active. I think if we look at the engagement numbers, we need to do a better job at really identifying who's using it, and who do we need to get to use it? And then how do we get them on that platform? Because my suspicion is that we have very high engagement levels with those that are very active, and not as high an engagement level with those that are inactive."

Table 31. Key Themes from Expert Interview

Key Theme	**Supporting Quote**
Drivers to Innovate	"… We saw an opportunity and a need to be able to service and have a direct relationship with individual Canadians. Up until that point, we were very, very population base based and we needed a mechanism to be able to work with and support individuals, and to be able to track that impact."
Understanding Efficacy	"I think, quite frankly, COVID just made us realize that we were on the right path, because if we didn't have an app, I think our ability to be a relevant organization this past year would have been in question"
Organizational Partnerships	"And we've worked with sport organizations, any type of organization that has a real strong desire to communicate with Canadians, and we have a vehicle to be able to do that. And so it's a it's a win-win situation, we get some really good quality content and they're able to access a user base that they don't have access to."
Capacity Constraints	"We're not a technology organization, we're a physical activity promotion organization. And, so we, you know, we don't know what we don't know. And so we had lots of great third party vendors. But they're, you know, they're technology companies, they're not physical activity companies… we still needed some in-house technical expertise that be that could speak that language and to be able to direct and monitor the work of that company. And so we have to increase our staff complement in in the digital side"
Future Concerns	"…how do we ensure the sustainability of this app long term beyond government funding, while still making it accessible to all? So, you know, we're looking at different ways to monetize the app that that I'd say that's the biggest challenge…"

Overall, the interview provided valuable insights about how organizations involved in the promotion of physical activity view and implement innovation, with five key themes emerging. It emerged that innovation can be a strong driver of positive outcomes, while also playing a role in protecting an organization from adverse events (such as a pandemic). The interview also

highlighted the fact that it takes a certain amount of organizational capital to implement innovations, with key challenges being funding and organizational buy-in.

4.5. Sport Organization Interviews

Another round of interviews was conducted with sport and physical activity organizations who had applied for a JumpStart "Sport Relief" grant. Researchers contacted 13 organizations who had participated in the program and conducted 7 interviews, a 54% response rate. The organizations were diverse in terms of their programming, participants, and regions covered. Some organizations were large, national organizations, some were provincial sport organizations (PSOs), and some were regionally/locally focused organizations. All of the organizations that were interviewed were servicing traditionally underserved populations. All of the individuals were either the leaders or founders of their organizations or held senior positions in the organization.

This research utilized the methodology of establishing saturation in thematic analysis developed by Guest et al. (2020) in which a base number of interviews are conducted and then coded to establish a "base" number of themes which is then compared to a "run" of interviews to establish how many new thematic codes emerge. When the number of new codes in the "run" is less than 5% of the total established in the "base", then it can be assumed that saturation has been reached. After the first five interviews were conducted, 43 thematic codes were established. The next two interviews were analyzed and resulted in only one new code. By using this technique, we can be reasonably sure that saturation within the group was reached by the seventh interview.

4.5.1. Community/Organizational Backgrounds and Challenges

The first part of the interviews consisted of questions regarding the general operation of the organizations and the communities they served. This included their missions, challenges that they faced as organizations. A few thematic areas emerged from these discussions, which are detailed in Table 32. These thematic areas were "Sport as a Tool", "Challenges Accessing Sport", "Facilities and Funding", and "Diversity of Program Impacts".

Table 32. Community and Organizational Background

Thematic Area	**Relevant Quotes**
Sport As a Tool: Many of the organizations provided opportunity to participants to play sports, however, many of the organizations were focused on using what they see as the positive impacts of sport to address other outcomes.	"So, it's really about using the sport as a place to give them the confidence to set goals and kinda work through barriers that they face in their lives off the ice and we just sort of use hockey as the test-tube for that"
	"I just think sports is such a valuable, valuable lesson, a valuable education in this world that probably a lot of people kind of take for granted. I'm a firm believer of academics plus athletics equals a total education."
	"We use sport and play to improve health and wellness, to advance education outcomes, drive community engagement and build community capacity as well."
Challenges Accessing Sport: All of the organizations interviewed identified that their participants faced barriers in accessing sport. The most common barriers identified were lack of access (n = 5) and socioeconomic challenges (n = 5)	"But if I was to make a really big, wide-sweep generalization, Indigenous kids do not have much opportunity when it comes to accessing sport and play programs, regular sport and play programs."
	"I know that you know, because you're talking to me, that the girls even if they're very wealthy, are under served in sport, regardless of their socioeconomic status."
	"So with people with disabilities and kids especially too, there's a lot of barriers to participation and equipment is the number one thing."
Facilities & Funding In terms of the challenges that organizations were facing pre-pandemic, the two most significant	"We can't get diamonds anywhere. We're obviously not a priority to any region because diamonds are grandfathered and in the new places that we're starting up, we're bottom of the list."

barriers were access to facilities (n = 4) and funding challenges (n = 3)	"…they have three girls teams who are fundamental made of girls from the area. The rink will not give them a single hour of ice."
	"Getting them, the cost is sometimes just off the charts ridiculous and then the staffing that is required during the time that we use it, insurance, it's just a lot of steps and hoops to go through, so it's, ya, facilities is a big challenge for sure"
	"I've been involved in helping kids and helping young adults for over 28 years and renting facilities is for me a huge, huge problem because the schools are empty in the summer time and I don't think the schools or these rental people really care."
	"We're always fundraising, we're always trying to raise money to keep the programs running and we had received a very large federal grant, they just stopped two years into the program, the program changes and they said "those funds are no longer available" so we just really had to scramble to try to replace that funding and that had to be our biggest challenge for sure."
Diversity of Program Impacts: Despite being organizations focused on physical activity, the impacts of their programs was most commonly reported in the form of mental health (n = 6) and academic improvements (n = 4)	"…anecdotal reports that I saw from teachers and educators this year was that the program was hugely important for the kids that did come back to school because it did provide a sense of normalcy for them and provide an outlet for some of them who are experiencing real stress and real disruption at home and at school."
	"I know from parental testimonials that our league is changing girls and their confidence level when it comes to sport and to me that's what we're trying to do."
	"…we sort of jokingly say we're hoping to produce hundreds and hundreds of beer league hockey players every year, because if our kids are able to sort of emotionally invest in a sport, and want to be able to do it for a long time, but then are also in a place

	where they are able to walk into a beer league or adult rec hockey league and be successful, it means that they have developed employability skills, it means they've developed self-confidence, it means they've developed skills like all of these sorts of things"
	"… it was happening in schools, teachers were noticing attendance improvement and reading scores changing and parent getting involved as volunteers and all these sort of wonderful effect that were happening as a result of the program"
	"We understand that academics is important and some kids might not want to play, they might just want to come and socialize or they might need help with their homework."

The interviews yielded four themes to summarize their pre-COVID operations, with there being discussion around how the organizations use sport to benefit their participants and the real-world impacts of their programs. There was also discussion regarding both the challenges that their target audiences face in accessing sport and the challenges that the organizations themselves have in delivering their programing.

4.5.2. Impacts of COVID-19

The second set of questioning was specifically around how the pandemic had impacted their organizations and their community of participants. The themes that emerged are detailed in Table 33. These themes were: "Changes in Revenue", "The COVID Pivot", "Different Restrictions, Different Regions, One Organization", and "Cloudy Crystal Balls".

Table 33. Impacts of the COVID-19 Pandemic

Thematic Area	Relevant Quotes
Changes in Resources: Most of the organizations interviewed highlighted the impact of the pandemic on their traditional revenue sources, with grants (n = 6) and fundraising (n = 6) being the most commonly cited impacts	"…a lot of interest in the program but it doesn't necessarily translate into, I mean people are making donations that's for sure and it's really appreciated and we certainly are grateful but it's not the level of funding that is needed to implement and have long term sustainable programming in community that will actually make a meaningful impact."
	"One of our biggest grants is contingent on us running in the fall. If we don't get permission and we don't run in the fall, we won't get that money, which effects staff being paid which effects our programs being run, and if we lose that opportunity, it's not something that we can pick up and do again later."
	"maybe I'm just underestimating Canadian philanthropy, but I still believe there's going to have to be a scale down, like people are going to get back to normal and realize what their personal financial impact has been due to COVID and corporate donors who have given us money and what they impact on their bottom line has been and is there going to be a challenge getting funding."
The COVID Pivot: Organizations consistently described how they adjusted their operations during COVID. Only one organization reported not running any programming between Spring 2020 and Summer 2021.	"However, we did also do a series of activity cards and sort of instructional games and skills and things that kids could take home because many of the kids, I feel it's about 40% in Indigenous communities don't have access to Wi-Fi so a lot of them are getting their school supplies at the school on a weekly basis so they would come in and collect the papers and assignments and then we would have and activity card as well for them to do at home as well as a part of that."
	"…it got to the point where we were like okay well lets at least try to launch the after-school program because that's something that can be done virtually. We can remove the tennis racked because of course we're not going to be playing tennis, but we can learn online. So our programming committee, we got together and tried to, not tried to, we drafted a program like okay how can we shift this from in person to online."
	"…we looked quickly to see what we could do to bring kids together and one of the silver linings was Zoom. We did, my count was we did 241 Zoom (sessions)"

	"We could have fed all our families and we could have bought devices and WIFI for all our kids so they could continue school, but if we did that at the expense of being able to get back on the ice this fall, at this point I'm talking about closing up the organization."
Different Restriction, Different Regions, One Organization All (n = 7) organizations reported that public-health restrictions had impacted their programming and operations in a negative way, and one of the comments that was consistently made was the impact of operating an organization while having to monitor many different sets of restrictions	"There's different rules for every single city and every single, you know it's not just a provincial return to sport, it's a city. And we also we've been affiliated with different provincial sport bodies or baseball specific sport bodies and we are no longer affiliated with them in terms of our governance and so it falls to us to do it ourselves"
	"You know, Toronto they never opened the rinks, it wasn't even an option. Regina there just wasn't access to ice, Manitoba has severely restricted hockey. Some of our programs like in Victoria BC, they got a full season, in Alberta we got 8 weeks in before that second shut down sort of kicked in."
	"The rules were really hard to understand and the rules around permits and what you could do on a diamond and how many people were there, I mean it still is, but it was always changing, it was confusing, I was worried about safety and liability, and just people's comfort levels and if it was even worth running a program and so I just though 'we're going to lay low'"
	"So, we had to know 12 different sets of rules, and have 12 different return plans in different places and that comes with cost and that comes with organizing and that comes with oversight and I totally get why that happened but those things again, most impact the kids that have the least resources."
	"In BC our regions were so different in terms of what was being allowed in the lower mainland as to what was being allowed on the island or in the north, so we continued to do school visits in Victoria and Vancouver Island the entire time and meanwhile people in the Fraser Valley and Vancouver are going 'why are these guys doing that in Victoria when we can't'"
Cloudy Crystal Balls: Many of the organizations detailed not being able to make plans for the future, with significant emphasis being placed on the reality that no plans could be made before further guidance was received from governments.	"we can't really make a move until we have guidance from the government. Because you know, you don't want to break rules, you don't want to put anybody in danger, other wise we end up right back where we started."
	"It's hard, it's difficult because essentially we should be planning for the fall right now. We should be opening registration right now. We should be starting to look for, doing interviews and hiring staff and getting prepared to roll out come September, but we can't do that if they

	can't make a decision on what they're going to do with schools and school openings and group sizes and I feel like everybody is just kind of winging it right now"
	"We can't plan for anything, so I can't plan, I can't say that we're going to have any future income because again, we're not entitled to grants and I don't know that we're going to be able to offer programming. So, there's so much uncertainty still that I don't, that we're still kind of stuck in this COVID hell."
	"Everybody's talking about how wonderful it's going to be to get back to school in the fall, we don't know what new normal looks like at the schools and how school boards, what they're going to do over the summer and that sorts of thing. Part of it's going to be seeing what happens when they go back to school in September and how schools and school boards have adapted and those sorts of things and what the lay of the lands is, so there's still lots of uncertainty"
	"We don't know what the new normal is going to look like, so we don't know if those impact costs too. If some jurisdictions decide masks are forever, well we've got to provide them, so that's a cost, right?"
	"So those are the things that when jurisdictions make decisions about social distancing, those are the unintended consequences that they don't recognize but then we have to figure out a solution for."

The second section of the interviews revolved around the impacts that the pandemic had on the respective organization. Interviewees' responses were thematically grouped into four distinct groups. The impacts of the pandemic were felt in different ways by different organizations, but common themes were that the resources available to the organizations had shifted, either on the funding/revenue side or on the expenses side; that both programming and operations had adjusted due to the restrictions imposed to curb the spread of the COVID-19 virus; larger organizations struggled to adapt to the different restrictions imposed on different localities, especially when those localities were within the same regions/provinces (i.e.

Vancouver having different restrictions than Vancouver Island); and finally that the pandemic had severely impacted the organizations' ability to plan for the future.

Chapter 5. Discussion

This research was conducted with two distinct goals in mind. The first was to investigate the impact that the COVID-19 pandemic has had and may continue to have on the sport participation ecosystem. The data sources used target both sport participants and sport organizations to understand the mechanisms through which the pandemic may have affected sport participation at both the individual and organizational levels. This research also used both device-based, quantitative data along with qualitative interview-based data to gain a comprehensive view of the impacts of the pandemic on sport participation. The second goal of this research was to synthesize a new framework to better understand how large changes (in the form of pandemics, recessions, or other significant phenomena) will affect sport participation in the future. This discussion will follow the research questions posed in the literature review and will reference the results generated from the four data sources examined in the results section. Each data set may be used to answer multiple research questions.

5.1. RQ1: How has the COVID-19 pandemic affected individuals' sport capital?

Sport Capital was developed by Rowe (2015) and contained three domains: psychological, physiological, and social. While the original measurement scale consisted of questions asked to individuals in a telephone interview, this research took a mixed-methods approach to examining the domains of sport capital. The first way in which this research examined sport capital was through the ParticipACTION survey. The survey asked questions related to the domains of sport capital, and those questions were used to help understand how sport participants perceived the COVID-19 pandemic. It was found that those who track sport participation had relatively higher scores in the physiological, psychological, and social domains of the sporting capital framework

as opposed to those that do not track their sport participation. Based on the survey results, scores for the measures associated with sport capital remained quite high, even though the survey was administered approximately 8 months into the pandemic. The levels of sporting capital seen in this research were relatively high as compared to Rowe (2015). There are several possible explanations which could account for this discrepancy: first, the survey conducted by ParticipACTION did not contain the exact questions as assessed by Rowe (2015); second, the nature of surveying a group of individuals who use a mobile phone app to track physical activity suggests that they are already involved with physical activity, and thus would have higher scores in the domains of sport capital.

