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Investigating 24-Hour Movement Behaviours of Children and Youth Attending Summer Camps

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by

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Abstract

The KiSS UC study (n=224) measured all four movement behaviours from the Canadian 24-Hour Movement Guidelines: light physical activity (LPA), moderate-to-vigorous physical activity (MVPA), sleep, and sedentary behaviour (SB). The study objectives were to determine the: 1) proportion of participants meeting those guidelines, 2) factors associated with meeting the guidelines (sex, age, camp type, ethnicity, number of other children in the household, parent education), and 3) out-of-camp activities engaged in. Garmin vivofits measured LPA and sleep; Garmin heart rate monitors and Actihearts measured MVPA; SB and out-of-camp activities were assessed using questionnaires (CAPL, CPAQ, respectively). A large proportion of participants met the LPA (88%), MVPA (100%), sleep (65%), and SB (78%) guidelines. Age, parent education, sex, and number of other children in the household were significant predictors for sleep and SB. In summary, summer camps may be a setting where each of the Canadian 24-Hour Movement Guidelines can be met.

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Dedication

This thesis is dedicated to my family:

my grandparents, Amarjit, Satwant, Surjit, and Jalwant;

my parents, Sukhminder and Prabhsharan;

and my brother, Sagar.

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List of Symbols, Abbreviations and Nomenclatures

Symbol	Definition
BMI	Body mass index
CAPL	Canadian Assessment of Physical Literacy
CPAQ	Children's Physical Activity Questionnaire
HSW	Heart & Stroke Walkabout
HT	Height
LPA	Light physical activity
MHR	Maximum heart rate
MVPA	Moderate-to-vigorous physical activity
RC	Research coordinator; graduate student; volunteer
s	Standard deviation
SB	Sedentary behaviour
SR	Systematic review
WC	Waist circumference
WT	Weight

Chapter 1 Introduction

1.1 Purpose

The purpose of this study was to investigate 24-hour movement behaviours of children and youth enrolled in summer camps. The study examined four movement behaviours: light physical activity (LPA), moderate-to-vigorous physical activity (MVPA), sleep, and sedentary behaviour (SB), in children and youth attending the Active Living summer camps at the University of Calgary, Alberta.

1.2 Canadian 24-Hour Movement Guidelines for Children and Youth

Individuals engage in various behaviours over a period of 24 hours which fall along a continuum of movement, ranging from no or low-intensity to high-intensity movement, and are collectively referred to as 24-hour movement behaviours (Saunders, 2014). These behaviours are LPA, MVPA, sleep, and SB, and they have implications for numerous health outcomes (Carson, Tremblay, Chaput, and Chastin, 2016). Until recently the recommendations regarding each of these behaviours existed in isolation and each behaviour was considered independently of the others. This isolation implied that the behaviours were unrelated. For example, the accumulation of 60 minutes of MVPA in a day does not override or undo the detrimental effects of engaging in SB such as sitting for prolonged periods of time (Tremblay and Poitras, 2016); both MVPA and SB should be considered together. The behaviours are independent in the sense that an individual can only be engaged in one of the behaviours at any given time. However, the behaviours are not isolated from one another because the amount of time spent engaging in one behaviour will have an impact on the amount of time that is available for the other behaviours. Therefore, all four behaviours should always be assessed together.

Canada was the first country to develop integrated guidelines that provide recommendations regarding the movement behaviours, called the Canadian 24-Hour Movement Guidelines for Children and Youth (Tremblay and Poitras, 2016; Canadian Society for Exercise Physiology, 2016). These guidelines state that children and youth should spend several hours engaging in LPA, accumulate at least 60 mins of MVPA, sleep uninterrupted for 9-11 hours if they are 5-13 years old or 8-10 hours if they are 14-17 years old, and accumulate no more than two hours of recreational screen-time, each day (Appendix A).

Prior to the integrated approach taken by these guidelines, physical activity was often assessed on its own. In many studies, individual physical activity was objectively assessed using accelerometers or pedometers (Tudor-Locke, Johnson, and Katzmarzyk, 2010; Graser, Pangrazi, and Vincent, 2009). Much of this research occurred in schools, and more recently in summer camps. For the last three years the Active Living summer camps have been part of a study titled: *Ki*ds' *S*teps in the *S*ummer at *U*niversity *C*amps, or KiSS UC (Doyle-Baker, 2018). The KiSS UC study investigated the number of steps accumulated in 24-hours by participants from select camps, over four days, to determine whether they were meeting the Heart & Stroke Walkabout (HSW) step recommendations (Heart & Stroke Walkabout, n.d.; Tudor-Locke and Bassett, Jr, 2004). The HSW recommendations state that children under the age of 10 should take 12000 or more steps each day while youth (older than 10 years) should aim for a minimum of 11000 steps/day. In the summer of 2017, the KiSS UC study made a conscious effort to assess all four movement behaviours from the Canadian 24-Hour Movement Guidelines for Children and Youth. Since the guideline for LPA does not provide an objective recommendation, for the purposes of this study, the HSW step recommendations were used instead.

1.3 Physical Activity in Summer Camps

During the vacation period from school many children have reduced structure to their days, and as a result they typically engage in less physical activity during the summer months (Carrel, Clark, Peterson, Eickhoff, and Allen, 2007). This lack of physical activity can have negative consequences for children, such as gaining back lost weight and losing any fitness gains that were made during the school year (Beets, Weaver, Beighle, Webster, and Pate, 2013; Carrel, et al., 2007; von Hippel, Powell, Downey, and Rowland, 2007). Structured activities during the summer, such as those offered at summer camps, can result in weight and physical activity maintenance among children who attend. Therefore, summer camps can play an important role in enabling continued engagement in physical activity and maintenance of health outcomes among children and youth.

Summer camps are one of the largest settings outside of school where movement behaviours, such as LPA and MVPA, can be assessed (Beets et al., 2013; Brazendale et al., 2017; Hickerson and Henderson, 2010; Jago and Baranowski, 2004). Previous studies have focused on assessing physical activity in summer camps however, all four movement behaviours should be measured because they all contribute to movement over 24 hours. Therefore, this study measured physical activity (LPA and MVPA) in summer camps, while also investigating sleep and SB, as well as out-of-camp activities.

1.4 Active Living at the University of Calgary

It is widely agreed upon that physical activity is an important part of summer camps and should be taken into consideration when programming activities for campers (Hickerson and Henderson, 2010; Hickerson and Henderson, 2014). For example, using facilities that enable

children to be active, such as pools, climbing walls, and fields or courts, can increase children's engagement in physical activity. It is equally important to also ensure that there is a high ratio of camp leaders to children, and that the behaviour of the camp leaders encourages children to be active (Henderson and Hickerson, 2010; Weaver, Beets, Turner-McGrievy, Webster & Moore, 2014). Strategies such as these may positively impact levels of physical activity and SB in children (Weaver, Beets, Turner-McGrievy, et al., 2014). Furthermore, if camp programming intentionally includes activities that involve high levels of movement, the campers are more likely to be physically active (Henderson and Hickerson, 2010). The Active Living summer camps at the University of Calgary have high enrollment (over 10,700 campers registered in 2017; Appendix B) and include a wide range of camps with varying themes and programming. Some of the camps focus on targeted sports or outdoor activities and are considered to be 'active' camps, while others focus on education or activities such as photography or film making and are referred to as 'non-active' camps. The camps utilize facilities on campus as well as locations in the community for their programming, and they typically have a 1:8 ratio of leaders to campers.

1.5 Rationale and Population

Summer camps can be an optimal setting for conducting research involving movement because physical activity is typically a key component of the programming, however, to date a limited number of studies have focused on tracking physical activity in summer camps. Although the available literature on movement behaviours and the Canadian 24-Hour Movement Guidelines is increasing, currently, there are no studies assessing multiple movement behaviours in summer camps. There have been a few studies examining LPA and MVPA in summer camps (Brazendale et al., 2017; Beets et al., 2013; Doyle-Baker, 2018). However, it is important to

measure all behaviours because they collectively account for movement over 24-hours. This study's goal was to add to the literature by concurrently measuring all four movement behaviours in a summer camp setting.

The Active Living camps had high enrollment numbers and a variety of camp themes, which enabled us to have a large sample and include camps that involved varying degrees of physical activity. The available facilities and leader to camper ratios likely also resulted in increased opportunities for physical activity. The camps had programming that intentionally included activities which increased movement and energy expenditure. In previous years, the KiSS UC study assessed LPA in select Active Living summer camps (Doyle-Baker, 2018). Our study's purpose included investigating all four of the 24-hour movement behaviours in the Active Living camps.

1.6 Objectives

The primary objective was to investigate what proportion of participants were meeting the recommendations from the HSW website and the Canadian 24-Hour Movement Guidelines for Children and Youth, while attending Active Living summer camps at the University of Calgary, Alberta. A secondary objective was to investigate whether sex, age, ethnicity, camp type, highest level of parent education, and the number of other children in the same household as the camp participant, were associated with the participants meeting the guidelines. A tertiary objective was to determine what types of activities the participants engaged in outside of camp and whether or not they differed based on the type of camp (active or non-active) that the participants were enrolled in.

1.7 Hypotheses

This study was exploratory as it was unknown which factors, if any, would be predictors of meeting the guidelines. For LPA it was hypothesized that age, sex, and camp type would be significant predictors of whether participants met the guidelines or not, based on previous research from the Doyle-Baker Lab (Doyle-Baker, 2018). Children's physical activity levels decrease with age, so it was expected that younger children would be more active than older children (Tudor-Locke et al., 2011). Girls tend to be less active than boys and this may be a conscious decision as girls might choose to engage in SB when given the option to be physically active (Hickerson and Henderson, 2014; Guagliano et al., 2017). Based on these studies it is also possible that girls are less active because of other factors such as differences in the way in which they are socialized. The camp type was determined by the programming; camps with more scheduled physical activity were deemed active camps. Participants in active camps were expected to meet the LPA and MVPA guidelines more than participants from non-active camps because they had more opportunities to be active. Previous research has also identified ethnic differences in physical activity (Owen, Nightingale, Rudnicka, Cook, Ekelund, and Whincup, 2009; Hickerson and Henderson, 2010), therefore it was hypothesized that ethnicity may be a significant predictor of LPA and MVPA as well. These ethnic differences may have to do with children's peer circles (Hickerson and Henderson, 2014). For example, Hickerson and Henderson suggest that minority campers' physical activity levels may depend on whether or not they have other minority campers in their peer circles who are active. This implies that regardless of what ethnicity participants identify with, belonging to the minority may impact their engagement in certain behaviours, as they may feel excluded by the majority. Ethnic differences in sleep duration could be indicative of cultural differences in sleeping habits (Bates et al., 2016).

In terms of SB, sex and the number of children in the household, were hypothesized to be significant predictors. Boys were expected to be less likely to meet the SB guideline than girls because they spend more time playing computer and video games (De Jong et al., 2013). The more children there are in a household, the more likely they may be to share screens, therefore, participants living with other children would be more likely to meet the SB guideline. Furthermore, participants with highly educated parents were expected to be more likely to meet the recommendations, as education is a determinant of health (Davidson, 2014).

Chapter 2 Literature Review

2.1 Literature Search

A literature search focusing on summer camps and physical activity was conducted through the Medline and SportDiscus databases. Mesh terms were used for the Medline search and translated for the search in SportDiscus. The following subject headings were used: exercise, movement, accelerometry, actigraphy, sports, camping, child and adolescent. The following key words were also used: physical activ*, pedometer*, accelerometer*, step count*, step*, activity track*, movement, sport*, exercise, summer adj2 camp*, day adj2 camp*, summer adj2 program*, camping, youth, adolescent, and child*. This search was limited to the English language and produced 290 results from Medline and 370 from SportDiscus. Each article's abstract was reviewed for exclusion, resulting in 19 papers. Articles were removed from the review if the focus was not on physical activity in a summer camp or program setting. A majority of the studies that were excluded involved participants with a specific health condition or disability, such as an autism spectrum disorder, cerebral palsy, or blindness. Studies that took place in a camp setting and had a specific program purpose or population were also excluded, such as studies about weight-loss camps for children who were obese. There were also a few articles about calibration or a specific measurement tool, which were not included either. While the participants in our study may have disabilities or health conditions, the Active Living summer camps are designed for generally healthy children based on various interests, rather than a particular outcome such as weight loss. The papers that were excluded were about camps or programs that differed from the Active Living summer camps in terms of their purpose and the population they served.

A separate literature search was conducted in Medline using the term "24-hour movement" for articles related to 24-hour movement behaviours and the Canadian 24-Hour Movement Guidelines. This search produced 22 results, from which 11 papers were included in the review. Some of the papers that were excluded pertained to guidelines developed for children under the age of five (i.e. they were for infants and toddlers not children and youth). The other articles excluded were guidelines developed outside of Canada for other countries.

2.2 Canadian 24-Hour Movement Guidelines for Children and Youth

2.2.1 What are the Canadian 24-hour movement guidelines?

The Canadian 24-Hour Movement Guidelines for Children and Youth provide recommendations about LPA, MVPA, sleep, and SB for children and youth between the ages of five and 17 (Roberts, Yao, Carson, Chaput, Janssen, and Tremblay, 2017). The guidelines state that, on average, children and youth should accumulate 60 minutes of MVPA and no more than two hours of recreational screen-time each day. They also specify that children 5-13 years old should sleep, uninterrupted, for 9-11 hours nightly, however, they are less specific with the recommendation for LPA (Roberts, et al., 2017).

Four systematic reviews (SR) were completed to inform the development of the movement guidelines (Tremblay, Carson, Chaput, Connor Gorber, et al., 2016). The first SR examined the relationship between physical activity and various health indicators in children and youth. The second SR focused on SB and health indicators, and the third examined sleep duration and health indicators. The fourth review investigated associations between combinations of physical activity, sleep, and SB, with health indicators in children and youth.

2.2.2 Why do we need the Canadian 24-Hour Movement Guidelines?

The manner in which children and youth spend their time during the 24-hours that comprise a day has important implications for their health (Tremblay, Carson, and Chaput, 2016). The combination of the movement behaviours has a greater influence on health than any independent behaviour (Tremblay, Carson, and Chaput; Chaput, Carson, Gray, and Tremblay, 2014). Until recently, each behaviour was considered in isolation, which implied that the behaviours were not related (Tremblay, Carson, and Chaput). This is a simplistic view as an individual's engagement in one movement behaviour influences, and is influenced by, engagement in the other movement behaviours. For example, if an individual does not obtain enough sleep he/she may feel tired, and as a result choose to be minimally physically active and overly sedentary the following day.

The isolation of behaviors also resulted in a focus on accumulating 60 minutes of MVPA; a somewhat misguided approach (Tremblay, Carson, and Chaput, 2016; Chaput et al. 2014). MVPA makes up about 5% of the day, whereas LPA makes up 15%, and sleep and SB each make up about 40% (Chaput et al.). Altogether physical activity only accounts for 20% of the day, therefore it is not practical to focus solely on physical activity. It makes more sense to integrate each of the behaviours into a single set of guidelines, hence the development of the Canadian 24-Hour Movement Guidelines. The guidelines include sleep and LPA, which account for a large portion of a 24-hour day, and for which guidelines previously did not exist (Chaput et al.). Measuring all of the behaviours is important as they can impact various aspects of health, both positively and negatively, depending on how much time over a 24-hour period is spent in each behaviour relative to the rest.

2.3 Perceptions Regarding Acceptability, Barriers to Uptake, and Dissemination

Numerous stakeholders were consulted regarding the implementation of the movement guidelines (Faulkner, White, Riazi, Latimer-Cheung, and Tremblay, 2016). Focus groups and interviews were conducted with youth (aged 15-17), parents, teachers, pediatricians and exercise professionals that work with children and youth, to determine their perceptions regarding the movement guidelines and their acceptability, potential barriers to uptake, and recommendations for dissemination. The majority of participants supported the development of the guidelines, with a few exceptions. For example, one pediatrician pointed out that the guidelines were unnecessary because the recommendations were common sense and he had been providing them to patients his entire career (Faulkner et al., 2016). Most of the youth were uninterested as well; they felt the guidelines were meant to influence their future health, which they were not presently worried about. One youth mentioned that, although she wanted to know what the guidelines were, she likely would forget them later, and therefore not follow them (Faulkner et al.).

In terms of dissemination, the participating stakeholders wanted to receive information about the guidelines from: community centres, schools, public health institutions, government, and physicians. They discussed the need for having credible sources with a large public outreach to distribute the guidelines, such as health institutions and government agencies. Overall, schools and physicians were considered the most common and credible sources (Faulkner et al., 2016).

The first of three barriers to implementation identified by the participants was the lack of concise definitions or interpretations for words such as LPA, MVPA, and recreational (in terms of screen-time). Participants did not fully understand what activities were considered light physical activities and which were considered moderate-to-vigorous, or how to distinguish between LPA and SB. It was also unclear what constituted recreational screen-time, as opposed

to other types of screen-time. A lack of clarity regarding the behaviours would reduce the importance of those behaviours. Therefore, having clear definitions and examples and providing strategies for assessing the behaviours would help the public with overcoming this barrier (Faulkner et al., 2016).

The second potential barrier was referred to as everyday challenges and included: lack of finances, access to facilities, and competing priorities. There was a belief among some stakeholders that children and youth of families with a lower socioeconomic status may have difficulty meeting these guidelines. Some participants believed that physical activity was a structured activity, performed at a certain time and place, incurring a monetary cost. For others, facilities and money were not necessary as people can be active without them, therefore children and youth of any socioeconomic status could meet the recommendations. The youth in particular felt that school and technology were the main barriers for them, while parents indicated that hectic schedules and not modeling or prioritizing the behaviours were their biggest challenges. Meeting the screen-time recommendation in particular seemed unlikely because parents often use screen-time to keep kids occupied while they do other things (Faulkner et al., 2016).

The third barrier was the possibility of the guidelines becoming a source of stress and guilt for parents. Both parents and teachers indicated that they did not know how much time children spent in MVPA or SB because they were not able to constantly monitor it. For parents, being unable to determine whether their children are meeting the guidelines or not could be stressful. Participants also believed it was unrealistic to expect certain recommendations, like the one for screen-time, to be consistently met, given that numerous screens are present in many households. One participant described the guidelines as being too prescriptive. The perception is that they dictate that children must meet all of the recommendations, every day. This puts

pressure on parents who feel responsible for ensuring that happens, and if children are not meeting all of the guidelines, parents may feel guilty and choose to ignore them altogether (Faulkner et al., 2016).

2.4 Dissemination and Implementation of the Guidelines

Presenting information in a novel way helps to increase its impact on the audience (Latimer-Cheung et al., 2016). While the guidelines may not be presenting information that is new, the manner in which they are presenting it is. Providing a single, integrated message about movement is an effective way of drawing attention to the behaviours, and one resource is easier to disseminate than multiple resources with different messages. It is also easier to recall the message of a single resource. Another benefit from a dissemination standpoint is that people will have information about movement behaviours that they may not have been looking for or been aware of. These inclusive guidelines make it easier and more feasible to develop interventions based on the recommendations as well (Latimer-Cheung et al.). While the primary intention of dissemination was to provide awareness about the guidelines, awareness alone has a limited impact on behaviour change. In order to create changes at the organizational level, steps beyond awareness must be taken; the guidelines must first be adopted, then implemented, and maintained to create change (Latimer-Cheung et al.). The key players for disseminating and implementing the guidelines are: exercise professionals, schools, health professionals, and organizations that focus on physical activity, movement health, child/youth services, and child development, and organizations for parents (Latimer-Cheung et al.). After dissemination of the guidelines the next step is to determine whether children and youth are meeting the guidelines.

2.5 Are Canadian Children and Youth Meeting the Guidelines?

Roberts et al. (2017) used data combined from cycles 2 and 3 of the Canadian Health Measures Survey to examine the percentage of children and youth meeting the guidelines for MVPA, sleep and SB. Participants completed a questionnaire at home and visited a mobile examination centre where they were given Actical accelerometers. The accelerometers provided data about daily MVPA and parents reported sleep duration and screen-time by questionnaire. Participants were split into two groups based on age: 5-11-years old and 12-17-years old.

On average, children (aged 5-11) spent significantly more time in MVPA and sleep and less in front of a screen than youth (aged 12-17). The children were more likely to meet each of the recommendations than the youth (47.6% versus 24.4% for MVPA; 70.6% versus 28.1% for screen-time; 82.6% versus 68.1% for sleep). Boys spent more time engaging in MVPA and in front of a screen than girls, but sleep duration was not significantly different. The percentage of boys meeting the MVPA recommendation was almost twice that of girls (46.8% versus 24.6%) and there were significant differences between the percentages of boys and girls meeting it in both age groups. For the youth, there was a higher percentage of girls meeting the screen-time recommendation than boys (32.8% versus 23.6%). Overall, 36.0% of the children and youth met the MVPA recommendation, 49.3% met the screen-time recommendation, and 75.3% met the sleep recommendation. Only 17.5% met all three, though the percentage was significantly higher when comparing the children to the youth (29.6% versus 5.5%). More than 10% did not meet any of the recommendations (Roberts et al., 2017).

Janssen, Roberts, and Thompson (2017a) also aimed to report the percentage of children and youth meeting the guidelines. They used data from the 2013/2014 cycle of the Health Behaviour in School-Aged Children study. Bed and wake up times reported by participants were

used to determine sleep duration, and responses to questions regarding physical activity and screen-time provided estimates of MVPA and SB. They found that 66% of 10-17-year-olds met the sleep recommendation, 35% met the MVPA recommendation, but only 8% met the screen-time recommendation. More boys met the MVPA recommendation than girls, and more girls met the screen-time recommendation than boys. There was no significant difference between boys and girls in meeting the sleep recommendation. More 10-13-year-olds met the screen-time recommendation than 14-17-year-olds, however, there were no differences between the children and youth for sleep or MVPA. From this sample, 21% of participants did not meet any of the recommendations, and less than 3% met all three.

2.6 Health Associations with Meeting the Movement Guidelines

Katzmarzyk and Staiano (2017), Roman-Vinas et al. (2016), Carson, Chaput, Janssen, and Tremblay (2017) and Janssen, Roberts and Thompson (2017b) conducted four studies in which they determined the proportion of participants that met the recommendations for each of the behaviours, and combinations thereof. The goal of these studies was to determine whether there were associations between meeting more of the recommendations and various health indicators.

Katzmarzyk and Staiano (2017) investigated the relationship between meeting the guidelines and cardiometabolic risk factors among American children, youth and adolescents between the ages of five and 18. They found that 26.9% of the sample met none of the guidelines (not including LPA) and 8.4% met all three. Sleep was the most commonly met guideline and MVPA was the least. Because their results are based on an American sample, it is possible that the values are not representative of Canadian children and youth. Katzmarzyk and Staiano (2017)

assessed BMI, waist circumference, total body fat (kg), abdominal subcutaneous fat and visceral adipose tissue (L), systolic and diastolic blood pressure (mmHg), triglycerides (mg/dL), HDL-C (mg/dL), glucose (mg/dL), and a cardiometabolic risk score. There were significant associations between meeting more of the recommendations and having less cardiometabolic risk factors. Blood pressure and HDL-C were the only risk factors that did not have a significant, beneficial association with meeting more of the recommendations. Lower odds of obesity were associated with meeting each of the recommendations, but they were significantly lower when meeting the sleep recommendation. Participants that met more recommendations had lower adiposity, triglycerides, glucose, continuous cardiometabolic risk scores and odds of obesity; there was no association with odds of high cardiometabolic risk.

Roman-Vinas et al. (2016) conducted a study with children from 12 countries evaluating the associations between meeting the recommendations, and obesity and BMI z-scores. Age, sex, highest level of parental education and unhealthy diet pattern scores were covariates in their analyses. They found that 14.0% of the Canadian participants met all of the recommendations and 14.4% met none. Similar to the study by Katzmarzyk and Staiano (2017), they found that sleep was the most commonly met recommendation and MVPA was the least. Participants who met all three recommendations were less likely to be obese, and participants who met one to three recommendations had significantly lower BMI z-scores compared to participants that did not meet any of the three recommendations. MVPA had the lowest overall odds ratio for obesity, but not meeting that recommendation was the strongest predictor of obesity. Participants who did not meet this recommendation had the highest odds for obesity. This relationship was more evident among the girls, possibly because they spent less time in MVPA than the boys.

