



Physical Activity and Enjoyment: Measurement, Evaluation, and Theory

Citation

Barnett, Elizabeth. 2016. Physical Activity and Enjoyment: Measurement, Evaluation, and Theory. Doctoral dissertation, Harvard T.H. Chan School of Public Health.

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PHYSICAL ACTIVITY AND ENJOYMENT:
MEASUREMENT, EVALUATION, AND THEORY

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A Dissertation Submitted to the Faculty of
The Harvard T.H. Chan School of Public Health
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Science
in the Department of Social and Behavioral Sciences
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Boston, Massachusetts.

May 2016

Physical Activity and Enjoyment: Measurement, Evaluation, and Theory

Abstract

Childhood engagement in physical activity improves health and contributes to the sustainment of physical activity in adulthood. My dissertation research broadens scholarship by disentangling the effects of sports- vs. non-sports-focused summer camps on children's physical activity and identifying modifiable activity characteristics contributing to physical activity enjoyment, an important predictor of physical activity sustainment. My work also challenges current discourse by presenting the analytical argument for bringing enjoyment research to the forefront of public health.

In Chapter 1, I hypothesize that children attending a sports camp spend more time in moderate-to-vigorous physical activity (MVPA) compared to children attending general day camps. Multivariable linear regression models estimated differences in percent of accelerometer-monitored time spent in MVPA. Children in the sports camp spent significantly more time in MVPA compared to children in a non-sports-oriented camp. This is the first study of its kind to use real data to document physical activity differences between sports and non-sports camps.

In Chapter 2, I investigate whether children in a sports camp experience higher enjoyment when the activity 1) is competitive, 2) has an active line or no line, 3) involves active coaches, 4) poses challenge, or 5) requires skill. Enjoyment scores were higher for competitive vs. non-competitive activities and those with higher perceived challenge and skill. Integrating challenging, competitive, and skill-building activities into sports camps is relatively simple, yet may have broad effects on children's physical activity behavior.

Chapter 3 presents rationales for bringing enjoyment to the forefront of public health dialogue and action to increase physical activity in children. I outline five challenges that have limited physical activity enjoyment research and offer strategies for addressing them. While other fields have linked physical activity enjoyment with physical activity maintenance, the public health field rarely measures or incorporates enjoyment in epidemiologic, intervention, or theory research.

Increasing physical activity in childhood should be prioritized in public health. The findings and lessons from these chapters not only contribute new scientific evidence, but also have the potential to inform policies and programs that improve children's relationship with and experiences of physical activity during childhood and across the life course.

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Acknowledgments

I am so grateful to the awesome group of camp kids who enthusiastically participated in my study, as well as the Sportsmen's team, who provided their feedback and support throughout the duration of this project. Research assistants Carolyn Brooks, James Daly, and Mia Murray dedicated their time and expertise to collect the data—and also made the process a lot more fun! SAS witchdoctor Jessica Barrett worked statistical magic and helped me safely navigate a strange new world. This work would not have been possible without the financial support from the Donald and Sue Pritzker Scholarship Fund over the past five years. Thank you!

Speaking of debt, I am greatly indebted to my committee. Somehow the stars aligned and I ended up with three people who are not only outstanding in their field, but also all-around fantastic people. Dr. Cassandra Okechukwu inspired me to be creative and challenged me to think outside the public health boxes, while actually encouraging me to make up songs along the way. She always takes time to give thoughtful feedback and mentors with style, grace, and honesty. I am thankful that Dr. Paul Ridker let me be his social science experiment; it has been enlightening and a true honor to work with someone who is not only brilliant but also cares deeply about giving back to the community. He is what a true health pioneer looks like. Also, he's really quick on the court! Finally, my adviser, Dr. Steve Gortmaker, a methodological and scientific mastermind, also happens to be (in his words) “Just Steve, a nice guy.” From my very first introduction to him in 2011, when I learned how to pronounce his name, I have thoroughly enjoyed our meetings that covered not only the tasks at hand, but also sports and parenting.

My friends in the program have kept me engaged and have motivated me to, one day, be able to string together sentences the way they do. They be so smart. The KEEL study group turned an onerous task into a fun learning adventure, complete with delicious professional-grade

baked goods and burnt waffles. And what started as a Tuesday Night Supper Club has become a cherished monthly time to listen, share, learn, cry, and laugh with three of my favorite folks.