In terms of how sport capital has changed because of the pandemic, it is unclear that a major impact has been felt by sport participants. The App data suggested that those who participated in resource intensive sports (such as swimming and team sports) participated in less sport, but not necessarily less overall physical activity. However, when compared to those who did not participate in sport, they did not see an overall gain in physical activity. This could be explained by the fact that while those that participate in sport lost the baseline level of activity from sport, it was replaced by general physical activity, while those who faced barriers to physical activity were able to get more physical activity when those barriers were removed.

These results provide interesting implications in terms of the Sport Demand Framework (SDF). Given the magnitude of the pandemic, and all of the implications it has had on nearly every facet of society, the fact that sport capital has remained relatively unaffected provides insights into how participation may occur. While it is beyond the scope of this preliminary work, it may be the case that sport participation has unique temporal aspects, where the level of sport

capital can be considered fixed in the short run but changeable in the long run; and that in the short-run only the micro and macro level determinants are changeable.

This interpretation is supported by the fact that in Rowe's (2015) original development, sport capital is specifically an adaptation of the concepts of human capital and social capital. Human capital and social capital are depicted classically in economics as the result of investments in things such as education (Nahapiet, 2011). It stands to reason, then, that sport capital is the result of investment (and grows as it is invested in) but does not necessarily diminish (much as human capital does not fall as a result of education not increasing, merely stagnating instead). Therefore, in moments of forced break from sport (such as during a pandemic) the immediate concern should not be on those who have developed sport capital, but should instead be focused on those who are still building sport capital (such as youth or new participants).

A possible explanation of the relatively low impact on individual's sport capital is included in Rowe's (2015) development of the theory of sporting capital, which suggests that sport capital is much more "sticky" than participation, and that sport capital does not change rapidly. This is perhaps related to the idea that sport participants build "resiliency" through their participation in sport (Hall, 2011). If sport participants are more resilient to adversity through their participation in sport, then it can be expected that a temporary (insomuch as an 18-month

period of absence from sport is temporary) will not have significantly affected an individual's sport capital. The findings for RQ1 are summarized in Figure 16.

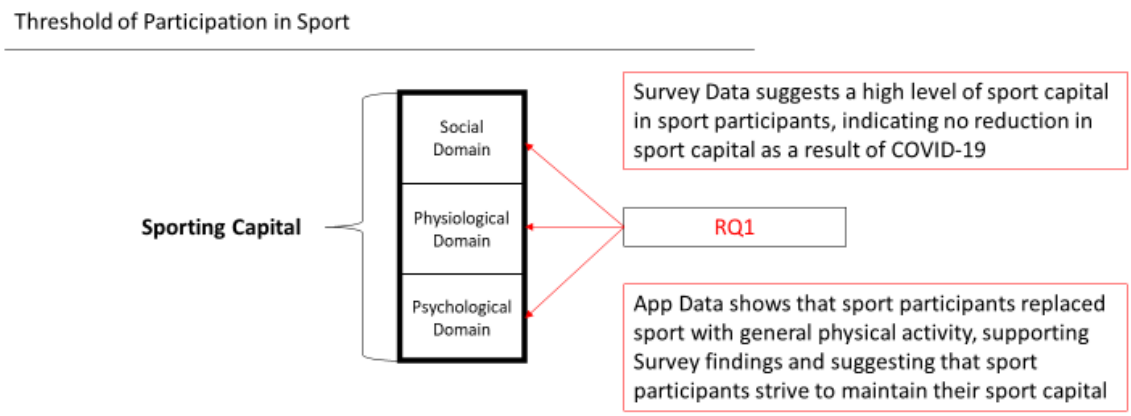

Figure 16. RQ1 Findings

To summarize, the data from the App data and the survey data provided somewhat reassuring (from the perspective of practitioners in recreational/participatory sport) that the overall level of sport capital has not been affected by the pandemic. This is encouraging as it suggests that former participants are likely to return to sport once restrictions are lifted. If the reverse had been true (that sport capital had been reduced by the pandemic), then even when restrictions were lifted, former participants would have been less likely to participate in sport than they were before the pandemic. With this knowledge, recreational/participatory sport organizations should endeavour to return as quickly as they can to full capacity to ensure that no

former participant is denied access, as it is likely that long periods without sport may result in lower sport capital.

5.2. RQ2: How has the COVID-19 pandemic affected micro-level factors related to sport participation?

At the individual participant level, it was found that overall, sport participants did not see a large impact of the pandemic on either their ability to afford sport (mean score of 2.54 on a five-point Likert scale) or their time available for sport (mean score of 2.35 on a five-point Likert scale). Sport participants did report that the pandemic had impacted their ability to access sport (mean of 3.6 on a five-point Likert scale). This makes intuitive sense, as lockdowns and related restrictions made accessing some certain facilities and activities impossible during the pandemic. Somewhat surprisingly, when the impacts of the pandemic were compared between provinces there were no significant differences in reported levels of pandemic influence on any of the barriers. This is even though restrictions varied widely across different regions, especially between dense urban areas such as Toronto and Vancouver as opposed to more rural areas and areas with lower populations.

When looking at how the impact of the pandemic was felt, it was found that there was significant negative correlation with both an increased reporting of negative impacts on time and affordability of sport with overall sport participation. It was found that there was a significant positive relationship between reduction in access and sport participation. However, when a regression analysis was conducted incorporating the sport capital framework and the micro-level factors of sport participation, only lack of time was a significant predictor of sport minutes. The positive correlation of restricted access to sport and sport participation could be explained by the

fact that those who participate in sports that require facilities or sports that involve close contact may already have higher rates of sport participation than those who do not.

The lack of reporting that time and ability to afford sport had been negatively impacted by the pandemic was surprising but may be explained by the measures that were put in place to a) curb the pandemic and b) support individuals who were impacted by those restrictions in Canada. The National Bureau of Economic Research (Brynjolfsson et al., 2020) suggested that as many as 35.2% of workers had switched to remote work from commuting. Research has suggested that long commutes are associated with decreased satisfaction with leisure time (Clark, Chatterjee, Martin, & Davis, 2019). By eliminating commutes (as workplaces were closed to prevent the spread of COVID-19) it is possible that the time barrier to sport was reduced as a result of the pandemic. Research from early in the pandemic has suggested that there was a very low level of economic anxiety from the pandemic, which supports the finding that financial barriers were unlikely to have increased as a direct result of the pandemic (Zajacova et al., 2020). Additionally, it is unlikely the main reason for a decrease in access to sport would have been financial, given that if a swimmer's pool is closed, and the sport organization cannot run programming, then the individual may report that they cannot access sport rather than reporting that they cannot afford it, even if they suffered negative financial consequences as a result of the pandemic.

5.3. RQ3: How has the COVID-19 pandemic affected macro-level factors related to sport participation?

Arguably, the most severe impacts of the pandemic (at least in terms of the sport participation ecosystem) demonstrated by this research were felt by sport organizations. From the interviews conducted with a diverse set of sport organizations, there were a few thematic areas that emerged regarding the impact of the pandemic. One of the most impactful was the impact that the pandemic had on their revenue streams. It was consistently reported that in-person fundraising was a key revenue stream that was taken away as a result of the pandemic. While many organizations utilized virtual technologies to adapt their programming or reach out to their participants, virtual fundraising was not something that was developed. In fact, one interview subject specifically mentioned that they did not think was appropriate:

> "So I figure you know, a lot of the times when we do fundraisers it's about thanking the people that help us, our sponsors, our donors, stuff like that and I would kind of like to do that in person instead of virtual."

The other revenue stream that was affected was grants, and organizations reported that they experienced something of a substitution effect:

> "Early on it was very interesting because a lot of money was flowing, but it was flowing to front line workers and front-line services so, our granting and foundation opportunities that we would normally would have gone to were saying straight up 'don't apply because we're going to only support frontline workers and emergency services at this time'"

While funding was a major component of the impact of the COVID-19 pandemic, the main impact of the pandemic on organizations future operation was the idea of uncertainty. The organizations (especially those who operate in multiple regions) identified a challenging

landscape when it came to navigating public-health restrictions. This uncertainty impacted the ability of organizations to plan.

> "Like, it changes my expansion plan for the organization. It's certainly slowed down sort of the timeline of the vision for opening new programs in the country pre-COVID to post-COVID. It's certainly stretched that out or slowed it down."

The restrictions also impacted organization's ability to budget:

> "…well if social distancing continues in place like it is, the bus that I spent $300 on to transport 40 kids, now becomes the bus that I spent $300 on to transport 10 kids, so by my math, I need 3 more buses. So I'm triple to quadrupling my transportation budget."

These factors have the ability to derail the progress that these organizations are making in addressing the challenges that their participants face. One organization mentioned that one of their major grants was contingent on running programs in the fall, but that whether they were able to run programming was "out of their hands".

From the perspective of the organization, one thematic area is worth mentioning as well despite only being heard from a few of the organizations. While four organizations mentioned that access to facilities was a significant challenge pre-pandemic, a few indicated that the pandemic had exacerbated their existing challenges. One subject stated:

> "We were supposed to have a home ice. It was supposed to be the (local) arena, which the (organization in charge of operating it) closed. … they're on what I definitely call emergency budget measures right now, so the rink never opened."

Another stated:

> "In one of the regions that we're going to, the city's not even opening (baseball) diamonds. Like the city is, even though the province says everything can be open, the city is like 'no, we don't agree, we're not opening it'."

All the comments from organizations suggest that they are doing their best to adapt to new challenges brought up by the pandemic, despite having to develop new skills and competencies:

> "I mean like I didn't know anything about Zoom or Teams before. But we had to adjust, I think everybody had to adjust and stuff like that but it became a useful tool for the world and we were conducting a lot of different kinds of meetings, a lot of games, just some kind of communication, some kind of verbal contact and I think was beneficial for the mental state of everybody, for the players, for the students, for the coaches, for our foundation as a whole."

It is clear – from the results - that these organizations are ready and willing to adapt to the challenges of the pandemic. Teare & Taks (2021) describe three areas that sport organizations should look to innovate in post-pandemic: programming, marketing, and resource management. As demonstrated by the quotes from interviews subjects, organizations were very capable of responding to the challenges of the pandemic from a programming perspective by innovating in the way they deliver programming and maintain contact with participants. From a marketing perspective, many of the organizations that were interviewed reported having "surplus" of participants and in fact not having enough resources to meet the demand for their programming. Based on some of the quotes from interview subjects, what may be more important than innovating to attract participants through marketing is how innovation may improve retention. Finally, from the interviews conducted it is not clear that innovation in resource management at the organizational level would result in better outcomes from the pandemic. Instead, what may

be important is that the innovation in resource management needs to come from the organizations and agencies that provide funding to these sport organizations. When asked about the funding they had received from Jumpstart, many mentioned the financial impact it had made, how it had helped their organization retain or adjust their operations during the pandemic, but one of the responses that came through was that the model for funding sport needed to be reassessed to better support organizations that were not focussed on high-performance. One respondent provided this quote:

> "I think through this whole thing, JumpStart has really been pushing the messaging that it's actually the reverse, it's the marginalized communities and the kids that are living with no opportunities that need this stuff the most, and I think that people still believe that, I just hope it sticks in September and I think that's what's been powerful with JumpStart's money has also been messaging behind the money and why it matters. I hope that that momentum doesn't get lost and I hope that that messaging doesn't get lost because if that shifts and we decide only the really good hockey players matter, well then we know what that means, that's issues for a lot of the social issues we see now because programs like ours, our participants are 70% BIPOC and always have been. Like all of those things where we're talking about inclusion, all that stuff directly impacts inclusion and accessibility and collaborative teams and communities and if the focus shifts back towards that high-performance level right?"

The final area to be discussed regarding how the pandemic has affected sport organizations is around their staff and volunteers, which is one of the capacity areas identified by Doherty et al. (2014). This was one area of impact that was different across organizations in different regions and different organizational structures. Three organizations indicated that they had laid off at

least some portion of their staff, and the commonality between the organizations is that they were some of the "youngest" organizations that were interviewed. In terms of volunteers, most reported that they did not experience a loss of volunteers, or if they did, it was not at a level that they may have expected:

> "We sort of predicted (we would lose) 10% of our volunteers just either through fear, recognizing that our kids are vulnerable, or just they lose that momentum. They lose that routine of going to the rink every week and they get into a new relationship, and they want to focus all their time on that. I thought we would lose like 10% of our volunteers and that doesn't seem to be happening and quite frankly in the past week we had 30 new volunteer applications."

In summary, the main issues facing organizations as they emerge from the pandemic are the uncertainty around the future of pandemic restrictions and a traditional funding structure that disadvantages participatory or sport-for-development organizations.

5.4. RQ4a: How has the actual rate of sport participation changed as a result of the pandemic?

The survey data indicated that participants in sport did not suffer an increase in either time-related barriers or financial barriers. The survey respondents did report that they had reduced access to sport as a result of the pandemic. Given many of the fears of economic distress and job losses caused by the pandemic, it is interesting that few respondents indicated that the pandemic had increased financial difficulties in accessing sport. While not directly investigated in this research, it is possible that the financial assistance to individuals that was deployed in Canada to

those suffering from pandemic-induced financial difficulty or job loss staved off many of the negative repercussions of the pandemic.

The App data suggested that physical activity in general increased year-over-year from March – May of 2019 to March-May of 2020. However, sport participation fell in the period of March to May of 2020. There were some distinctions in the data. Cycling and running experienced no drop in participation because of the pandemic, while swimming was hardest hit. Considering that App users are Canadian, it makes sense that individual sports which can be practiced outdoors were very popular as a result of pandemic restrictions, while sports with heavy reliance on "infrastructure" like swimming (one would imagine that much of the swimming done in the period of March to May in Canada is done in a swimming pool) or on close contact with others (soccer, football, rugby) would decline in terms of participation rates.

5.5. RQ4b: How do sport participants differ from non-sport participants in relation to the effects of the pandemic on their physical activity?

Both the survey responses and the App data suggested that those who participate in sport had significantly higher weekly MVPA rates than non-sport participants. App data suggested that overall, physical activity increased between the spring of 2019 and the spring of 2020, but that those who participated in sport prior to the pandemic did not have the same magnitude of increase that those that did not. The App data also showed that those who participated in sport were much less likely to "drop out" of App usage. While this does not indicate that they drop out

of physical activity or sport, it does suggest that tracking sport provides utility to sport participants.