The purpose of the study conducted by Carson et al. (2017) was to examine associations between meeting the recommendations, or combinations of the recommendations, with various health indicators. The participants in this study were 6-17-year-old children and youth who provided data for cycles 1-3 of the Canadian Health Measures Survey. The health indicators assessed were BMI z-scores, waist circumference (WC), aerobic fitness (determined using the mCAFT), systolic and diastolic blood pressures, HDL-C, triglycerides, insulin, and c-reactive protein in the fasting sub sample. Additional measures included the assessment of behavioural strengths and difficulties scores as a broad indicator for social and emotional health. None of the recommendations were met by 11% of the sample while 17.1% met all three. Once again, sleep was the most commonly met recommendation while MVPA was the least. Meeting only one or two of the recommendations was significantly associated with worse health in these five indicators: BMI, WC, behavioural strengths and difficulties scores, aerobic fitness, and insulin. Meeting at least one recommendation, rather than none, was significantly associated with better health for seven indicators: BMI, WC, systolic blood pressure, behavioural strengths and difficulties scores, aerobic fitness, triglycerides, and insulin. Meeting recommendations for specific movement behaviours, was less important than the number of recommendations met overall, and meeting fewer recommendations was associated with worse health in a gradient pattern.

Janssen, Roberts, and Thompson (2017b) used data from the 2013/2014 cycle of the Health Behaviours in School-Aged Children study. The data were self-reported, and the health indicators assessed were: BMI z-scores, emotional problems, life satisfaction, and prosocial behaviours (i.e. doing things for others without being asked). Indicators for mental and social health were additionally assessed using questionnaires. Based on the results, less than 3% of the

participants met all of the recommendations, less than 10% of participants selected the option corresponding to the highest degree of emotional problems, and more than 15% indicated that they had prosocial behaviour. Children and youth that met each recommendation had lower BMI and emotional problems scores, and higher life satisfaction and prosocial behaviour scores, when compared with participants that did not meet those recommendations. BMI z-scores were not significantly different between participants that met the SB recommendation and those that did not, but all other differences were significant after controlling for confounding and the other behaviours. Participants that did not meet any recommendations had higher BMI z-scores and emotional problems scores, and lower life satisfaction and prosocial behaviours scores after controlling for confounding, than participants that met only one of the recommendations. The results of this study indicate that meeting even one of the recommendations can be associated with health indicators in a positive way (Janssen, Roberts and Thompson 2017b).

2.7 Measuring Physical Activity in Summer Camps

There are many different settings in which children and youth engage in physical activity, and there are numerous approaches to providing opportunities to increase engagement. Summer camps are a setting where a non-curricular approach to promoting physical activity is taken (Jago and Baranowski, 2004). Summer camp attendees are a captive audience, and they may be willing to try activities that would not normally be a part of the physical education curriculum, however, a gap exists currently in translating physical activity during summer camps into habitual activity outside of the camp setting (Jago and Baranowski, 2004). Many studies have assessed physical activity levels in summer camp settings using various tools and methods.

Hickerson and Henderson (2014) completed a study based on step counts, which determined on average, residential campers took more steps than day campers. Day campers took an average of 11916 steps/day (range=9284-13222 steps) and residential campers took 19699 steps/day on average (range=16481-23726 steps). The difference in wear time between the two groups was primarily responsible for the difference in step counts (Hickerson and Henderson, 2010; Hickerson and Henderson, 2014). When the step counts were averaged based on wear time, the day campers took more steps per hour than residential campers, however, the difference was not statistically significant (Hickerson and Henderson 2014). Girls and campers belonging to a minority, in day and residential camps, were significantly less active than boys and non-minority campers. Boys took 2671 more steps/day than girls at day camps and 2611 more steps/day than girls at residential camps. Non-minorities took 2604 more steps/day than minorities at day camps and 3757 more steps/day than minorities at residential camps. In day camps only, participants with a higher BMI were significantly less active than participants with a normal weight BMI (Hickerson and Henderson, 2010; Hickerson and Henderson, 2014). Participants with a BMI below the 85th percentile took 1858 more steps/day at day camps and 2226 more steps/day at residential camps than campers with a BMI above the 85th percentile.

Hickerson and Henderson (2010) found that campers were more likely to be active if their peers were active. In their study sample there were more non-minority (i.e. white) campers than minority campers (Hispanic, Black, American Indian, Asian/Pacific Islander, Other), and they believed that certain campers were excluded because of their race. It is possible that some campers would have been more likely to participate if they had more minority campers to engage in physical activity with (Hickerson and Henderson, 2014). It is also possible that, in other camps, there would not be any significant differences based on race. Hickerson and Henderson

(2014) also stated that the children with higher BMIs may not have participated in physical activity as much as under/normal weight campers because they may have felt excluded as well. Having access to activity areas, such as climbing walls or lakes, was related to higher physical activity levels, especially in the residential camps, and having to walk longer distances to get to these areas resulted in increased step counts. The camper-staff ratios, and frequency and intensity of programmed physical activities were also important organizational influencers (Hickerson and Henderson, 2014).

Brazendale et al. (2017) measured the physical activity of children attending 20 camps, operated by nine organizations in South Carolina. They found that on average, 80% of boys and 73% of girls spent at least 60 minutes per day engaging in MVPA. The median MVPA accumulated in a day by boys and girls was 96 and 82 minutes, respectively. Participants from camps that enrolled 40-60 campers each day accrued 12 more minutes of MVPA, compared to participants from camps enrolling less than 40 or greater than 60 children. Participants in larger camps (>60) spent six minutes less in MVPA than participants in smaller (<40) camps. Furthermore, children in camps that scheduled more than four hours of physical activity throughout the day spent more time in MVPA than children in camps that scheduled less than two hours of physical activity. Girls attending camps with more than four hours of scheduled physical activity were four times more likely to accumulate 60 minutes/day of MVPA than girls attending camps that scheduled two hours or less. Participants attending camps in non-traditional locations, as opposed to community centres, also spent less time engaging in MVPA by 30 and 48 minutes, for girls and boys, respectively. Factors such as lack of space or facilities for physical activity, including swimming pools, may have contributed to the reduced MVPA in camps at non-traditional locations (Brazendale et al.).

Weaver et al. (2017) designed an intervention to increase the percentage of children in summer day camps spending 60 minutes/day in MVPA. Post-intervention, both boys and girls in the intervention camps were 2.04 and 3.84 times more likely to achieve 60 minutes/day of MVPA than boys and girls from the control camps (Weaver et al.). In the intervention group there was a 10.6% (11.8 minutes/day) increase in the number of boys achieving 60 minutes/day of MVPA compared to a 1.6% (4.3 minutes/day) increase in the control group, and for girls there was a 12.6% (12.8 minutes/day) increase in the intervention group and a decrease of 5.5% (7.5 minutes/day) in the control group. Boys and girls in both the intervention and control groups increased their sedentary time per day from baseline to outcome, and girls in both groups increased their MVPA as well. The camps in the intervention group increased their daily scheduled time for physical activity by approximately 67 minutes while the controls increased it by five minutes. The intervention camps went on eight active field trips at baseline and outcome, whereas the control camps decreased the number of active field trips they went on from three to one. Intervention camps also increased the number of days on which they had activity breaks compared to the control camps. This intervention appears to have been successful in increasing the number of children that were engaging in physical activity.

The summer camp named Girls in the Game was a community-based program for girls living in Chicago neighbourhoods with ethnic minority and low-income youth, and limited resources (Bohnert, Ward, Burdette, Silton, and Dugas, 2014). The sleep, physical activity and SB of the participants in the Girls in the Game summer camp were assessed. Initially the participants slept for an average of eight hours and 54 minutes each night, 52% of participants slept for the recommended nine hours, and they recorded a daily average of 14.40 minutes of MVPA (2% achieved 60 minutes of MVPA). Latina participants had longer sleep durations and

earlier sleep onset times than African American participants at the beginning of the program. At the end of the program, participants were going to bed earlier, waking up earlier and attaining more minutes of MVPA during the programming; the sleep duration was eight hours and 35 minutes, 33% of participants received nine hours of sleep each night and recorded 41.20 minutes of MVPA daily, and 20% achieved 60 minutes of MVPA/day. The participants may have had to wake up earlier than usual to attend the programming and that change in the waking time may have resulted in a decrease in sleep duration if the sleep onset time did not also adapt (Bates et al., 2016). The difference in sleep duration between Latina and African American girls could also be due to cultural differences. Latina girls may come from a culture that is accepting of an afternoon nap, so they may have different sleep patterns than African-American girls, and a questionnaire-based assessment of sleep duration may not accurately reflect that (Bates, et al.).

Participants also engaged in more MVPA when involved in the structured programming, most likely because of the focus on increasing physical activity (Bates et al., 2016). Bohnert et al. (2014) found increases in total physical activity by 151 minutes/day and in MVPA by 26 minutes/day; these increases occurred independently of age. Changes in weight over the course of the camp did not differ by baseline weight or age. Prior to the programming, participants spent an average of 12 minutes/day engaged in MVPA which increased to an average of 38 minutes/day at camp, and perhaps even more because swimming time was not included (Bohnert et al.). The participants also had one more 10-minute bout of MVPA per day than before, and the minutes spent in a bout of MVPA lasting at least 10 minutes went up by 18.76 minutes/day. There was a significant decrease in sedentary time by 121 minutes/day, but there was no significant difference in the amount of time spent using media. Therefore, participants in the

Girls in the Game program benefited by improving their patterns of physical activity and sedentary behaviour (Bohnert et al.).

The study by Bohnert et al. also used a portion of the full sample for analysis, while the 2017 study includes the full sample from the Girls in the Game camp. At baseline, participants reported 14.87 minutes/day of MVPA and only 5% met the recommendation of 60 minutes/day (Bohnert et al., 2017). After the program, participants recorded an additional 28.18 minutes/day of MVPA, with 20% of participants meeting the recommendation. Changes in all of the main outcome variables occurred regardless of weight status or age, paralleling the findings from the previous paper (Bohnert et al., 2014). Among these participants, changes in MVPA and sedentary behaviour were significant for the African American girls, but not for the Latina girls, which could be due to the smaller subsample of Latina girls (Bohnert et al., 2017). Prior to taking part in the structured programming, participants only spent 15 minutes/day in MVPA, but while attending programming that time increased to 45 minutes/day (Bohnert et al., 2017). The participants accumulated almost two more 5-minute bouts/day of MVPA, spent an additional 22 minutes/day in those bouts, and reduced their sedentary time by 2 hours and 29 minutes per day. This indicates that the programming was effective in increasing girls' physical activity levels.

Previous research has shown that implementing the Sport Education model in camps can result in high levels of participation, enjoyment and positive engagement, and improve aerobic fitness as well (Wahl-Alexander and Morehead, 2017). Wahl-Alexander and Morehead (2017) conducted a study comparing campers' MVPA during Sport Education and traditional activities in a residential summer camp. Campers in the traditional condition spent significantly more time sitting and standing than those enrolled in the Sport Education condition. In the traditional model, campers spent 29.2% of the time sitting, 25.3% of the time standing, 3.2% of the time

lying down, and 42.2% of the time engaged in MVPA; in the Sport Education model, campers spent 18.6% of the time sitting, 17.1% of the time standing, 2.7% of the time lying down, and 61.6% of the time in MVPA. The Sport Education group also engaged in vigorous activity more than the traditional group. This indicates that a Sport Education model could be one strategy for increasing physical activity among campers, although it is important to have staff that are trained in, and have experience with, the use of this model leading the activities for them to be effective.

Guagliano et al. (2017) conducted a study with a sample of Russian girls, to investigate the effects of three different physical activity sessions on girls' physical activity: free play, organized physical activity with no choice of activity, and organized physical activity with choice of activity. Overall, the participants spent more time engaging in MVPA with the organized no choice (~30%) and organized with choice (~28%) sessions compared to the free play (~21%). This finding is the opposite of the results by Weaver, Beets, Turner-McGrievy, et al. (2014), which found slightly higher percentages of boys and girls engaging in MVPA during free play. It is possible that the types of organized activities, or the way they were led, could have impacted how much MVPA children achieved. Activity levels also differed by context in terms of steps taken, as participants took more steps in the two organized contexts (no choice had the greatest mean step count) compared to the free play (Guagliano et al.). Cultural factors may also have influenced the level of MVPA. The authors describe the norm for Russian children as one of structured environments with an authoritarian figure directing them on what to do. Therefore, it is possible that the girls had lower levels of MVPA because they did not have the skills to make their own decisions about activity in the free play context (Guagliano et al). It is also possible that they chose to do something less active, such as sitting and talking, which was

observed by the researchers (Guagliano et al.). The results of this study could also differ from what Weaver, Beets, Turner-McGrievy, et al. (2014) found because this camp had girls only.

Another strategy for influencing behaviour is competency-based training, which focuses on developing observable skills (Weaver, Beets, Turner-McGrievy, et al., 2014). Weaver, Beets, Turner-McGrievy, et al. investigated the effects of competency-based training on children's physical activity levels in summer camps. In this study, SB during scheduled activities was reduced by the end of the intervention by 16.9% in girls and 17.4% in boys, with the biggest reduction occurring during organized physical activity (Weaver, Beets, Turner-McGrievy, et al.). During organized play, free play, and assembly, there were statistically significant increases in MVPA for boys and girls, and in enrichment as well for the girls only (Weaver, Beets, Turner-McGrievy, et al.). The largest difference was during assembly, and from the scheduled activities, the largest increase was during organized physical activity. The greatest percentage of children were engaged in physical activity during swimming and water activities; therefore, it may be worthwhile to include water activities in camp programming. Post-intervention, Weaver, Beets, Turner-McGrievy, et al. found there were similar percentages of boys and girls engaged in MVPA during free play and organized physical activity. There may be some aspect of organized opportunities that reduces engagement in physical activity (Weaver, Beets, Turner-McGrievy, et al.). The gap between boys and girls MVPA levels was also diminished during free play and organized physical activity, which is an important observation because girls are typically reported in the literature as having lower MVPA levels than boys (Weaver, Beets, Turner-McGrievy, et al.; Hickerson and Henderson, 2014).

Beets et al. (2013) used four large summer camps for their study. Based on their observations, more girls were sedentary than boys, and boys spent more time walking and

engaging in vigorous activity. Boys and girls were most active during scheduled physical activity times as opposed to other unspecified but scheduled activity times (Beets et al.). Availability of equipment and scheduled free-play were associated with a reduction in the proportion of sedentary campers, and water-based activities were associated with a greater proportion of campers in vigorous activity. Being outdoors was associated with less campers in vigorous activity and more campers observed walking. Having campers waiting in line and spending a lot of time giving instructions were associated with greater SB among the campers, while elimination games and having two or more choices of physical activities were associated with less (Beets et al.). Even though approximately 38% of the time during camps was allocated for physical activity, most children were not active during this time. Beets et al. noted that staff are critical for influencing children's behaviour, and they can play a role in managing opportunities to increase the number of children engaging in physical activity.

2.8 Physical Activity in School and Community-Based Programs

Kien and Chiodo (2003) developed a summer and after-school recreation program that used non-competitive games and outdoor activities, like gardening, to attempt to increase children's physical activity in relation to what they would habitually be doing at home. The summer and fall sessions both took place outdoors at a school and involved two different programs: gardening and adventure education. The energy expenditure during the summer program, measured as the rate of carbon dioxide production, was 60% higher than it was while watching TV. During the fall, there was a 95% increase in movement compared to when the children were at home. There was also a 16% increase in movement in the fall compared to the summer. The results of this study indicate that participating in a recreation program offering

activities like gardening or adventure education can increase physical activity. This is especially important for children who do not participate in activities like competitive sports, because it demonstrates that nonathletic and non-competitive activities can also increase energy expenditure (Kien and Chiodo, 2003).

The Active Winners study evaluated the effects of a community-based intervention that was implemented in two rural communities to increase youth physical activity (Pate et al., 2003). There were no significant differences between the intervention and comparison groups in the number of 30-minute blocks of moderate to vigorous or vigorous physical activity. There were also no significant interactions for the psychosocial determinants, however, the girls in the intervention group scored significantly lower on social influences and beliefs about physical activity compared to girls in the comparison group. There was no dose-response relationship between attendance and physical activity or psychosocial variables. The process evaluation determined that social factors, such as not having friends participate or disruptive children, greatly influenced the attendance. In the target group (n=225), 82% participated at least once, but only 5% participated in a minimum of half the sessions. Due to low attendance, the exposure to the intervention may not have been sufficient for affecting levels of physical activity or its determinants. Heart rate monitoring did confirm that participants were engaged in vigorous physical activity 30-34% of the time they were in attendance (Pate et al.).

2.9 Environmental, Social-Motivational, and Psychosocial Factors Affecting Physical Activity

Zarrett, Sorensen and Skiles (2013) conducted observations of four summer day camps, two of which were deemed highly-resourced and two of which were deemed low-resourced

camps. The purpose of this study was to examine the relationship between physical and social-motivational characteristics of summer camps and campers' engagement in physical activity. Across all four camps, youth were engaged in MVPA during 28% of the observations and were sedentary for 72% of the observations. The males were more active than the females, and there were differences in the proportions of MVPA by camp, due largely to the differences in the males' MVPA across camps. High-resourced camps had higher levels of MVPA than low-resourced camps, and in the low-resourced camps there were half as many males engaged in MVPA than there were in high-resourced camps (Zarrett et al., 2013). Availability of equipment and high temperatures were related to higher levels of MVPA in girls. The researchers noted that when the temperature was above 90 degrees Fahrenheit (32 degrees Celsius) the girls were more likely to participate in indoor activities than outdoor, but the boys were equally likely to participate in either.

In terms of the social-motivational context, 66% of the observations were of some sort of autonomous activity, and they mostly occurred during free play. Across the camps, 20% of the activities that were observed were inclusive and 27% were organized. Highly engaging games and bullying were significantly related to increased participation in physical activity for males, and positive peer interactions was related to greater physical activity for females; clarity of rules was related to decreased participation in physical activity for males and females. Overall, the features of the social context, rather than the environment, were more predictive of physical activity participation. For the sex-specific features, staff may need to ensure that all of the features are taken into consideration to ensure participation by both males and females. For males, it seems the quality of the game is important, as highly engaging games and games that were competitive in nature, were related to their participation. For girls however, peer relations

seem to be important for motivating them to participate in physical activity. Any variations that were found between camps were between high- and low-resourced camps, which could indicate that having enough resources and funding for camps can also affect physical activity levels (Zarrett et al.).

Welk and Schaben (2004) studied the relationships between psychosocial correlates and physical activity in contexts where children were given similar opportunities to be active. Their results indicated that Perceived Athletic Competence was correlated with physical activity. This may be because children who perceive themselves to be more competent may be more willing to engage in physical activity because it gives them an opportunity to show others how competent they are, but children's perceptions of their physical selves may not influence whether they engage in physical activity or not (Welk and Schaben, 2004). There were no associations between physical activity and attraction to physical activity, which may be related to children's interest in physical activity in general, but not their willingness to engage in it. Welk and Schaben (2004) also found that children's activity levels were consistent from week to week, so the children that were active in the first week were also active in the other weeks, which may indicate that some children seek out or take advantage of opportunities to be active, while others do not. This study indicates that Perceived Athletic Competence may be a mediator of physical activity, and it may be more important than attraction to activity and physical self-perception (Welk and Schaben, 2004).

Wilson, Sibthorp and Brusseau (2017) conducted a study to determine whether goal-setting in a summer camp environment could increase physical activity levels and enjoyment of physical activity among campers. This study involved the use of three different goal-setting programs: individual goals, group goals, and camp-wide goals. The step counts for the week

when campers set individual goals were significantly higher than the step counts from the baseline week, however, the enjoyment was not significantly different. During the week when group goals were set, the enjoyment was significantly different from baseline, but the step counts were not. For the week when the camp-wide goal was set both step counts, and enjoyment were significantly higher than they were at baseline. Boys were more active than girls, and older campers had lower enjoyment levels than younger campers. Based on these results, setting a camp-wide goal may be the best way to increase physical activity levels and enjoyment in summer camps (Wilson, et al. 2017).

2.10 Staff Perceptions and Behaviours Relating to Physical Activity

Ventura and Garst (2013) explored camp professionals' perceptions regarding the importance of promoting healthy eating and physical activity, and strategies that could be used to promote these behaviours. Regarding the promotion of physical activity, ~50% of the professionals (n=123) mentioned that they had implemented at least one strategy to increase children's physical activity in camps. The most common strategy was encouraging staff to be active, so they could set a good example for the campers. Eighty percent of the professionals also indicated that their camps included opportunities for physical activity, and several stated that they did not feel the need to use any more strategies to increase physical activity in their camps. Significantly more professionals from independent, not-for profit camps explained that it was required that children attending their camps participate in physical activity, when compared to agency camp professionals (Ventura and Garst, 2013). This study highlights how camp professionals' perceptions regarding the necessity of physical activity in camps may be an important factor related to campers' physical activity levels. Camp professionals that believe it is

necessary to include physical activity in camps may be more likely to try to include numerous opportunities for physical activity and attempt to ensure that campers are taking advantage of them, which would lead to higher physical activity levels.

Zarrett et al. (2013) found that the staff were present and interacting with campers throughout the day but, minimally so in relation to promoting physical activity. Most commonly, staff were seen observing physical activity (56% of the time), though they also demonstrated or participated in it sometimes (10% of the time). Verbal cues were provided minimally (about 2% of the time) to increase activity or praise campers for taking part in it. Observing youth during physical activity was significantly related to increased rates of physical activity, particularly for the boys (Zarrett et al.). This indicates that campers may be more likely to participate in physical activity if they are aware that they are being observed by their camp leaders.

Weaver, Beets, Turner-McGrievy, et al. (2014) found that physical activity promoting behaviours increased significantly, which indicates that staff were more engaged with children in physical activities, they were providing more choices, and verbally promoting physical activity more. There was also a significant decrease in the number of children that were waiting idly or standing in line waiting for their turn, and staff were not withholding physical activity as a punishment or consequence of behaviour as much as they were at baseline (Weaver, Beets, Turner-McGrievy, et al.). Overall, this study demonstrates that professional development training can influence staff physical activity promoting behaviours, which can in turn have an impact on children's sedentary behaviour and physical activity levels. The benefit of providing competency-based training was that the staff were not asked to implement new activities, they were only asked to incorporate certain principles into the activities they were already doing, which makes this approach very adaptable.

2.11 Limitations of Previous Research

The studies that assessed 24-hour movement behaviours in relation to the movement guidelines have only attempted to assess the three movement behaviours for which there are specific recommendations: minutes of MVPA, hours of sleep, or hours of recreational screen-time (Roberts et al., 2017). They have not assessed LPA, which can be considered a limitation because the studies are missing a behaviour that makes up a large portion of the day. Many studies also relied on questionnaires and self-reporting for measures of the movement behaviours and certain health indicators, which may have resulted in bias due to recall and social desirability, and along with misclassification resulting in over or under representation of the proportion of children and youth meeting a recommendation (Roberts et al., 2017; Janssen et al., 2017a; Katzmarzyk and Staiano, 2016; Janssen et al., 2017b; Carson et al., 2017; Roman-Vinas et al., 2016). Our study attempted to overcome these limitations by using questionnaires to assess behaviours only where it was not feasible to assess objectively. The studies that used data from the Canadian Health Measures Survey or the Health Behaviours of School-Aged Children Study also excluded certain populations of children and youth, such as those with special needs or those living on reservations, therefore, their samples are not entirely representative of Canadian children and youth (Roberts et al., 2017; Janssen et al, 2017a). Our study did not exclude children and youth from those populations, however, we are unaware of whether any of our participants had special needs or lived on a reservation because we did not ask them to provide us with that information.

In terms of the studies investigating physical activity, one of the limitations was the lack of generalizability to other camps or other physical activity settings because of the variation in

summer camp programming (Hickerson and Henderson, 2010; Hickerson and Henderson, 2014; Beets et al., 2013; Wahl-Alexander and Morehead, 2017; Bohnert et al., 2014; Bates et al., 2016; Guagliano et al., 2017; Wilson et al., 2017). There also were no studies identified in the literature search that measured all four of the movement behaviours in a summer camp setting.