I met Henry and Finn's aunties in 2011, but it's crazy to imagine life without them. They have provided every type of social support we learn about in this program and then some. From box seats to boda-de-borga, creating memories with them makes Boston truly feel like home.

My family deserves an honorable degree. My brother has provided career coaching for the past 20 or so years, and has gifted me some great athletic clothing that is super comfortable to wear while sitting and writing. My parents, who supported my decisions even though they weren't quite sure why I wanted to go back to school *again*, have instilled in me the importance of working hard, enjoying life, and "doing good." I always will try to make them proud, even at this old age.

Finally, to my mishpacha, Sarah, Henry, and Finn... What can I say? Sarah, you continue to keep me laughing, nourished, and balanced, every day, in every way. Over the past five years, you brought me carefully concocted snacks, led me through stretch breaks, and made me drink water. (Basically you kept me alive.) I am thankful to you for that, but even more grateful that you have agreed to share your life with me, and that I get to navigate through life's big moments with you and our beautiful family. Henry and Finn, I couldn't have dreamed of more wonderful children. You guys won't remember this, but I was a student during your early years of life. That is why mommy was in sweatpants all day. You probably know a lot about public health because of what you heard while you were in one of our wombs, but you can choose to be whatever you want to be (as of yesterday, Henry, you decided you'd be a friendly lion and Finny would be a spoon). The joy you three give me is way off the charts, and can't be captured by even the most sophisticated of measures.

Chapter 1: Children's Physical Activity Levels in a Sports-Oriented Summer Day Camp

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Abstract

Background: Physical activity engagement during childhood helps create lifelong patterns of health and fitness. Summer camps are an important domain of influence for health promotion, with over 14 million American children attending annually. No known studies have evaluated the impact of sports-focused camps on children's activity levels.

Purpose: Test the hypothesis that children attending a sports camp spend a higher percent of monitored time in moderate-to-vigorous physical activity (MVPA) compared to children attending general day camps.

Methods: A repeated measures design used waist-worn accelerometers to measure MVPA and vigorous physical activity (VPA) among children at Sportsmen's Tennis and Enrichment Center (STEC) in Dorchester, Massachusetts (n=40). We compared these data with data from a similar study at five Boston-area summer day camps (BSC) (n=142), resulting in 764 total person-days analyzed. Multivariable linear regression models estimated differences in

percent of accelerometer-monitored time spent in physical activity, adjusting for potential confounders and clustering of observations.

Results: STEC children spent a higher percentage of camp time in MVPA and VPA compared to BSC children (MVPA: 11.4%, $P = 0.005$, 95% CI = 3.41, 19.42; VPA: 2.4%, $P = 0.023$, 95% CI = 0.33, 4.44).

Conclusion: These findings support the hypothesis that sports-focused camps can provide children with significantly more activity than general day camps. STEC children also spend a higher percent of wear time in MVPA than do children in a school-day national sample (NHANES). This is the first study to document that a sports-oriented camp generates more physical activity compared to a general summer camp. Our findings are relevant for public health efforts to promote physical activity and prevent chronic disease.

Introduction

Physical activity plays a significant role in the overall health of children. Research suggests that an increase in children's physical activity is related to a wide range of positive outcomes during childhood, including improved cognitive skills and academic performance (8,10,23), emotional well-being (5), and psychological functioning (15). Engagement in moderate-to-vigorous physical activity (MVPA) not only positively impacts health in childhood, but also may contribute to sustainment of physical activity in adulthood and improved health and fitness across the life course (25). Those who are physically inactive during adulthood increase their risk of many diseases, including coronary heart disease, obesity, type 2 diabetes, and some cancers (17). Thus, increasing physical activity in childhood can have a long-term impact and should be at the forefront of public health efforts.

The US Department of Health and Human Services issues guidelines for physical activity, recommending that children engage in at least 60 minutes of MVPA each day (22). However, the majority of children in the US do not meet this recommendation, and lower levels of physical activity have been observed among minority youth (13,26). Studies have demonstrated that increasing physical activity opportunities for youth during the school day significantly increases activity levels (7,16,18), but little is known about how to impact children's physical activity behaviors during out-of-school time.