As discussed around RQ1, sport participants had higher levels of sport capital than non-sport participants. One of the aspects of the theory of sport capital is that a higher level of capital results in a higher likelihood of sport participation. Taken together with the App data and Survey data suggesting that sport participants achieve a higher level of physical activity than non-sport participants, it could be said that sport participants are exhibiting a high level of resilience in their levels of physical activity.

5.6. RQ5a: How has the COVID-19 pandemic impacted the capacity of community sport organizations?

The capacity of sport organizations as suggested by Doherty et al. (2014) is said to have five dimensions, namely human resources, finance, infrastructure, planning and development, and external relationships. The interviews conducted with sport organizations suggested that there was some level of impact across all five dimensions.

In terms of human resources, there were significant impacts on both volunteer-driven organizations and organizations with full-time and part-time staff. Those with volunteers reported that there had been little impact on their volunteer base (some had in fact been able to recruit more volunteers) but those who had paid staff reported that there were impacts to those staff including reduction in hours (full-time to part-time) or even layoffs. However, none of the organizations suggested that the impacts on human resources were existentially threatening to the organization, or that they were in danger of reducing or eliminating programming.

Infrastructure was a capacity limit for many of the organizations, with two of the organizations interviewed stating that it was the single biggest barrier they faced to providing programming prior to the pandemic. In terms of the effect of the pandemic, many organizations stated that access to infrastructure (both in terms of equipment and access to facilities) had been impacted. Sporting equipment had been harder to procure, leaving some participants without the equipment they needed. In terms of facilities, organizations reported not being able to access facilities that closed due to COVID-19, and that when those facilities re-opened the priority for access was given to "traditional" sport organizations through what is known as the "grandfathering" system whereby the oldest organizations received first access to rent the facility. Organizations also reported that where they had previously been able to run "dense" programming (in terms of number of participants per program), they had not been able to do that because of social distancing measures that had been put in place. This could create a challenge for organizations as they already face capacity constraints in the form of availability and affordability of facilities, so by reducing the number of participants allowed in a facility, organizations will either have to pay more for increased facility time or reduce the number of participants in their programs.

The third capacity dimension, external relationships, was not as significantly impacted as the other capacity dimensions. The impact of the pandemic on external relationships was felt mostly by the sport organizations who worked with schools to provide programming to youth participants. These organizations reported that while their relationship with schools and school

boards were still good, the reality was that collaboration with sport non-profits had fallen down the list of priorities for schools as they figured out how to adjust to a pandemic-influenced world.

Financial capacity, as discussed in section 5.3, was influenced in a number of ways that track with the critical elements identified by Doherty et al. (2014). In particular, organizations had lost stability in their revenue, with many organizations reporting that their traditional funding tools (grants and donations) had changed drastically. One organization reported that a large grant they rely on for operational funding was contingent upon running programming, but that they do not know if they will be allowed to run that programming due to pandemic rules. Expenses had also been impacted by the pandemic, both through direct costs (i.e., purchasing personal protective equipment (PPE) for volunteers and staff) and also through indirect costs incurred as a result of the pandemic, for example increased transportation costs because busses could only have half the number of occupants, necessitating two busses when one would normally suffice.

The overriding sentiment from all the organizations that were spoken to in this study was one of uncertainty, which, when combined with all of the other capacity dimensions, resulted in the most significant impact of the pandemic being the organizational ability to plan. Many organizations discussed the way that uncertainty with regards to their ability to operate programming in the coming months resulted in limiting enrolment for participants, their plans for expansion to areas that requested their programs, or their ability to hire new staff or purchase new equipment.

5.7. RQ5b: How do community sport organizations see the role of innovation in the recovery of from the COVID-19 pandemic?

Many of the organizations interviewed indicated that they had adapted to the pandemic by launching virtual programming. These organizations found that the shift to virtual programming had benefits to their participants:

> "We were able to bring kids together from different cities that otherwise wouldn't get to see each other, and even countries. So we were able to engage our Belfast players, our Northern Ireland players in with our Canadian kids."

The interview participants also indicated that embracing technology helped them improve their operations:

> "Well one of the things that we do now that we never did before is with the kids that apply (for the equipment support program), we would normally just give them the (equipment) either to the teacher or their physio or whatever, and now we're actually doing like a Zoom interview, it's not a test or anything, but we talk to the family and child and have a conversation with them and it's actually proven to be quite valuable and we're going to continue to do that, do our sort of intake that way."

The organizations also indicated that the pandemic influence their thinking about staffing:

> "I think working from home has been an interesting thing for our staff too and we're kind of realizing that we don't really need to be in the office, not that, during normal times we're not in the office five days a week anyways, we're always out running around and doing programming and delivering equipment and stuff like that. But, realizing that we can pretty much do our jobs form anywhere was actually pretty cool for our boss to be like "wow okay"."

It is clear to see that sport organizations are ready and willing to innovate in response to challenges. The interview that was conducted with a sport and physical activity promotion organization on how they utilized innovation also provided clear evidence that innovation will allow for the sport and physical activity organizations of the future to better implement programming, more effectively collaborate with partners, and better track outcomes.

In the interview with the physical activity promotion expert, the reality of implementation of innovation was explored. The interview subject suggested that investing in new technology and innovations allowed for more positive organizational outcomes, and that while there were challenges getting buy-in from stakeholders, challenges with funding, and challenges with implementation, the investment in innovation was worth it from an organizational perspective. In fact, the technology that the organization implemented prior to the pandemic resulted in much better organizational outcomes:

> "I think, quite frankly, COVID just made us realize that we were on the right path, because if we didn't have an app, I think our ability to be a relevant organization this past year would have been in question."

This comment has interesting implications when considering the wider sport participation landscape. It suggests that innovation and the use of technology can help mitigate some of the effects that organizations have seen due, in part, to the pandemic. This benefit of innovation aligns with the innovations that these sport organizations have already implemented, such as the use of Zoom to meet with participants, YouTube videos to deliver instructional content, and even organizational innovations such as remote work.

In conclusion, organizations see innovation (specifically technological innovation) not as a tool for recovery, but as a way that they adapted to the challenges prevented by the pandemic.

The innovations that occurred during the pandemic will continue to be used as they improve the outcomes for the organization. The interviews have shown that sport organizations are able to innovate to meet challenges, while the organizations were also unsure of what the future holds.

5.8. Discussion Summary

This thesis has looked at the disparate potential impacts of the pandemic on sport participation, focusing on the individual level and the organizational level. These two levels combine in the Sport Demand Framework (SDF). The SDF was investigated using four different data sources to essentially triangulate the impact of the pandemic. The results are summed up in the below series of graphics. The first graphic demonstrates how the data sources related to RQ1:

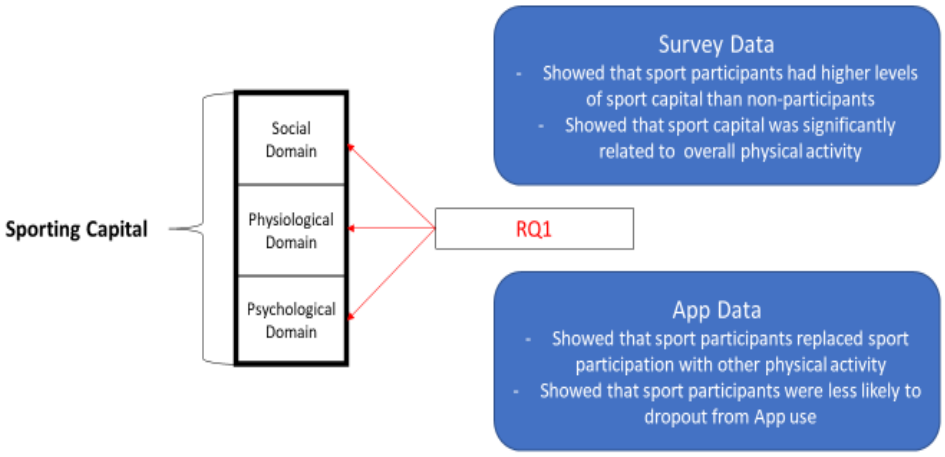

Figure 17. Summary of Pandemic impacts on Sport Capital

Figure 18 shows which data sources were used for RQ2, and what those data sources showed:

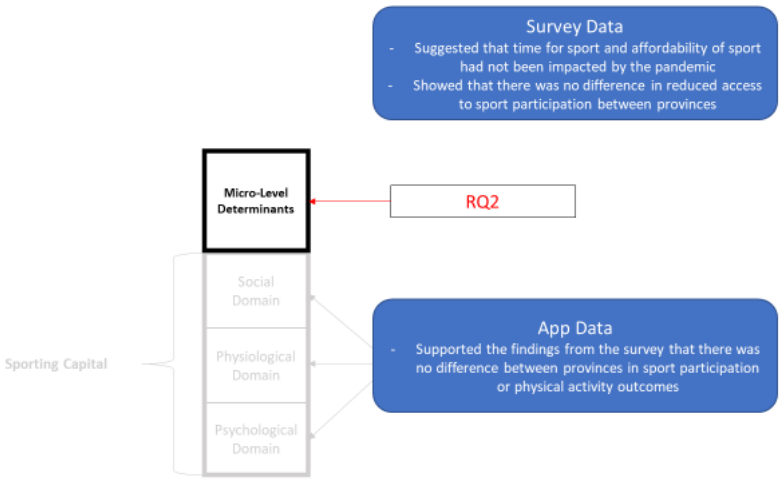

Figure 18. Summary of Pandemic Impacts found for RQ2

Figure 19 shows which data sources were used to investigate RQ3 & RQ5 and the most significant findings:

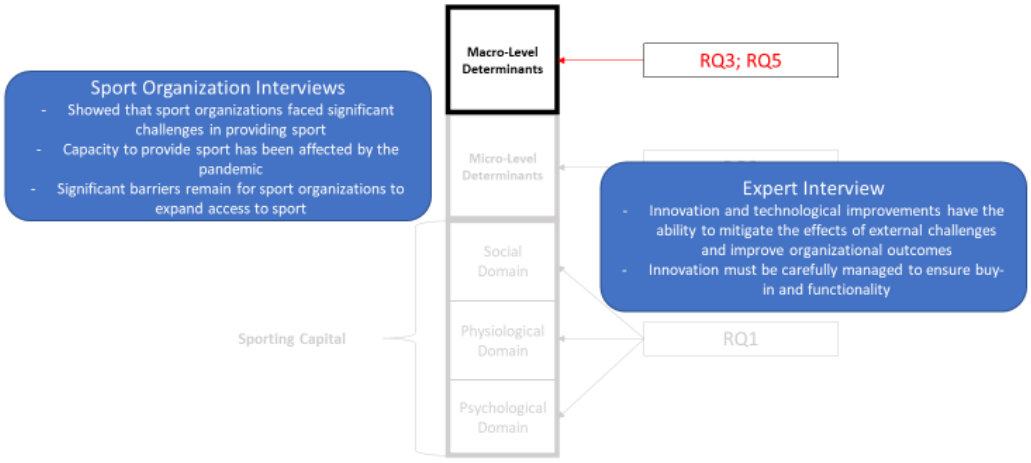

Figure 19. Summary of Pandemic Impacts for RQ3 & RQ5

Finally, Figure 20 summarizes the data sources used and major findings for RQ4:

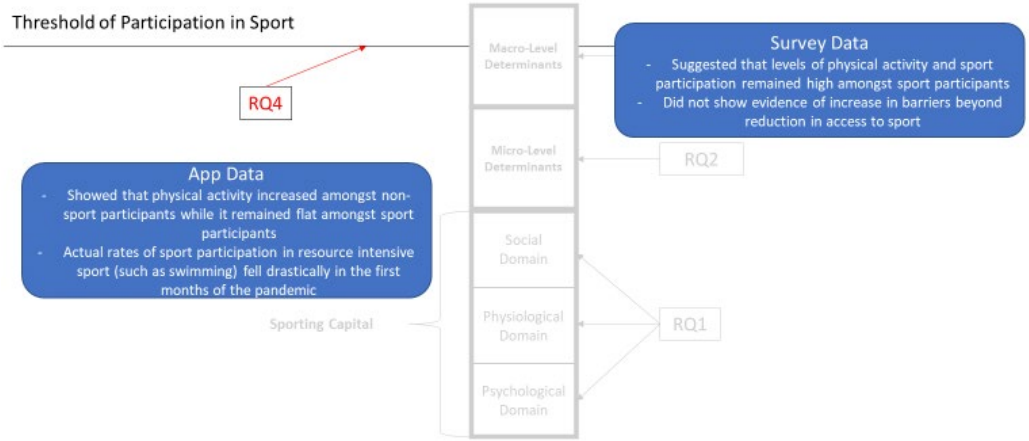

Figure 20. Summary of Pandemic Impact for RQ4

This thesis was meant to investigate the impact of the COVID-19 pandemic on the participatory sport system in Canada. By developing the SDF, this research was able to frame five research questions around the potential impacts of the pandemic. By examining multiple aspects of sport participation, and using a mixed methods approach, this research was able to arrive at some interesting conclusions. The first was that sport participants are resilient when it comes to physical activity. Survey data suggested that sport participants had high levels of sport capital, even well into the pandemic. App data suggested that sport participants made up for a lack of access to sport by participating in more general physical activity. The second conclusion of this research is that the traditional barriers to sport of lack of time and affordability were not impacted by the pandemic. The third finding of this research was that sport organizations faced a significant challenge during the pandemic in many of the capacity dimensions identified by Doherty et al. (2014). The final finding was that sport organizations are ready and willing to

embrace innovation and new technology, and that embracing new technology can lead to improved organizational performance in challenging times, but that resource limitations may prevent organizations from being able to take the risk involved with developing innovations.

Chapter 6. Implications

6.1. Theoretical Implications

The major theoretical contribution of this work is the amalgamation of the theory of Sport Capital developed by Rowe (2015) and the micro and macro level determinants of sport participation developed by Wicker et al. (2012) into the Sport Demand Framework (SDF). The SDF is an attempt to frame the two aspects of sport participation that are prevalent in the sport participation literature, namely the internal/individual component (represented by the concept of sport capital) and the contextual/external (represented by the micro and macro level determinants of sport participation). By combining these two perspectives, the SDF seeks to accurately explain how and why an individual arrives at sport participation. This concept is explored throughout the study, with results supporting the idea that the SDF can accurately explain the demand of an individual for sport. This research also provides support for the idea of sport capital, with measures related to the concepts included within the theory being higher amongst sport participants than among non-sport participants, and that higher levels of sport capital were related to increased sport participation and higher levels of physical activity in general.