2.12 Conclusions from the Literature

This review of literature included two separate searches based on: 1) the Canadian 24-Hour Movement Guidelines and, 2) physical activity in summer camps. The literature regarding the movement guidelines discussed the importance of developing the Canadian 24-Hour Movement Guidelines, and the importance of ensuring that children and youth are meeting them. The guidelines were developed because it was recognized that there was a need to present information to both professionals and the general public in an integrated format. As for meeting the guidelines, studies have demonstrated that it is imperative for children and youth to meet the guidelines because the movement behaviours are associated with various health indicators (Roman-Vinas et al., 2016; Katzmarzyk and Staiano, 2017). Several studies have attempted to determine how many children and youth are meeting the guidelines with different cohorts and varying sample sizes. These studies do not include LPA, but they do indicate that MVPA is typically the least met guideline (Roman-Vinas et al.; Katzmarzyk and Staiano, 2017). Furthermore, not meeting the MVPA guideline was found to be the strongest predictor for obesity (Roman-Vinas et al. 2016). It has been established that meeting the guidelines is important, especially MVPA, so it would make sense to investigate whether children and youth are able to meet the guidelines in a setting where they are given the opportunity to engage in and

increase their levels of physical activity. One such setting where movement behaviours can be investigated is summer camps.

There are studies that have measured physical activity levels in summer camps however, the focus was on understanding factors associated with physical activity. Various methods for assessing physical activity were used in these studies, such as direct observation and the use of pedometers and accelerometers. Many personal and contextual factors were found to affect children's engagement in and levels of physical activity, such as the behaviours of staff, availability of and access to equipment and facilities, and perceived athletic competence. More recently, research in summer camps has begun investigating other movement behaviours such as sleep and SB (Bates et al., 2016). In this study Bates et al found that about half of the participants were getting nine hours of sleep prior to the program start, however these hours decreased by about two-thirds at the end of the camp, suggesting participation in summer camps may influence sleep duration. This implies that even behaviours like sleep, that would normally occur in a different setting (i.e. at home), can be affected by settings such as summer camps. This identifies the value of assessing behaviours in various settings. Other studies also found that sedentary time decreased as a result of involvement in summer camps (Weaver, Beets, Saunders, et al., 2014; Bohnert et al. 2014; Bohnert et al., 2017), but screen-time SB was unaffected by this involvement (Bohnert et al., 2014). Along with the recommendation about screen-time, the guidelines also state that children and youth should limit sitting for extended periods of time, so it is clear that in some camps it is possible to meet at least a part of that guideline (Weaver, Beets, Saunders, et al.; Bohnert et al. 2014; Bohnert et al., 2017). The Girls in the Game study is the closest that any of the summer camp studies have come to assessing all of the movement

behaviours in one camp setting. To the best of our knowledge there were no studies published at the time of this review that used Canadian summer camps.

Although there are some studies that investigate multiple movement behaviours in summer camps, no study thus far has investigated whether children and youth are able to meet each of the four recommendations from the Canadian 24-hour Movement Guidelines in a summer camp setting.

Chapter 3 Methods

3.1 Sample Selection and Recruitment

3.1.1 Selection of camps.

In June, the Manager of Youth Programs from Active Living (Logan Jones), the graduate student and research coordinator (RC), identified 15 camps located on the main campus of the University of Calgary to be included in the study. A number of camps were not selected for this study for various reasons (see Appendix C for exclusion criteria). The selected camps were one-week in duration and had various themes such as athletics, outdoor activities, science, and film making (see Appendix D for a detailed list of all the camps included in the study and Appendix E for the camp schedule). The Active Living camps were scheduled in the months of July and August, resulting in eight weeks of data collection.

3.1.2 Recruitment.

All participants from the selected camps were notified one week before each camp start date via an email sent to the parents with information about the study. This information package included: a recruitment poster (Appendix F), a cover letter (Appendix G), and the consent form (Appendix H). On the first day of camp, during the registration process, the camp leaders told parents about the study and how to enroll their children if interested. Participants in camps not part of the study were enrolled if they approached the study coordinator on registration day (n=23). Some parents were not informed or aware of which specific camps (i.e. age/grade group) were in the study. This resulted in participants from additional camps, some of whom were siblings of intended participants (n=10), being enrolled in the study as well (see Appendix I for notes about enrollment).

3.1.3 Ethics.

The study was approved by the Conjoint Health Research Ethics Board at the University of Calgary (REB 15-1718). A member of the research team (RC) verbally explained the study to each camper in accordance with the child assent protocol. All campers who provided verbal assent and had written parental consent participated.

3.2 Data Collection

3.2.1 Biometrics.

On the first day of camp four biometrics: height (HT), weight (WT), waist circumference (WC), and step length (the number of steps taken over a prescribed distance) were measured for each participant. Participants' HT and WT were determined using the Centers for Disease Control and Prevention's (2015a) guidelines for taking measurements at home (Appendix J). During the WC measurement participants stood behind a tri-fold for privacy and the tape measure was placed just above the hip bone and circled around the waist, crossing over on the front, on the right side of the participant's body. For the step length, participants walked a distance of three metres and the RC counted the number of steps taken. All biometrics were measured to the nearest half unit (cm, kg, steps) and recorded on data sheets that were later transferred to a master sheet in Microsoft Excel. However, an exception occurred with the Garmin Connect algorithm which required a whole number, so half-steps were rounded down to the nearest whole number for the input. The biometrics were required to personalize each participants' Garmin ®vivofit. Not all participants agreed to the measurements, and logistically

it was challenging to get some participants because of late arrival, etc. (n=15; see Appendix I for more information).

3.2.2 Participant characteristics.

Parents of participants were asked to complete a Participant Characteristics Form (Appendix K) after signing the consent form. This form required parents to confirm their child's name, date of birth, sex, and camp, as well as complete a few questions about demographic information regarding their family (number of children in household, ethnicity, and parent's highest level of education). These variables were used as predictors in the logistic regression models for the analysis

3.2.3 Light physical activity.

The LPA measurement was based on steps taken over 24 hours, tracked by a Garmin vivofit® accelerometer (1st or 2nd generation; Garmin Ltd., Kansas, USA) fitted to the participants' wrists. The vivofit is a valid tool for measuring step counts in adults and it has been used with children in other studies (Simunek et al., 2016; Bronikowski, Bronikowski and Glapa, 2016). The vivofits have been found to be reliable in tracking steps when calibrated with an individual's biometrics (Ghazavi, Spytkowski, Kashluba, Grewal, and Doyle-Baker, 2016). They are waterproof and battery operated, which are important considerations since many camps have water-based activities, and unlike many other activity devices, charging is not required. To personalize and calibrate each device the participant's HT, WT, date of birth, and step length were inputted into the vivofit through the Garmin Connect website (https://connect.garmin.com/en-US/). An estimated value was entered for participants with

incomplete or missing measurements (see Appendix I for more information). Participants were fitted to their device on the first day of camp (Monday). They were instructed to wear it for 24 hours each day and told the device would be collected on their last camp day (Friday). The step data were from days the participants were wearing the vivofit for a 24-hour period; typically, Tuesday, Wednesday, and Thursday. The data from Monday and Friday were excluded as they were incomplete tracking days. There was one week when camps began on Tuesday instead of Monday, so data were not collected for that Tuesday. Data were collected over multiple days throughout the week to get a reliable estimate for the average of each behaviour (Hickerson and Henderson, 2014; Trost, Pate, Freedson, Sallis and Taylor, 2000).

3.2.4 Moderate-to-vigorous physical activity.

MVPA was measured by heart rate intensity. Some of the participants who were wearing the vivofits (n=68) were chosen to wear either Actihearts (Cambridge Neurotechnology, Cambridge, UK) or Garmin heart rate monitors (Garmin Ltd., Kansas, USA) as well, so that MVPA could be determined. Initially, from each camp, every second or third participant was chosen to wear one of the heart rate monitoring devices. If any of the chosen participants did not want to wear the devices, other participants were chosen based on their order of arrival at camp. Attention was paid to ensure that both boys and girls in each camp were given the devices. Only the heart rate data were used from the Actihearts, which alone is predictive of children's physical activity energy expenditure according to Corder, Brage, Wareham, and Ekelund (2005). The participants' age-predicted maximum heart rate (MHR) was determined using the Tanaka equation (Tanaka, Monahan, and Seals, 2001). From the MHR, the 50% and 85% values were calculated. This range is used to classify a participant's heart rate in the moderate-to-vigorous

zone (American Heart Association, 2018; Centers for Disease Control and Prevention, 2015b). The time spent within the moderate-to-vigorous zone (in minutes) determined the time spent engaging in MVPA.

The heart rate monitors were worn around the chest and consisted of a plastic heart rate module fastened to an adjustable, elastic strap. The heart rate monitors, when paired with the vivofits, allowed the participants to see their heart rates on their vivofits. The Actihearts were placed on the participants' chests using commercial grade ECG electrodes. The heart rate monitors and Actihearts were worn each day (Tuesday to Friday) to assess whether the participants were able to meet the guideline for MVPA during camp hours. The wear time for the heart rate monitors and Actihearts was 7 hours (9 am to 4 pm).

3.2.5 Sleep.

Sleep was tracked using the vivofits; participants were instructed to wear the device for 24 hours so that their step counts could be measured during the day, and sleep could be measured at night. Sleep was measured in hours, to one decimal place, and data collection occurred for every night of the camp (Monday, Tuesday, Wednesday, and Thursday).

3.2.6 Sedentary behaviour.

We used self-report and an objective measure to assess SB. Firstly, screen-time was assessed by questions taken from the Canadian Assessment of Physical Literacy (CAPL) Questionnaire (Healthy Active Living and Obesity Research Group, 2014) and given to the participants in the form of a short questionnaire (Appendix L). The CAPL has been found to be acceptable for assessing physical literacy among children 8-12 years old (Longmuir et al., 2015).

The questionnaire included two separate questions about screen-time during a typical weekday and asked about: 1) television viewing, and 2) time spent using a computer/tablet or playing video games. The responses for the two questions were added together to get a value for total screen-time during a typical weekday. This questionnaire was administered to participants on the last day of camp, and they self-reported their screen-time.

Secondly, ActiGraph wGT3X-BT accelerometers (ActiGraph Corp., Florida, USA) were given to one or two participants from each camp (n=25). Initially the ActiGraphs were given randomly to any of the participants but, later in the study, efforts were made to select from participants who were also providing heart rate data. The ActiGraphs were worn on an elastic belt and placed at the right hip. They provided pilot data about sedentary time (in minutes) during the camp day; they have been shown to accurately classify sedentary behaviour using the Evenson cut points (Janssen et al., 2013). The participants received the ActiGraphs in the morning upon arrival and they returned them at the end of each camp day. They were not given to participants if they were involved in water-based activities and, similar to the Actihearts and heart rate monitors, the ActiGraphs were worn by participants for 1-3 days, depending on their camp activities and whether they wanted to continue wearing them or not. They had a wear time of 7 hours (9 am to 4 pm).

3.2.7 Activity outside of camp.

Activity outside the camp day was recorded using the Children's Physical Activity Questionnaire (CPAQ; Medical Research Council Epidemiology Unit, n.d.). The questionnaire is valid and has been used to assess MVPA in previous studies (Corder et al., 2009; Anderson et al., 2017). The questionnaire (Appendix M) was sent home with parents on the first day of camp

and was to be completed and returned on the last day of camp. Parents were instructed to record the types of activities the participants engaged in after each camp day was over.

3.3 Analysis

Descriptive statistics were reported as ranges, means, standard deviations, frequencies, and percentages for the biometrics and demographic characteristics of the participants, and for the proportion of participants meeting each guideline. Independent t-tests and Wilcoxon rank sum tests were used to determine whether differences existed in the sedentary time data from the ActiGraphs based on sex, age group, and camp type. Logistic regression analyses were performed to determine which participant characteristics (predictor variables), if any, were related to the participants meeting the guidelines. The alpha level was set at α=0.05 for all analyses. The statistical analyses were completed using SPSS (versions 22 & 24) and Stata (version 14.2) statistical software.

Chapter 4 Results

4.1 Participants

A total of 224 campers (54.9% males) with a mean age of 10.16 years (s=1.68 years, n=222) participated in the study. The participants' demographics are described by group size and frequency in Table 4.1.

Table 4.1. Description of the participants' demographics.

Demographics	**n (%)**
Sex	**224**
Boys	123 (54.9)
Girls	101 (45.1)
Camp category	**224**
Active	107 (47.8)
Non-active	117 (52.2)
Age	**222**
5	1 (0.5)
6	4 (1.8)
7	6 (2.7)
8	21 (9.5)
9	40 (18.0)
10	68 (30.6)
11	31 (14.0)
12	29 (13.1)
13	20 (9.0)
14	2 (0.9)
Ethnicity	**217**
Caucasian/European	145 (66.8)
East/South Asian	35 (16.1)
Hispanic/Middle Eastern	6 (2.8)
African/Caribbean	4 (1.8)
Other/Mixed	27 (12.4)
Number of children in the household, other than the participant	**187**
0	17 (9.1)
1	103 (55.1)
2	48 (25.7)
3	18 (9.6)
4	1 (0.5)
Highest level of parent education	**206**

No schooling completed	1 (0.5)
Nursery school to 8th grade	4 (1.9)
Some high school, no diploma	2 (1.0)
High school graduate, diploma or other equivalent	4 (1.9)
Some college credit, no degree	7 (3.1)
Trade/technical/vocational training	9 (4.4)
Associate degree	2 (1.0)
Bachelor's degree	77 (37.4)
Master's degree	44 (21.4)
Professional degree	24 (11.7)
Doctorate degree	32 (15.5)

The mean values for the participants' biometrics (HT, WT, WC, steps/3 m) are reported in Table 4.2.

Table 4.2. Description of the participants' biometrics.

	Range	**Mean (s)**	**n**
Height (cm)	100-192	147.38 (13.36)	220
Weight (kg)	20-83.5	38.89 (10.60)	212
Waist circumference (cm)	51-95.5	65.53 (8.38)	219
Steps/3 m	3-7	4.92 (0.72)	221

4.2 The Proportion of Participants Meeting the Guidelines

The proportion of participants meeting the guidelines varied for each of the four movement behaviours. For LPA, 88.4% of the participants (190/215) met the guideline by taking more than 11000 or more than 12000 steps per day. The mean step count for the participants (n=217) was 16592. 66 steps (s=4270.16). Of the 224 participants that were enrolled in the study, 217 had 24-hour step count data, and seven were missing data due to technical issues. Of those 217 with step count data, we did not have the ages of two of the participants, therefore, we could not determine whether they met the step count recommendations (which are age-specific); the LPA sample consisted of 215 participants. Sixty-eight participants wore heart rate monitors (n=43) or Actihearts (n=25), and they all met the MVPA guideline. The selection process for

participants wearing these devices was described in the previous chapter. The only consideration when selecting these participants was to ensure that both boys and girls had been selected. It is possible that the participants who opted not to wear the devices could be different from the participants who did agree to wear them, and that there could be some bias because of this. Of the participants who wore the heart rate monitors or Actihearts, 14 were also wearing ActiGraphs. Based on the ActiGraph data for MVPA, only 28.6% of the participants (4/14) met the guideline by spending 60 minutes engaged in MVPA. For sleep, 65.3% of the participants (141/216) met the sleep guideline. The mean sleep duration was 9.24 hours (s=1.08, n=216). Sleep duration was measured using the vivofits. The guidelines for this behaviour are age-specific as well, therefore we could not determine in two participants whether they were meeting the guidelines or not. The rest of the missing data could be due to technical issues or because the participants did not wear the vivofits when they went to sleep. We did not ask the participants with missing data whether they wore the vivofits to sleep or not, so we do not know how many of the remaining six participants were missing data because of non-compliance. The participants had a mean of 0.78 hours of screen-time on a typical camp day (s=0.42, n=168) and 78.0% of the participants (131/168) met the SB guideline. This behaviour had a lot of missing data and we were unable to match questionnaire responses to the participants because early in the study the questionnaires were completed anonymously. This was primarily a concern with the camps from the first week of data collection, which were non-active camps. This missing data resulted in less participants from the non-active camps being included in the SB sub-sample. Fifty-seven participants had data for all four movement behaviours and only 12.3% (n=7) met all four recommendations. This value is similar to the values of 8.4% and 14% reported by Katzmarzyk and Staiano (2017) and Roman-Vinas et al. (2016), respectively.

4.3 Factors Related to Participants Meeting the Guidelines

The analyses indicated that age (OR=0.780; 95% CI: 0.629 to 0.966) and level of parent education (OR=1.217; 95% CI: 1.026 to 1.444) were associated with whether or not the participants met the sleep guideline. Sex (OR=0.199; 95% CI: 0.065 to 0.606) and number of children in the household (OR=2.256; 95% CI: 1.167 to 4.362) were associated with whether or not the participants met the SB guideline. However, there were no significant predictors for LPA. The analysis was not completed for MVPA because 100% of the participants met the guideline based on the heart rate data. The MVPA data from the ActiGraphs was not included because of the small sample size.

The results of the logistic regression analyses are reported in Table 4.3 as odds ratios.

Table 4.3. Logistic regression results for light physical activity, sleep and sedentary behaviour.

	Odds Ratio	**P-Value**	**95% Confidence Interval**
LPA (n=215)			
Camp category	0.751	0.576	0.275 to 2.051
Sex	2.566	0.096	0.845 to 7.793
Age	0.873	0.409	0.633 to 1.205
Number of other children in the house	1.173	0.626	0.617 to 2.228
Parent education	0.852	0.267	0.642 to 1.131
Caucasian	1.077	0.891	0.372 to 3.118
Constant	58.490	0.047	1.060 to 3226.959
Sleep (n=216)			
Camp category	1.668	0.161	0.816 to 3.409
Sex	0.686	0.329	0.321 to 1.462
Age	0.780	**0.023**	0.629 to 0.966
Number of other children in the house	1.137	0.564	0.736 to 1.756
Parent education	1.217	**0.024**	1.026 to 1.444
Caucasian	2.010	0.056	0.983 to 4.111

Constant	2.911	0.405	0.236 to 35.961
SB (n=168)			
Camp category	1.287	0.619	0.476 to 3.478
Sex	0.199	**0.005**	0.065 to 0.606
Age	0.841	0.259	0.622 to 1.136
Number of other children in the house	2.256	**0.016**	1.167 to 4.362
Parent education	0.962	0.753	0.754 to 1.227
Caucasian	0.830	0.698	0.323 to 2.129
Constant	25.877	0.096	0.563 to 1189.236

Based on the analyses, age was negatively associated with participants meeting the sleep guideline. For each increase in age (in years), the odds of meeting the sleep guideline decreased by 0.780 (95% CI: 0.629 to 0.966). The level of parent education was positively associated with the participants meeting the sleep guideline. For each increase in the level of parent education, as per the questionnaire, the odds of meeting the sleep guideline increased by 1.217 (95% CI: 1.026 to 1.444). Girls were the reference group for participants meeting the SB guideline. The regression analysis indicated that girls had greater odds of meeting the guideline than boys (OR=0.199; 95% CI: 0.065 to 0.606). There was a positive association between the number of other children in the household and meeting the SB guideline, such that, with each additional child the odds of meeting the guideline increased by 2.256 (95% CI: 1.167 to 4.362).

4.4 Activity Outside of Camp

The CPAQ was completed by 91 participants; 51% (n=46) were from non-active camps and 49% (n=45) were from active camps. Based on a number of issues, such as the burden of completing a questionnaire, there was a poor rate of return for these questionnaires. The questionnaires, which were sent home with the participants, were to be returned on the last day

of camp. Participants may have forgotten to bring the questionnaires back or parents could have forgotten to complete them for the younger participants. Some parents could also have chosen not to complete them because of the burden of tracking the participants' activities over the week and the time required to complete the questionnaire, while others could have chosen not to complete them if they felt they would be unable to respond accurately.

There were two categories of activities in the questionnaire, sport and leisure time, and participants were asked to indicate which activities they engaged in during the camp week. In the sport category, running or jogging was the most popular participant activity at 38% (35/91), followed by swimming for fun at 34% (31/91). For non-active camp participants, running or jogging was the most popular activity at 46% (21/46), and swimming for fun was second at 26% (12/46). For active camp participants it was the opposite; there were more participants swimming for fun, at 42% (19/45), than running or jogging, at 31% (14/45). In the leisure time category, watching TV/videos was the activity that participants most commonly engaged in (80/91; 88%) and reading was second (73/91; 80%). Participants in the non-active camps most commonly engaged in reading (43/46; 93%) and sitting and talking (40/46; 87%). Participants in the active camps most commonly watched TV/videos (41/45; 91%) and did household chores (34/45; 76%). Overall, more leisure time activities were engaged in than sport activities. Table 4.4 presents the number of participants that engaged in each activity.

Table 4.4. Participants that engaged in each activity from active and non-active camps.

Sport	Non-active (n)	Active (n)
Aerobics	3	2
Baseball/softball	2	4
Basketball/volleyball	9	11
Dancing	6	4
Football	2	2
Gymnastics	3	3

Hockey (field or ice)	4	1
Martial arts	0	0
Rugby	1	0
Running or jogging	21	14
Swimming lessons	4	1
Swimming for fun	12	19
Tennis/badminton/squash/racquet sport	5	3
Other	0	4
Leisure time	**Non-active (n)**	**Active (n)**
Bike riding	15	22
Bounce on the trampoline	11	16
Bowling	1	0
Household chores	33	34
Play in a play house	6	8
Play on playground equipment	11	20
Play with pets	24	22
Rollerblading/roller-skating	3	5
Scooter	3	8
Skateboarding	2	8
Skipping rope	3	1
Tag	11	6
Walk the dog	10	11
Walk for exercise/hiking	19	13
Art & craft	17	15
Doing homework	14	4
Imaginary play	15	16
Listen to music	33	29
Play indoors with toys	26	20
Playing board games/cards	20	17
Playing computer games	28	28
Playing a musical instrument	16	10
Reading	43	30
Sitting talking	40	32
Talk on the phone	14	12
Using the computer/internet	35	33
Watching TV/videos	39	41
Other	9	3

4.5 In-camp Sedentary Time

The ActiGraph (n=25) data was analyzed using Wilcoxon rank sum tests since the data did not meet all of the assumptions necessary for independent t-tests. The t-tests were still

conducted however, and the results agreed with those from the Wilcoxon rank sum tests. Overall, the in-camp sedentary time ranged from 61 minutes to 265 minutes, and the mean sedentary time was 157.56 minutes (s=54.55 minutes).

Based on the independent t-tests there was a significant difference in minutes of in-camp sedentary time by camp type, as non-active camp participants spent a mean of 60.372 more minutes being sedentary than participants from active camps (p=0.003), but there was no difference between boys and girls (mean difference=30.981 minutes; p=0.163) or children and youth (mean difference=9.067 minutes; p=0.693). Equal variances could be assumed with this continuous data because the p-values for Levene's test for equality of variances were non-significant, indicating that the variances were not significantly different. However, the group sizes were not equal, the data was not normally distributed, and the sample size was too small for normality to be approximated based on the Central Limit Theorem, so Wilcoxon rank sum tests were used instead.

The Wilcoxon rank sum tests also indicated that there were no differences in in-camp sedentary time between boys (mean rank=11.36) and girls (mean rank=15.09; p=0.2078) or between children (mean rank=12.73) and youth (mean rank=13.40; p=0.8243), however, there was a difference between participants from active camps (mean rank=8.79) and those from non-active camps (mean rank=16.88; p=0.0060).

Chapter 5 Discussion

There were 224 participants recruited from the Active Living summer camps. Prior to the start of summer camps, the recruitment process involved emailing parents with information about the study and communicating with camp staff to ensure they were informing parents of the study. The emails did not specify which camps were selected, therefore, children from other camps asked to be in the study as well.

Participant biometrics included age, HT, WT, WC and step length; HT, WT and step length were needed to calibrate and personalize the data collection devices. A wide range was observed in the values for HT, WT and WC as the children were between five and 14 years of age and still growing. There were slightly more males (55%) than females, suggesting that children and youth of both sexes were interested in participating. We aimed to select for equal numbers of active and non-active campers (48% from active camps). Parents were university-educated, as 87% of participants had a parent with an associate degree or higher. The registration and location of the camps was on campus at the university, therefore, the high percentage of parents with degrees may have been influenced by their employment at the institution. Most participants had at least one other child living with them; 9% were from an only-child household.

