



WellSpring

Sharing physical activity knowledge

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Kids' Steps in the Summer at University Camps:

The KiSS UC study

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In 2015, YMCA Canada released their Healthy Kids Report at the same time YMCA of the USA released their Family Health Snapshot. Each report surveyed parents about their children's activity levels.^{1,2} Parents who were interviewed in Canada (35%) thought their 6- to 12-year-olds were not getting enough physical activity on a weekly basis. Those surveyed in the USA (65%) said their children spent three or more hours each day playing video games, using the Internet, or watching television during the summer months. Both results suggest that children and youth need to be more active, and perhaps, particularly so during summer months when school is out.

Summertime Activity

Based on previous research, a child's day has reduced structure during the summer months, resulting in less engagement in physical activity when compared to a typical school day.^{3,4,5} This lack of physical activity can have negative consequences for the children and youth, particularly related to the loss of health and fitness gains made during the school year.^{5,6} Structured activities, such as those offered at summer camps, could help prevent and reduce these negative consequences of inactivity and maintain weight and physical activity among children who attend.

Summer Camps

Limited attention has been paid to summer camp physical activity, even though summer camps rank second to schools in the number of children who attend.^{3,7,8} The Active Living summer camps at the University of Calgary (U of C) have a wide range of camp themes and programming with an enrollment that exceeds 5,000 over the summer. The camps are loosely categorized into **active**, which target sport and outdoor activities, and **non-active**, which have an educational art and science focus. The camps utilize the facilities on campus and the greater community to provide opportunities for children and youth to engage in physical activity.⁹

S U M M A R Y

When school is out, child and youth opportunities to be active may be reduced. Summer camps can provide an opportunity for children and youth to maintain their daily activity levels.

This WellSpring highlights study findings from the KiSS UC study that examined daily step counts of camp attendees and achievement of recommendations through informal and formal physical activities.

KiSS UC study

For the last three years (2015–17), the U of C Active Living camps have been a part of the **KiSS UC** study: an investigation of **Kids' Steps in the Summer at University Camps**.¹⁰ The study objectives were to investigate:

1. Whether children and youth participating in the camps met the Heart and Stroke (HS) Walkabout website's daily step recommendations of 12,000–16,000 steps daily for children (≤ 10 years of age) and a minimum of 11,000–12,000 steps daily for youth (>10 years of age).¹¹
2. The number of steps that participants took during day camp.
3. Whether step count differences existed between boys and girls, as boys tend to be more physically active.^{12,13,14}

The KiSS UC study utilized a rolling recruitment of two camps per week over the eight weeks of the summer programming. Enrolled camps were chosen by the Active Living Youth manager and each year different camps from both active and non-active categories were included. Siblings or friends of participants interested in the study could also participate even if they were not enrolled in one of the selected camps.

Measuring Steps

Step Counts

Step counts can be objectively and easily measured with body-worn motion sensors, such as pedometers and accelerometers, which record the number of steps and distance covered over a time period.^{15,16,17,18} The step counts in KiSS UC study were recorded by a first generation Garmin Vivofit™ device (GV) fitted to the participants' wrist. The GV displayed step count progress in real time and were waterproof — a key consideration as many camps have water-based activities. Unlike some devices, the GV is battery-operated, so charging was not required.

Calibrating Pedometer Device

Each device was calibrated to the child's height, weight, date of birth, and step-length using the Garmin Connect website.¹⁹ Access to the data on the website required both a password and an "ant" plug-in device, which restricted access to the research coordinator only.

The GV wrist band came in two sizes which helped with fitting the smaller kids' wrists. The participants wore the device for five consecutive days beginning on the first day of camp (Monday). Although the wear time was five days, data analysis was based on three consecutive 24-hour time blocks from Tuesday to Thursday resulting in average step counts per day (steps/day). The GV would automatically reset to zero at midnight, and therefore, data collected on Monday and Friday were disregarded as each were incomplete 24-hour periods. The three consecutive collection days fit the criterion for estimating an individual's average steps/day. Most studies have found that at least two days of data collection are necessary for adequate reliability.^{20,21}

24-Hour Movement

The participants were instructed to wear the GV for the entire 24-hour period of each day so that in-camp and out-of-camp steps could be differentiated. The leaders recorded the out-of-camp steps on arrival each morning and the in-camp steps each afternoon when participants were picked up at the end of the camp day. The total out-of-camp steps were determined manually by subtracting the in-camp steps from the 24-hour total.



Promoting Physical Activity in a Summer Camp Setting

Over three summers (2015-17), 669 campers participated, of which 52% were girls, and 59% were children 10 years or younger. In total, 92% (n=611) of the participants' steps/day met the HS daily recommendations over a 24-hour period. This positive result was surprising as there were more participants enrolled in non-active camps (55%). However, we discovered that the campers did a group walk, to and from their respective camp locations, because of the centralized campus drop off and pick area. This campus commute, although unintentional in terms of formal physical activity, contributed to the participants' total step counts and likely influenced the high proportion of campers meeting the HS recommendations of the minimum 11,000 steps/day.

This very interesting result aligns particularly well with the goal of the Healthy People 2010 initiative, to increase the percentage of children walking to and from their daily activities, particularly to school.²² This campus walking also fits nicely into the public health strategy of active commuting; whether it be at school or summer camp.

Canadian Physical Activity Guidelines

When successfully implemented, moderate to vigorous physical activity (MVPA) can be expected to improve fitness and health, as well as reduce the prevalence of overweight and obesity in children and youth.²³ The steps/day equivalent for meeting 60 minutes per day of MVPA is based on the reasonable "rule of thumb" value of $\geq 11,500$ steps for children and youth.^{24,25}

Even more impressive about the camp participants' steps/day was that they were just over 16,793 (standard deviation (SD)=5,407) in a 24-hour period, regardless of the camp category. This high number of steps suggests that the participants may have also met the Canadian Physical Activity Guidelines related to intensity of physical activity.