This study also addresses the questions posed by Evans et al. (2020) about the future of sport in relation to the pandemic. Specifically, these questions were:

1. What role will sport, exercise and physical activity play in the future?
2. Will the organizational structure of sport change in response to the pandemic?
3. Will the inequalities highlighted by the pandemic begin to be addressed?

While the "role" of sport in the future is not something that the current research can answer, the results of this research suggest that sport participants are ready and willing to return to sport as

soon as restrictions lift, and sport programs are offered again. None of the organizations that were interviewed suggested that they were aiming to change their organizational structure, however, they were using the pandemic to investigate different ways to adapt their programming, including using technology to adapt programming (such as virtual coaching sessions and instructional videos) and to adapt organizational processes (such as encouraging remote work).

The final questions, about inequalities highlighted by the pandemic, is one where the organizations that were interviewed are making a difference. Based on the themes identified and the organizations interviewed, there are a significant number of organizations that are working to address the inequities in the sport participation landscape and provide sport to those populations that are underserved. However, the interviews suggested that many of these organizations exist outside of the traditional Canadian sport structure (namely the National, Provincial, and Regional Sport Organizations) and as such were exposed to a large amount of uncertainty and reduction in resources because of the pandemic. This means that, if these organizations whose goal it is to reduce these inequalities do not receive support to continue their work, then there may be a regressive effect on access to sport.

The final theoretical contribution is methodological in nature. This research combined two separate "big data" sets to answer wide ranging research questions and supported the exploratory data analysis with qualitative data to further understand the phenomena. While mixed methods studies are not new, to our knowledge this research is novel in its approach to mixing big data with depth interviews to arrive at a more thorough understanding of a phenomena. This research shows that there is promise in the ability of big data to provide researchers with more efficient ways to conduct larger studies that seek to understand wider trends in larger populations. While previous studies have worked to incorporate both quantitative

“big data” analysis and qualitative research (e.g. Bogolyubov, 2019), this study was unique in the way that the big data sets were used to draw population-level conclusions, with the qualitative methods being used to deepen understanding of related issues. Essentially, this method provides a way to look and broad phenomena, identify and interpret high-level trends, and then examine those trends in more depth in an iterative fashion. Given that large data sets are becoming increasingly common using tools such as mobile phone applications by organizations such as charities and non-profits who are partners to researchers, this method provides a roadmap for exploring and understanding the impact of changes to systems. This method could be used in various disciplines who examine disruptions, such as business researchers investigating the impact of a disruptive technology or social science/economics researchers seeking to understand how a recession impacts consumers.

6.2. Practical Implications

The first practical implication of this study comes from the organizational perspective. Funding for sport in Canada has traditionally come from the top down through government funding of the NSO/PSO/RSO system and, at the local level, municipal budgets and fees for participants. What this research has shown is that many participants have been left behind or excluded from sport through this system, and that the organizations that have been created to fill the gap face significant challenges in carrying out their work. These organizations are reliant on grants from sources from other agencies and non-profits along with donations from the public. This means that revenue streams are quite volatile, and any abrupt challenges or crises (such as a global pandemic) have the potential to shut down these organizations. At the same time, the organizations face barriers in accessing facilities that are traditionally focused on servicing the

NSO/PSO/RSO model and as such leave little room for new organizations seeking to address the systemic inequities in sport participation. Given that sport participation continues to decline amongst the public, it is perhaps time to re-evaluate how sport organizations are funded, and what the long-term goals of sport organizations should be. To increase sport participation by eliminating or reducing barriers, governments and granting agencies should re-target funding to focus on supporting organizations whose goal is to develop long term sport participants rather than high-performance athletes.

The second practical implication of this research is that sport organizations should seek out opportunities to continue to utilize the in-house expertise built by necessity throughout the pandemic. When discussing the role of innovation in the physical activity space, the expert interviewed suggested that one of the biggest challenges was that they were a physical activity promotion organization, not a tech organization. In the interviews with sport organizations, many suggested that they had learned how to utilize different technologies to interact with participants, provide engagement and programming, and streamline operations. Given the success that the organization represented by the expert had with their technological innovation, it is possible that organizations who invest in the technologies and skills developed by the pandemic will prove more resilient to future challenges.

Another implication of this research, and one unique to these current global circumstances, is the understanding that is provided of the response to crises by sport participants and sport organizations. This occurs at two levels. First, at the participant level, we have learned that in times of forced break from sport, participants are likely to try to maintain their levels of physical activity through different means. This means that there is an opportunity for sport organizations to attempt to connect with their participants through non-traditional means. The organization that

created online videos that participants could watch and interact with at home, providing sport-specific skills and workouts, allowed them to stay engaged with participants despite not being able to host in-person activities. This type of adaptation is incredibly important in times of crisis but may be equally helpful when the crisis occurs at the individual level, not at the societal level. For example, if a person who suffers a job loss and can no longer afford to participate in their previous sport is given access to sport-specific media and tools, not only are they maintaining engagement for when they can return to sport, but they are also working to build sport capital in the physiological domain. The second way in which the results can help the managers of sport programs is by using the SDF to understand how future crises, big and small, will affect their organization. If the organization has used the SDF to analyze their participants and understand how they arrive at participation, they can accurately predict the impact of things like facility closures or financial downturns. For example, a golf club can use the SDF to understand how a financial crisis will impact them. If, in using the SDF framework, they know that most of their participants are elderly and affluent, then a financial crisis may not influence participation. However, if they know that distance to facilities is a large factor for most participants as they are not comfortable driving long distances, then the closure of the course will likely prevent participation and so efforts should be made to assist them in terms of things like establishing a dedicated taxi or bus to get participants to the next closest course.

The final practical implication comes from the theory of Sport Capital. Many organizations do not assess long-term participation outcomes. This research showed that sport capital could be a valuable tool in assessing how participation in each program may lead to improved lifetime participation outcomes. By assessing programming based on its ability to build sport capital, it is

possible that organizations can move away from focusing on high-performance as it's metric of long-term success.

Chapter 7. Limitations and Future Studies

7.1. Limitations

While this study aimed to take a broad look at the impact of the COVID-19 pandemic on sport participation, there are several limitations. The first and most important limitation to consider when examining this research is the exploratory nature of the current study. While there is hope that with vaccinations increasing across Canada that the worst effects of the pandemic are behind us, the pandemic is not yet "over" and as such there may still be implications that emerge in the coming months and years. Also, the data sources were not collected concurrently, with the App data looking at a period at the start of the pandemic in Canada (March to May of 2020), the survey data being collected in October of 2020, and the interviews being conducted in the summer of 2021. Given the fast-moving nature of the pandemic and its related impacts, it is not clear that trends or themes identified early in the pandemic will continue to be valid as we emerge from the pandemic.

The second major limitation of this study is the nature of the data used in the mixed-methods approach. Specifically, the App data and the survey data was secondary in nature which resulted in some important caveats needing to be applied to the research conducted. First, the App data, while a very large sample, was not representative of all sport participants in Canada, and the demographics of those who used the App skewed more female and older than the general population. Secondly, with the App data, the App allowed users to either manually track their physical activity or have it be tracked using device-based wearable technology. It has been shown that self-reported physical activity differs from objectively recorded physical activity (Jakicic et al., 2015). The ability of users to self report also introduced limitations as to record

sport in their physical activity count, users had to manually record their physical activity. This means that in order to consistently record their sport, they had to be constantly using the App. Additionally, for those sport participants who track their physical activity using wearable devices and have it automatically sync to the App, it will not have been recorded as sport. In any case, the App may under-report sport participation (in the case of users who do not manually input their sport) or over-report physical activity for those that do add manual activity (given that manual reporting of physical activity is prone to over-reporting compared to objective measures). This limitation was addressed to the best of our ability by keeping subjectively reported measurements separate from the device-based measurements, and by analysing the effect that manually reporting PA data had on overall PA rates. The App data was used because it represented the best opportunity analyze the data of a large sample of Canadians, along with the fact that the App had records of that user's activity in a pre-COVID environment.

Another limitation with the survey and the App data is that, as secondary data sources, the measures and variables collected were not designed with this research in mind. This resulted in challenges, particularly regarding investigating differences in demographic groups. It also meant that some of the conceptual developments proposed in the model development were measured via proxy (i.e., the elements of the sport capital framework). The lack of demographic data impacted the present research especially regarding the survey data, which indicated that a lack of financial resources was not an impact of the pandemic. This stands in direct contrast to one of the key themes that emerged when speaking to sport organizations who consistently mentioned that their participants faced financial barriers accessing sport. Hence, we are unable to say that the

survey data is representative of all Canadians. Again, the benefit of using the secondary data was that a much larger sample could be achieved along with much more rich data.

7.2. Future Studies

The exploratory nature of this research leads to multiple avenues for future research. These are detailed below.

Further investigation of the Sport Demand Framework (SDF). The SDF was an amalgamation of two existing frameworks looking at sport participation, the Sport Capital (Rowe, 2015) model and the Micro/Macro Level Determinants of Sport Participation. This current research provided support for the idea that an individual's proclivity to participate in sport is a function of their sport capital and the environmental determinants of sport participation. Future research should begin to further develop and validate measurement scales for the sport capital domains and investigate how the impact of micro and macro level determinants interact with sport participation. Future studies should work to develop a standardized measurement scale for the SDF by testing amongst a sample of both sport participants and non-sport participants across various regional contexts.

Longitudinal research on sport participation outcomes. There are studies that have looked at sport participation in youth and its impact on healthy behaviors in adulthood (i.e. (Palomäki et al., 2018) but there have been few studies investigating lifetime sport participation. Recent research from Eime et al. (2020) has begun investigating long-term sport participation in women and girls, and has found results consistent with what could be expected with the SDF, with segments of participants dropping out, some cycling in and out of sport, and some remaining as participants throughout the seven year observation period. There are challenges to conducting

longitudinal research, but the way in which individuals progress through the participatory sport system as they age remains under-researched. Additionally, there is little to no research being conducted on the efficacy of sport organizations in developing long-term sport participation. An interesting avenue for future research would be to investigate what sport, programs or organizations best promote lifetime engagement in sport. Future studies should investigate how organizations approach their participant outcomes, and how the concept of sport capital could be applied to further long-term participation from youth to adulthood.

One of the ideas presented in the interviews with sport organizations was the barriers that they faced in securing facilities as organizations focusing on traditionally underserved populations. There seems to be little research on the impact that the so-called "grandfathered" system of allocating sport facility access has on the ability for those traditionally excluded from sport to access it through the organizations that are working on reducing barriers. Future studies should investigate whether the allocation of time from facilities to sport organizations facilitates or acts as a barrier to sport participation for groups that are traditionally underserved.

Sport organizations recovery from the pandemic. All the organizations that were interviewed in this research suggested that they were uncertain about the future of their programming. This research showed that organizations are committed to expanding and innovating to ensure that they continue to bring sport to individuals that may not traditionally have access to sport.

The SDF can also be used to help researchers tackle issues of diversity, equity, and inclusion in future research. Recent research from Hanlon et al. (2019), for example, has looked at how sport organizations can build capacity for increasing female participation in sport. When viewed through the lens of the SDF, this research addresses only one area of the identified factors of sport participation. Future studies can use the SDF to identify exactly which

determinants of participation are missing and/or limited from a given group. The SDF is also prescriptive in that interventions can be designed around the findings relating to whether it is sport capital, micro determinants, or macro determinants of sport. As an example, future research could investigate the experience of female collegiate athletes after their athletic career is over and determine why they (hypothetically) drop out of sport participation. The SDF would suggest that sport capital is unlikely to be the reason for non-participation, so research should focus on the micro and macro level determinants of participation; the results will help determine what interventions could be most useful. Future research should look to determine the effect of intersectionality on the SDF, as in how (for example) lack of representation influences sport capital, or how gender relates to time available for sport. While the framework is not yet established enough to develop interventions at this stage, designing interventions to increase participation amongst those traditionally excluded from sport should be a priority of SDF research.

This research also shows that big data sets can be effectively analyzed by researchers without a significant background in coding or computer programming. This research was conducted using two powerful software tools in R and SPSS, and by using only relatively basic techniques the data was able to be effectively analyzed. Cheung & Jak (2016) state that "2.5 exabytes of data are produced around the world each day" (Cheung & Jak, 2016, pg. 1). Researchers should not be afraid to learn the skills necessary to work with these data sets, as with the increasing accessibility of powerful software has made working with the data sets relatively straightforward. It should be said, however, that *more* data does not necessarily mean *better* data. For example, a significant limitation of this work is that the secondary data provided by the App lacked many demographic variables that would have assisted in providing more nuanced

analysis. Future researchers should ensure that the big data sets have enough breadth or data to be able to draw both powerful, population level data while also being able to determine the differences between various demographic groups, especially with regards to variables such as identity.

Finally, research should be conducted into how different countries around the world fund sport, and how the system may perpetuate the inequalities seen in access to sport. Future studies should look at how organizations exist outside of traditional funding models and investigate how best practices developed by these organizations can be applied to the wider sport participation ecosystem to begin to reduce barriers to sport participation.

Chapter 8. Conclusion

This thesis has the goal of assessing how the COVID-19 pandemic impacted the participatory sport ecosystem. Given that there is a global crisis of physical inactivity, and that sport participation has been declining in Canada over the past decades, it is important to understand what the impact of perhaps the most consequential global public health crisis seen in 100 years will have on physical activity and sport. This research looked at the trends of both physical activity and sport from a global and national perspective, along with the barriers to sport and physical activity that prevent individuals from participation. Initial impacts of the pandemic on physical activity and sport were also assessed in the literature review. A new framework (the Sport Demand Framework) was developed through an amalgamation of the theory of Sport Capital (developed by Rowe (2015)) and the micro and macro level determinants of sport participation (determined by Wicker et al., (2012)) to better frame the ways in which the pandemic may have affected sport participants. Four data sources were used to help triangulate the impact of the pandemic on the sport system. The first was a large data set of device-based and subjective physical activity tracking data from the ParticipACTION mobile App, which provided a pre and in-pandemic data set to analyse any differences that occurred. The second was a survey conducted amongst those who use the App to gain a deeper understanding of how and through what processes the pandemic may have impacted users. The third data source was semi-structured interviews conducted with sport organizations in Canada who are attempting to remove barriers to sport participation and provide programming to individuals who are underserved by the traditional sport participation ecosystem. The final data source was an expert interview with a senior executive at a physical activity promotion organization that helped

develop a technological innovation targeting physical activity promotion. These data sources were analysed to answer five research questions related to the impact of the pandemic. The results of the analysis found that sport participants' physical activity has been resilient throughout the pandemic despite challenges that faced sport during the pandemic (such as indoor gatherings being banned) and that sport participants are ready and willing to return to sport once restrictions are lifted. However, it was found that the sport organizations that are working to address inequities in sport are suffering significant capacity constraints and uncertainty around future operations.