5.1 Movement Behaviours

5.1.1 Light physical activity.

To meet the LPA guideline children were required to take a minimum of 12000 steps and youth a minimum of 11000, and 88.4% (190/215) of the participants met these guidelines. At the start and end of each camp day, all camps met at a location on one side of the campus for drop-off and pick-up. From there, camps walked to various locations where their programming took

place, some of which were across campus. This daily commute unintentionally contributed to step counts and physical activity (Doyle-Baker, 2018).

The Mini University and Minds in Motion camps included Body Breaks in their programming which also contributed to step counts. There were two 30-minute Body Breaks per day (am and pm), which consisted of snack time and a physical activity break. It was observed that sometimes camp leaders would organize a game or activity and encourage campers to participate in it, while other times campers were left to organize something on their own. Based on data from the previous year, participants (from non-active camps) were able to increase their step counts by approximately 700 steps (mean=699.32; s=391.51; n=68) during Body Breaks (Mikolajczak et al., 2017). Body Breaks were intentionally included in the programming for Mini University and Minds in Motion camps to introduce physical activity into camps that were not based on sports or outdoor activities (Mikolajczak et al.), thereby increasing their step counts and LPA.

5.1.2 Moderate-to-vigorous physical activity.

MVPA was based on heart rate and was measured using two devices (heart rate monitors and Actihearts). All 68, or 100%, of the participants had hearts rates within 50-85% of their age-predicted MHR for a minimum of 60 minutes per day. Heart rate monitoring is considered a valid way of estimating physical activity (Rowlands and Eston, 2007), however, it may not be the best way to determine how much time children and youth spend engaged in intense activity for two reasons. The first reason is, not all heart rate changes are related to physical activity, as children can experience increases in heart rate due to stress or anxiety (Rowlands and Eston, 2007). The second reason is, most devices measuring heart rate have an epoch of one minute.

Children typically engage in short, rapid bursts of activity, which would be better captured using a smaller epoch (Rowlands and Eston, 2007). The heart rate monitors used in this study had an epoch of two minutes and the Actihearts had an epoch of one minute. Although all of the participants' heart rates were in the moderate-to-vigorous range for an average of 60 minutes/day, it is possible that they were not engaging in physical activity during some of that time.

To identify the proportion of participants meeting the MVPA guideline more accurately, ActiGraphs were used in combination with the heart rate monitors and Actihearts. Based on the Evenson cut-points, 28.6% of participants (n=14) met the guideline (ActiGraph Corp., 2018; Evenson, Catellier, Gill, Ondrak, and McMurray, 2008). Of those 14 participants, six were from active camps, and only 50% (n=3) of the active camp participants met the guideline. Although the programming was designed to provide opportunities for physical activity, the campers may have been spending more time in LPA than MVPA at these camps. MVPA has previously been measured using pedometer-based step counts (New Lifestyles SW-200) with a cut-off of 12000 steps (Hickerson and Henderson, 2014). Based on this metric, 87% of the participants met the MVPA guideline (Appendix O).

Another method for determining whether individuals are engaging in physical activity is through self-report methods. The CAPL questionnaire asked participants to report frequency of physical activity engagement, and only 32% of participants reported engaging in 60 minutes of physical activity for 7-days in a week (Appendix O).

In comparison to our values, the 2016 ParticipACTION Report Card (ParticipACTION, 2016; Barnes et al., 2016) stated that only 9% of Canadian children were meeting the MVPA guideline. The Report Card used data from numerous sources that provided estimates based on

pedometry, accelerometry, and self-report (Barnes et al.), while this study primarily used heart rate, along with accelerometry. The method of measuring MVPA may influence the proportion of children meeting the guideline. The value of 100%, based on heart rate data from this study, is unrealistically high. The value of 28%, based on the ActiGraph data, is more realistic and higher than the value from the Report Card (9%). This is important because a low value, such as 9%, may lead people to believe that children and youth are not active, when that likely is not the case.

Our study indicates that children and youth may be more active at higher intensities than the research reports and the media currently claim they are. When the four methods of determining how many participants achieved 60 minutes of MVPA are considered, they all provide proportions that are greater than 9%. This indicates that even though different methods of assessing physical activity intensity will result in different values, more than 9% of participants are able to meet the MVPA guideline. However, this may only be true for certain settings, such as summer camps, which provide many opportunities for physical activity.

5.1.3 Sleep.

The sleep guideline was met by 65.3% (141/216) of participants. Our results were lower than the value of 79% reported by the ParticipACTION Report Card (ParticipACTION, 2016). Our value could be lower because the Report Card result is based on self-reported (or parent-reported) data from the Canadian Health Measures Survey, which may be biased. For the survey, the participants or parents/guardians provided a response that was recorded to the nearest half-hour (Carson et al., 2016), whereas the vivofits used in this study provided objective values in hours, up to one decimal place, for sleep duration. The possibility of bias exists as the respondents might not have remembered how much time they spent sleeping (recall bias) or they

may have responded with what they thought was ‘a good answer’ (social desirability). The social desirability in particular could have led to a higher proportion of children meeting the guideline, if the respondents were intentionally reporting a longer sleep duration and could explain why the value from the Report Card was higher than the one from this study. A limitation of using tools such as the vivofit is that they determine sleep duration based on movement rather than brain activity (Marino et al., 2013). Therefore, it is possible that this measurement device either over or under estimated sleep duration.

For every year that age increased, the odds of meeting the sleep guideline decreased by 0.780 (95% CI: 0.629 to 0.966), suggesting that younger participants had greater odds of meeting the sleep guideline than older participants. This is likely attributed to a lack of bed time rules and more late-night screen time for older participants (Chaput et al., 2016). For each increase in the level of parent education, the odds of meeting the sleep guideline increased by 1.217 (95% CI: 1.026 to 1.444), implying that participants with more educated parents had greater odds of meeting the sleep guideline. This could also be related to socioeconomic status, as the literature states that low socio-economic status is related to shorter sleep durations (McDowall, Elder and Campbell, 2017).

5.1.4 Sedentary behaviour.

5.1.4.1 Screen-time.

Seventy-eight percent (131/168) of the participants met the SB guideline based on screen-time, which is higher than the 24% reported by the ParticipACTION Report Card (ParticipACTION, 2016). In our study, participants self-reported during camp hours, however, for the Report Card, parents reported their children’s screen-time (Carson et al., 2017). The self-

reporting by children could explain why our value was higher than the value from the Report Card. Some of the participants were young and their understanding of time may have led them to underestimate how long they spent in front of a screen. Children may have difficulty understanding the questions and accurately recalling time if they are not forced to pay attention to it (Droit-Volet, 2012), and it is doubtful that they regularly take note of their screen-time. This underestimation of screen-time would have resulted in a higher proportion of participants meeting the guideline.

The camp leaders and/or researchers were present while the participants completed the questionnaire to answer any questions they may have had. This helped to ensure that there were no misunderstandings regarding what was being asked of the participants. However, the researchers found that the participants often commented on their screen-viewing habits in such a way that it was clear to the researchers that the questions were not specific enough for children to answer. For example, one of the questions referred specifically to the act of watching television and many children responded by saying 'I don't watch TV, I watch Netflix on my iPad' or 'I watch videos on YouTube'. To children, those are very different things, however, adults may consider them to be the same.

Sex was negatively associated with meeting the SB guideline, as girls had greater odds of meeting it than boys (OR=0.199; 95% CI: 0.065 to 0.606). This was not an unexpected result, because boys tend to spend more time on computers than girls (De Jong et al., 2013). There were also greater odds of meeting the SB guideline with an increased number of children in the household. With each additional child the odds of meeting the guideline increased by 2.256 (95% CI: 1.167 to 4.362). The size and composition of a family influences a child's television viewing; bigger families and families with more children typically watch more television than smaller

families, or families with less children (Truglio, Murphy, Oppenheimer, Huston and Wright, 1996; Dobrow, 2014). Furthermore, Edwards et al. (2015) explain that older siblings can influence younger children's television viewing behaviours in terms of content and total screen-time, as viewing television together is common among siblings. This is contrary to the results of our study which indicate that children from households with multiple children engage in less screen-time than children from households where they are the only child. Bagley, Salmon, and Crawford (2006) also found that girls watched more television if they had siblings to watch with, whereas, boys watched more television if they were an only child.

Our findings may also differ from the Report Card and other literature because previous research focused primarily on television viewing and did not include many other ways of accumulating screen-time. For example, many participants in our study indicated while completing the CAPL questionnaire that they do not watch television, but they do use tablets and mobile devices. It is easier for children to watch a television together, but harder to share a tablet or mobile device, which could explain why participants with other children in the house had greater odds of meeting the guideline.

5.1.4.2 In-camp sedentary behaviour.

Based on the analysis of the ActiGraph data, there was a difference in in-camp sedentary time for participants from active and non-active camps, as was expected. The programming for active and non-active camps was very different, with active camps spending a majority of the day engaging in some form of physical activity. Although active camps scheduled activities that involved movement, participants were not always moving. For example, our observations of the basketball camp demonstrate this point. All of the campers were split into teams, and in the

afternoon, the teams played 3-on-3 (three players from one team played against three from another). There were three courts, with one game being played per court, so in a camp with more than 100 campers, less than 20 were playing basketball at any given moment during this activity. The rest of the campers were sitting on the benches, waiting for a substitution, or sitting in the bleachers, waiting for their team's turn to play. In this active camp, the waiting contributed to the in-camp sedentary time, along with the sitting that occurred during lunch and other breaks.

The non-active camps typically focused on activities that required little movement, and educational camps, like Physics 101 and MediCamp, were located in classrooms where there was limited space and probably 'ground rules' limiting movement. Other camps that were based on a certain type of activity, such as Mini Brick Builders which was a LEGO® themed camp, typically involved activities that were sedentary in nature, like building with LEGO® blocks. This data does not imply that participants in the non-active camps were less active as individuals than the participants from the active camps, but it does indicate that they spent more time being sedentary. Our observations and the camp schedules lead us to believe that camp programming influenced the in-camp sedentary time.

The difference between boys and girls was small and not statistically significant and this could be because, for the most part, they were participating in the same activities within the various camps. Their movement patterns could have differed during Body Breaks, when most campers took the opportunity to engage in some physical activity, but in such a short period of time (30 minutes or less) there may not have been a big difference. The literature states that boys tend to be more active than girls (Hickerson and Henderson, 2010; Tudor-Locke et al., 2011) but boys and girls were observed as being active as well as sedentary during Body Breaks. Furthermore, the games played during the breaks were usually tag games or circle games, so

campers could still have been sedentary while playing, as these games require minimal movement, or only short bursts of movement.

The difference between younger children (< 11 years old) and older children (11 years or older) was not significant either. Age may not have as much of an influence on a participant's sedentary time as the camp type or programming. There was a mixture of camp types and ages among the participants, and they all participated in the activities that were outlined in the program plans for the camps. This data demonstrates the need to consider activities that could limit sedentary time when planning camps.

5.2 Activity Outside of Camp

The responses from the CPAQ indicate that regardless of whether the participants were in active or non-active camps during the day, they all spent some time engaging in sedentary activities at home. Most of the activities that the participants engaged in were leisure activities rather than sports, even for the participants who were in sports camps. The most popular sports activity was running/jogging, while the most popular leisure-time activity was watching TV/videos. Watching TV/videos contributed to screen-time, however, there were many sedentary activities that participants engaged in that did not involve the use of a screen. For example, reading, or sitting and talking, were both popular sedentary activities. This type of SB is important to consider as the guideline for SB states that sitting for extended periods of time should be limited, but this form of SB is often overlooked, as the focus tends to be on screen-time. It is important to further investigate how much time children and youth spend engaging in different forms of sedentary activities because, although they may be meeting the SB guideline based on screen-time, they may still be sedentary overall.

Typically, SB is viewed negatively because too much of it can have implications for physiological health. However, it is also important to consider that certain sedentary activities can have a positive impact in other areas of health, such as the mental and social components. For example, activities like reading a book may be beneficial for mental wellbeing and for strengthening social connections (Kidd and Castano, 2013; Boyes, Tebbut, Prrece, Badcock, 2018). Some participants may have been sedentary for extended periods of time at camp and then again at home, however, it is important to consider what sedentary activities they were doing throughout a 24-hour period, and whether those activities could have a positive impact on their health.

The CPAQ was sent home with parents, so the parents may have completed it instead of the children. Parents may not always be aware of what children are doing so it is possible that they could have missed some activities or guessed. For example, a questionnaire was returned on Thursday, but it stated that it had been completed for Friday as well. It is possible that the child had a very predictable routine which the parent was aware of, and therefore was able to comment on. However, it is also possible that the parent guessed what activities the child would be doing the following day.

Parents may dictate what activities children engage in outside of camp. If a child is enrolled in a soccer camp, and coming home to play soccer, that does not mean that the child loves soccer, or enjoys being physically active. The parent may have chosen to enroll his/her child in that particular camp and told him/her to practice what was learned at camp, at home. The same can be said of sedentary activities like reading. Reading was a popular leisure-time activity, but it cannot be determined from the data whether the participants were reading because they loved to read, or because their parents told them to. If parents were telling children and youth

what activities to engage in, then they, like the camp programming, are an influencer of SB.

5.3 Strengths

This is the first study to have assessed whether all four of the recommendations from the Canadian 24-Hour Movement Guidelines were being met, as previous studies only assessed three behaviours simultaneously. It is also the only study to have investigated all four of the movement guidelines in a summer camp setting. Previous studies used data from surveys, some of which were subjective and self-reported (Roberts et al., 2017; Janssen, Roberts, and Thompson, 2017a). An advantage of conducting this research in summer camps is that the behaviours are being assessed in a setting that promotes physical activity. Investigating the guidelines in such a setting is important because it enables researchers to understand how much engagement there is in physical activity compared to SB when children and youth are given opportunities to be physically active. It might also assist participants with meeting the guidelines, which would be beneficial for them. It is evident from previous research that summer camps are a setting where physical activity can be increased (Weaver et al., 2017), and MVPA has been identified as the least commonly met guideline, but also the most important in terms of its impact on health (Roman-Vinas et al., 2016). For this reason, it is meaningful to conduct research assessing the movement behaviours in summer camps.

This study was complex and required support and funding from Active Living. It also required a Research Coordinator, working full-time, to oversee the project and ensure that data was being collected without technical difficulties. Additionally, volunteers were needed for collecting biometric data every week and doing observations during the Body Breaks. It would have been difficult to conduct this research, had this support not been available.

Although not evaluated an unintended outcome of the study may be that it has drawn attention to or increased awareness of the Canadian 24-Hour Movement Guidelines. All parents, regardless of whether their child participated or not, were emailed an infographic with mean values for the camp their child was enrolled in, a summary of the guidelines, and a link to the pdf (Appendix A). Parents were also emailed their child's step and sleep data in the week following his/her participation, so they could have been informed of whether their child was meeting those two guidelines or not.

5.4 Limitations

Despite the relative strengths of this study, there are also limitations to consider. The devices that were used in this study were selected because we had access to them. The funding for the KiSS UC study was provided by Active Living. The devices used in this study provided objective data, but the number of available devices was finite thereby limiting the sample size. The devices were not specifically designed or calibrated for child use, and many participants did not enjoy wearing them. The heart rate monitor straps were uncomfortable, especially during physical activity, and too large for many of the children, so they repeatedly needed to be adjusted. Initially, the electrodes for the Actihearts did not stay on due to poor adhesiveness. The participants in the basketball camp worked at high intensity levels and the sweat from the activity reduced the stickiness on the electrodes, resulting in the devices falling off. Different electrodes were purchased, which were more adhesive and required more effort to take off. The Actihearts and ActiGraphs were not water resistant so they could not be used on days when camps had water-based activities planned.

In the future, if the budget allows for it, purchasing one device that could measure step counts (LPA), heart rate intensity or activity counts (MVPA and SB), and sleep duration would be ideal. Newer devices that record heart rate with an epoch of five seconds, or every second when tracking activity intensity, would be appropriate for this population. ActiGraph accelerometers are also an option, as various cut-points can be used during analysis to differentiate between various intensities of activity, and they are capable of tracking sleep as well. The use of one device would be more user-friendly and would reduce the amount of work the researchers would need to do in terms of calibration.

Another limitation is the use of questionnaires. As identified above, the data are subjective and subject to bias, however, there is currently no other method for assessing screen-time, so they must be used. As highlighted earlier, the programming also plays a large role in determining what behaviours campers are able to engage in at camp, and for what duration. For this reason, some of the results of this study might only be generalizable to camps that have similar programming and a similar sample of campers. The cross-sectional design is also limiting as cause and effect relationships cannot be determined from the findings (Coggon, Rose, and Barker, 1997).

While not a limitation of this study, there are some issues associated with the movement guidelines as well. The main concern is that they are too vague. There are no definitions and no examples that can be used to determine whether children and youth are meeting the guidelines. There is no specific recommendation for LPA (Canadian Society for Exercise Physiology, 2016), or example of what constitutes LPA, which makes it difficult to determine how to best assess this behaviour. This may be why no other study thus far has attempted to investigate it. There is also no explanation in the guidelines that would enable a lay-person to differentiate between LPA and

MVPA (Faulkner et al., 2016). Furthermore, there are many different ways to assess MVPA, and no standard method for doing so, which is evident in the literature on physical activity in summer camps (Brazendale et al., 2017; Beets et al., 2013). This can result in a variety of findings in the literature, and it highlights the need for more clarity regarding the assessment of MVPA. Perhaps a supplementary document accompanying the guidelines is needed, to provide some insight about how to assess each behaviour in a multitude of settings. It would be beneficial to have a document providing examples of common activities that are considered LPA, MVPA and SB, and to provide recommendations on how to adapt those activities for special populations, including children with disabilities, such as visual impairment or confinement to a wheelchair.

5.5 Future Directions

In their study, Bagley et al. (2006) found that having siblings influenced screen-time differently for boys and girls, and our study found that both sex and number of siblings in the household were significant predictors of meeting the SB guideline. It is possible that there was a combined effect of sex and number of children in the household on meeting the guideline. We did not include interaction terms in the analysis because this study was exploratory, however, this may be something to consider doing in the future.

A larger sample of children and youth meeting the recommendations for all four movement behaviours would enable identification of which behaviour is the most commonly met and which is the least. This would enable interventions to be developed in the future to try to increase the number of children and youth meeting the least commonly met behaviour. Knowledge of which predictors are significant for each behaviour could also be used to create

interventions targeting specific groups of children and youth that are less likely to meet the guidelines than others.

Other studies could investigate the movement behaviours once in each season, over the course of a calendar year, to determine whether there are seasonal changes in the proportions of children and youth meeting the guidelines (Staiano, Broyles, and Katzmarzyk, 2015). There may be differences in levels of physical activity, SB, and sleep that vary with changes in weather, location, and daylight. For example, in Canada, children and youth may be less likely to engage in physical activity during the cold winters compared with the summers and may be more likely to get more sleep in the winter when there is less daylight. Alternatively, a comparison could be done while children and youth are in school, and when they are attending summer camps, to determine whether they are meeting the guidelines to the same extent in both settings.

Previously published studies about the movement behaviours or summer camps focus on physiological wellbeing, however, mental and social wellbeing are equally important. Future research needs to take these two components of health into consideration as well. Currently there is an increased awareness in society about mental health and there is greater recognition of the impact that poor mental health can have on an individual's wellbeing (Hildebrand, 2015). It may be worthwhile to investigate mental and social health in a pediatric population, and to determine how the movement behaviours can positively influence it.

Another potential project could involve an assessment of whether setting goals on tracking devices, based on the movement guidelines, has an impact on the number of children and youth meeting the guidelines for sleep and physical activity. Future research could also assess the levels of physical activity and SB among children and youth who begin the day by

having breakfast, and compare that to children and youth who skip breakfast (Amigo-Vazquez, Busto-Zapico, Errasti-Perez, and Pena-Suarez, 2016).

5.6 Conclusions

To the best of our knowledge this is the first study to investigate 1) 24-hour movement behaviours and 2) in a summer camp setting, therefore our results have the potential to contribute to the existing literature. The findings from this study indicate that children and youth in a summer camp setting are able to meet each of the recommendations from the Canadian 24-Hour Movement Guidelines. Furthermore, in our study, factors such as sex, age, number of other children in the house, and parent education influenced which children and youth were more likely to meet some of the guidelines. However, these factors may not always be significant; samples with different demographics may find different or other associations.

The available literature regarding the movement guidelines and the proportions of children and youth meeting them was based on national surveys and only provides national estimates. In comparison, this study provides estimates for a smaller, more specific population, which can be used for comparison in future research. Generally, the findings from this study can encourage staff in summer camps or other similar settings, to provide more opportunities for increasing physical activity in their programming, and to decrease sedentary time.

This study was exploratory; it provided insights into how many children and youth met the Canadian 24-Hour Movement Guidelines in a summer camp setting. It also highlighted factors that influenced which children and youth were more likely to meet the recommendations, and the various activities that participants engaged in outside of summer camps.

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APPENDIX A: CANADIAN 24-HOUR MOVEMENT GUIDELINES

CANADIAN 24-HOUR MOVEMENT GUIDELINES FOR CHILDREN AND YOUTH:

An Integration of Physical Activity, Sedentary Behaviour, and Sleep

PREAMBLE

These guidelines are relevant to apparently healthy children and youth (aged 5–17 years) irrespective of gender, race, ethnicity, or the socio-economic status of the family. Children and youth are encouraged to live an active lifestyle with a daily balance of sleep, sedentary behaviours, and physical activities that supports their healthy development.

Children and youth should practice healthy sleep hygiene (habits and practices that are conducive to sleeping well), limit sedentary behaviours (especially screen time), and participate in a range of physical activities in a variety of environments (e.g., home/school/community; indoors/outdoors; land/water; summer/winter) and contexts (e.g., play, recreation, sport, active transportation, hobbies, and chores).

For those not currently meeting these 24-hour movement guidelines, a progressive adjustment toward them is recommended. Following these guidelines is associated with better body composition, cardiorespiratory and musculoskeletal fitness, academic achievement and cognition, emotional regulation, pro-social behaviours, cardiovascular and metabolic health, and overall quality of life. The benefits of following these guidelines far exceed potential risks.

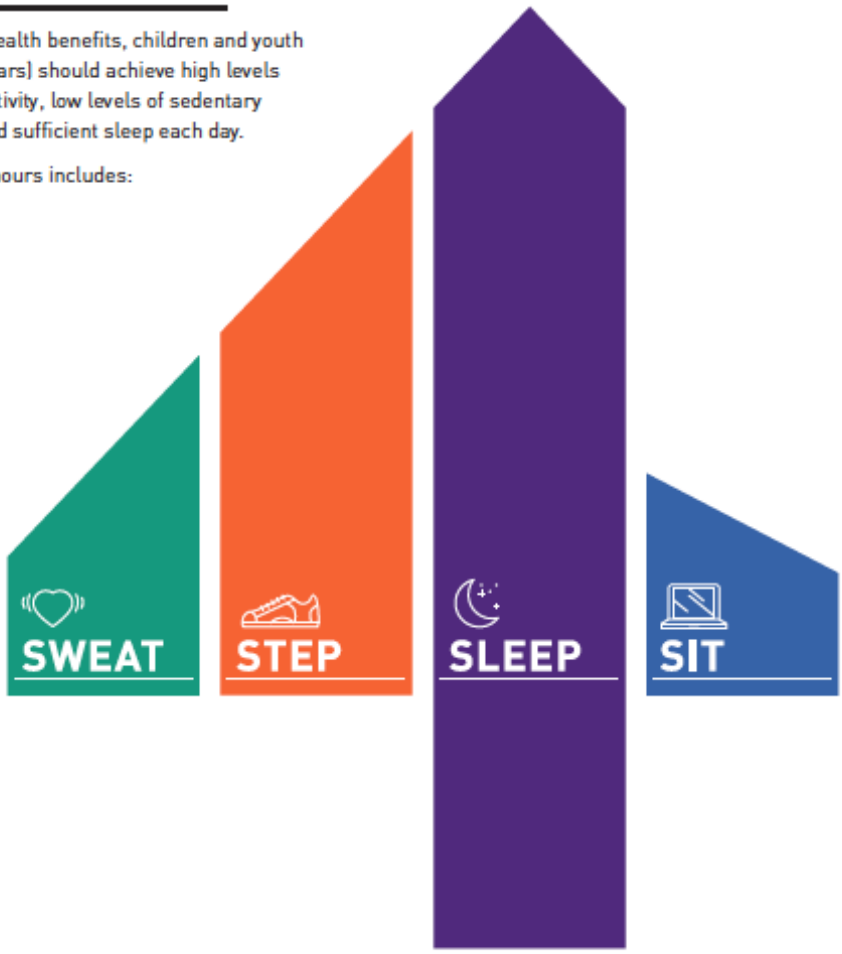
These guidelines may be appropriate for children and youth with a disability or medical condition; however, a health professional should be consulted for additional guidance.