Boys vs. Girls

Overall, the boys logged more **total** steps/day than girls with a mean difference of 1,529 steps/day, which was found to be statistically significant (Table 1). However, in the active camps where boys and girls were participating in the same sport, youth soccer for example (not shown in Figure 1), the 3-day average in-camp steps/day was a 2% difference in favour of the girls (18,835 boys; 19,040 girls). This result may not be indicative of all camp sports, but it suggests that sport camps may not be the reason why boys logged more total steps than girls. Also, offering sport activities that girls are interested in may be a way of increasing their total steps.

In addition, the summer months may not be where this difference in mean daily steps is most pronounced between boys and girls.²⁸

Children vs. Youth

Inconsistent with the literature^{12,23}, the youth in the KiSS UC study accumulated more steps/day than the children. However, the average difference was less than 1,000 steps/day (see Table 1) and there was considerable variability in steps/day across camps as illustrated in Figure 1. We could speculate that there was potential for undercounting of the quick stepping of young children based on their walking stride pattern.²⁹ But more likely, this finding may be due to the bias selection of the "active" youth camps chosen for the study by the manager of the camps.

Intensity Matters

The intensity was not a study objective originally, because we did not know how well the GV would perform given that the device had not been used with

Table 1. The 3-day mean step differences over 24 hours between groups

Participant number by Group	Mean difference	P-Value	95% CI
Girls (n=338)	1529	<0.0001	(899, 2159)
Boys (n=317)			
Children (n=378)	995	≤ 0.0026	(350, 1640)
Youth (n=275)			
Non-active (n=353)	3167	<0.0001	(2572, 3762)
Active (n=302)			

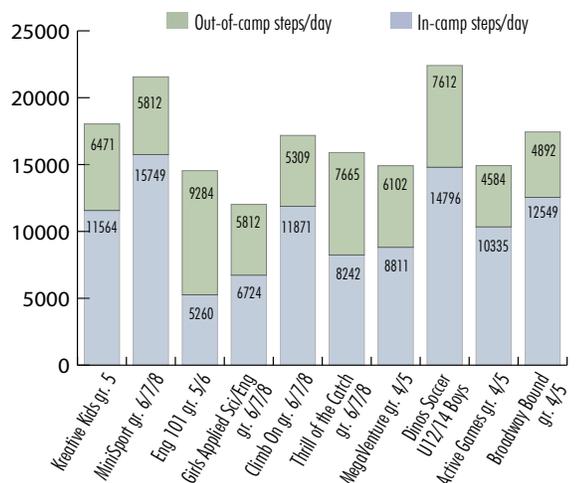


Figure 1. Examples of Camps in the KiSS UC Study

children. We conducted a small pilot study that investigated the GV (step counts) against an Actiheart device (heart rate monitor-beats per minute and accelerometer-activity counts).²⁶ This sub-study showed excellent agreement (ICC=0.989) between devices, and therefore, we feel reasonably confident that the steps/day in these camps are generally congruent with the intensity and duration-based physical activity guidelines.²⁵

In-camp vs. Out-of-camp Steps

The campers in the KiSS UC study averaged about 10,377 (SD=3,282) in-camp steps/day. Although it is unknown if there are steps/day camp norms available, the KiSS UC study findings are similar to a study investigating day campers (11,916) versus residential campers.³ Out-of-camp steps/day averaged 6,694 (SD=3,084), identifying that children and youth continue to move before the camp day starts and after the camp day ends. This suggests that those enrolled in summer camps might not experience a seasonal variation in behaviours related to energy-balance as identified in the literature.²⁷

Active vs. Non-Active Camps

Kids in the active camps, as expected, achieved more steps/day due to the nature of those camp activities. Similarly, the non-active camps, such as Physics 101 or MediCamp, achieved fewer steps/day because they spent a lot of time sitting in classrooms doing group activities. The non-active camps had two scheduled 30-minute daily “body breaks” to provide time for snack, bathroom, and an environment change from indoor to outdoor.

Fit Breaks

We conducted another pilot study implementing structured Fit Breaks led by a kinesiology student and recorded step counts as a proxy measure of increased physical activity.³⁰ Four science-based camps were targeted for the Fit Breaks, which included various tag and ball games, and had an average duration of 18 minutes (SD=3.48).

The results showed an increase of in-camp steps/day of 699 (SD=391.51) with participation rates ranging from 41% to 91% (n=96). Step count totals were influenced by factors, such as weather, activity type, and gender composition of camps.

Participation in Fit Breaks was influenced by the camp leaders. Camp organizers should consider providing physical activity training to camp leaders to be able to support an active camp day for children and youth. In turn, this may help change campers’ attitudes to one of a more positive involvement in physical activity.⁴

Summary

A number of studies on children’s physical activity have yielded average steps/day ranging from about 7,000 to 15,000, depending on the child’s age and gender, the brand of pedometer used, and the study design.¹⁴ These differing factors make it difficult to compare across studies. The KiSS UC study is no exception as the results are at the high end of the step ranges due to the 24-hour tracking method utilized, which provided detailed “time of day” information on steps. This information illustrated that children and youth in summer camps were active in the evening based on the number of steps they logged after camp hours. This pattern of evening steps has been found in the summer months between 17:00 and 21:00, previously.²⁹

The KiSS UC study also highlights the importance of both informal and formal activity for non-active camps. Both the campus commute and Fit Breaks were important additions to the total steps/day. Most importantly, regardless of the camp type, the participants were able to meet the physical activity guidelines based on 24 hours. This is good news, particularly for parents who chose enriching or educational camp activities for their children.



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