This research has established that sport participants are incredibly resilient when it comes to the impact of the pandemic on their physical activity. Even those whose regular form of physical activity was severely impacted due to the pandemic (such as those reliant on swimming pools) still managed to stay active throughout the pandemic. This suggests that getting more people to engage in sport throughout their life stages will lead them to being more resilient against potential shocks. Essentially, if a person raises their sport capital level, any impact to the micro or macro level determinants of sport participation will be less likely to result in that individual reducing their physical activity. This has implications for sport organizations, who should endeavour to return programming to full capacity as soon as possible after the pandemic, and for the physical activity promotion/sport participation ecosystem, who should focus on ensuring that sport programs work to raise the sport capital levels of participants for the purpose of getting individuals to continue engaging in sport throughout their lives. Future research should focus on establishing a consistent measure of sport capital and applying it to measure the impact of sport programs.

The other focus of this research was on the sport organizations that provide the programming that allows participants to engage in sport. The organizations that were interviewed were not within the traditional NSO/PSO framework but instead organizations that were focused on providing sport to individuals who have been traditionally excluded from sport. It was discovered that even as these organizations work to reduce barriers to sport participation, the organizations face significant barriers in terms of facilities and funding models, and that those barriers had increased since the pandemic. While these organizations operate outside traditional funding from the NSO/PSO structure, their work is vital in ensuring that individuals who face significant barriers participating in "traditional" sport can access sport. The sport ecosystem and funders of sport should work to ensure that these organizations are better supported and have access to stable funding to ensure that sport continues to become more accessible to more people. In the future, the knowledge and expertise developed by these organizations should be brought into the traditional sport ecosystem to ensure that future generations of potential sport participants do not face these barriers in the first place. Future research should attempt to establish how the traditional participatory sport landscape can adapt to include the organizations working to expand access to sport, and how that affects population-level sport outcomes.

In conclusion, this research looked at five research questions related to how the COVID-19 pandemic may have influenced the sport participation ecosystem. By taking a mixed-methods approach to establish broad population-level trends using quantitative analysis of large datasets, and qualitative analysis of semi-structured interviews to establish depth of understanding, this research established that while physical activity among sport participants has remained stable despite the impact of the pandemic, the impact of the pandemic on sport organizations has the potential to derail some of the progress that they participatory sport system has made in

broadening access to sport participation among those that have been traditionally excluded by sport. Four areas of potential future research were established, with an emphasis on longitudinal data collection to better understand any potential long-term implications of the trends that were discovered in the current research.

References

Abbaspour, S., Farmanbar, R., Najafi, F., Mohamadkhani Ghiasvand, A., & Dehghankar, L. (2017). Decisional balance and self-efficacy of physical activity among the elderly in Rasht in 2013 based on the transtheoretical model. *Electronic Physician*, *9*(5), 4447–4453. https://doi.org/10.19082/4447.

Abula, K., Gröpel, P., Chen, K., & Beckmann, J. (2018). Does knowledge of physical activity recommendations increase physical activity among Chinese college students? Empirical investigations based on the transtheoretical model. *Journal of Sport and Health Science*, *7*(1), 77–82. https://doi.org/10.1016/j.jshs.2016.10.010.

Abichahine, H., & Veenstra, G. (2016). Inter-categorical intersectionality and leisure-based physical activity in Canada. *Health Promotion International*, *32*(4), 691–701. https://doi.org/10.1093/heapro/daw009.

Ainsworth, B. E., Haskell, W. L., Herrmann, S. D., Meckes, N., Bassett, D. R., Tudor-Locke, C., Leon, A. S. (2011). 2011 compendium of physical activities: A second update of codes and MET values. *Medicine and Science in Sports and Exercise*, *43*(8), 1575–1581. https://doi.org/10.1249/MSS.0b013e31821ece12.

Ajzen, I. (1985). From intentions to actions: A theory of planned behaviour. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behaviour*. Springer.

Ajzen, I. (2015). The theory of planned behaviour is alive and well, and not ready to retire: a commentary on Sniehotta, Presseau, and Araújo-Soares. In *Health Psychology Review* (Vol. 9, Issue 2, pp. 131–137). Routledge. https://doi.org/10.1080/17437199.2014.883474.

Ajzen, I., Albarracin, D., & Hornik, R. (2007). *Prediction and Change of Health Behavior*.

Alexandris, K., & Stodolska, M. (2004). The influence of perceived constraints on the attitudes toward recreational sport participation. *Loisir et Societe*, *27*(1), 197–217. https://doi.org/10.1080/07053436.2004.10707647.

Althoff, T., Sosič, R., Hicks, J. L., King, A. C., Delp, S. L., & Leskovec, J. (2017). Large-scale physical activity data reveal worldwide activity inequality. *Nature*, *547*(7663), 336–339. https://doi.org/10.1038/nature23018.

Almeida, V., Barrios, S., Christl, M., Poli, S. De, Tumino, A., & Wielen, W. van der. (2021). The impact of COVID-19 on households′ income in the EU. *The Journal of Economic Inequality 2021*, 1–19. https://doi.org/10.1007/S10888-021-09485-8.

Amagasa, S., Machida, M., Fukushima, N., Kikuchi, H., Takamiya, T., Odagiri, Y., & Inoue, S. (2018, July 9). Is objectively measured light-intensity physical activity associated with health outcomes after adjustment for moderate-to-vigorous physical activity in adults? A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, Vol. 15, p. 65. https://doi.org/10.1186/s12966-018-0695-z.

Andersen, M. H., Ottesen, L., & Thing, L. F. (2019, December 1). The social and psychological health outcomes of team sport participation in adults: An integrative review of research. *Scandinavian Journal of Public Health*, Vol. 47, pp. 832–850. https://doi.org/10.1177/1403494818791405.

Anderson, E. S., Wagstaff, D. A., Heckman, T. G., Winett, R. A., Roffman, R. A., Solomon, L. J., Sikkema, K. J. (2006). Information-motivation-behavioral skills (IMB) model: Testing direct and mediated treatment effects on condom use among women in low-income housing. *Annals of Behavioral Medicine*, *31*(1), 70–79. https://doi.org/10.1207/s15324796abm3101_11.

Arem, H., Moore, S. C., Patel, A., Hartge, P., Berrington De Gonzalez, A., Visvanathan, K., Campbell, P. T., Freedman, M., Weiderpass, E., Adami, H. O., Linet, M. S., Lee, I. M., & Matthews, C. E. (2015). Leisure time physical activity and mortality: A detailed pooled analysis of the dose-response relationship. *JAMA Internal Medicine*, *175*(6), 959–967. https://doi.org/10.1001/jamainternmed.2015.0533.

Baker, J., Fraser-Thomas, J., Dionigi, R. A., & Horton, S. (2010). Sport participation and positive development in older persons. *European Review of Aging and Physical Activity*, *7*(1), 3–12. https://doi.org/10.1007/s11556-009-0054-9.

Balish, S. M., McLaren, C., Rainham, D., & Blanchard, C. (2014, July 1). Correlates of youth sport attrition: A review and future directions. *Psychology of Sport and Exercise*, 15, 429–439. https://doi.org/10.1016/j.psychsport.2014.04.003.

Ball, K., Crawford, D., & Owen, N. (2000). Too fat to exercise? Obesity as a barrier to physical activity. *Australian and New Zealand Journal of Public Health*, *24*(3), 331–333. https://doi.org/10.1111/j.1467-842X.2000.tb01579.x.

Bengoechea, E. G., Sabiston, C. M., Ahmed, R., & Farnoush, M. (2010). Exploring links to unorganized and organized physical activity during adolescence: The role of gender, socioeconomic status, weight status, and enjoyment of physical education. *Research Quarterly for Exercise and Sport*, *81*(1), 7–16. https://doi.org/10.1080/02701367.2010.10599623.

Berg, B. K., Warner, S., & Das, B. M. (2015). What about sport? A public health perspective on leisure-time physical activity. *Sport Management Review*, *18*(1), 20–31. https://doi.org/10.1016/j.smr.2014.09.005.

Berger, I. E., O'Reilly, N., Parent, M. M., Séguin, B., & Hernandez, T. (2008). Determinants of Sport Participation Among Canadian Adolescents. *Sport Management Review*, *11*(3), 277–307. https://doi.org/10.1016/S1441-3523(08)70113-X.

Beyleveldt, J. S., Burnett, C., & Hollander, W. J. (2004). Health-related knowledge and behaviour of primary school children. *African Journal for Physical, Health Education, Recreation and Dance*, *9*(3), 1040–1048. https://doi.org/10.4314/ajpherd.v9i3.24651.

Boone-Heinonen, J., Diez Roux, A. v., Kiefe, C. I., Lewis, C. E., Guilkey, D. K., & Gordon-Larsen, P. (2011). Neighborhood socioeconomic status predictors of physical activity through young to middle adulthood: The CARDIA study. *Social Science and Medicine*, *72*(5), 641–649. https://doi.org/10.1016/j.socscimed.2010.12.013.

Bogolyubov, P. (2019). Big Data and Analytical Induction: An Exploratory Mixed-Methods Example. In *Big Data and Analytical Induction: An Exploratory Mixed-Methods Example*. https://doi.org/10.4135/9781526467324.

Braun, V., & Clarke, V. (2012). Thematic analysis. In *APA handbook of research methods in psychology, Vol 2: Research designs: Quantitative, qualitative, neuropsychological, and biological.* (pp. 57–71). https://doi.org/10.1037/13620-004.

Breuer, C., Hallmann, K., & Wicker, P. (2011). Determinants of sport participation in different sports. *Managing Leisure*, *16*(4), 269–286. https://doi.org/10.1080/13606719.2011.613625.

Brown, W. J., Mielke, G. I., & Kolbe-Alexander, T. L. (2016, September 24). Gender equality in sport for improved public health. *The Lancet*, Vol. 388, pp. 1257–1258. https://doi.org/10.1016/S0140-6736(16)30881-9.

Brynjolfsson, E., Horton, J. J., Ozimek, A., Rock, D., Sharma, G., & TuYe, H.-Y. (2020). COVID-19 and Remote Work: An Early Look at US Data. *National Bureau for Economics Research Working Papers*. https://doi.org/10.3386/W27344.

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical Activity, Exercise, and Physical Fitness: Definitions and Distinctions for Health-Related Research. *Notes and Queries*, *100*, *No. 2*(2), 125–131.

Cheung, M. W.-L., & Jak, S. (2016). Analyzing Big Data in Psychology: A Split/Analyze/Meta-Analyze Approach. *Frontiers in Psychology*, *0*(MAY), 738. https://doi.org/10.3389/FPSYG.2016.00738

Choi, M., Prieto-Merino, D., Dale, C., Nüesch, E., Amuzu, A., Bowling, A., Ebrahim, S., & Casas, J. P. (2013). Effect of changes in moderate or vigorous physical activity on changes in health-related quality of life of elderly British women over seven years. *Quality of Life Research*, *22*(8), 2011–2020. https://doi.org/10.1007/s11136-012-0332-2.

Clark, B., Chatterjee, K., Martin, A., & Davis, A. (2019). How commuting affects subjective wellbeing. *Transportation*, *47*(6), 2777–2805. https://doi.org/10.1007/S11116-019-09983-9.

Coakley, J., & White, A. (2016). Making Decisions: Gender and Sport Participation among British Adolescents. *Sociology of Sport Journal*, *9*(1), 20–35. https://doi.org/10.1123/ssj.9.1.20.

Coen, S. E., Subedi, R. P., & Rosenberg, M. W. (2016). Working out across Canada: Is there a gender gap? *The Canadian Geographer / Le Géographe Canadien*, *60*(1), 69–81. https://doi.org/10.1111/cag.12255.

Darker, C. D., French, D. P., Eves, F. F., & Sniehotta, F. F. (2010). An intervention to promote walking amongst the general population based on an 'extended' theory of planned behaviour: A waiting list randomised controlled trial. *Psychology & Health*, *25*(1), 71–88. https://doi.org/10.1080/08870440902893716.

Davis, R., Campbell, R., Hildon, Z., Hobbs, L., & Michie, S. (2015). Theories of behaviour and behaviour change across the social and behavioural sciences: a scoping review. *Health Psychology Review*, *9*(3), 323–344. https://doi.org/10.1080/17437199.2014.941722.

Dinkel, D. M., Hein, N., Snyder, K., Siahpush, M., Maloney, S., Smith, L., Farazi, P. A., & Hanson, C. (2020). The impact of body mass index and sociodemographic factors on moderate-to-vigorous physical activity and sedentary behaviors of women with young children: A cross-sectional examination. *Women's Health*, *16*, 174550651989782. https://doi.org/10.1177/1745506519897826.

Doherty, A., Misener, K., & Cuskelly, G. (2014). Toward a Multidimensional Framework of Capacity in Community Sport Clubs. *Nonprofit and Voluntary Sector Quarterly*, *43*(S2), 124–142. https://doi.org/10.1177/0899764013509892.

Doherty, A., Jackson, D., Hammerla, N., Plötz, T., Olivier, P., Granat, M. H., White, T., van Hees, V. T., Trenell, M. I., Owen, C. G., Preece, S. J., Gillions, R., Sheard, S., Peakman, T., Brage, S., & Wareham, N. J. (2017). *Large Scale Population Assessment of Physical Activity Using Wrist Worn Accelerometers: The UK Biobank Study*. https://doi.org/10.1371/journal.pone.0169649.

Dollman, J., & Lewis, N. R. (2010). The impact of socioeconomic position on sport participation among South Australian youth. *Journal of Science and Medicine in Sport*, *13*(3), 318–322. https://doi.org/10.1016/J.JSAMS.2009.04.007.

Ding, D., Lawson, K. D., Kolbe-Alexander, T. L., Finkelstein, E. A., Katzmarzyk, P. T., van Mechelen, W., & Pratt, M. (2016). The economic burden of physical inactivity: a global analysis of major non-communicable diseases. *The Lancet*, *388*(10051), 1311–1324. https://doi.org/10.1016/S0140-6736(16)30383-X.

Drummond, M., Elliott, S., Drummond, C., & Prichard, I. (2020). Youth sport and COVID-19: a potential generation lost. *Emerald Open Research*, *2*, 27. https://doi.org/10.35241/emeraldopenres.13661.1.