Over 14 million American children and youth attend summer day camps each year (1), making summer camps a promising sphere of influence for physical activity promotion. A research project completed in 2013 by the Harvard Prevention Research Center assessed physical activity of children attending five Boston-area summer camps (BSC) (2). While other research has assessed children's activity levels at summer camps using direct observation (3,29,31), the

Harvard Prevention Research Center study was the first study of its kind to assess children's daily summer camp activity levels using accelerometers.

Nevertheless, no known studies to date have evaluated the impact of a sports-focused summer day camp on physical activity, nor have they compared the activity levels of children at sports-focused compared to non-sports-focused day camps. A systematic review found that youth who participate in sports are more physically active compared to those who do not participate in sports (21). Furthermore, there is some evidence to suggest that participation in sports contributes to children's overall health and that youth who regularly participate in sports are less likely to have adverse health outcomes (9,24,30). While the evidence base is growing for the effect that sports programs can have on children's health, it is unknown whether children who attend sports-oriented summer camps experience significantly more physical activity than those who attend general summer day camps.

Sportsmen's Tennis and Enrichment Center (STEC) provides youth in the Dorchester neighborhood and surrounding Boston communities with safe, accessible, and affordable physical activity opportunities. Compared to other Boston neighborhoods, Dorchester has a high prevalence of obese/overweight individuals and residents who report inadequate physical activity (4). Youth from Dorchester also have lower sports participation levels than youth from other Boston neighborhoods: Dorchester youth comprise 21% of Boston's 5-18 year olds, but represent only 18% of all youth sports and physical activity participants in Boston (6,14). Founded in 1961, STEC was the first non-profit tennis club built to provide tennis training, academic programs, and social enrichment for low-income children. STEC is now one of more than 500 National Junior Tennis and Learning chapters of the United States Tennis Association (28). Like its similar centers across the country, STEC focuses on improving educational,

physical, and cultural opportunities in predominantly minority and low-income communities. STEC’s geographic location, membership in a national network of similar centers, focus on tennis—commonly called “the sport of a lifetime” because it can be played at any age—and diverse enrichment and athletic offerings present a unique opportunity for physical activity research.

The present study evaluates the effect of STEC’s youth summer tennis camp on physical activity, measured by accelerometers. This study quantifies the amount of physical activity that camp participants attain while at STEC and analyzes whether physical activity varies by age, sex, race/ethnicity, level, or past STEC participation. Estimates derived from accelerometer data collected over the course of two weeks are compared with estimates derived from a similar study completed by the Harvard Prevention Research Center that quantified children’s physical activity at five Boston summer (non-sports-oriented) camps.

Methods

Sample and Setting

STEC: A cross-sectional repeated measures design used waist-worn accelerometers to measure physical activity levels among children ages 9-17 at STEC summer tennis camp in Dorchester, Massachusetts, from July 7 – July 18, 2014. Children attending the STEC summer tennis camp during the two weeks of data collection were recruited to wear accelerometers during camp hours for one week (5 days), except for swimming periods. Children were considered eligible for data collection if they were between the ages of 9-17 and were planning to attend the camp for at least four out of five days of the week during the data collection period.

Boston Summer Camps: A cross-sectional repeated measures design used waist-worn accelerometers to measure physical activity levels among children ages 5-12 attending one of

five summer camps in Boston, Massachusetts, from July – August, 2013 (2). Children attending one of the five Boston summer camps during the data collection period were recruited to wear accelerometers during the camp day for one week (5 days), except while swimming (2).

Children were considered eligible for data collection if they were between the ages of 5-12 and were planning to attend the camp for at least four out of five days of the week during the data collection period.

Parents completed written informed consent forms. Research assistants were trained and obtained parent consent and child assent. The study was approved by the Harvard T.H. Chan School of Public Health Committee on Human Subjects.