The specific guidelines and more details on the background research informing them, their interpretation, guidance on how to achieve them, and recommendations for research and surveillance are available at www.csep.ca/guidelines.

GUIDELINES

For optimal health benefits, children and youth (aged 5–17 years) should achieve high levels of physical activity, low levels of sedentary behaviour, and sufficient sleep each day.

A healthy 24 hours includes:



SWEAT

MODERATE TO VIGOROUS PHYSICAL ACTIVITY

An accumulation of at least 60 minutes per day of moderate to vigorous physical activity involving a variety of aerobic activities. Vigorous physical activities, and muscle and bone strengthening activities should each be incorporated at least 3 days per week;

STEP

LIGHT PHYSICAL ACTIVITY

Several hours of a variety of structured and unstructured light physical activities;

SLEEP

SLEEP

Uninterrupted 9 to 11 hours of sleep per night for those aged 5–13 years and 8 to 10 hours per night for those aged 14–17 years, with consistent bed and wake-up times;

SIT

SEDENTARY BEHAVIOUR

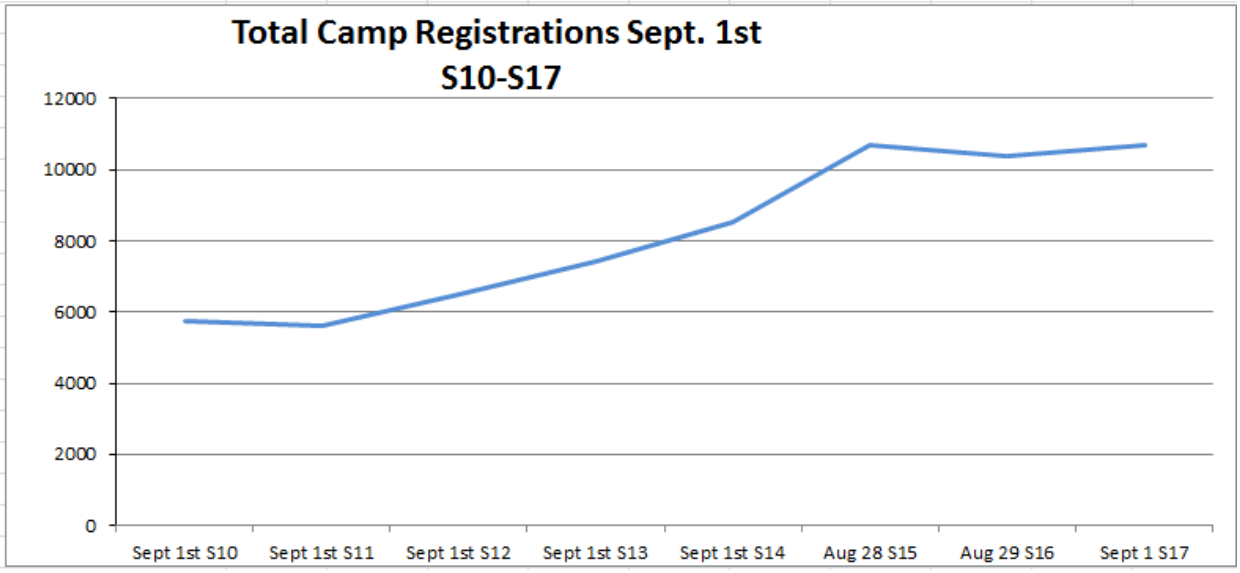
No more than 2 hours per day of recreational screen time;

Limited sitting for extended periods.

Preserving sufficient sleep, trading indoor time for outdoor time, and replacing sedentary behaviours and light physical activity with additional moderate to vigorous physical activity can provide greater health benefits.

APPENDIX B: ACTIVE LIVING ENROLLMENT NUMBERS

Program Area(s)	Sept 1st S10	Sept 1st S11	Sept 1st S12	Sept 1st S13	Sept 1st S14	Aug 28 S15	Aug 29 S16	Sept 1 S17	Change Reg	Change %
YA + A Aquatics	0	0	0	0	0	87	57	155	98	172%
E Computers	113	111	96	112	100	79	68	75	7	10%
MM Minds	666	710	741	747	760	1186	1442	1529	87	6%
P Physics	0	0	0	0	0	0	0	160	160	#DIV/0!
N Design	0	0	0	0	0	286	241	282	41	17%
OY Outdoor Youth	732	765	909	1049	1261	1694	1534	1703	169	11%
OZ Outdoor Teen	111	162	160	184	164	190	188	198	10	5%
V Oval	703	328	357	336	263	160	134	112	-22	-16%
YD Dinos	1429	1465	1929	1899	2293	2505	2439	2048	-391	-16%
R Racquet	225	248	252	271	234	182	252	309	57	23%
SRYT Triathlon							10	7	-3	-30%
YF Directors	339	336	367	328	371	371	452	443	-9	-2%
YM Mini U	1436	1432	1584	2419	2971	3868	3480	3585	105	3%
YV Vet	0	47	97	101	100	102	100	100	0	0%
***Overall**	**5754**	**5604**	**6492**	**7446**	**8517**	**10710**	**10397**	**10706**	309	2.97
YC Before/After Care	1104	1204	1470	1643	2165	2628	2837	3156	319	11.24



APPENDIX C: EXCLUSION CRITERIA

Active Living offered 14 different types of camps in the summer of 2017: Minds in Motion, Mini University, Dinos Sports, Aquatic Camps, Figure Skating, Outdoor Camps, Design Camp, Vet Camp, Youth Triathlon, Cochrane Gymnastics Camps, Racquet Camps, Computer Camps, Physics Camps, and Director's Cut.

There were many camps that were intentionally not selected for the study. The reasons for not including those camps are listed below:

- Camps that included primarily water-based activities were not included because the Actihearts and ActiGraphs were not waterproof, so the participants would not have been able to wear those devices (*ex. Mermaid University*). Camps that involved some water-based activities, such as swimming on one afternoon of the camp, were still included because data could still be collected on the rest of the days.
- Some camps may have had children under the age of 5 or teens over the age of 17, who would have been outside of the age range for this study, so those camps were avoided (*ex. Kinder Kamp, Soar and More Camp*).
- Skating and cycling may have influenced step counts, so camps focused on skating or cycling were not included (ex. *Learn to Leap Skating Camp, Tour de Calgary).* Camps that did one of those activities for a portion of the camp, such as cycling on one day of the week, were still considered for the study.
- Camps that were located off-site or involved an overnight stay were not included (ex. *Dinos Football, Wilderness Survivors)*.
- Camps that were more than one-week in duration were not included (*ex. Electronics for Young Inventors Level 1*).

Of the camps that could have been included in the study, some were considered better choices than others, and during the selection process efforts were made to select those camps as much as possible. For example, the Dinos Volleyball camps could have been included but the campers may have found it difficult to play volleyball while wearing activity trackers on their wrists. As a result, we could have had a high dropout rate or low enrollment from that camp, so we tried to choose other camps, such as the soccer or basketball camps instead.

APPENDIX D: CAMPS THAT PARTICIPANTS WERE ENROLLED IN

- Active Camps (n=107)
  - Dinos Sports
    - Boys Basketball (n=30)
    - Girls and Boys Soccer (n=21)
  - Outdoor Camps
    - Kananaskis Explorers (n=11)
    - Keiki Longboarding (n=11)
    - MegaVenture (n=3)
    - Climb On! (n=12)
  - Mini University
    - Mini Sport (n=19)

- Non-active Camps (n=117)
  - Physics Camps
    - Physics 101 (n=7)
  - Technology (n=11)
  - Packs and Pixels (n=11)
  - Outdoor Camps
    - Thrill of the Catch (n=1)
  - Director's Cut
    - Film Making (n=16)
    - Lego Animation (n=1)
  - Mini University
    - MediCamp (n=17)
    - Mini Camp Sampler (n=11)
    - Mini Brick Builders (n=10)
    - Mini U (n=3)
  - Minds in Motion
    - Natural Science (n=1)
    - Girls Applied Science and Engineering (n=14)
    - Engineering 101 (n=13)
    - Science Trek (n=1)

APPENDIX E: CAMP SCHEDULE

	Camp	Grade	Location
July 10-14	Technology	5,6	Gold Gym
	Physics 101	7,8,9	Gold Gym
July 17-21	Boys Basketball	7,8,9	Jack Simpson
July 24-28	Keiki Longboarding 101	5,6,7,8,9	Track
	Kananaskis Explorers	4,5	Track
	Packs and Pixels	4,5	Track
July 31-Aug 4	MediCamp	4,5	Red Gym
	Mini Camp Sampler	4,5	Red Gym
Aug 8-11	Soccer	U10 & U12	Track
Aug 14-18	Climb On!	4,5	Track
	Film Making	5,6,7,8	Track
Aug 21-25	Girls Applied Science and Engineering	5,6	Gold Gym
	Engineering 101	7,8,9	Gold Gym
Aug 28-Sept 1	Mini Brick Builders	4,5	Red Gym
	Mini Sport	6,7,8	Red Gym

APPENDIX F: RECRUITMENT POSTER

Is your child registered in an Active Living Summer Camp and the University of Calgary?

You may be eligible for the "Kid Steps" study tracking the steps they take and the amount of physical activity they do in summer camps!

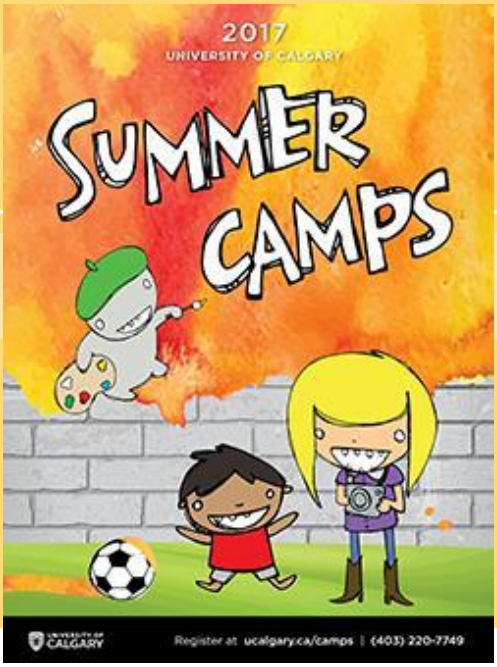
Do you wish to know if your child is meeting the Canadian Physical Activity Guidelines (5-11 and 12-17 years) during camp?

If you are interested in learning more about the study and what participation would involve, please contact
Eshleen Grewal ekgrewal@ucalgary.ca
researcher coordinator.

An investigation of Kids Steps in the Summer at University Camps.

P.I. Dr. P.K. Doyle-Baker. July - August 2017 Ethics ID (REB15-1718)

This study has been approved by the University of Calgary Conjoint Health Research Ethics Board"



APPENDIX G: COVER LETTER

Leading the way to healthy,
ACTIVE LIVING
Email: pdoyleba@ucalgary.ca
UNIVERSITY OF CALGARY

July-August 2017
Dear Parents;

Would you like to know how many steps your child takes and whether they are also meeting the Canadian 24-Hour Movement Guidelines for Children and Youth while participating in the Active Living Summer Camps at the University of Calgary, Alberta

Summer camps are becoming increasingly popular for children and youth and many summer camps advertise that their campers likely meet the physical activity guidelines while at camp.
We would like to measure whether your child is meeting the Canadian Physical Activity Guidelines through step counts while participating in the Active Living Summer Camps at the University of Calgary, Alberta. We will measure your child's step counts by having them wear a wrist tracker for their summer camp duration. See the picture below:

We will also like to have some of the campers wear a heart rate monitor (chest strap) and an accelerometer attached their waist/thigh while they are at the camp during the day. (see picture above). We will also need to your fill in a *Children's Physical Activity Questionnaire* which is about all the activities your child completed for the past 7 days. This takes about 10 minutes. Lastly a quick survey on your family –one page. We believe that this study will provide important insights into whether day-campers step counts meet the Canadian Physical Activity Guidelines during camp time.

If you're interested in reading the guidelines click on the links:
http://walkaboutns.ca/walkabout-info/resources/step-count-recommendation/
http://www.csep.ca/view.asp?x=696

If you would like your child to be involved and contribute to this ground-breaking research, please read the attached Informed Consent form. You may bring the signed form on Monday morning or we will have a copy for you to sign.

Thank you so very much for your contribution to this research.

APPENDIX H: CONSENT FORM

An investigation of Kids Summer Steps in University Camps.

Principal Investigator: Dr. P.K. Doyle-Baker (403.220.7034)
Co-Investigators: Eshleen Grewal (MSc Trainee) and Logan Jones (Active Living Coordinator)

This consent form is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, please ask. Take the time to read this carefully and to understand any accompanying information.

BACKGROUND

Summer camps are becoming increasingly popular for children and youth and many camps pride themselves on providing a venue for campers to engage in physical activity. Few studies have investigated the actual number of steps taken per day during a summer camp. Recently the Canadian Society for Exercise Physiology developed integrated guidelines that provide recommendations for four 24-hour movement behaviours. The overall goal of this study is to investigate whether children are meeting the Heart and Stroke Walkabout step recommendations and whether they are also meeting the Canadian 24-Hour Movement Guidelines for Children and Youth while participating in the Active Living Summer Camps at the University of Calgary, Alberta.

WHAT IS THE PURPOSE OF THE STUDY?

1. To investigate whether step counts (measured by an activity tracker) differ based on sex, age or type of camp (i.e. active vs. non-active camp) in children participating in the Active Living Summer Camps at the University of Calgary, Alberta
2. To determine the composition of movement behaviours during a 24-hour period as measured by activity trackers, heart rate monitors and accelerometers, and the types of activities contributing to the 24-hour movement behaviours (as measured by self-report using the Children's Physical Activity Questionnaire) in children participating in the Active Living Summer Camps at the University of Calgary, Alberta

HOW DO I KNOW IF I CAN PARTICIPATE?

Your child must be registered in one of the Active Living Summer Camps during July and August and you will need to sign this informed consent before any procedures specific to the study occur.

WHAT WOULD I HAVE TO DO?

You must agree to have your children wear a device that tracks steps on their wrist. Your child's voluntary participation in this study will include the following commitments:

1) A testing duration of 10-15 minutes at the beginning of their summer camp to complete:

APPENDIX I: NOTES REGARDING DATA COLLECTION

Enrollment:

- Additional camps/campers – there was some confusion regarding who was meant to participate in the study. This resulted in the enrollment of additional camps and individual campers that were not meant to be in the study based on the initial selection of camps. There were a number of factors that contributed to this confusion. For one, the week prior, emails were sent to parents of children enrolled in the chosen camps, inviting them to participate in the study. The emails did not specify which camps were chosen to be in the study, as a result, parents with multiple children enrolled in different camps were under the impression that all of their children could participate. Some of those parents came to camp the following week with signed consent forms for all of their children. At first, we did not realize what was causing this confusion. We thought the wrong mailing list may have accidentally been selected when sending out the email. However, it was only when a parent eventually explained to us that the email did not specify the camp, that we realized what the issue was.
    - We decided to allow these campers to participate because it was our mistake for not clearly identifying the camps in the email. Also, they were only contributing to the step and sleep data while wearing the vivofit, and possibly to the data regarding activities engaged in outside of camp if they brought back a completed CPAQ. We did not give the other devices (Actihearts, heart rate monitors, or ActiGraphs) or the CAPL to those participants.
    - We also decided to include those additional campers because some of them were enrolled in camps that we had chosen anyway, but during a different week or with a different age group. For example, we had chosen MediCamp for grades 4-5, but there was a MediCamp for grades 6-8 the same week. On the first day of camp, there was one leader doing registration for both of those camps and he/she told all of the parents that their children could participate in the study. For that reason, we ended up with participants from grades 6-8 participating in the study as well. We also ended up with a MediCamp participant during the week we were collecting data from the soccer camp, because she was the sibling of a participant from that camp.
- Dropouts – we had campers who signed up for the study but told us later the same day that they no longer wanted to participate (n=9). Some of them changed their minds when we went to their camps to give them the vivofits, others took the vivofits, tried them out for a bit, then gave them back at the end of the day because they did not like wearing them. We recorded their biometrics when they signed up for the study, but we did not add that information to our data sheets because they were not going to be providing us with any data from the devices, so they were not included in the total number of participants. Having these dropouts could have resulted in selection bias.
- We did not believe that the participants from camps that were not selected for the study, or the participants with missing data, were more or less likely to meet the guidelines than

the rest of the participants. Data from previous years regarding LPA is similar to the data from this year so there is no reason to believe that including different camps in the study would have greatly impacted the results. The missing data was also primarily due to logistical issues in collecting the data, and there is no reason to believe that the participants with missing data are different from the other participants in an important way.

Devices and Questionnaires:

- The vivofits and CPAQ were given to all participants, including the ones that were not meant to be in the study; the other devices (Actihearts, ActiGraphs, heart rate monitors) and the CAPL were only given to participants that were enrolled in the camps that were initially selected to be a part of the study.
    - The other devices and CAPL were given to participants from camps with multiple ages groups, for example, participants from MediCamp for grades 4-5 (initially selected) and 6-8 (later included) were given all of the devices and both questionnaires.
- Participants who had water-based activities were not given the Actihearts or ActiGraphs, as they were not waterproof.
- Garmin changed the device settings during week 3 of data collection so the most recent year of birth that we could select was 2001, whereas, previously we were able to select 2004. A lot of the participants were born after 2001 so their date of birth as it was entered in Garmin Connect was incorrect. This probably did not affect any of the measures that we were interested in.
- 2nd generation vivofits – We realized in week 4 that the heart rate monitors, when paired with the 2nd generation vivofits, would only detect heart rate if the vivofits were in 'activity mode'. We were unaware of this until then because that is not how the 1st generation vivofits work; those begin recording as soon as they are paired and continue to record until they are not. Going into 'activity mode' meant turning on the timer. If any of the participants accidentally turned off the timer, the heart rate monitor would stop recording their heart rate. The 1st generation vivofit can record for 24 hours and the 2nd generation can record for 10 hours (according to Garmin's support personnel). The 2nd generation vivofits are supposed to be more accurate but because keeping the timer on could have been challenging, we decided not to use them with the selected camps after learning about this. We used them for the participants from camps that were not initially selected for the study instead, because we were not monitoring their heart rate.
- Participants did not always wear the vivofits for a full 24 hours. Sometimes they took them off for periods of the day, which is why the step counts are really low for some days. This probably happened outside of camp more than in-camp, because we told participants that they were allowed to take the vivofit off if it was bothering them or if they had to (for example, if they were not allowed to wear it during a soccer game).
- Active participants (i.e. the ones that were in active camps) found the heart rate monitors annoying to wear (the non-active participants did too, but not to the same extent). Upon talking to the participants, we learned that the monitor's strap became very

uncomfortable when they were engaged in physical activity; it did not bother them as much when they were doing something that was not very active.
    - Perhaps in the future, if we are going to measure heart rate again, we should either use vivofits that are capable of measuring heart rate, so we do not need the monitors, or we should use a different type of monitor (i.e. not a chest strap).
- The Acihearts did not bother the participants the way the heart rate monitors did, but the electrodes we used kept falling off initially. We noticed this happening a lot in the basketball camp. Those participants were probably sweating a lot which could have resulted in the electrodes falling off. We were missing data for the ones that that happened to. The new ones that we bought were very sticky and left red marks on the participants' skin. We tried using alcohol wipes and spraying water on them, but those techniques were minimally effective, so we often told kids to go home and soak in the bath tub and remove them then. We had kids tell us they did not want to wear them anymore, probably because the glue sometimes stayed stuck to their skin even the day after they had been wearing it, and sometimes they left red marks on their chests where the electrodes were.
- The parents did not always read the instructions for the CPAQ and the Participant Characteristics Form so sometimes the answers did not make much sense. We still used the parents' responses unless we had some way of verifying them. It makes sense for the Participant Characteristics Form to be answered incorrectly because Monday mornings were chaotic, and parents were usually in a rush to get their kids settled in and leave, so they probably did not read the questions carefully as they were in a hurry. This happened most often with the questions about the number of kids in the household and the highest level of parent education. For the question about the kids in the household, parents were confused about what it was asking them when it said, 'not including the participant'. Parents also did not read that it was asking about the parent's schooling, not the child's schooling. We also should have made the CPAQ different, with a new sheet for every day or with the dates already on it, to clarify what was expected. This was usually an issue if parents indicated that they included Friday when answering the questionnaire because the questionnaire had to be returned before or by the end of the camp day on Friday, so the participants would not have done any activities outside of camp that day. Parents who included Friday were probably predicting what their children would do on Friday – which is one of the reasons why we ignored the times that the parents had mentioned.
- When entering age into the data sheets we used what was written in the class list that we got from Active Living. Sometimes the date of birth was wrong (for example, the year would be written as 2017 instead of 2007) in which case, we used the Participant Characteristics Form to confirm.
- Some participants may not have had a good understanding of how much time they spent engaging in sedentary activities. For example, one of the participants that EG was assisting from Mini Camp Sampler, pointed out that he only engaged in sedentary activities other than watching TV or using the computer, for half an hour on the weekend. When she asked again to confirm that, for instance, the previous Saturday he was only sitting down for half an hour in the entire day, he responded by affirming what he had said previously and proceeded to mention that he was 'busy' to explain the short duration of sedentary time.

- We had a lot of kids tell us that they did not want to wear the devices. Some did not want to wear them at all, and some tried them out for a day and then said that they did not want to wear them again the next day. We could not force kids to wear them, so we found someone else to wear the devices when we could. This was difficult though though because 1) sometimes the participants would tell others that 'it sucked' having to wear those devices, so the other participants would refuse to wear them as well, and 2) all of the devices had to be set up before hand on a laptop. Initially this meant that if participants refused, we had less participants wearing them. Eventually we thought of trying to take our laptops out to the field and setting the devices up there but that was also a challenge sometimes because the wifi connection on the field was not good, and because it was a time-consuming process. Plus, there was the fear that while we had our backs turned someone might step on or ride their bike over the laptops.
- The Actihearts had an issue sometimes with the data. We set them up before the first day that participants would be wearing them but sometimes we left them on the reader/charger unit. We gave them out as usual and found that when we went to download the data, we had nothing. We were unaware that this issue was caused by leaving the Acihearts on the unit after the sync is complete. We emailed Camntech to find out why it was happening, and we no longer had issues once we stopped leaving the devices on the charging unit, but in the mean time we lost some data because of it.
- Missing data – there were a number of people missing data from the soccer camp because they decided to join the study after we had initially collected the biometric data. The camp was outdoors all day, so we had to do the measurements out on the soccer field, which was fine for all of the measurements except weight. The scale was not giving an accurate measure of the participants' weights, so those participants did not have weight data. For the purposes of setting up the devices, we estimated their weights.