Eime, R. M., Harvey, J. T., Sawyer, N. A., Craike, M. J., Symons, C. M., & Payne, W. R. (2016). Changes in sport and physical activity participation for adolescent females: a longitudinal study. *BMC Public Health*, *16*(1), 1–7. https://doi.org/10.1186/s12889-016-3203-x.

Eime, R., Harvey, J., Charity, M., & Westerbeek, H. (2020). Longitudinal Trends in Sport Participation and Retention of Women and Girls. *Frontiers in Sports and Active Living*, *0*, 39. https://doi.org/10.3389/FSPOR.2020.00039.

Elliott, S., Drummond, M. J., Prichard, I., Eime, R., Drummond, C., & Mason, R. (2021). Understanding the impact of COVID-19 on youth sport in Australia and consequences for future participation and retention. *BMC Public Health*, *21*(1), 1–16. https://doi.org/10.1186/s12889-021-10505-5.

Engel, C., & Nagel, S. (2011). Sports participation during the life course. *European Journal for Sport and Society*, *8*(1–2), 45–63. https://doi.org/10.1080/16138171.2011.11687869.

Estabrooks, P. A., Lee, R. E., & Gyurcsik, N. C. (2003). Resources for physical activity participation: Does availability and accessibility differ by neighborhood socioeconomic status? *Annals of Behavioral Medicine*, *25*(2), 100–104. https://doi.org/10.1207/S15324796ABM2502_05.

Farrell, L., & Shields, M. A. (2002). Investigating the economic and demographic determinants of sporting participation in England. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *165*(2), 335–348. https://doi.org/10.1111/1467-985X.00626.

Ford, E. S., Merritt, R. K., Heath, G. W., Powell, K. E., Washburn, R. A., Kriska, A., & Haile, G. (1991). Physical Activity Behaviors in Lower and Higher Socioeconomic Status Populations. *American Journal of Epidemiology*, *133*(12), 1246–1256. https://doi.org/10.1093/oxfordjournals.aje.a115836.

French, D., & Hainsworth, J. (2010). "There aren't any buses and the swimming pool is always cold!": obstacles and opportunities in the provision of sport for disabled people. *Http://Dx.Doi.Org/10.1080/13606710010026359*, *6*(1), 35–49. https://doi.org/10.1080/13606710010026359.

Gal, R., May, A. M., van Overmeeren, E. J., Simons, M., & Monninkhof, E. M. (2018, December 1). The Effect of Physical Activity Interventions Comprising Wearables and Smartphone Applications on Physical Activity: A Systematic Review and Meta-analysis. *Sports Medicine - Open*, 4, 1–15. https://doi.org/10.1186/s40798-018-0157-9.

Green, M. (2006). From 'Sport for All' to Not About 'Sport' at All?: Interrogating Sport Policy Interventions in the United Kingdom. *European Sport Management Quarterly*, *6*(3), 217–238. https://doi.org/10.1080/16184740601094936.

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1·9 million participants. *The Lancet Global Health*, *6*(10), e1077–e1086. https://doi.org/10.1016/S2214-109X(18)30357-7.

Hagger, M. S., Polet, J., & Lintunen, T. (2018). The reasoned action approach applied to health behavior: Role of past behavior and tests of some key moderators using meta-analytic structural equation modeling. *Social Science and Medicine*, *213*, 85–94. https://doi.org/10.1016/j.socscimed.2018.07.038.

Hall, N. (2011). "Give it everything you got": Resilience for young males through sport. *International Journal of Men's Health*, *10*(1), 65–81. https://doi.org/10.3149/JMH.1001.65.

Harada, M. (2016). Early and Later Life Sport Participation Patterns among the Active Elderly in Japan. *Journal of Aging and Physical Activity*, *2*(2), 105–114. https://doi.org/10.1123/japa.2.2.105.

Hobbs, N., Dixon, D., Johnston, M., & Howie, K. (2013). Can the theory of planned behaviour predict the physical activity behaviour of individuals? *Psychology and Health*, *28*(3), 234–249. https://doi.org/10.1080/08870446.2012.716838.

Hoeber, L., Doherty, A., Hoeber, O., & Wolfe, R. (2015). The nature of innovation in community sport organizations. *European Sport Management Quarterly*, *15*(5), 518–534. https://doi.org/10.1080/16184742.2015.1085070.

Hoeber, L., & Hoeber, O. (2016). Determinants of an Innovation Process: A Case Study of Technological Innovation in a Community Sport Organization. *Journal of Sport Management*, *26*(3), 213–223. https://doi.org/10.1123/jsm.26.3.213.

Holt, N. L., Kingsley, B. C., Tink, L. N., & Scherer, J. (2011). Benefits and challenges associated with sport participation by children and parents from low-income families. *Psychology of Sport and Exercise*, *12*(5), 490–499. https://doi.org/10.1016/J.PSYCHSPORT.2011.05.007.

Hu, F. B., Sigal, R. J., Rich-Edwards, J. W., Colditz, G. A., Solomon, C. G., Willett, W. C., Speizer, F. E., & Manson, J. A. E. (1999). Walking compared with vigorous physical activity and risk of type 2 diabetes in women: A prospective study. *Journal of the American Medical Association*, *282*(15), 1433–1439. https://doi.org/10.1001/jama.282.15.1433.

Humphreys, B. R., & Ruseski, J. E. (2011). An economic analysis of participation and time spent in physical activity. *B.E. Journal of Economic Analysis and Policy*, *11*(1). https://doi.org/10.2202/1935-1682.2522.

Humphreys, B. R., & Ruseski, J. E. (2015). *A comparison of the results from the 1996-1997 National Population Health Survey International Journal of Sport Finance* (Vol. 10).

Hutchison, A. J., Breckon, J. D., & Johnston, L. H. (2009). Physical Activity Behavior Change Interventions Based on the Transtheoretical Model: A Systematic Review. *Health Education & Behavior*, *36*(5), 829–845. https://doi.org/10.1177/1090198108318491.

Ifedi, F. (2005). *Sport Participation in Canada*. Retrieved from https://www150.statcan.gc.ca/n1/pub/81-595-m/81-595-m2008060-eng.htm.

IPAQ Research Committee. (2005). *Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire*. https://sites.google.com/site/theipaq/scoring-protocol.

Jaarsma, E. A., Dijkstra, P. U., Geertzen, J. H. B., & Dekker, R. (2014). Barriers to and facilitators of sports participation for people with physical disabilities: A systematic review. In *Scandinavian Journal of Medicine and Science in Sports* (Vol. 24, Issue 6, pp. 871–881). Blackwell Munksgaard. https://doi.org/10.1111/sms.12218.

Jakicic, J. M., King, W. C., Gibbs, B. B., Rogers, R. J., Rickman, A. D., Davis, K. K., Wahed, A., & Belle, S. H. (2015). Objective Versus Self-Reported Physical Activity in Overweight and Obese Young Adults. *Journal of Physical Activity and Health*, *12*(10), 1394–1400. https://doi.org/10.1123/JPAH.2014-0277

Janssen, I. (2012). Health care costs of physical inactivity in Canadian adults. *Applied Physiology, Nutrition and Metabolism*, *37*(4), 803–806. https://doi.org/10.1139/H2012-061.

Jenkin, C. R., Eime, R. M., Westerbeek, H., O'Sullivan, G., & van Uffelen, J. G. Z. (2017). Sport and ageing: A systematic review of the determinants and trends of participation in sport for older adults. *BMC Public Health*, *17*(1). https://doi.org/10.1186/s12889-017-4970-8.

Jones, G. J., Carlton, T., Hyun, M., Kanters, M., & Bocarro, J. (2020). Assessing the contribution of informal sport to leisure-time physical activity: a new perspective on social innovation. *Managing Sport and Leisure*, *25*(3), 161–174. https://doi.org/10.1080/23750472.2019.1620627.

Joseph, R. P., Ainsworth, B. E., Keller, C., & Dodgson, J. E. (2015). Barriers to Physical Activity Among African American Women: An Integrative Review of the Literature. *Women & Health*, *55*(6), 679–699. https://doi.org/10.1080/03630242.2015.1039184.

Kallio, H., Pietilä, A.-M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing*, *72*(12), 2954–2965. https://doi.org/10.1111/jan.13031.

Khan, K. M., Thompson, A. M., Blair, S. N., Sallis, J. F., Powell, K. E., Bull, F. C., & Bauman, A. E. (2012). Sport and exercise as contributors to the health of nations. *The Lancet*, *380*(9836), 59–64. https://doi.org/10.1016/S0140-6736(12)60865-4.

Kilpatrick, M., Hebert, E., & Bartholomew, J. (2005). College students' motivation for physical activity: Differentiating men's and women's motives for sport participation and exercise. *Journal of American College Health*, *54*(2), 87–94. https://doi.org/10.3200/JACH.54.2.87-94.

Kivimäki, M., Singh-Manoux, A., Pentti, J., Sabia, S., Nyberg, S. T., Alfredsson, L., Goldberg, M., Knutsson, A., Koskenvuo, M., Koskinen, A., Kouvonen, A., Nordin, M., Oksanen, T., Strandberg, T., Suominen, S. B., Theorell, T., Vahtera, J., Väänänen, A., Virtanen, M., … Jokela, M. (2019). Physical inactivity, cardiometabolic disease, and risk of dementia: An individual-participant meta-analysis. *BMJ (Online)*, *365*. https://doi.org/10.1136/bmj.l1495.

Kohl, H. W., Craig, C. L., Lambert, E. V., Inoue, S., Alkandari, J. R., Leetongin, G., Kahlmeier, S., Andersen, L. B., Bauman, A. E., Blair, S. N., Brownson, R. C., Bull, F. C., Ekelund, U., Goenka, S., Guthold, R., Hallal, P. C., Haskell, W. L., Heath, G. W., Katzmarzyk, P. T., … Wells, J. C. (2012). The pandemic of physical inactivity: Global action for public health. In *The Lancet* (Vol. 380, Issue 9838, pp. 294–305). Lancet Publishing Group. https://doi.org/10.1016/S0140-6736(12)60898-8.

Kuh, D. J. L., & Cooper, C. (1992). Physical activity at 36 years: patterns and childhood predictors in a longitudinal study. *Journal of Epidemiology and Community Health*, *46*(2), 114–119. https://doi.org/10.1136/jech.46.2.114.

LaMonte, M. J., Lewis, C. E., Buchner, D. M., Evenson, K. R., Rillamas-Sun, E., Di, C., Lee, I. M., Bellettiere, J., Stefanick, M. L., Eaton, C. B., Howard, B. v., Bird, C., & LaCroix, A. Z. (2017). Both light intensity and moderate-to-vigorous physical activity measured by accelerometry are favorably associated with cardiometabolic risk factors in older women: The objective physical activity and cardiovascular health (opach) study. *Journal of the American Heart Association*, *6*(10). https://doi.org/10.1161/JAHA.117.007064.

Langley, D. J., & Knight, S. M. (1999). Continuity in sport participation as an adaptive strategy in the aging process: A lifespan narrative. In *Journal of Aging and Physical Activity* (Vol. 7, Issue 1, pp. 32–54). Human Kinetics Publishers Inc. https://doi.org/10.1123/japa.7.1.32.

Lear, S. A., Hu, W., Rangarajan, S., Gasevic, D., Leong, D., Iqbal, R., … Yusuf, S. (2017). The effect of physical activity on mortality and cardiovascular disease in 130 000 people from 17 high-income, middle-income, and low-income countries: the PURE study. *The Lancet*, *390*(10113), 2643–2654. https://doi.org/10.1016/S0140-6736(17)31634-3.

Lim, S. Y., & Dixon, M. A. (2018). A conceptual framework of sport participation and women's empowerment. *Https://Doi.Org/10.1080/23750472.2018.1499437*, *22*(5), 400–413. https://doi.org/10.1080/23750472.2018.1499437.

MacNamara, A., Collins, D., Bailey, R., Toms, M., Ford, P., & Pearce, G. (2011). Promoting lifelong physical activity and high level performance: realising an achievable aim for physical education. *Physical Education & Sport Pedagogy*, *16*(3), 265–278. https://doi.org/10.1080/17408989.2010.535200.

Marques, A., Ekelund, U., & Sardinha, L. B. (2016). Associations between organized sports participation and objectively measured physical activity, sedentary time and weight status in youth. *Journal of Science and Medicine in Sport*, *19*(2), 154–157. https://doi.org/10.1016/j.jsams.2015.02.007.

Marshall, S. J., & Biddle, S. J. (2001). The transtheoretical model of behavior change: A meta-analysis of applications to physical activity and exercise. *Annals of Behavioral Medicine*, *23*(4), 229–246. https://doi.org/10.1207/S15324796ABM2304_2.

Martel, L. (2015). Canada goes urban. Retrieved May 29, 2021, from Statistics Canada website: https://www150.statcan.gc.ca/n1/pub/11-630-x/11-630-x2015004-eng.htm.

McBride, F. (1975). Toward a non-definition of sport. *Journal of the Philosophy of Sport*, *2*(1), 4–11. https://doi.org/10.1080/00948705.1975.10654092.

McBride, K. A., MacMillan, F., George, E. S., & Steiner, G. Z. (2019). The use of mixed methods in research. In *Handbook of Research Methods in Health Social Sciences* (pp. 695–713). https://doi.org/10.1007/978-981-10-5251-4_97.

McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. In *Health Psychology Review* (Vol. 5, Issue 2, pp. 97–144). Taylor & Francis Group . https://doi.org/10.1080/17437199.2010.521684.

Migueles, J. H., Cadenas-Sanchez, C., Ekelund, U., Delisle Nyström, C., Mora-Gonzalez, J., Löf, M., Labayen, I., Ruiz, J. R., & Ortega, F. B. (2017). Accelerometer Data Collection and Processing Criteria to Assess Physical Activity and Other Outcomes: A Systematic Review and Practical Considerations. In *Sports Medicine* (Vol. 47, Issue 9, pp. 1821–1845). Springer International Publishing. https://doi.org/10.1007/s40279-017-0716-0.

Moore, S. A., Faulkner, G., Rhodes, R. E., Brussoni, M., Chulak-Bozzer, T., Ferguson, L. J., … Tremblay, M. S. (2020). Impact of the COVID-19 virus outbreak on movement and play behaviours of Canadian children and youth: A national survey. *International Journal of Behavioral Nutrition and Physical Activity*, *17*(1), 85. https://doi.org/10.1186/s12966-020-00987-8.