Measures

Physical Activity: Past research has established strong evidence for validity of accelerometers as measures of physical activity among children by comparing them to gold standard measures of activity-related energy expenditure (*e.g.*, doubly labeled water) and fitness (*e.g.*, VO_{2max}) (11,27). The same ActiGraph accelerometers (models GT3X and GT3X+; Pensacola, FL) and protocol were used to assess physical activity for all participants. Protocols and accelerometer data reduction were modeled after those used in the National Health and Examination Survey (NHANES) (18,26).

Trained RAs distributed accelerometers to all STEC participants at the start of the camp day on each day of data collection. Accelerometers were fastened at the hip with an adjustable belt. Participants were instructed to keep the accelerometer on for the entire camp day, except during swimming periods. RAs collected accelerometers at the end of the camp day or when participants left. Daily wear sheets were used to record the times the accelerometers were put on and taken off for each participant.

Valid minutes of physical activity were restricted to those during the defined camp day. Percent accelerometer time spent in MVPA or VPA per day was estimated by dividing minutes of MVPA or VPA per day by minutes of accelerometer wear time per day. Percent time spent in physical activity was used as the outcome to account for different wear times between STEC and Boston summer camp participants.

Other data: Participants' age, sex, and race/ethnicity were reported by parents and coaches on consent forms in response to open-ended questions. Level of camper (beginner, intermediate, advanced), first time at STEC camp (Y/N), and participant in other STEC programs (Y/N) were reported to study staff by STEC coaches and administrators. Weather data (inches of precipitation, deviation from average annual mean daily temperature, dew point) were derived from National Oceanic and Atmospheric Administration (NOAA) local daily reports for Boston, MA (20).

Statistical Analysis

As in the Boston summer camps study, STEC Actigraph accelerometer data were collected in 1-minute epochs and then were converted to vigorous (VPA) and MVPA minutes. Accelerometer analyses followed algorithms used in previous studies to identify age-specific Metabolic Equivalent of Task (MET) cut-points for MVPA and VPA (13,26,27). The Freedson group age-specific criteria were applied, with thresholds of 4 METs for moderate activity and 6 METs for vigorous activity (27). Nonwear periods were defined as 60 or more consecutive minutes of zero accelerometer counts, per national guidance. SAS code specifying the national NHANES protocol is available at http://appliedresearch.cancer.gov/nhanes_pam/ (19).

After converting accelerometer data, we computed basic descriptive statistics to quantify the amount of MVPA and VPA children at STEC get on a daily basis. Second, we assessed the

crude difference in percent MVPA and percent VPA by comparing STEC data to data from the Boston summer camps. Third, adjusting for weather and participant demographics (age, sex, and race/ethnicity), we conducted a multilevel multivariable linear regression, with day nested within child nested within camp, to test the hypothesis that children attending STEC engage in MVPA or VPA during a higher percentage of camp time compared to children attending the Boston summer camps. Finally, we specified a multilevel model, with day nested within child, to assess which of the following variables may predict percent MVPA within STEC: age, sex, race/ethnicity, tennis level, and past STEC participation.

Results

Participants. Out of 52 eligible STEC participants, 41 (79%) provided parental consent and assent, and 40 (77% of eligible) provided at least two hours per day of accelerometer wear for at least two days. Each consenting participant wore an Actigraph accelerometer on an elastic belt around the waist. STEC data analyzed comes from 40 camp participants, who wore the meters over the course of approximately 4.5 days each for an average of 299 minutes per day, yielding an estimated 53,244 person-minutes of data.

Out of 179 eligible Boston summer camp participants, 164 (92%) provided parental consent and assent, and 142 (79% of eligible) provided at least five hours per day of accelerometer wear for at least two days. Each child who consented wore an Actigraph accelerometer on an elastic belt around the waist. Boston summer camp data analyzed comes from 142 camp participants, who wore the meters over the course of approximately 4.1 days each for 549 minutes per day, yielding an estimated 319,570 person-minutes of data.

STEC participants' average age was 11.5 years, while Boston summer camp participants' average age was 7.6 years. Both STEC and Boston summer camps provided a multi-racial/ethnic

sample, with the largest proportion being black (43% for STEC, 36% for BSC). Both the STEC and Boston summer camp samples had slightly more boys than girls (55% for STEC, 54% for BSC). Demographics and accelerometer data from both samples are summarized in Table 1.

Differences in accelerometer measures between STEC and Boston Summer Camps.