Notes About Camps:

July 10-14 – Physics 101/Technology

- We got the leaders' phone numbers which made it really easy to communicate with them and send them reminders
- Had to use athletic tape to ensure the heart rate monitors were staying on
- vivofits #108 and #100 had a lot of cross talk throughout the week, as did some of the other vivofits
    - In the future, we need to pair the heart rate monitors one at a time, in separate rooms, to avoid crosstalk
- The leaders were good to work with, they warmed up to us over the week and let us know whenever there were issues, like the crosstalk
- It was hard to do observations without the leaders knowing we were doing them because we always had to ask for their location. The breaks usually took place in an open, green space so we were very visible to the campers as well, but they may not have realized we were there to observe them

- We didn't get heart rate data for a lot of people even though they were wearing heart rate monitors, and the data we did get (the graphs) can't be downloaded
- We gave the CAPL questionnaires to the leaders and asked them to have the kids fill them out. When we got them back we had no idea who they belonged to because the kids didn't put their names on them. Going forward, we're adding a spot for kids to write their names on the sheet

July 17-21 – Dinos Jr Boys Basketball

- Although camp sign-in was supposed to start at 8:30 the camp didn't really start at that time, so we had to find the kids to give them the devices while they were running around on the court – we managed to get a lot of them with help from the volunteers
    - We started using a list with the names of the kids we still needed to see highlighted, so the leaders could call out the names of those kids – there were too many kids in the gym for us to be hunting them down individually
- The leaders weren't good at texting us when there were issues
- Some kids took off their heart rate monitors or the Actihearts fell off, but we weren't told about it, so we couldn't put them back on. As a result, some of the devices weren't worn throughout the whole day
    - We didn't get data for the Actihearts for the first two days, possibly because they fell off
    - We were only told that the Actihearts or ActiGraphs fell off by the participants at the end of the day when we asked them for the devices
- There were times when kids left before we could get the devices back from them (not because we weren't there on time, we were always there early, but because they were getting picked up early or they just didn't see us or know to come to us, etc.)
    - It would have been nice if the leaders could have kept track of that because they were given a sheet with the names of the participants along with information regarding who was wearing what device
- Morning step recording usually didn't start until 9:15 (or later in some cases, when the leaders weren't around because they were sick or busy buying breakfast) so by that time, the kids who had been there since 8:30 got in-camp steps that weren't recorded as such
    - This could be due to the fact that they didn't have sign-in (the parents just dropped the kids off and left) so it would have been hard to record the steps just as the kids were getting to camp
    - The kids also started shooting around when they got there so they were doing some activity in the half hour leading up to the start of camp
- Camp leaders didn't really know what was going on so asking them to do things was very hard. They needed to be reminded of things and they didn't communicate with us at all, they were even reluctant to give us their phone numbers initially
- ** don't select this camp again; the coordinator and leaders were very hard to work with and seemed unwilling, therefore they weren't very diligent in recording steps
    - The camp coordinator was asked to pick two leaders that would be tasked with tracking steps and communicating with us throughout the week but the leaders he

chose were not interested in helping us and they were not very responsible; things may have been better if different leaders had been chosen

- The leaders lost the tracking sheet and couldn't find it on Friday when we asked for it; we figured they probably didn't bother looking for it, so we asked about it again on Monday and they still didn't know where it was
    - Luckily someone from Active Living was able to find it and give it to us
- Had 7 kids drop out on Monday, i.e. they signed up in the morning then changed their minds by the end of the day
- Lost heart rate monitor #209 so we're down to 9 monitors now
- A lot of kids weren't too keen on wearing the other devices
    - For the ones that wore the Actihearts and ActiGraphs a lot of them only wore them for one of the two days they were supposed to wear them for
    - The kids in this camp didn't seem too interested in wearing the vivofits in general, compared to the participants in the Minds in Motion camps from the first week; the age of the participants and the camp setting may have affected their interest
- Dinos camps don't have Body Breaks but we did observations anyway at the same times when Body Breaks would normally take place
- Friday Incident – On Friday the heart monitors were supposed to be collected, and usually what happens is, 5 minutes before they call the kids to all come in and sit down in center court at the end of the day, we give them a list of names of the kids we still need to collect from. On Friday only two teams were playing during the last little bit of camp, and camp ran a little late, so some of the parents were leaving with the kids that weren't playing before the camp was officially over. One kid left, and instead of giving his Actiheart to us or one of the leaders, he left it on the table that we usually used (although this table was never assigned to us, it was always there so we used it). EG texted me (TN) and asked me to call the parents to find out if the kid took the Actiheart home by accident. This equipment is quite expensive, so we wanted to make sure that if the kid did take it home, he wouldn't wear it into the shower. After a few phone calls, the kid told me he had placed it on the table we were using. I called Client Services to see if they could check if it was still there, but they directed me to Campus Security because the gym was locked. Campus Security found it and kept it for me until Monday. As mentioned above, EG asked for the data sheet from the leaders. I'm not too sure why the two leaders who were assigned to work on this study with us were chosen. I tried asking all the leaders on Monday morning and no one wanted to give me contact info, which I needed to communicate in case things weren't working, etc. I asked the coordinator and he just said, 'those two'. I explained that it was very important for them to record the steps when the kids came in and when they left. They were pretty good about doing it (except for the timing of it) and typically we collect the sheet when we grab the vivofits on Friday. This didn't happen because, in the morning when we were collecting the vivofits, the leaders came in late, so we couldn't ask for it then. We asked again when we came back in the afternoon to collect the heart monitors but one of the leaders told EG that it was lost and then texted me saying he left it on the table that we usually worked at.

EG didn’t see anything there (when she came in) so I told the leader to give it to the coordinator, and I would get it from him. I checked that table on Monday morning to see if it was there, but it wasn’t so about mid-day on Monday I texted the coordiantor asking if he had it. He told me to talk to the leader. I talked to the leader and he just pointed to the general area where he left it and told me it was in a yellow milk crate. The basketball team was very unwilling to help me look for it and I had no idea where they had actually placed it, I just knew of the general area. By the end of the day I still hadn't heard back from them, so I was talking to someone from Intramurals in Active Living and she told me she had the keys for the equipment rooms and that if I needed to go in and look, she could help. She was very kind, she did a quick run down to the equipment rooms to see if she could find it. According to her, she ran into someone wearing a Dinos t-shirt and when she told him she was looking for a form that was placed in a milk crate, that person got it for her because he knew exactly what she was talking about and where it was. That’s how we got the data sheets back for that camp.

July 24-28 – Keiki Longboarding/Kananaskis Explorers/Packs and Pixels

- One parent made a comment about 'Aboriginal' not being listed as an ethnicity on the Participant Characteristics Form
    - It was listed as an option last year, but no one picked it so it wasn't used this time around as an option on its own; if there are people of Aboriginal descent they can pick the 'Other/Mixed' option
- The "Thrill of the Catch" camp may have been emailed accidentally about the study so one parent came with a form filled out for his son who was in that camp
    - We let the kid participate anyway because he really wanted to and because it was a mistake on our part – we realized later that the classlist for that camp probably wasn’t emailed accidentally, that kid had an older sister who was in one of the camps that was supposed to be in the study
    - The kid from this camp had his data collected as if he was in the Packs and Pixels camp
- One of the parents said her daughter wanted to participate but didn't want to wear any additional devices
    - A lot of kids tell us they don't want to wear the other devices, and this may be because they don't want to wear anything around their chests
    - A lot of the girls in particular seem to be a little uncomfortable with us putting Actihearts and heart rate monitors on them
- Based on our many conversations with various Garmin support people, here's what needs to happen in order for us to get heart rate data:
    - Need to use the vivofit 2s because the 1s don't record all-day heart rate
    - Need to pair them far away from everyone else and get the kids to go for a run or do some jumping jacks to get the heart rate to show up
    - Once the heart rate shows up the heart rate monitors need to be put in 'activity mode' i.e. the timer needs to be started by holding the button down – this means

the steps, etc. will go to 0 but this timer needs to be on for the vivofit to track the heart rate

- Garmin randomly changed the minimum age to 16 so when entering birth dates in the settings, the year has to be set to 2001 for everyone, even though all of the kids are born after that year
- Some of the kids didn't put their names on the CAPL and the leaders didn't notice so we're missing screen-time data for a number of kids this week

July 31-Aug 4 – MediCamp/Mini Camp Sampler

- Had kids from both MediCamp 4/5 and 6-8 sign up for the study – it was only supposed to be one of the camps originally, but this worked out better for us anyway because we got more kids signed up
- The kids in Mini Camp Sampler and MediCamp 4/5 may have been a little too young to truthfully answer the questions from the CAPL questionnaire – some of the participants didn't seem to fully understand what some of the questions were asking, and some of them may not have a very good grasp of the concept of sedentary behaviour or time
    - For example, some kids said that they didn't do anything, or didn't spend more than an hour on the weekend doing something that involved sitting but there's no way that's true
- The leaders for MediCamp 4/5 were a little difficult to work with because none of them really wanted to track the steps for us or give us their contact info so we could find them for Body Breaks – even when one of them did give us her contact info she didn't respond to TN's texts in a timely manner regarding the location of the Body Breaks so we weren't able to fully observe very many of them
- We alternated between observing MediCamp 4/5 and 6-8 during Body Breaks
    - For the most part it was just a half-hour snack break for the kids, and even if the kids were done eating snack they basically had to organize their own games because the leaders sat around for the entire break
    - The kids played camouflage a lot
- We finally figured out half-way through this week how to ensure that we are getting the heart rate data that we want
    - The vivofit 1 automatically detects and tracks the heart rate while the monitor is worn, the vivofit 2 needs to be in 'activity mode' to record heart rate data
        - To put it into activity mode the heart rate has to be detected, then the timer has to be started; the timer will run for 10 hours on the vivofit 2, and the data will only be recorded while the timer is on
        - The 2s are more accurate but the problem with using those is that the timer could get turned off if the kids are playing around with the vivofit, and if they don't notice and turn it back on, or inform their leaders who can call us to turn it back on, we won't get any data from them
    - ** have to look for heart rate data under the Activities tab, not Daily Summary (for the 2s)

- The new electrodes are very sticky, and some parents seem a little concerned when we peel them off the kids' skin (the skin becomes red)
    - Actihearts might not be the best tool to use with kids because, if the electrodes aren't sticky enough they can fall off during activity (like they did with the basketball camp), and if they're too sticky the kids complain that they're not pleasant to take off and that deters them from wearing them again
- Based on what we had been told by Garmin's tech support before, we decided to use only the vivofits 2s to pair the heart rate monitors this week, but that was a mistake because we didn't know how to get them to record heart rate, and we didn't figure it out until later in the week, so we don't have any data from them
- We started going to camps ourselves with the participants' names pre-written on the CAPL so we will know for sure who has filled out the questionnaire

August 8-11 – Dinos Soccer

- Had 13 sign up originally from the morning but when we went to give the kids the vivofits more kids expressed interest. Instead of giving them the vivofits right away we programmed them and brought them to sign out with some extra forms. Once the parents filled out the paper work the kids got their vivofits – this is a good method because it ensures we have consent for all kids so we don't have to keep hunting them down. We had 10 more kids sign up afterwards
- We couldn't measure the weight outside on the grass and the camp never really came inside (not even to go to the washroom), so we had to do the measurement for the kids that signed up late, outside on the grass. We measured height by taping the measuring tape to a pole in the fence, put pens and clipboards down for the step length, did waist circumference measurements by hiding behind trees/bushes or just going far away from the rest of the camp, and couldn't do weight because the scale wouldn't accurately measure it. We had to guess their weight when entering it into Garmin Connect and we just left it as missing data in the data sheets.
- Some of the kids had siblings in other camps and parents asked if the siblings could also get a vivofit so 2/10 of the kids that were added later were siblings
- Leaders were generally easy to work with; they recorded all the steps and were diligent about it. They were very good at taking off the heart rate monitors as well.
- The kids really didn't like the heart rate monitors; many complained and opted out of wearing them, so we struggled to find new kids who would wear them. There was one heart rate monitor originally meant for the girls' team (because we split them evenly between the boys and girls) but since none of the girls wanted to wear it, we asked a boy to wear it instead
- For the vivofits we did a mix of both vivofit 1s and vivofit 2s
    - Vivofit 2 – once we put them into 'activity mode' in the morning it started the timer but when we exported the data it showed that only a few kids had the timer on for the full day. Most of the time it was only on for 1-3 hours then there was a break (in the graph) then another activity session
    - Vivofit 1s all had graphs

    - After this we decided to only use vivofit 1 because it recorded without needing the ‘activity mode’ making it much easier to record the entire day
- Some parents really wanted the CPAQ results as well; when they were handing in the forms they asked for the results to be emailed out
    - The parents had filled out the questionnaires (or so we think) so we expected them to know what they wrote and were a little confused by this request, but they wanted to know whether their kids were healthy or not, based on their responses to the questionnaire and the other data. For the parents who had filled out times for the screen-time related activities we gave them the values they had recorded and the ones that their kids had reported in the CAPL
- Went swimming on Thursday so no heart rate or sedentary time data for that day
- This was a short week; Monday was a holiday, so camp didn’t begin until Tuesday, meaning we weren’t able to collect data until Wednesday.

August 14 – 18 – Climb On/Film Making

- Had 33 sign up, 5 of them were from other camps
- Film making really enjoyed it, the camp coordinator was the main contact person and he said the kids were very excited and really enjoyed being a part of the study. They didn't miss a single recording for any of vivofits. He was very easy to work with – replied to texts right away
- Climb On! was very good at recording as well. The leaders seemed okay with doing the study
- One boy didn't want to wear the Actiheart at all, he said it was bothering him. His vivofit also didn't export any data even though the vivofit had numbers showing on the screen

August 21 – 25 – Girls Applied Science and Engineering & Engineering 101

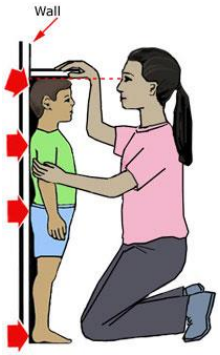
- Had 27 sign up originally and one girl from GASE dropped out of the camp on day 1
- Both camps were very good at recording steps
- The kids were also good with wearing heart monitors, we didn’t have to find new kids to wear them
- They didn’t do any swimming, so we had heart rate monitors on for all days
- Didn’t have any sign ups from other camps
- The battery from one of the vivofits exploded inside of it; not to worry, the girl that was wearing the vivofit is okay

APPENDIX J: CDC GUIDELINES

Measuring Height Accurately At Home

To measure height accurately at home to calculate BMI-for-age:

Remove the child or teen's shoes, bulky clothing, and hair ornaments, and unbraid hair that interferes with the measurement.



Take the height measurement on flooring that is not carpeted and against a flat surface such as a wall with no molding.

Have the child or teen stand with feet flat, together, and against the wall. Make sure legs are straight, arms are at sides, and shoulders are level.

Make sure the child or teen is looking straight ahead and that the line of sight is parallel with the floor.

Take the measurement while the child or teen stands with head, shoulders, buttocks, and heels touching the flat surface (wall). (See illustration.) Depending on the overall body shape of the child or teen, all points may not touch the wall.

Use a flat headpiece to form a right angle with the wall and lower the headpiece until it firmly touches the crown of the head.

Make sure the measurer's eyes are at the same level as the headpiece.

Lightly mark where the bottom of the headpiece meets the wall. Then, use a metal tape to measure from the base on the floor to the marked measurement on the wall to get the height measurement.

Accurately record the height to the nearest 1/8th inch or 0.1 centimeter.

Measuring Weight Accurately At Home

To measure weight accurately at home to calculate BMI-for-age:

Use a digital scale. Avoid using bathroom scales that are spring-loaded. Place the scale on firm flooring (such as tile or wood) rather than carpet.

Have the child or teen remove shoes and heavy clothing, such as sweaters.

Have the child or teen stand with both feet in the center of the scale.

Record the weight to the nearest decimal fraction (for example, 55.5 pounds or 25.1 kilograms).

APPENDIX K: PARTICIPANT CHARACTERISTICS FORM

An investigation of Kids Summer Steps in University Camps.

Participant Characteristics Form

Date of Birth _____

Sex _____

Camp_____

Number of children in the household (not including the participant)

_____

Ethnicity:

- Caucasian/European
- East/South Asian
- Hispanic/Middle Eastern
- African/Caribbean
- Other/Mixed

Highest level of Parental Education:

- No schooling completed
- Nursery school to 8th grade
- Some high school, no diploma
- High school graduate, diploma or the equivalent (for example: GED)
- Some college credit, no degree
- Trade/technical/vocational training
- Associate degree
- Bachelor's degree
- Master's degree
- Professional degree
- Doctorate degree

APPENDIX L: CANADIAN ASSESSMENT OF PHYSICAL LITERACY QUESTIONNAIRE

Child Questionnaire

Name:

When answering the following questions, please tell us about what you did <u>THIS WEEK AND ON THE WEEKEND</u>.

On a <u>camp day</u>, how many hours did you watch TV ?

☐ I did not watch TV

☐ Less than 1 hour ☐ 1 hour ☐ 2 hours ☐ 3 hours ☐ 4 hours ☐ 5 or more hours

On a <u>camp day</u>, how many hours did you play video or computer games or use a computer or tablet?

☐ I did not play video/computer games or use a computer or tablet

☐ Less than 1 hour ☐ 1 hour ☐ 2 hours ☐ 3 hours ☐ 4 hours ☐ 5 or more hours

On a <u>weekend day</u>, how many hours did you watch TV?

☐ I did not watch TV on weekend days

☐ Less than 1 hour ☐ 1 hour ☐ 2 hours ☐ 3 hours ☐ 4 hours ☐ 5 or more hours

On a weekend day, how many hours did you play video or computer games or use a computer or tablet?

☐ I did not play video/computer games or use a computer or tablet

☐ Less than 1 hour ☐ 1 hour ☐ 2 hours ☐ 3 hours ☐ 4 hours ☐ 5 or more hours

During the camp week and weekend (last 7 days), on how many days were you physically active for a total of at least 60 minutes per day? (all the time you spent in activities that increased your heart rate and made you breathe hard)

a) 0 days
b) 1 day
c) 2 days
d) 3 days
e) 4 days
f) 5 days
g) 6 days
h) 7 days

On a <u>camp day</u> how many hours did you spend sitting down doing non-screen based activities (e.g. reading a book, doing homework, sitting and talking to friends, drawing, etc.)? Do not count the time that you sit at camp.

☐ I did not spend time sitting down in non-screen based activities (e.g. reading a book, doing homework, sitting and talking to friends, drawing, etc.)

☐ Less than 1 hour ☐ 1 hour ☐ 2 hours ☐ 3 hours ☐ 4 hours ☐ 5 or more hours

On a <u>weekend day</u> how many hours did you spend sitting down doing non-screen based activities (e.g. reading a book, doing homework, sitting and talking to friends, drawing, etc.)?

☐ I did not spend time sitting down in non-screen based activities (e.g. reading a book, doing homework, sitting and talking to friends, drawing, etc.)

☐ Less than 1 hour ☐ 1 hour ☐ 2 hours ☐ 3 hours ☐ 4 hours ☐ 5 or more hours

☺ Thank you for your help!

APPENDIX M: CHILDREN'S PHYSICAL ACTIVITY QUESTIONNAIRE

An Investigation of Kids Steps in the Summer at University Camps

Please fill out the following questionnaire based on the activities that your child does this week, outside of camp.

Please indicate which days the questionnaire has been completed for (ex. Monday-Thursday) in the space provided below, and return the completed questionnaire to your child's leader. This questionnaire asks about a child's activity in the past 7 days, however, it only needs to be completed for this week. The weekend portion of the questionnaire can be left blank, as can the portion regarding 'Activities at School'.

This questionnaire has been completed for the following days: _____

CHILDREN'S PHYSICAL ACTIVITY QUESTIONNAIRE (C-PAQ)

Parent Questionnaire

Your child's name: .....

Your child's date of birth (dd/mm/yy): ..... / ..... / .....

Are you the child's: mother / father / guardian / other

Please note: - this questionnaire will take approximately 10 minutes to complete
- please answer the questions in relation to the child named above
- please **complete every line** in the questionnaire

Did your CHILD do the following activities in the past 7 days?		MONDAY – FRIDAY		SATURDAY – SUNDAY	
		How many times Mon–Fri?	Total hours/minutes Mon-Fri?	How many times Sat-Sun?	Total hours/minutes Sat-Sun?
EXAMPLE: **Bike riding**	No **Yes**	**2**	**40 mins**	**1**	**15 mins**
SPORTS ACTIVITIES Aerobics	No Yes				
Baseball/softball	No Yes				
Basketball/volleyball	No Yes				
Cricket	No Yes				
Dancing	No Yes				
Football	No Yes				
Gymnastics	No Yes				
Hockey (field or ice)	No Yes				
Martial arts	No Yes				
Netball	No Yes				
Rugby	No Yes				

Did your CHILD do the following activities in the past 7 days?		MONDAY – FRIDAY		SATURDAY – SUNDAY	
		How many times Mon–Fri?	Total hours/minutes Mon-Fri?	How many times Sat-Sun?	Total hours/minutes Sat-Sun?
Running or jogging	No Yes				
Swimming lessons	No Yes				
Swimming for fun	No Yes				
Tennis/badminton/squash/ other racquet sport	No Yes				
LEISURE TIME ACTIVITIES Bike riding (not school travel)	No Yes				
Bounce on the trampoline	No Yes				
Bowling	No Yes				
Household chores	No Yes				
Play in a play house	No Yes				
Play on playground equipment	No Yes				
Play with pets	No Yes				
Rollerblading/roller-skating	No Yes				
Scooter	No Yes				

Did your CHILD do the following activities in the past 7 days?		MONDAY – FRIDAY		SATURDAY – SUNDAY	
		How many times Mon–Fri?	Total hours/minutes Mon-Fri?	How many times Sat-Sun?	Total hours/minutes Sat-Sun?
Skateboarding	No Yes				
Skiing, snowboarding, sledging	No Yes				
Skipping rope	No Yes				
Tag	No Yes				
Walk the dog	No Yes				
Walk for exercise/hiking	No Yes				
ACTIVITIES AT SCHOOL Physical education class	No Yes				
Travel by walking to school (to and from school = 2 times)	No Yes				
Travel by cycling to school (to and from school = 2 times)	No Yes				
OTHER please state:	No Yes				

Did your CHILD do the following activities in the past 7 days?		MONDAY-FRIDAY Total hours/minutes	SATURDAY-SUNDAY Total hours/minutes
EXAMPLE: **Watching TV/videos**	**No** **(Yes)**	**15hrs**	**6hrs 30mins**
Art & craft (eg. pottery, sewing, drawing, painting)	No Yes		
Doing homework	No Yes		
Imaginary play	No Yes		
Listen to music	No Yes		
Play indoors with toys	No Yes		
Playing board games / cards	No Yes		
Playing computer games (e.g. playstation / gameboy)	No Yes		
Playing musical instrument	No Yes		
Reading	No Yes		
Sitting talking	No Yes		
Talk on the phone	No Yes		
Travel by car / bus to school (to and from school)	No Yes		

Did your CHILD do the following activities in the past 7 days?		MONDAY-FRIDAY Total hours/minutes	SATURDAY-SUNDAY Total hours/minutes
Using computer / internet	No Yes		
Watching TV/videos	No Yes		
Other (please state):	No Yes		

APPENDIX N: RAW DATA

N.1. Biometrics

	Camp ID	Weight	Height	Steps/3m	Waist Circumference
July 10-14	P1	52.5	168	4	79
	P2	45	176	4.5	75
	P3	43	154	4	73
	P4	41	156	5	73
	P5	48.5	165.5	4.5	74
	P6	60	175	3.5	74.5
	P7	48	145.5	5.5	77.5
	T1	36	149.5	4.5	62.5
	T2	35	147	4.5	57
	T3	28.5	132	4.5	62.5
	T4	33.5	136.5	4.5	64
	T5	32.5	147	5	62.5
	T6	38	154	4.5	63.5
	T7	35.5	151	4	64
	T8	39	144	7	68
	T9	29	137	5	64
	T10	44.5	151.5	3.5	74.5
	T11	45.5	163	4	74
July 17-21	BB1	39	152	5	63
	BB2	49	171	3.5	72
	BB3	56.5	162	4	87
	BB4	46.5	156.5	5.5	83
	BB5	35.5	138	4.5	65
	BB6	37	139.5	5.5	65
	BB7	52.5	156.5	4.5	82
	BB8	41.5	166.5	4.5	65.5
	BB9	75	161.5	4.5	86
	BB10	45	161	4.5	65
	BB11	40.5	150.5	5.5	65
	BB12	49.5	175	4	72.5
	BB13	58	170.5	4.5	70
	BB14	38	152.5	4.5	61
	BB15	42	160	4.5	65