Muntaner, A., Vidal-Conti, J., & Palou, P. (2016). Increasing physical activity through mobile device interventions: A systematic review. *Health Informatics Journal*, *22*(3), 451–469. https://doi.org/10.1177/1460458214567004.

Mutz, M., & Gerke, M. (2021). Sport and exercise in times of self-quarantine: How Germans changed their behaviour at the beginning of the Covid-19 pandemic. *International Review for the Sociology of Sport*, *56*(3), 305–316. https://doi.org/10.1177/1012690220934335.

Nahapiet, J. (2011). A Social Perspective. *The Oxford Handbook of Human Capital*. https://doi.org/10.1093/OXFORDHB/9780199532162.003.0003

Neely, K. C., & Holt, N. L. (2014). Parents' perspectives on the benefits of sport participation for young children. *Sport Psychologist*, *28*(3), 255–268. https://doi.org/10.1123/tsp.2013-0094.

Newitt, R., Barnett, F., & Crowe, M. (2016). Understanding factors that influence participation in physical activity among people with a neuromusculoskeletal condition: a review of qualitative studies. *Disability and Rehabilitation*, *38*(1), 1–10. https://doi.org/10.3109/09638288.2014.996676.

Oliver, N., Lepri, B., Sterly, H., Lambiotte, R., Deletaille, S., Nadai, M. De, … Vinck, P. (2020). Mobile phone data for informing public health actions across the COVID-19 pandemic life cycle. *Science Advances*, *6*(23), eabc0764. https://doi.org/10.1126/SCIADV.ABC0764.

O'Loughlin, J., Paradis, G., Kishchuk, N., Barnett, T., & Renaud, L. (1999). Prevalence and correlates of physical activity behaviors among elementary schoolchildren in multiethnic, low income, inner-city neighborhoods in Montreal, Canada. *Annals of Epidemiology*, *9*(7), 397–407. https://doi.org/10.1016/S1047-2797(99)00030-7.

O'Reilly, N., Berger, I. E., Hernandez, T., Parent, M. M., & Séguin, B. (2015). Urban sportscapes: An environmental deterministic perspective on the management of youth sport participation. *Sport Management Review*, *18*(2), 291–307. https://doi.org/10.1016/j.smr.2014.07.003.

Palomäki, S., Hirvensalo, M., Smith, K., Raitakari, O., Männistö, S., Hutri-Kähönen, N., & Tammelin, T. (2018). Does organized sport participation during youth predict healthy habits in adulthood? A 28-year longitudinal study. *Scandinavian Journal of Medicine & Science in Sports*, *28*(8), 1908–1915. https://doi.org/10.1111/SMS.13205.

ParticipACTION. (2018). *The Brain + Body Equation: Canadian kids need active bodies to build their best brains. The 2018 ParticipACTION Report Card on Physical Activity for Children and Youth*. 1–114. Retrieved from https://www.participaction.com/sites/default/files/downloads/the_participaction_report_card_on_physical_activity_for_children_and_youth_-_2018.pdf%0Afile:///V:/HALO/HALO Staff/Longmuir/New Literature B/the_participaction_report_card_on_physical_activity_f.

ParticipACTION. (2019). *ParticipACTION Report Card on Physical Activity for Adults*.

Pawlowski, T., Breuer, C., Wicker, P., & Poupaux, S. (2009). Travel Time Spending Behaviour in Recreational Sports: Econometric Approach with Management Implications. *European Sport Management Quarterly*, *9*(3), 215–242. https://doi.org/10.1080/16184740903023971.

Pfeiffer, K. A., Dowda, M., Dishman, R. K., McIver, K. L., Sirard, J. R., Ward, D. S., & Pate, R. R. (2006). Sport Participation and Physical Activity in Adolescent Females across a Four-Year Period. *Journal of Adolescent Health*, *39*(4), 523–529. https://doi.org/10.1016/j.jadohealth.2006.03.005.

Piercy, K. L., Troiano, R. P., Ballard, R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., … Olson, R. D. (2018). The physical activity guidelines for Americans. *JAMA - Journal of the American Medical Association*, *320*(19), 2020–2028. https://doi.org/10.1001/jama.2018.14854.

Plotnikoff, R. C., Mayhew, A., Birkett, N., Loucaides, C. A., & Fodor, G. (2004). Age, gender, and urban-rural differences in the correlates of physical activity. *Preventive Medicine*, *39*(6), 1115–1125. https://doi.org/10.1016/j.ypmed.2004.04.024.

Plotnikoff, R. C., Lippke, S., Courneya, K., Birkett, N., & Sigal, R. (2010). Physical activity and diabetes: An application of the theory of planned behaviour to explain physical activity for Type 1 and Type 2 diabetes in an adult population sample. *Psychology & Health*, *25*(1), 7–23. https://doi.org/10.1080/08870440802160984.

Powell, K. E., Paluch, A. E., & Blair, S. N. (2011). Physical activity for health: What kind? how much? how intense? on top of what? *Annual Review of Public Health*, *32*, 349–365. https://doi.org/10.1146/annurev-publhealth-031210-101151.

Presseau, J., Sniehotta, F. F., Francis, J. J., & Gebhardt, W. A. (2010). With a little help from my goals: Integrating intergoal facilitation with the theory of planned behaviour to predict physical activity. *British Journal of Health Psychology*, *15*(4), 905–919. https://doi.org/10.1348/135910710X494105.

Prochaska, J. O., & di Clemente, C. C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy*, *19*(3), 276–288. https://doi.org/10.1037/h0088437.

Quinton, T. S. (2020). The impact of past behaviour on social cognitive factors and sports participation in university students. *Https://Doi.Org/10.1080/13548506.2020.1847304*. https://doi.org/10.1080/13548506.2020.1847304.

Reade, I., Rodgers, W., & Norman, L. (2009). The Under-Representation of Women in Coaching: A Comparison of Male and Female Canadian Coaches at Low and High Levels of Coaching: *Http://Dx.Doi.Org/10.1260/174795409790291439*, *4*(4), 505–520. https://doi.org/10.1260/174795409790291439.

Reis, R. S., Salvo, D., Ogilvie, D., Lambert, E. V., Goenka, S., & Brownson, R. C. (2016, September 24). Scaling up physical activity interventions worldwide: stepping up to larger and smarter approaches to get people moving. *The Lancet*, 388, 1337–1348. https://doi.org/10.1016/S0140-6736(16)30728-0.

Rhodes, R. E., & Dickau, L. (2012). Experimental evidence for the intention-behavior relationship in the physical activity domain: A meta-analysis. *Health Psychology*, *31*(6), 724–727. https://doi.org/10.1037/A0027290.

Richman, E. L., & Shaffer, D. R. (2000). IF YOU LET ME PLAY SPORTS: How Might Sport Participation Influence the Self-Esteem of Adolescent Females? *Psychology of Women Quarterly*, *24*(2), 189–199. https://doi.org/10.1111/j.1471-6402.2000.tb00200.x.

Rimmer, J. H., Riley, B., Wang, E., Rauworth, A., & Jurkowski, J. (2004). Physical activity participation among persons with disabilities: Barriers and facilitators. *American Journal of Preventive Medicine*, *26*(5), 419–425. https://doi.org/10.1016/j.amepre.2004.02.002.

Ruseski, J. E., Humphreys, B. R., Hallman, K., Wicker, P., & Breuer, C. (2014). Sport participation and subjective well-being: Instrumental variable results from german survey data. *Journal of Physical Activity and Health*, *11*(2), 396–403. https://doi.org/10.1123/jpah.2012-0001.

Saint-Maurice, P. F., Troiano, R. P., Berrigan, D., Kraus, W. E., & Matthews, C. E. (2018). Volume of Light Versus Moderate-to-Vigorous Physical Activity: Similar Benefits for All-Cause Mortality? *Journal of the American Heart Association*, *7*(7). https://doi.org/10.1161/jaha.118.008815.

Sallis, J. F., Bull, F., Guthold, R., Heath, G. W., Inoue, S., Kelly, P., … Hallal, P. C. (2016, September 24). Progress in physical activity over the Olympic quadrennium. *The Lancet*, 388, 1325–1336. https://doi.org/10.1016/S0140-6736(16)30581-5.

Sawrikar, P., & Muir, K. (2010). The myth of a "fair go": Barriers to sport and recreational participation among Indian and other ethnic minority women in Australia. *Sport Management Review*, *13*(4), 355–367. https://doi.org/10.1016/j.smr.2010.01.005.

Schnitzer, M., Schöttl, S. E., Kopp, M., & Barth, M. (2020). COVID-19 stay-at-home order in Tyrol, Austria: sports and exercise behaviour in change? *Public Health*, *185*, 218–220. https://doi.org/10.1016/j.puhe.2020.06.042.

Shier, M. L., & Handy, F. (2014). From Advocacy to Social Innovation: A Typology of Social Change Efforts by Nonprofits. *Voluntas*, *26*(6), 2581–2603. https://doi.org/10.1007/s11266-014-9535-1.

Shimp, T. A., & Kavas, A. (1984). The Theory of Reasoned Action Applied to Coupon Usage. *Journal of Consumer Research*, *11*(3), 795. https://doi.org/10.1086/209015.

Silva, P., Sousa, M., Aires, L., Seabra, A., Ribeiro, J., Welk, G., & Mota, J. (2010). Physical activity patterns in Portuguese adolescents: The contribution of extracurricular sports. *European Physical Education Review*, *16*(2), 171–181. https://doi.org/10.1177/1356336X10381305.

Sit, C. H. P., Kerr, J. H., & Wong, I. T. F. (2008). Motives for and barriers to physical activity participation in middle-aged Chinese women. *Psychology of Sport and Exercise*, *9*(3), 266–283. https://doi.org/10.1016/j.psychsport.2007.04.006.

Sniehotta, F. F., Presseau, J., & Araújo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, *8*(1), 1–7. https://doi.org/10.1080/17437199.2013.869710.

Somerset, S., & Hoare, D. J. (2018). Barriers to voluntary participation in sport for children: A systematic review. *BMC Pediatrics*, *18*(1). https://doi.org/10.1186/s12887-018-1014-1.

Sport Canada. (2017). Sport in Canada - Canada.ca. Retrieved September 3, 2021, from https://www.canada.ca/en/canadian-heritage/services/sport-canada.html.

National Sport Organizations - Canada.ca. (n.d.). Retrieved September 2, 2021, from https://www.canada.ca/en/canadian-heritage/services/sport-organizations/national.html.

Sport Participation 2010. (2013). Ottawa.

Stalsberg, R., & Pedersen, A. v. (2010). Effects of socioeconomic status on the physical activity in adolescents: a systematic review of the evidence. *Scandinavian Journal of Medicine & Science in Sports*, *20*(3), 368–383. https://doi.org/10.1111/j.1600-0838.2009.01047.x.

Steenhuis, I. H. M., Nooy, S. B. C., Moes, M. J. G., & Schuit, A. J. (2009). Financial barriers and pricing strategies related to participation in sports activities: The perceptions of people of low income. *Journal of Physical Activity and Health*, *6*(6), 716–721. https://doi.org/10.1123/jpah.6.6.716.

Stephens, J., & Allen, J. (2013, July). Mobile phone interventions to increase physical activity and reduce weight: A systematic review. *Journal of Cardiovascular Nursing*, 28, 320–329. https://doi.org/10.1097/JCN.0b013e318250a3e7.

Taliaferro, L. A., Rienzo, B. A., Miller, M. D., Pigg, R. M., & Dodd, V. J. (2008). High School Youth and Suicide Risk: Exploring Protection Afforded Through Physical Activity and Sport Participation. *Journal of School Health*, *78*(10), 545–553. https://doi.org/10.1111/j.1746-1561.2008.00342.x.

Tammelin, T., Näyhä, S., Laitinen, J., Rintamäki, H., & Järvelin, M. R. (2003). Physical activity and social status in adolescence as predictors of physical inactivity in adulthood. *Preventive Medicine*, *37*(4), 375–381. https://doi.org/10.1016/S0091-7435(03)00162-2.

Taylor, T., & Doherty, A. (2005). Adolescent sport, recreation and physical education: experiences of recent arrivals to Canada. *Sport, Education and Society*, *10*(2), 211–238. https://doi.org/10.1080/13573320500111770.

Teare, G., & Taks, M. (2021). Exploring the Impact of the COVID-19 Pandemic on Youth Sport and Physical Activity Participation Trends. *Sustainability*, *13*(4), 1744. https://doi.org/10.3390/su13041744.

Telama, R., Yang, X., Hirvensalo, M., & Raitakari, O. (2006). Participation in organized youth sport as a predictor of adult physical activity: A 21-year longitudinal study. *Pediatric Exercise Science*, *18*(1), 76–88. https://doi.org/10.1123/pes.18.1.76.

Telford, R. M., Telford, R. D., Cochrane, T., Cunningham, R. B., Olive, L. S., & Davey, R. (2016). The influence of sport club participation on physical activity, fitness and body fat during childhood and adolescence: The LOOK Longitudinal Study. *Journal of Science and Medicine in Sport*, *19*(5), 400–406. https://doi.org/10.1016/j.jsams.2015.04.008.

Thivel, D., Tremblay, A., Genin, P. M., Panahi, S., Rivière, D., & Duclos, M. (2018). Physical Activity, Inactivity, and Sedentary Behaviors: Definitions and Implications in Occupational Health. *Frontiers in Public Health*, *6*, 288. https://doi.org/10.3389/fpubh.2018.00288.

Trost, S. G. (2020). Population-level physical activity surveillance in young people: Are accelerometer-based measures ready for prime time? In *International Journal of Behavioral Nutrition and Physical Activity* (Vol. 17, Issue 1, pp. 1–4). BioMed Central Ltd. https://doi.org/10.1186/s12966-020-00929-4.

Vanreusel, B., Renson, R., Beunen, G., Claessens, A. L., Lefevre, J., Lysens, R., & Eynde, B. vanden. (1997). A LONGITUDINAL STUDY OF YOUTH SPORT PARTICIPATION AND ADHERENCE TO SPORT IN ADULTHOOD. *International Review for the Sociology of Sport*, *32*(4), 373–387. https://doi.org/10.1177/101269097032004003.

Vaismoradi, M., Turunen, H., & Bondas, T. (2013, September). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing and Health Sciences*, Vol. 15, pp. 398–405. https://doi.org/10.1111/nhs.12048.

Wang, L., & Zhang, Y. (2016). An extended version of the theory of planned behaviour: the role of self-efficacy and past behaviour in predicting the physical activity of Chinese adolescents. *Journal of Sports Sciences*, *34*(7), 587–597. https://doi.org/10.1080/02640414.2015.1064149.