The crude analysis indicates that STEC children are more active during monitored time at camp compared to Boston summer camp children; the percent of wear time per day that is MVPA is 24% for STEC children, compared to 16% for Boston summer camp children (see Table 1).

After controlling for covariates, children at STEC were more active, measured in percent of accelerometer wear time spent in MVPA and VPA, compared to children at Boston summer camps (MVPA: 11% difference, $P = 0.005$, 95% CI = 3.41, 19.42; VPA: 2% difference, $P = 0.023$, 95% CI = 0.33, 4.44) (see Table 2).

Predictors of physical activity within STEC. Physical activity significantly varied by age, after adjusting for other covariates, as indicated by regression coefficients in the models for Table 3. Every year increase in age was associated with a decrement of 3.1% MVPA time ($P = 0.009$, 95% CI = -5.29, -0.83). MVPA also varied by past STEC participation; campers who participated in school year programs at STEC averaged 11.3% more MVPA time compared to those who did not participate in school year programs ($P = 0.006$, 95% CI = 3.43, 19.14). Being an intermediate or advanced player was associated with a 14.2% increase in MVPA time compared to beginners ($P=0.06$, 95% CI = 4.36, 23.97). In addition, being Asian was associated with 11.8% more MVPA time ($P=0.042$, 95% CI = 0.47, 23.14) compared to black participants. There were no significant predictors of percent wear time spent in VPA.

Discussion

Community interventions to improve physical activity can be disseminated in many settings. Past research has identified out-of-school time as an important setting for physical activity interventions targeting children (1–3,29,31). This study systematically measured the physical activity of children who attend summer programs so that researchers and practitioners who plan interventions can better understand the physical activity contributions of existing community resources such as STEC, as well as begin to disentangle any activity differences between sports- and non-sports-focused programs. The primary aim was to test the hypothesis that participants in a sports-focused camp show higher levels of percent wear time spent in MVPA compared to participants in non-sports-focused camps. A secondary aim was to analyze whether MVPA within STEC varied by certain predictors. A major strength of this study is that it employed a community-engaged research approach; for example, it addressed community needs (*e.g.*, asked research questions that were developed with the help of community representatives) and disseminated results to the community, with an end goal of community capacity-building.

Results indicated that STEC participants averaged 71.9 minutes of MVPA/day, well above the Department of Health and Human Services' 60 minutes/day national recommendation. In an effort to place the results in a broader context, we also compared STEC accelerometer data with US national averages for children, obtained from the 2003 – 2006 National Health and Nutrition Examination Survey (NHANES), analyzed in 2012 to estimate physical activity levels during the school day among 2548 youth ages 6-19 (18,26). We found that STEC campers were more active during monitored time at camp compared to the national sample, in which the percent of wear time spent in MVPA per day was less than 11% for all groups reported: 10.3% for boys ages 6-11, 4.8% for boys ages 12-19, 8.0% for girls ages 6-11, and 2.7% for girls ages

12-19 (18). In the national sample, activity during the school day (hours similar to summer camp hours) accounted for the largest proportion of daily MVPA on weekdays (approximately 45%), but still is considerably less than the activity accrued during the STEC day (18). The proportion of wear time per day that was MVPA for the school-day national sample was 7.0% for boys and 4.7% for girls (18, Appendix A), compared to 29.0% for boys at STEC and 19.1% for girls at STEC. Children participating in STEC spent a much higher percent of accelerometer wear time in MVPA than did children in the school-day national sample.

This paper does not address the fact that camp-day physical activity may *not* result in an increase of total physical activity if children ultimately decrease physical activity outside of camp (e.g., compensate for their busy day by sitting on the couch all evening). While outside the scope of our paper, this issue was addressed in a separate study regarding school-day physical activity, which found that higher school-day MVPA was in fact associated with higher daily MVPA among US youth. That is, there was no evidence that children experienced same-day “compensation” (18). Even if STEC children completed no physical activity for the remainder of the day, they still would have exceeded national recommendations.