	BB16	48	171	5	71.5
	BB17	46	158	4.5	70
	BB19	48.5	166.5	4	71.5
	BB18	39	153	4	64.5
	BB20	49	172	4.5	68
	BB21	41.5	154.5	4.5	67.5
	BB22	46.5	162	4.5	72.5
	BB23	54.5	175	.	76.5
	BB24	69	161	6	95.5
	BB25	37.5	156.5	4.5	61
	BB26	42.5	161	4.5	66
	BB27	37.5	164	4	65
	BB28	47	164.5	5	68
	BB29	83.5	183	3.5	95.5
	BB30	74.5	192	3.5	81
July 24-28	KE1	33.5	142.5	6	53
	KE2	39.5	150.5	4.5	66
	KE3	48	145.5	5.5	81
	KE4	29	135.5	5.5	55.5
	KE5	27	134	5	54.5
	KE6	27	134.5	5	56
	KE7	28	138.5	6	54.5
	KE8	37.5	150	5	59
	KE9	47	143	7	77
	KE10	28	135	4.5	60
	KE11	30	137.5	7	52
	KL1	31	142	6	57
	KL2	47.5	163	4.5	67
	KL3	29	112	5	.
	KL4	32.5	150	4.5	60
	KL5	47	155	5.5	73.5
	KL6	28	135.5	6	58.5
	KL7	43.5	151.5	5	63
	KL8	49	169.5	3.5	68.5
	KL9	53	161	4.5	70.5
	KL10	44.5	163.5	5.5	65.5
	KL11	65	100	3.5	71
	PP1	33.5	142	5.5	60.5

	PP2	33	146.5	4.5	60
	PP3	30	142	6	58
	PP4	40	150.5	5.5	67
	PP5	28	138.5	5	57
	PP6	33.5	146	6	63
	PP7	31	137.5	5.5	59.5
	PP8	28	135.5	6	61
	PP9	41	148	4.5	70
	PP10	35.5	147	5.5	63
	PP11	29.5	142.5	6	54.5
	TTC1	31	133.5	6	58
July 31-Aug 4	MC1	33.5	140.5	4.5	67
	MC2	61	157.5	4.5	94
	MC3	29	134	5	61.5
	MC4	23.5	134.5	6	51
	MC5	35	151.5	4.5	62
	MC6	38	140	5	70
	MC7	23	131.5	5	56
	MC8	48.5	154.5	4.5	72.5
	MC9	31.5	145	4.5	62.5
	MC10	58.5	158	4.5	80
	MC11	31.5	142	4.5	62
	MC12	67	170	4	79.5
	MC13	31.5	145.5	4.5	.
	MC14	63	153.5	4.5	86.5
	MC15	38.5	161.5	4.5	60.5
	MC16	48.5	162	3.5	71
	MCS1	32	132	5	54
	MCS2	41.5	152	4	64.5
	MCS3	29.5	140.5	7	57
	MCS4	33.5	148	4.5	63
	MCS5	27.5	139.5	5	57
	MCS6	34.5	144.5	4.5	64
	MCS7	37	148	4.5	63.5
	MCS8	36	153	4.5	61.5
	MCS9	26.5	133.5	5	52
	MCS10	35	145.5	4.5	63

	MCS11	30	140	4.5	57
	ST1	26.3	129.5	5	58.5
	MU1	23	123.5	5.5	56.5
Aug 8-11	S1	42.5	148.5	4.5	71
	S2	39	149	5	66
	S3	34	132	5	67
	S4	22	126.5	6	52.5
	S5	43.5	156.5	4	65.5
	S6	32.5	143	5	65.5
	S7	40	143.5	5	66
	S8	34.5	138	5.5	64.5
	S9	.	138	5	61
	S10	.	140	5	66.5
	S11	.	.	.	.
	S12	33	136	6.5	69.5
	S14	.	145.5	4.5	59.5
	S15	.	150	4	57
	S16	.	131	6	61.5
	S17	.	147	4.5	70.5
	S18	49.5	153	6	72.5
	S19	37	154	5.5	63.5
	S20	37	150.5	6	62.5
	S21	.	140	5	61.5
	S22	.	129	6	58
	MS0	.	.	5	.
	MV1	.	.	.	.
Aug 14-18	CO1	47	147	4.5	73.5
	CO2	27	132.5	5	57.5
	CO3	33	141	5.5	58.5
	CO4	46.5	145	5	74.5
	CO5	30	139.5	5	57
	CO6	35	146	4.5	66.5
	CO7	21.5	121	5.5	53.5
	CO8	46.5	145.5	5.5	74.5
	CO9	34	145.5	5.5	64.5
	CO10	28.5	137	4.5	56.5
	CO11	31.5	129	6	65
	CO12	30	138.5	5.5	59

	FM1	34	148	6	59
	FM2	50.5	161.5	4.5	69.5
	FM3	30.5	133	6	62
	FM4	39	151	4.5	63
	FM5	43	144.5	4.5	76
	FM6	49.5	148	5.5	85.5
	FM7	31	138	4.5	60.5
	FM8	47	152	4.5	72
	FM9	38	146	5	68.5
	FM10	43	158.5	4.5	69.5
	FM11	38	140	5.5	67
	FM12	33	135.5	4.5	65.5
	FM13	34	153	4.5	59
	FM14	28	140	5.5	55
	FM15	40	154.5	5.5	63.5
	FM16	38	145	4.5	69.5
	MV2	26	133.5	4.5	58
	MV3	20	117	5.5	52
	MC17	26.5	137.5	6.5	56
	NS1	25.5	142	5.5	53.5
	LA1	21.5	120.5	5.5	51
Aug 21-25	GASE1	27.5	134	5.5	64
	GASE2	28	133	5.5	57
	GASE3	48.5	161	4.5	70.5
	GASE4	42.5	157	4.5	72
	GASE5	36.5	142.5	6	63.5
	GASE6	36.5	142	5.5	69
	GASE7	39	153	4.5	62.5
	GASE8	32.5	143	5	58
	GASE9	41	151.5	4.5	65.6
	GASE10	30	139	4	57.5
	GASE11	34.5	139.5	4	57.5
	GASE12	40	161	5	59
	GASE13	28.5	138.5	5.5	61.5
	GASE14	44	157	4.5	70.5
	E1	64	161.5	4.5	83
	E2	46	158	4.5	67
	E3	33	146.5	5.5	59

	E4	35	148	4.5	61.5
	E5	52.5	171	4	72
	E6	44.5	157.5	4.5	70.5
	E7	34.5	148	5	64.5
	E8	47	150.5	4.5	74
	E9	43	149	4.5	71.5
	E10	33	155	4.5	61
	E11	53.5	155	5	80.5
	E12	36.5	142	5	62
	E13	51.5	173	4	65
Aug 28-Sept 1	MS1	51.5	148	4	81.5
	MS2	47	158	5	69
	MS3	42.5	152	5.5	69.5
	MS4	56	182	3	72
	MS5	29.5	144	4.5	59
	MS6	48	162	5	67.5
	MS7	37.5	152	5.5	61
	MS8	44.5	157	4.5	69
	MS9	37.5	153	4.5	61.5
	MS10	40	148	5	63.5
	MS11	26.5	139	5	55
	MS12	35	139	4.5	66.5
	MS13	38.5	143	4.5	68.5
	MBB1	31	134	5	58
	MBB2	30	133.5	6	60
	MBB3	42.5	150.5	5	76
	MBB5	40	143.5	6	66
	MBB6	36	146	5	71.5
	MBB7	45	150	5	78.5
	MBB8	29	144	5	61
	MBB9	30.5	148	5	62
	MS14	33	122	6.5	73
	MS15	30	132	5	59
	MS16	.	.	5	58.5
	MS17	39	144	5	63.5
	MS18	32.5	140	5	59
	MBB10	34	125	5	52.5

	MBB11	21	116	6.5	57.5
	MU2	25	126	5.5	57
	MU3	20.5	118	5	52.5

N.2. Participant Characteristics

	Camp ID	Camp Type	Sex	Age	Ethnicity	# of Other Children in the House	Parent Education
July 10-14	P1	0	0	13	1	2	2
	P2	0	1	13	0	1	9
	P3	0	1	11	1	2	2
	P4	0	0	11	2	.	10
	P5	0	1	12	0	2	7
	P6	0	0	14	0	2	7
	P7	0	1	11	0	1	9
	T1	0	1	10	0	1	7
	T2	0	1	11	0	2	10
	T3	0	1	9	0	0	7
	T4	0	1	10	0	1	6
	T5	0	1	10	0	2	7
	T6	0	0	10	1	1	7
	T7	0	1	10	.	.	.
	T8	0	0	10	2	.	8
	T9	0	1	10	0	1	6
	T10	0	1	10	4	1	1
	T11	0	1	11	1	0	7
July 17-21	BB1	1	1	12	0	1	9
	BB2	1	1	13	0	2	7
	BB3	1	1	12	0	1	.
	BB4	1	1	11	0	1	7
	BB5	1	1	13	1	1	10
	BB6	1	1	12	4	1	5
	BB7	1	1	13	0	1	5
	BB8	1	1	12	0	1	4
	BB9	1	1	12	1	2	5
	BB10	1	1	13	0	3	10

	BB11	1	1	10	1	1	7
	BB12	1	1	13	0	1	7
	BB13	1	1	10	2	.	8
	BB14	1	1	13	0	0	8
	BB15	1	1	13	1	1	7
	BB16	1	1	13	0	2	5
	BB17	1	1	12	0	2	7
	BB19	1	1	12	0	3	10
	BB18	1	1	12	0	1	7
	BB20	1	1	12	4	1	3
	BB21	1	1	12	0	2	8
	BB22	1	1	9	0	1	.
	BB23	1	1	13	0	1	8
	BB24	1	1	11	0	3	3
	BB25	1	1	12	0	1	7
	BB26	1	1	10	.	.	.
	BB27	1	1	13	1	1	10
	BB28	1	1	13	0	2	7
	BB29	1	1	13	0	1	7
	BB30	1	1	14	4	1	8
July 24-28	KE1	1	0	9	0	0	1
	KE2	1	0	10	0	3	7
	KE3	1	1	10	0	1	7
	KE4	1	0	9	0	2	7
	KE5	1	0	8	0	1	0
	KE6	1	0	9	0	2	9
	KE7	1	0	9	4	1	7
	KE8	1	0	10	0	1	9
	KE9	1	0	9	0	1	7
	KE10	1	0	10	0	3	9
	KE11	1	0	9	1	1	7
	KL1	1	1	10	4	1	10
	KL2	1	1	11	0	1	1
	KL3	1	1	9	0	1	8
	KL4	1	0	9	4	1	5
	KL5	1	1	13	0	1	7
	KL6	1	1	10	0	2	10

	KL7	1	1	11	0	2	5
	KL8	1	1	12	0	2	1
	KL9	1	1	12	.	1	.
	KL10	1	1	12	0	1	8
	KL11	1	1	13	0	1	7
	PP1	0	0	10	0	1	8
	PP2	0	0	10	0	2	10
	PP3	0	1	10	0	2	10
	PP4	0	0	9	0	1	10
	PP5	0	0	10	1	1	7
	PP6	0	0	9	0	0	7
	PP7	0	0	9	0	1	7
	PP8	0	0	10	0	2	10
	PP9	0	0	9	0	1	8
	PP10	0	0	10	0	1	8
	PP11	0	1	10	1	2	7
	TTC1	0	1	.	0	1	10
July 31-Aug 4	MC1	0	0	8	1	1	7
	MC2	0	0	9	0	0	7
	MC3	0	0	10	0	2	10
	MC4	0	0	8	0	1	9
	MC5	0	0	9	.	.	.
	MC6	0	0	9	0	2	4
	MC7	0	0	9	1	.	7
	MC8	0	0	10	0	1	7
	MC9	0	0	8	0	2	10
	MC10	0	0	10	0	2	7
	MC11	0	0	9	0	3	7
	MC12	0	1	12	4	1	7
	MC13	0	1	12	0	1	10
	MC14	0	0	12	0	1	5
	MC15	0	1	13	0	3	7
	MC16	0	0	12	2	.	8
	MCS1	0	1	8	0	0	8
	MCS2	0	0	9	0	4	4
	MCS3	0	1	8	0	2	7

	MCS4	0	0	10	0	3	8
	MCS5	0	1	9	0	1	8
	MCS6	0	1	9	0	.	7
	MCS7	0	1	10	.	0	.
	MCS8	0	0	10	1	0	7
	MCS9	0	1	8	2	1	10
	MCS10	0	0	8	0	.	.
	MCS11	0	0	9	4	1	7
	ST1	0	1	7	4	1	5
	MU1	0	1	6	0	2	7
Aug 8-11	S1	1	1	11	4	3	7
	S2	1	1	10	0	1	8
	S3	1	1	8	4	2	.
	S4	1	1	10	1	2	.
	S5	1	1	10	0	3	.
	S6	1	1	9	0	1	9
	S7	1	1	9	0	1	.
	S8	1	1	7	0	0	7
	S9	1	1	8	4	1	9
	S10	1	1	9	4	2	9
	S11	1	1	10	0	.	3
	S12	1	1	10	0	3	7
	S14	1	0	10	0	1	10
	S15	1	0	10	0	2	9
	S16	1	0	9	4	2	9
	S17	1	0	9	0	.	.
	S18	1	0	10	0	.	9
	S19	1	0	11	0	1	10
	S20	1	0	10	0	3	7
	S21	1	0	9	0	.	7
	S22	1	0	8	0	0	8
	MS0	1	1	7	0	1	8
	MV1	1	0	7	0	1	10
Aug 14-18	CO1	1	0	10	0	2	8
	CO2	1	1	8	3	1	7

	CO3	1	0	9	0	2	8
	CO4	1	0	9	0	.	7
	CO5	1	0	8	0	.	9
	CO6	1	0	10	0	2	7
	CO7	1	0	9	1	1	7
	CO8	1	0	10	0	.	4
	CO9	1	0	9	0	1	8
	CO10	1	0	10	0	1	8
	CO11	1	0	9	1	1	7
	CO12	1	1	10	1	1	7
	FM1	0	1	10	1	1	7
	FM2	0	0	11	3	2	.
	FM3	0	1	10	0	1	9
	FM4	0	0	10	0	1	.
	FM5	0	0	11	0	2	7
	FM6	0	1	10	0	1	10
	FM7	0	0	10	0	1	10
	FM8	0	1	11	0	0	10
	FM9	0	1	10	0	.	10
	FM10	0	0	11	4	1	10
	FM11	0	1	10	.	1	8
	FM12	0	0	10	0	1	8
	FM13	0	1	12	0	2	8
	FM14	0	1	10	1	1	7
	FM15	0	1	10	.	.	.
	FM16	0	0	11	0	1	8
	MV2	1	1	8	4	1	7
	MV3	1	1	6	4	1	7
	MC17	0	0	9	0	1	8
	NS1	0	1	8	1	1	7
	LA1	0	0	6	0	0	4
Aug 21-25	GASE 1	0	0	10	0	1	10
	GASE 2	0	0	10	0	1	7
	GASE 3	0	0	10	1	1	7
	GASE 4	0	0	10	4	.	10

	GASE 5	0	0	10	4	1	7
	GASE 6	0	0	10	0	.	8
	GASE 7	0	0	11	1	0	7
	GASE 8	0	0	10	0	.	8
	GASE 9	0	0	9	0	1	10
	GASE 10	0	0	10	1	.	7
	GASE 11	0	0	9	0	.	7
	GASE 12	0	0	11	0	0	7
	GASE 13	0	0	11	0	.	8
	GASE 14	0	0	11	1	.	3
	E1	0	0	13	3	3	8
	E2	0	0	12	3	3	8
	E3	0	1	12	1	1	8
	E4	0	1	12	4	1	10
	E5	0	1	13	0	1	10
	E6	0	1	11	1	.	9
	E7	0	1	11	4	0	8
	E8	0	0	11	1	3	.
	E9	0	0	12	0	.	8
	E10	0	0	10	4	1	8
	E11	0	1	11	1	3	.
	E12	0	0	12	0	.	5
	E13	0	1	12	1	1	8
Aug 28-Sept 1	MS1	1	0	10	0	1	7
	MS2	1	0	11	0	1	7
	MS3	1	1	11	4	.	9
	MS4	1	1	12	1	1	8
	MS5	1	0	10	0	.	7
	MS6	1	1	13	2	1	4
	MS7	1	1	12	0	1	7
	MS8	1	1	11	0	2	9

	MS9	1	1	12	4	2	10
	MS10	1	1	11	4	2	10
	MS11	1	1	11	1	2	8
	MS12	1	1	11	4	0	7
	MS13	1	1	11	0	2	7
	MBB1	0	1	8	0	3	9
	MBB2	0	1	10	0	.	9
	MBB3	0	0	10	0	2	7
	MBB5	0	1	.	0	2	8
	MBB6	0	1	8	0	1	7
	MBB7	0	1	9	0	1	7
	MBB8	0	1	10	1	2	8
	MBB9	0	0	9	0	.	9
	MS14	1	0	7	0	2	7
	MS15	1	1	8	0	1	9
	MS16	1	1	8	0	2	4
	MS17	1	0	8	1	.	8
	MS18	1	1	9	0	.	7
	MBB10	0	1	7	0	.	8
	MBB11	0	0	8	0	.	9
	MU2	0	1	6	0	3	9
	MU3	0	0	5	0	1	8

N.3. 24-Hour Steps

Camp ID	Day 1	Day 2	Day 3	Average
P1	10716	10566	12302	11194.6667
P2	9971	7587	10043	9200.33333
P3	13090	14372	17058	14840
P4	14565	13096	16950	14870.3333
P5	14628	14943	13890	14487
P6	9896	10765	9768	10143
P7	10872	16269	13770	13637
T1	16505	16473	17501	16826.3333
T2	14509	2309	.	8409
T3	14897	18312	19557	17588.6667

T4	12489	15405	19601	15831.6667
T5	13553	16035	20162	16583.3333
T6	7198	11761	13425	10794.6667
T7	14134	14233	23331	17232.6667
T8	12597	11637	14153	12795.6667
T9	14360	1405	.	7882.5
T10	11262	16491	14646	14133
T11	10845	19226	13233	14434.6667
BB1	26903	24881	16043	22609
BB2	18848	15241	20494	18194.3333
BB3	20439	17426	17082	18315.6667
BB4	24784	22229	22095	23036
BB5	17289	25939	26194	23140.6667
BB6	28213	18149	28588	24983.3333
BB7	24692	21665	22867	23074.6667
BB8	20785	18168	22432	20461.6667
BB9	34154	25191	28169	29171.3333
BB10	17519	17808	19190	18172.3333
BB11	22143	15833	17875	18617
BB12	26149	21598	19005	22250.6667
BB13	18625	16701	16630	17318.6667
BB14	21313	23204	26895	23804
BB15	24868	17654	20390	20970.6667
BB16	21474	20735	19738	20649
BB17	20733	24291	22440	22488
BB19	3009	.	.	3009
BB18	16721	17293	16422	16812
BB20	25106	10494	.	17800
BB21	.	.	17016	17016
BB22	27718	20069	25006	24264.3333
BB23	2975	.	.	2975
BB24	18916	16234	18180	17776.6667
BB25	23521	24217	23864	23867.3333
BB26	19495	17131	18710	18445.3333
BB27	23290	20885	21839	22004.6667
BB28	18912	20095	15803	18270
BB29	16823	18182	18435	17813.3333
BB30	16577	10257	16503	14445.6667

KE1	14388	12256	9935	12193
KE2	14690	12298	13285	13424.3333
KE3	14469	13241	9540	12416.6667
KE4	15334	16104	14739	15392.3333
KE5	11931	13496	8016	11147.6667
KE6	18558	13177	8642	13459
KE7	10418	9469	9489	9792
KE8	14736	12198	6579	11171
KE9	9963	10869	5920	8917.33333
KE10	.	12178	8337	10257.5
KE11	15479	14631	13356	14488.6667
KL1	15250	16054	16387	15897
KL2	17421	19181	12720	16440.6667
KL3	15683	17517	9011	14070.3333
KL4	16220	15054	.	15637
KL5	17453	17291	11171	15305
KL6	13071	12920	14702	13564.3333
KL7	21846	19973	20142	20653.6667
KL8	12188	11081	13509	12259.3333
KL9	14081	11163	12041	12428.3333
KL10	19533	15976	14417	16642
KL11	9515	14120	.	11817.5
PP1	17868	23324	15793	18995
PP2	25891	18651	12410	18984
PP3	21454	20006	17055	19505
PP4	14910	18101	12076	15029
PP5	20155	21077	16498	19243.3333
PP6	19478	20520	14186	18061.3333
PP7	21634	16595	15546	17925
PP8	22452	16691	12731	17291.3333
PP9	22452	20667	15992	19703.6667
PP10	21951	17043	15503	18165.6667
PP11	17820	25686	13474	18993.3333
TTC1	20867	17148	15899	17971.3333
MC1	13680	22551	20509	18913.3333
MC2	17645	14526	7143	13104.6667
MC3	15282	16217	17771	16423.3333
MC4	16116	18543	17902	17520.3333

MC5	14992	16753	23080	18275
MC6	18345	17531	17139	17671.6667
MC7	12848	.	17812	15330
MC8	18467	18349	22685	19833.6667
MC9	12779	16302	16881	15320.6667
MC10	12723	15540	14288	14183.6667
MC11	14499	15210	15821	15176.6667
MC12	17734	15293	18518	17181.6667
MC13	14508	16606	20471	17195
MC14	19178	16522	17843	17847.6667
MC15	16431	13320	16328	15359.6667
MC16	15390	13880	14182	14484
MCS1	17986	20531	20019	19512
MCS2	14429	15965	19106	16500
MCS3	19807	21844	20521	20724
MCS4	14190	15761	16929	15626.6667
MCS5	19260	14849	22321	18810
MCS6	21452	19234	18866	19850.6667
MCS7	19457	18055	22647	20053
MCS8	15804	17641	16867	16770.6667
MCS9	19176	21240	22018	20811.3333
MCS10	16933	18227	21675	18945
MCS11	17477	16560	17180	17072.3333
ST1	.	.	.	.
MU1	.	.	.	.
S1	.	18263	15333	16798
S2	.	17865	19096	18480.5
S3	.	16419	13446	14932.5
S4	.	15952	15250	15601
S5	.	19534	16483	18008.5
S6	.	10069	18072	14070.5
S7	.	25102	23786	24444
S8	.	23998	21285	22641.5
S9	.	23966	22988	23477
S10	.	23927	24178	24052.5
S11	.	13393	13766	13579.5
S12	.	19295	20562	19928.5
S14	.	18810	18217	18513.5

S15	.	27401	23794	25597.5
S16	.	18082	16744	17413
S17	.	18350	18109	18229.5
S18	.	23145	21849	22497
S19	.	21646	21150	21398
S20	.	17413	15436	16424.5
S21	.	12248	14247	13247.5
S22	.	17668	18416	18042
MS0	.	22488	22328	22408
MV1	.	9713	12796	11254.5
CO1	14231	14392	18428	15683.6667
CO2	9259	9418	13873	10850
CO3	10749	9851	17665	12755
CO4	9085	7689	13043	9939
CO5	14593	16237	19998	16942.6667
CO6	13004	11747	15798	13516.3333
CO7	9501	9312	11646	10153
CO8	14230	14322	17453	15335
CO9	13169	18654	22225	18016
CO10	21322	12334	13898	15851.3333
CO11	13345	10634	15288	13089
CO12	.	.	.	.
FM1	25702	19439	12970	19370.3333
FM2	15548	13809	12083	13813.3333
FM3	20411	24854	21170	22145
FM4	15056	17231	23289	18525.3333
FM5	20252	13526	23135	18971
FM6	11545	11673	14076	12431.3333
FM7	16184	14082	16462	15576
FM8	17639	14865	14748	15750.6667
FM9	10158	11768	11890	11272
FM10	14945	15387	13793	14708.3333
FM11	16067	18009	17882	17319.3333
FM12	17096	18284	19868	18416
FM13	18645	15219	18472	17445.3333
FM14	18200	23888	18211	20099.6667
FM15	17724	19292	16947	17987.6667
FM16	18852	20122	21994	20322.6667