Wankel, L. M., & Berger, B. G. (1990). The Psychological and Social Benefits of Sport and Physical Activity. *Journal of Leisure Research*, *22*(2), 167–182. https://doi.org/10.1080/00222216.1990.11969823.

Whitley, M. A., Forneris, T., & Barker, B. (2015). The Reality of Sustaining Community-Based Sport and Physical Activity Programs to Enhance the Development of Underserved Youth: Challenges and Potential Strategies. *Http://Dx.Doi.Org/10.1080/00336297.2015.1084340*, *67*(4), 409–423. https://doi.org/10.1080/00336297.2015.1084340.

Wickel, E. E., & Eisenmann, J. C. (2007). Contribution of Youth Sport to Total Daily Physical Activity among 6- to 12-yr-old Boys. *Medicine & Science in Sports & Exercise*, *39*(9), 1493–1500. https://doi.org/10.1249/mss.0b013e318093f56a.

Witcher, C. S. G., Holt, N. L., Spence, J. C., & Cousins, S. O. B. (2007). A case study of physical activity among older adults in rural Newfoundland, Canada. *Journal of Aging and Physical Activity*, *15*(2), 166–183. https://doi.org/10.1123/japa.15.2.166.

Wijndaele, K., Westgate, K., Stephens, S. K., Blair, S. N., Bull, F. C., Chastin, S. F. M., Dunstan, D. W., Ekelund, U., Esliger, D. W., Freedson, P. S., Granat, M. H., Matthews, C. E., Owen, N., Rowlands, A. v., Sherar, L. B., Tremblay, M. S., Troiano, R. P., Brage, Sø., & Healy, G. N. (2015). Utilization and Harmonization of Adult Accelerometry Data: Review and Expert Consensus. In *Medicine and Science in Sports and Exercise* (Vol. 47, Issue 10, pp. 2129–2139). Lippincott Williams and Wilkins. https://doi.org/10.1249/MSS.0000000000000661.

Williams, S. N., Armitage, C. J., Tampe, T., & Dienes, K. (2020). Public perceptions and experiences of social distancing and social isolation during the COVID-19 pandemic: a UK-based focus group study. *BMJ Open*, *10*(7), e039334. https://doi.org/10.1136/BMJOPEN-2020-039334.

World Health Organization. (2010). *Global Recommendations on Physical Activity for Health*. https://doi.org/978 92 4 159 997 9.

Yang, Q., & Van Stee, S. K. (2019). The comparative effectiveness of mobile phone interventions in improving health outcomes: Meta-analytic review. *Journal of Medical Internet Research*, *21*(4), e11244. https://doi.org/10.2196/11244.

Zajacova, A., Jehn, A., Stackhouse, M., Choi, K. H., Denice, P., Haan, M., & Ramos, H. (2020). Mental Health and Economic Concerns from March to May during the COVID-19 Pandemic in Canada. *SocArVix Papers*. https://doi.org/10.31235/OSF.IO/76ME2.

Zhou, Y., Xu, R., Hu, D., Yue, Y., Li, Q., & Xia, J. (2020). Effects of human mobility restrictions on the spread of COVID-19 in Shenzhen, China: a modelling study using mobile phone data. *The Lancet Digital Health*, *2*(8), e417–e424. https://doi.org/10.1016/S2589-7500(20)30165-5.

Appendices

Appendix 1. All App Variables

Variable	Description
Original Variables	
User ID	A unique User ID assigned to App users
Province	The province in which the user is located
Age Category	The age category of the User
Gender	The gender of the User
Week	The week of the data aggregated
Master Active	The sum of active (MVPA) minutes for the user for the week (includes both manually tracked and device-based tracked data)
Manual Active	The sum of active (MVPA) minutes for the user for the week (manually inputted only)
Cycling	Time spent cycling for the week
Running	Time spent running for the week
Sport	Time spent on sport for the week
Swimming	Time spent swimming for the week
Non-sport MVPA	Time spent on activities not represented in the above categories
Computed Variables	
Total Activity	Sum of the user's activity over the observed period
Activity per Week	Average of the user's activity per week over the observed period
Valid Weeks	Number of weeks where the user had valid activity data
Proportion of Sport	The proportion of valid weeks in which a user tracked sport
Weeks above 150	The number of weeks in the observed period in which the user achieved 150 MVPA minutes
M1M3	The percentage change in activity levels between month 1 and month 3 in the observed period
Sport	The number of minutes a user reported participating in running, cycling, swimming, and "Sport")
Infrastructure	The number of minutes a user reported participating in either swimming or "sport"

Appendix 2. Additional Survey Questions Used in Analysis

Self-Reported Physical Activity

A. Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

Q1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

☐ No vigorous physical activities → ***Skip to question 3***

Q2. How much time did you usually spend doing **vigorous** physical activities on one of those days? Example: If you participate in 90 minutes of physical activity, enter it as 1 hour and 30 minutes per day.

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

B. Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat

harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

Q3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include **walking.**

_____ **days per week**

☐ No moderate physical activities → ***Skip to question 5***

Q4. How much time did you usually spend doing **moderate** physical activities on one of those days? Example: If you participate in 110 minutes of physical activity enter it as 1 hour and 50 minutes per day.

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Barriers to Physical Activity (Answered on a five-point Likert scale)

Q3. I receive support to be physically active on a regular basis from friends, family members or other people in my life.

Q5. I have enough time to be physically active on a regular basis.

Q6. [My family and I can afford the costs of me / I can afford the costs of] being physically active on a regular basis.

Q7. My neighbourhood has several free or low-cost recreation facilities, such as parks, walking trails, bike paths, recreation centres, playgrounds or public swimming pools.

Q8. I am confident in my ability to engage in physical activity.

Capability (Answered on a five-point Likert scale)

Q1. I have the skills I need to be physically active

Q2. I am physically capable of doing moderate to vigorous physical activity for 150 min across a week if I really had to

Appendix 3. REB approval letter

UNIVERSITY of GUELPH

RESEARCH ETHICS BOARDS

Certification of Ethical Acceptability of Research Involving Human Participants

APPROVAL PERIOD:	April 6, 2021
EXPIRY DATE:	April 5, 2022
REB:	G
REB NUMBER:	21-01-020
TYPE OF REVIEW:	Delegated
PRINCIPAL INVESTIGATOR:	O'Reilly, Norman (noreilly@uoguelph.ca)
DEPARTMENT:	Business and Economics
SPONSOR(S):	N/A
TITLE OF PROJECT:	Sports' Contribution to Physical Activity Rates: A Mixed Methods Analysis of Mobile App Data

The members of the University of Guelph Research Ethics Board have examined the protocol which describes the participation of the human participants in the above-named research project and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement, 2nd Edition.

The REB requires that researchers:

- Adhere to the protocol as last reviewed and **approved** by the REB.
- Receive approval from the REB for any **modifications** before they can be implemented.
- Report any **change in the source of funding.**
- Report **unexpected events or incidental findings** to the REB as soon as possible with an indication of how these events affect, in the view of the Principal Investigator, the safety of the participants, and the continuation of the protocol.
- Are responsible for **ascertaining and complying with all applicable legal and regulatory requirements** with respect to consent and the protection of privacy of participants in the jurisdiction of the research project.

The Principal Investigator must:

- Ensure that the ethical guidelines and approvals of facilities or institutions involved in the research are obtained and filed with the REB prior to the initiation of any research protocols.
- Submit an **Annual Renewal** to the REB upon completion of the project. If the research is a multi-year project, a status report must be submitted annually prior to the expiry date. Failure to submit an annual status report will lead to your study being suspended and potentially terminated.

The approval for this protocol terminates on the **EXPIRY DATE**, or the term of your appointment or employment at the University of Guelph whichever comes first.

Signature: Date: April 6, 2021

Stephen P. Lewis
Chair, Research Ethics Board-General

Appendix 4. ParticipACTION RAG Approval Form

ParticipACTION - Research Advisory Group (RAG)

Data Request, Presentation, or Publication Proposal

Type of Project or Publication:

☒ **Conference**	**Name of conference:**	ASAC
☒ **Peer-reviewed paper**	**Targeted Journal:**	Journal of Sport Management
☐ **PhD thesis**		
☒ **Master's thesis**		
☐ **Other (Specify Type):** ____		

Title: Success Stories in Sport Participation: Case Studies from the ParticipACTION App

Lead Authors: Norm O'Reilly & Sarah Moore

Co-Authors: Lance Warwick and all RAG Authors

Date: October 19th, 2020

Hypothesis or Aim:

The objective of this study is to understand the relationship between deeper/more engaged ParticpACTION app usage and improved physical activity outcomes. Through a series of in-depth case studies with interviews with selected participants on the ParticipACTION app who have experienced a transition from sedentary life to an active one (that includes sport participation) due, at least in part, to the use of the App and its content, and data surrounding app usage and physical activity tracking, this study will understand the public health value of the ParticipACTION app.

Variables or Data Required:

The data required from ParticipACTION is twofold.

First, for the interviews, it is to review email and other communications from app users to identify potential candidates who may fit the criteria of an individual who has gone from sedentary to active in sport, along with a screening process including a review of those individuals app data and a survey to them to determine if they meet the criteria. Then, those who meet the criteria are interviewed by the research team. A possible ask would be a small incentive (perhaps something on the App) to anyone who agrees to participate.

Second, for the analysis of app data in looking at wider outcomes, two sets of metrics would be looked at:

1. Metrics on app usage (# of app installations – paid, # of app installations – organic, E-Comms open rate, Push notification open rate, total content consumption, usage (app opens/day?), preferably as far back time-wise as possible.
2. Physical Activity metrics from app, preferably objectively tracked and self-reported for the same time-period as above.

Note that two graduate students at Dal (Katelynn Ramage and Sam Sadler) may join the project depending on their workload.

Working title of article: "Success Stories of Sport Participation Impacts Through use of Digital Media".

Approval required: ***YES*** NO

ParticipACTION Signature

Date: October 22, 2020

Chair of the Research Advisory Group Signature

Date: October 22, 2020

Appendix 5. Sport Organization Interview Guide

Interview to be conducted with leadership of sport organizations who were part of the Jumpstart Grant program

Note that the Informed Consent document will be read to interview subjects prior to the start of the interview and will be asked to verbally consent to being interviewed.

Note that participants will be made aware of the types of questions that will be asked.

1. Hello, how are you today? Thank you for agreeing to be a part of this research. To give you a bit of a background on the study, we are interested in examining the effect of the COVID-19 pandemic on sport participants and physical activity, and also on the organizations that are working to facilitate people's involvement in sport and physical activity. These interviews will be focused on your organization and what the impacts of the past 18 months or so have been, along with some questions about how the Jumpstart grant has impacted your organization. We expect that the interview will take approximately 45 minutes. Is that okay?
2. Are you familiar with the functions of Microsoft Teams?
    a. If not, explain how to exit the call, turn off audio and/or video.
3. So that you are aware, you have the right to leave the interview at any time, you can choose to not answer a question but still continue with the interview, and you can ask to have any response removed from your interview. Due to the function of Teams both audio and video will be recorded, although the video will not be used for analysis or kept once the transcription is complete. If you would not like your video to be recorded you can turn off your video now. Are you comfortable with us starting to record this interview?
4. Can you tell me a bit about your organization?
    a. What is your organizational goal?
5. Can you tell me about the population that your organization serves?
    a. Approximately how many people access your programs?
    b. What is your organizations reach? *(Local, regional, provincial, national?)*
    c. How do you provide services? *(Membership based, pay as you go, other?)*
    d. How do users find out about and/or register your programming?
6. All of the organizations we are talking to do amazing things to get their communities moving. Can you tell me more about how your organization does this?
    a. Do you think your organization is successful at increasing physical activity in your community?
    b. What are some examples of strategies or programs you have implemented which worked really well at impacting physical activity in your community?
    c. Not including the pandemic, what are the biggest challenges you face as an organization?

7. Canada really started feeling the effects of COVID-19 in early March of 2020. Could you elaborate on the way that the pandemic has affected your organization over the past 18 months?
    a. If you can remember, what were the first few months and weeks of the pandemic like for your organization?
    b. How has it impacted the capacity of your organization in the following ways:
        i. (Human resources) Has it affected your ability to acquire, retain or train volunteers?
        ii. (Human resources) Have you had to make any cuts to any paid positions?
        iii. How has the pandemic affected your ability to access the facilities and equipment you need for your programming (Infrastructure Capacity)
        iv. Has there been any impact on the quality of the facilities and/or equipment that your organization needs?
        v. Can you tell me about how the pandemic has impacted your organization's overall financial health?
        vi. Have you experienced a change in your funding over the pandemic?
        vii. Have you experienced a change in your revenues and expenses?
        viii. Have you been able to create any plans for emerging from the pandemic?
        ix. Relationship capacity (ability to work with partners, effect of "red tape"/restrictions, flexibility of partners)
        x. Other impacts not listed above?
8. Just to summarize, was your organization at risk of cutting programs during the pandemic?
    a. Were any programs actually cut?
9. Again, to summarize, was your organization at risk of shutting down completely due to the COVID-19 pandemic?
    a. How significant was this risk? Were any measures implemented?
10. We'd like to switch gears here and ask about the Jumpstart Grant program if that's okay?
11. How did you find out about the grant program?
    a. Why did your organization decide to apply?
12. Can you tell me about how the grant funding has impacted your organization, programming, or services?
    a. Did the funding from the grant allow you to retain programming?
        i. Is yes, how?
        ii. If not, why not?
    b. Did the funding allow you to remain operational?
        i. Is yes, how?
        ii. If not, why not?
    c. Did the funding allow you to address any of the challenges we've discussed?
        i. Is yes, how?
        ii. If not, why not?

13. So we had talked about how the pandemic impacted your organization over the past 18 months or so. Assuming we begin to emerge from the pandemic in the near future, what do you see as the biggest challenge in returning to "normal"?
    a. How do you see your organization responding to those challenges?
14. Well that wraps up all of the questions that I had for you, is there anything else that you would like to share that I haven't asked about?
15. Alright, well thank you so much for taking the time to speak with us today, we really appreciate it! Your answers have been incredibly valuable, and we hope to use them to help expand the knowledge surrounding how sport and physical activity organizations have been affected by the past 18 months and how they can best be supported moving forwards to ensure that all organizations that are doing this great work can continue. Just to reiterate, all of your comments and responses will be anonymized and neither your name or the name of your organization will be attributed to any quotes. If you have any questions or concerns feel free to reach out to any of the research team at any time.