Consistent with past research, the results in this sample show that children’s physical activity declines as they enter adolescence (12,26). Although physical activity in the STEC sample did not vary significantly by sex, the coefficient suggests that girls at STEC may be less active than boys. The lack of significance may be due to the small sample size or to the fact that STEC is more effectively equalizing the amount of activity between boys and girls. Campers who participated in STEC’s school year programs had a higher percent of MVPA, suggesting that familiarity with a program or place may impact physical activity. In addition, intermediate and advanced players experienced more activity, which may be explained by their ability to

elongate points on the court by keeping the ball in play, thus spending less time receiving inactive instruction. The results suggesting that Asian participants experience a higher percent of MVPA at STEC may be attributed to the small sample size, as there were only five Asian participants in the STEC sample.

This study's primary limitation is that the two populations are not directly comparable. Ideally, we would have collected data from the Boston summer camps and STEC camp during the same summer for children of the same age range. Although this was not logistically feasible, the same methodology, measures, and data collection protocols were used from 2013 to 2014. Further, research suggests a linear decline in MVPA as age increases, so the statistical model should account for the differences in age distribution (12,26). Other efforts were undertaken to make the studies as comparable as possible. Research assistants were trained by the same instructor, using nearly identical training materials, and the same model and type of accelerometer was used for both studies. The STEC data analysis also duplicates the protocol used to analyze Boston summer camp and NHANES accelerometer data. Implicit in the comparison of data from different years is the assumption of temporal stability; the suitability of this assumption is supported by past research, which suggests that there has been no significant change in children's physical activity since 2003 (12,26). Since total accelerometer wear time was longer for children at Boston summer camps, one may suggest that it was easier to keep STEC children active in a shorter amount of time. We adjusted for accelerometer wear time by reporting differences in percent of wear time spent in physical activity. However, future studies could compare summer camps that have more similar day lengths.

This study utilized a convenience sample to collect data from one site in Dorchester, MA. For this reason, and because the sample size was relatively small, the results may not be

generalizable to a larger population. Children who attended STEC may be systematically different from those who attended other Boston area summer camps (*e.g.*, those who attend STEC may prefer sports and may be more active). Similarly, children who agreed to participate in the study may be systematically different from those who did not agree (*e.g.*, they may have more health-conscious parents), so generalizability even to the STEC population is not guaranteed. However, the high response rate (77%), diversity of the participants, and observational nature of the study (*i.e.*, the population is not restricted the way it would be with a randomized controlled trial) suggest that the sample is representative of the population of interest—children who attend STEC summer camp—and bode well for external validity. Ultimately, however, future research should test the generalizability of these findings by conducting similar studies among different populations and settings (*e.g.*, urban and suburban areas, other tennis camps, and other sports camps). Until then, the results can be helpful for estimating trends and useful for hypothesis generation, especially for summer camp physical activity studies. Researchers specifically interested in further understanding the health impact of inner-city tennis centers could investigate physical activity levels at other National Junior Tennis and Learning chapters, which reach more than 225,000 under-resourced youth (28).

Many unmeasured factors could have affected children’s level of activity during camp time. For example, we did not measure sleep patterns, maturity level, height/weight, or physical activity levels at other times of the day. In addition, while ActiGraph accelerometers have been validated, they cannot be used in water, so values of physical activity may be underestimated because they did not capture swim periods during camp days. If underestimation has occurred, it likely has occurred not only in STEC but also in Boston summer camps.

Evaluating the physical activity contributions of STEC's programs will be helpful to the surrounding Dorchester community and also to the Center as its leaders seek to expand STEC's reach and improve upon existing opportunities. By more thoroughly understanding the impact of a not-for-profit tennis and enrichment model, other communities may be inspired to establish similar centers in their neighborhoods, ultimately helping to potentially decrease the incidence of disease, increase physical activity opportunities, improve the community's overall health, and diminish health disparities.

The results of our study may not be surprising. After all, it makes sense that children at a sports camp would be more active than children at a general day camp. However, this is the first and only study to our knowledge that uses real data to document physical activity differences between sports- and non-sports-oriented summer camps. This study does not intend to detract from other positive experiences and outcomes that may result in attending a non-sports-oriented camp. However, having data that support our hypothesis that sports camps generate significantly more physical activity for children could have important implications at the community, school, and policy level. Support for and promotion of more sports-oriented programs could ultimately play a key role in the management and prevention of obesity, diabetes, and chronic disease.