MV2	14850	18689	16298	16612.3333
MV3	17742	23376	21957	21025
MC17	27237	25447	28369	27017.6667
NS1	29378	24345	16286	23336.3333
LA1	15313	14696	17774	15927.6667
GASE1	.	.	.	.
GASE2	15709	9474	11277	12153.3333
GASE3	16669	10682	11755	13035.3333
GASE4	13382	10892	12009	12094.3333
GASE5	.	.	.	.
GASE6	17362	10252	7759	11791
GASE7	16484	12189	12046	13573
GASE8	14046	12024	14087	13385.6667
GASE9	14208	10469	9780	11485.6667
GASE10	15630	12638	12742	13670
GASE11	.	.	.	.
GASE12	10169	12334	14088	12197
GASE13	12450	12307	15701	13486
GASE14	9238	6968	4917	7041
E1	.	.	13108	13108
E2	16346	12927	15409	14894
E3	17090	15316	12052	14819.3333
E4	12992	13802	10783	12525.6667
E5	11608	9463	7630	9567
E6	12250	10110	10297	10885.6667
E7	23385	20054	16253	19897.3333
E8	22376	10476	8712	13854.6667
E9	10681	14973	12538	12730.6667
E10	14190	9199	8506	10631.6667
E11	21950	15194	14659	17267.6667
E12	8594	12317	11407	10772.6667
E13	9179	9896	9204	9426.33333
MS1	21632	15304	14309	17081.6667
MS2	18499	13931	18327	16919
MS3	23743	18761	17546	20016.6667
MS4	19836	11314	N/A	15575
MS5	20899	13300	18718	17639
MS6	27428	20746	24143	24105.6667

MS7	.	.	.	.
MS8	14723	21733	19298	18584.6667
MS9	19582	16731	17747	18020
MS10	25296	16868	16570	19578
MS11	28589	26360	31725	28891.3333
MS12	22214	8865	9624	13567.6667
MS13	25865	29639	28223	27909
MBB1	.	15747	19572	17659.5
MBB2	20918	16357	20429	19234.6667
MBB3	11789	11624	17378	13597
MBB5	1781	12862	16080	10241
MBB6	16846	16293	17600	16913
MBB7	11448	12306	19134	14296
MBB8	16396	15974	18601	16990.3333
MBB9	20315	17154	22016	19828.3333
MS14	16568	21169	19916	19217.6667
MS15	18145	18402	20238	18928.3333
MS16	13415	18091	18370	16625.3333
MS17	15126	18450	18866	17480.6667
MS18	21319	20577	22102	21332.6667
MBB10	17355	20343	18295	18664.3333
MBB11	18425	18260	11962	16215.6667
MU2	18793	15279	17350	17140.6667
MU3	17301	13682	12332	14438.3333

N.4. 24-Hour Sleep Duration

Camp ID	Day 0	Day 1	Day 2	Day 3	Average
P1	6.7	7.4	10.7	8.7	8.375
P2	9.9	9.2	.	11.8	10.3
P3	7.3	6.8	8.1	7.3	7.375
P4	8	8.2	8.6	8.4	8.3
P5	9.6	9	9.3	8.9	9.2
P6	7.3	6.9	6.9	7.4	7.125
P7	8.9	8.4	9.3	6.4	8.25
T1	9.4	10.1	8.4	9.2	9.275
T2	8.8	9.7	.	.	9.25

T3	7.4	7.8	9.2	8.8	8.3
T4	11.2	9.5	8.7	8.9	9.575
T5	11.2	8.8	8.5	6.7	8.8
T6	9.2	8.2	8.3	8.8	8.625
T7	8.6	8.2	10.5	9.1	9.1
T8	7.6	8.3	7.6	8	7.875
T9	7.9	.	.	.	7.9
T10	8.4	9.5	8.2	8.8	8.725
T11	8.6	6.3	7.6	7.6	7.525
BB1	9.1	9	8.8	.	8.96666667
BB2	9.7	9.7	8.1	9.5	9.25
BB3	8.7	8.6	9.2	10.5	9.25
BB4	8.6	8.4	9.9	10.4	9.325
BB5	10.3	.	8.3	.	9.3
BB6	8.3	9.1	8.7	5.2	7.825
BB7	10.5	7.8	8.6	9.7	9.15
BB8	9.6	10	.	.	9.8
BB9	6.4	7.9	8	6.9	7.3
BB10	9.5	11	9.9	.	10.1333333
BB11	9.4	9.9	.	.	9.65
BB12	8.8	7.7	7.9	8	8.1
BB13	6.9	7.6	8.8	6.2	7.375
BB14	10.2	9.5	9.5	10.5	9.925
BB15	8	8.4	8.4	8	8.2
BB16	8.2	9.9	6.7	.	8.26666667
BB17	8.5	8	8.1	8.2	8.2
BB19	9.9	.	.	.	9.9
BB18	8.3	.	10.2	.	9.25
BB20	7.8	7.6	.	.	7.7
BB21	.	.	6.3	9.2	7.75
BB22	8.6	8.1	8	13.4	9.525
BB23	.	.	.	.	.
BB24	8.5	8.4	9.4	8.6	8.725
BB25	9.3	8.9	9.2	9	9.1
BB26	9.3	9.7	10.3	.	9.76666667
BB27	8.3	8.2	8.2	9.1	8.45
BB28	9.2	9	9.1	8.3	8.9
BB29	8.2	8.7	9	9.2	8.775

BB30	8.2	10.7	5.3	12.4	9.15
KE1	10.5	10	10.5	9.3	10.075
KE2	9.8	9.6	9.7	9.7	9.7
KE3	8.2	9	8.7	8.7	8.65
KE4	9.1	10	.	8.7	9.26666667
KE5	.	.	9.2	10.7	9.95
KE6	9.8	9.4	.	.	9.6
KE7	9.8	9.8	9.4	9.5	9.625
KE8	10.5	10.5	10.8	10	10.45
KE9	8.8	9.1	.	8.7	8.86666667
KE10	.	.	.	9.9	9.9
KE11	9	9.3	8.5	7.9	8.675
KL1	9.2	8.8	9.9	8.3	9.05
KL2	9.4	9.8	9.2	9.2	9.4
KL3	9.6	10.3	8.8	9.3	9.5
KL4	9.6	9.8	10.1	.	9.83333333
KL5	.	9.7	.	.	9.7
KL6	10.1	9.2	9.1	8.9	9.325
KL7	9.7	10.4	10.1	9.5	9.925
KL8	.	14.1	.	.	14.1
KL9	.	.	.	11.3	11.3
KL10	8	8	7.9	8.1	8
KL11	.	.	.	.	.
PP1	9.9	9.7	9.4	9.8	9.7
PP2	9.9	9.9	10.3	9.9	10
PP3	10	9.1	9.4	2.8	7.825
PP4	9.4	10.8	9.6	9.1	9.725
PP5	9.2	9	9.1	9.4	9.175
PP6	9.3	4.1	9.2	.	7.53333333
PP7	9.4	9.4	9.8	8.1	9.175
PP8	9.5	8.5	8.8	8.8	8.9
PP9	9	8.7	9.2	8.8	8.925
PP10	10	9.6	10.5	9.1	9.8
PP11	10.9	11.3	10.8	11.1	11.025
TTC1	9.2	8.9	8.1	8.5	8.675
MC1	8.6	8.1	8.6	8.4	8.425
MC2	9.4	8.7	9.2	9.8	9.275
MC3	9.6	.	9.8	9.9	9.76666667

MC4	9.6	9.6	9.6	10.6	9.85
MC5	8.9	11.2	9.2	8.4	9.425
MC6	8.6	8.3	9	9.4	8.825
MC7	8.9	.	.	8.5	8.7
MC8	9.9	9.2	9.7	9.2	9.5
MC9	10.5	9.3	8.8	9.6	9.55
MC10	10.2	10.4	9.7	9.1	9.85
MC11	11.1	10.8	10.6	9.7	10.55
MC12	7.9	9.1	8.2	7.6	8.2
MC13	9.8	10.6	10.5	8.5	9.85
MC14	8.7	7.9	8.9	9.1	8.65
MC15	10.9	10.9	9.1	9.7	10.15
MC16	9.2	8.4	8.9	9.5	9
MCS1	9.7	8.6	9.3	10.1	9.425
MCS2	10	9.3	9.5	8.4	9.3
MCS3	8.3	8.9	9.1	8.6	8.725
MCS4	9.3	9.8	10	10	9.775
MCS5	8.5	8.9	3.9	9.5	7.7
MCS6	.	8.5	9.6	.	9.05
MCS7	8.8	8.8	8.5	7.8	8.475
MCS8	9.6	9.6	8.1	8.5	8.95
MCS9	10.2	10.7	10.4	9.9	10.3
MCS10	8.8	10	8.7	9.9	9.35
MCS11	9.8	10.6	9.9	.	10.1
ST1	.	.	.	.	.
MU1	.	.	.	.	.
S1	.	9.2	9.8	10.2	9.73333333
S2	.	10.5	10.5	10.7	10.5666667
S3	.	9.3	10.1	9.7	9.7
S4	.	10.6	10.5	9.3	10.1333333
S5	.	8.8	8.7	8.2	8.56666667
S6	.	.	10.3	8.3	9.3
S7	.	10.1	9.7	9.4	9.73333333
S8	.	9.6	9.4	10.7	9.9
S9	.	9.7	9.9	10.8	10.1333333
S10	.	9.8	9.1	8.6	9.16666667
S11	.	.	7.2	8.7	7.95
S12	.	9.1	8.9	8.5	8.83333333

S14	.	9.7	10.4	9.7	9.93333333
S15	.	9.7	9.9	9.3	9.63333333
S16	.	10.3	9.9	8.7	9.63333333
S17	.	9.1	10	10.1	9.73333333
S18	.	10.1	10.2	9.8	10.0333333
S19	.	8.3	9.4	8.4	8.7
S20	.	9.7	8.7	9.5	9.3
S21	.	9.8	8.9	9.6	9.43333333
S22	.	9.9	10.2	10.1	10.0666667
MS0	.	9.7	9.4	9.2	9.43333333
MV1	.	.	9.9	9.4	9.65
CO1	8.7	9.3	8.7	9.4	9.025
CO2	.	.	7.8	.	7.8
CO3	10.9	9.9	9.8	9	9.9
CO4	9.8	10.6	10.5	10.1	10.25
CO5	9.2	8.9	8.7	9.4	9.05
CO6	9.4	10.3	9.4	9.9	9.75
CO7	10.3	9.7	9.6	10.9	10.125
CO8	10.7	9.6	10.3	10	10.15
CO9	7.2	11.8	7.5	8	8.625
CO10	10.8	9.1	8.6	9.1	9.4
CO11	10.2	10.1	10.2	9.9	10.1
CO12	.	.	.	.	.
FM1	9.1	8.8	9.3	8.8	9
FM2	7.1	6.1	8.3	6.9	7.1
FM3	9.5	9.7	9.4	8.8	9.35
FM4	9.3	9.2	9.1	9.4	9.25
FM5	8.7	9.1	11.9	9	9.675
FM6	10.3	9.7	9.5	9	9.625
FM7	9.5	9.6	9.7	9.2	9.5
FM8	9.3	9.2	9.2	9.5	9.3
FM9	8.8	9.4	9	8.9	9.025
FM10	9	9.1	8.5	9.1	8.925
FM11	9.9	9	8.9	10	9.45
FM12	10.1	9.8	9.6	10.8	10.075
FM13	9.5	8.9	8.3	8.3	8.75
FM14	10.2	10	9.8	10.4	10.1
FM15	9	8.8	9.2	9.3	9.075

FM16	9.5	9.6	9.2	8	9.075
MV2	8.6	8.5	9.3	8.7	8.775
MV3	8.8	8.7	9.3	9	8.95
MC17	9.6	9.8	9.4	9.5	9.575
NS1	11.4	10.2	10	11.1	10.675
LA1	8.9	8.5	9	9	8.85
GASE1	.	.	.	.	.
GASE2	9.6	9.7	10.3	9.6	9.8
GASE3	9.4	9.2	9.3	10.2	9.525
GASE4	10.4	9	10.2	10.2	9.95
GASE5	.	.	.	.	.
GASE6	8.2	8.3	9	9.3	8.7
GASE7	8.5	9.3	9	8.7	8.875
GASE8	8.9	8.8	9.1	3	7.45
GASE9	9.6	9.3	9	9.4	9.325
GASE10	9.8	9.2	9.1	.	9.36666667
GASE11	.	.	.	.	.
GASE12	.	9.2	9.3	9.5	9.33333333
GASE13	10.2	10.4	9.7	10.5	10.2
GASE14	.	.	16.4	.	16.4
E1	.	.	5.9	8.2	7.05
E2	8.4	9	7.6	8.2	8.3
E3	9.4	8.4	8.9	8.9	8.9
E4	12	11.8	.	.	11.9
E5	8.2	8.2	8.2	8.5	8.275
E6	8.3	7.4	8.7	8.2	8.15
E7	8.1	8.5	7.7	7.5	7.95
E8	8.6	9	.	.	8.8
E9	9.8	9.3	6.5	9.9	8.875
E10	9.2	9.8	9.6	9.6	9.55
E11	8.8	9.2	8.9	.	8.96666667
E12	8.7	9.6	9.2	8.6	9.025
E13	10.3	9.9	10	9.2	9.85
MS1	8.5	9.2	9.4	8.7	8.95
MS2	10.4	10	10.5	10.2	10.275
MS3	8.8	9	.	.	8.9
MS4	10	8.9	8.9	6.4	8.55
MS5	10	10	9.8	9.8	9.9

MS6	8.4	7.9	8.8	8.6	8.425
MS7	.	.	.	7.9	7.9
MS8	9.9	.	9.8	10.4	10.0333333
MS9	11.3	9.4	9.6	6.6	9.225
MS10	11.2	.	10.6	7.7	9.83333333
MS11	8.5	7.9	7.8	8.9	8.275
MS12	10.5	9.6	8.8	9.2	9.525
MS13	9.3	9.6	9.3	8.9	9.275
MBB1	.	.	8.8	9.1	8.95
MBB2	9.6	10	10.1	9.3	9.75
MBB3	10.2	10.3	9.7	10	10.05
MBB5	.	.	9.2	9.8	9.5
MBB6	10.1	9.7	10.4	10.2	10.1
MBB7	10.3	9.7	10.1	10.7	10.2
MBB8	10.4	9.7	10.1	10.7	10.225
MBB9	9.9	9.9	9.7	10.1	9.9
MS14	10.8	11.4	10.4	9.7	10.575
MS15	10.2	10.1	9.3	10.2	9.95
MS16	10.3	9.7	10	10.1	10.025
MS17	9.7	9.7	9.3	9.2	9.475
MS18	10.1	10.1	10.2	9.8	10.05
MBB10	9.1	9.3	9.4	9.3	9.275
MBB11	9.2	10.3	9.6	.	9.7
MU2	9.8	9.8	10.2	10.2	10
MU3	9.2	.	10.2	9.2	9.53333333

N.5. CAPL Responses

Camp ID	Camp Day Screen Time	Weekend Screen Time	Days of 60 mins of PA	Camp Day Non-Screen Time	Weekend Non-Screen Time
P1	.	.	.	.	.
P2	.	.	.	.	.
P3	.	.	.	.	.
P4	.	.	.	.	.
P5	.	.	.	.	.
P6	.	.	.	.	.
P7	.	.	.	.	.
T1	.	.	.	.	.

T2	.	.	.	.	.
T3	.	.	.	.	.
T4	.	.	.	.	.
T5	.	.	.	.	.
T6	.	.	.	.	.
T7	.	.	.	.	.
T8	.	.	.	.	.
T9	.	.	.	.	.
T10	.	.	.	.	.
T11	.	.	.	.	.
BB1	.	.	.	.	.
BB2	1	2	7	2	4
BB3	4	4	6	1	2
BB4	1.5	2	7	0.5	1
BB5	.	.	.	.	.
BB6	.	.	.	.	.
BB7	0.5	4	5	1	0.5
BB8	0.5	2	7	3	2
BB9	1.5	1	6	2	3
BB10	1	3.5	7	1	3
BB11	0.5	1.5	5	3	4
BB12	2	3	7	0.5	1
BB13	0	2.5	7	0.5	0.5
BB14	4	4	0	2	2
BB15	1	3	7	2	3
BB16	2	4	7	2	3
BB17	3	4	.	.	.
BB19	.	.	.	.	.
BB18	3	3	7	1	2
BB20	3	3	4	2	3
BB21	2.5	4	5	0.5	2
BB22	3	3	6	2	2
BB23	.	.	.	.	.
BB24	1.5	1	7	0	0
BB25	2.5	5	2	1	2
BB26	1.5	3	6	1	1
BB27	2	3	7	1	2
BB28	1	4	5	1	3

BB29	3	4	7	1	1
BB30	4	5	.	.	.
KE1	1	0	7	1	1
KE2	.	.	.	1	1
KE3	.	.	.	.	.
KE4	0	0.5	5	0.5	1
KE5	.	.	.	.	.
KE6	.	.	.	.	.
KE7	.	.	.	.	.
KE8	1	0	5	5	4
KE9	1	2	5	0.5	1
KE10	0.5	1	4	5	3
KE11	.	.	.	.	.
KL1	10	10	3	0.5	0.5
KL2	2	4	.	5	0.5
KL3	.	.	.	.	.
KL4	1	2.5	7	1	1
KL5	4	8	5	1	0.5
KL6	2	0	7	0.5	2
KL7	.	.	.	.	.
KL8	2	4	7	0.5	0
KL9	0.5	2	7	1	1
KL10	9	10	7	5	5
KL11	.	.	.	.	.
PP1	1	1	0	1	2
PP2	2	2	7	0.5	0.5
PP3	2	2	5	1	3
PP4	1.5	1	6	2	0.5
PP5	.	.	.	.	.
PP6	3.5	6	3	0.5	0.5
PP7	.	.	.	.	.
PP8	1	2	2	3	4
PP9	1.5	5	7	2	2
PP10	0	2.5	2	3	4
PP11	2	2.5	7	2	2
TTC1	.	.	.	.	.
MC1	1.5	1.5	3	0	0
MC2	1	3	6	3	0.5

MC3	1	0	3	1	0.5
MC4	1	2	5	0.5	1
MC5	0.5	2	2	0.5	0.5
MC6	2.5	3.5	4	0.5	1
MC7	1	1.5	1	2	2
MC8	1	2	2	2	4
MC9	0.5	1	5	0	4
MC10	0.5	0.5	7	0.5	0.5
MC11	1	2.5	7	1	0.5
MC12	1.5	2.5	5	3	2
MC13	10	10	0	0	0
MC14	1	0.5	7	2	2
MC15	1.5	6	5	1	2
MC16	0	1	7	5	5
MCS1	6	8	1	3	4
MCS2	1.5	1.5	6	1	1
MCS3	6	8	7	5	5
MCS4	1	1	5	1	1
MCS5	1	2	7	3	0.5
MCS6	5	9	7	0.5	1
MCS7	1.5	2	6	2	3
MCS8	4	10	3	4	3
MCS9	2	0.5	5	1	0.5
MCS10	0.5	0.5	3	0.5	0.5
MCS11	0.5	0.5	5	0.5	0.5
ST1	.	.	.	.	.
MU1	.	.	.	.	.
S1	1	6	5	1	0.5
S2	2	3	7	1	1
S3	8	.	5	3	4
S4	4	4	4	1	0
S5	0	3.5	6	1	2
S6	1	1.5	5	1	1
S7	0.5	1	3	0.5	1
S8	0.5	1	7	0.5	0.5
S9	5.5	3.5	6	0.5	0.5
S10	1	4	7	2	3
S11	2	1.5	2	2	1

S12	8	10	2	0	0
S14	2	1.5	7	0.5	1
S15	1	0.5	5	0.5	0.5
S16	0.5	2	5	3	1
S17	0	0.5	7	4	5
S18	1	0	6	3	4
S19	1.5	2	6	1	2
S20	1	2	4	0.5	0.5
S21	0	.	7	4	.
S22	1.5	1.5	5	2	3
MS0	.	.	.	.	.
MV1	.	.	.	.	.
CO1	0	0	5	0	0
CO2	1.5	2	1	1	1
CO3	5	5	6	3	3
CO4	0.5	0.5	7	2	3
CO5	1.5	2.5	7	0.5	1
CO6	1	1	6	1	1
CO7	2	2	7	1	1
CO8	0.5	0.5	5	0	0.5
CO9	0.5	1.5	6	5	5
CO10	0.5	2	7	2	4
CO11	0.5	1.5	6	1	1
CO12	0.5	1	4	1	0.5
FM1	2.5	2.5	5	5	3
FM2	0.5	1.5	2	2	2
FM3	1.5	4	2	2	3
FM4	1.5	1	6	0.5	0.5
FM5	2	1	5	5	4
FM6	1.5	6	6	0.5	0.5
FM7	1.5	2	5	0.5	2
FM8	5	5	3	3	5
FM9	0.5	3	5	3	4
FM10	5	5	4	0.5	0.5
FM11	1	1	2	1	2
FM12	2	4	3	5	4
FM13	1.5	2	6	4	5
FM14	0	0	3	2	1

FM15	2	3	3	3	3
FM16	2	3.5	7	1	2
MV2	.	.	.	.	.
MV3	.	.	.	.	.
MC17	.	.	.	.	.
NS1	.	.	.	.	.
LA1	.	.	.	.	.
GASE1	2.5	5	7	3	0.5
GASE2	1	0	2	0	0.5
GASE3	1	0.5	1	1	0.5
GASE4	1.5	0.5	5	0.5	0.5
GASE5	.	.	.	.	.
GASE6	0.5	0	6	0	0.5
GASE7	0	1	1	2	1
GASE8	0	1.5	7	0.5	1
GASE9	2	2	5	0.5	0.5
GASE10	1	0.5	3	0.5	0.5
GASE11	.	.	.	.	.
GASE12	1.5	2	4	1	1
GASE13	0.5	0.5	7	0.5	0.5
GASE14	0.5	1.5	5	1	1
E1	0.5	1.5	5	4	5
E2	1	1	6	5	3
E3	3	3	4	3	2
E4	0	0.5	4	3	2
E5	5	4	7	1	3
E6	1	2	3	1	3
E7	1.5	1.5	7	1	0.5
E8	0	0	7	4	5
E9	1.5	3	4	2	5
E10	1	0.5	4	1	1
E11	0	0	7	3	4
E12	1.5	2	5	3	2
E13	1	1	2	1	2
MS1	0.5	1.5	6	2	0.5

MS2	1	2	1	0.5	0.5
MS3	3	2	5	3	3
MS4	3	2.5	7	3	4
MS5	2	0.5	6	0.5	1
MS6	3	3	7	5	2
MS7	2.5	1.5	7	0.5	2
MS8	2	3	7	2	3
MS9	1.5	5	4	2	3
MS10	1.5	5	4	2	3
MS11	2	3	7	1	1
MS12	.	.	.	.	.
MS13	1	2.5	7	5	2
MBB1	0	2	7	2	1
MBB2	0.5	3	2	1	1
MBB3	1	2	1	0.5	1
MBB5	1	2	6	3	5
MBB6	4	7	3	3	3
MBB7	1	2	4	2	1
MBB8	5	4	5	3	3
MBB9	1.5	2	5	0.5	3
MS14	.	.	.	.	.
MS15	.	.	.	.	.
MS16	.	.	.	.	.
MS17	.	.	.	.	.
MS18	.	.	.	.	.
MBB10	.	.	.	.	.
MBB11	.	.	.	.	.
MU2	.	.	.	.	.
MU3	.	.	.	.	.

APPENDIX O: ADDITIONAL RESULTS

O.1. CAPL Questionnaire

Days of 60 mins of PA	Freq.	Percent	Cum.
0	3	1.82	1.82
1	7	4.24	6.06
2	13	7.88	13.94
3	14	8.48	22.42
4	15	9.09	31.52
5	36	21.82	53.33
6	24	14.55	67.88
7	53	32.12	100.00
Total	165	100.00	

Of the 165 participants who completed the CAPL questionnaire, 32% (n=53) self-reported engaging in 60 minutes of physical activity on 7 days of the week.

O.2. MVPA Based on Step Counts

MVPA	Freq.	Percent	Cum.
0	28	12.90	12.90
1	189	87.10	100.00
Total	217	100.00	

Using average step counts of 12000 steps or more, it can be determined that 87.10% of the participants in the study were getting 60 minutes of MVPA.