Acknowledgments

We are grateful to the enthusiastic summer camp children and youth who participated in data collection, as well as to the STEC staff, coaches, and administration, especially executive director Toni Wiley, who provided their support throughout the course of the study. Research assistants Carolyn Brooks, James Daly, and Mia Murray dedicated their time and expertise to help collect this data. This work was supported in part by the Donald and Sue Pritzker Nutrition and Fitness Initiative, the BWH Training Program in the Epidemiology of CVD (National

Institute of Health T-32 Training Grant HL07575), and the Centers for Disease Control and Prevention (Prevention Research Center grant U48DP001946). The content is solely the responsibility of the authors and does not represent the official views of the National Institute of Health or the Centers for Disease Control and Prevention.

The results of the present study do not constitute endorsement by the American College of Sports Medicine.

Conflict of Interest

The authors disclose no conflicts of interest.

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Table 1.1. Characteristics of Sportsmen's Tennis and Enrichment Center (STEC) participants and Boston summer camp (BSC) participants: demographics and accelerometer data during summer day camps*

Characteristic	STEC * (n=40 participants; 179 person-days)	BSC ** (n=142 participants; 585 person-days)
Camps		
Daily duration range (hours)	3-9	7.5-10
Sites	1	5
Age (years), mean \pm SD	11.5 \pm 2.2	7.6 \pm 1.4
5-6 years	0	21 (15%)
7-8 years	0	101 (71%)
9-10 years	17 (43%)	12 (8%)
11-12 years	9 (23%)	8 (6%)
13-14 years	9 (23%)	0
15-17 years	5 (13%)	0
Sex		
Male	22 (55%)	76 (54%)
Female	18 (45%)	66 (46%)
Race/Ethnicity		
African American/Black	17 (43%)	51 (36%)
White non-Hispanic	7 (18%)	12 (8%)
Asian	5 (13%)	0
Hispanic/Latino	4 (10%)	37 (26%)
Multiracial/Other/Unknown	7 (18%)	42 (30%)
Accelerometer Data		
Average wear time (days per week)	4.5	4.1
Average wear time (minutes per day)	298.8	548.9
Wear time (person-minutes)	53,244	319,570
Percent of time spent in MVPA	24.3%	15.6%
Percent of time spent in VPA	5.5%	3.5%

* Consented participants with 2+ days of 2+ hours of wear.

** Consented participants with 2+ days of 5+ hours of wear.

Percentages have been rounded up and may not sum to 100.

Table 1.2. Estimated differences in percent of camp day accelerometer wear time spent in moderate-to-vigorous physical activity (MVPA) and vigorous physical activity (VPA) between Sportsmen’s Tennis and Enrichment Center (STEC) and Boston summer camp (BSC) participants

Measure	STEC (n=179)*	BSC (n=585)*	Crude Difference	Adjusted Difference**	95% CI	P
Percent of time spent in MVPA	24.3%	15.6%	8.7%	11.4%	3.41, 19.42	0.005
Percent of time spent in VPA	5.5%	3.5%	2.0%	2.4%	0.03, 4.44	0.023

* “n” refers to the number of person-days (from 40 STEC subjects and 142 BSC subjects).

** Adjusted difference represents the difference in scores in STEC compared to BSC, after adjusting for age, sex, race/ethnicity, weather, nesting of days within children, and nesting of children within camps.

Table 1.3. Regression estimates from linear models predicting percent of camp day accelerometer wear time spent in moderate-to-vigorous physical activity (MVPA) and vigorous physical activity (VPA) for Sportsmen’s Tennis and Enrichment Center (STEC) participants (n=40 participants; 179 person-days)*

Independent Variable	VPA (min)					
	β	95% CI	<i>P</i>	β	95% CI	<i>P</i>
Intercept	27.98	4.13, 51.84	0.023	8.68	-0.80, 18.16	0.071
Age (yr)	-3.06	-5.29, -0.83	0.009	-0.52	-1.84, 0.79	0.425
Female (=1) vs. Male (=0)	-6.39	-13.69, 0.90	0.084	-0.66	-4.96, 3.65	0.758
Race/Ethnicity						
Asian (=1) vs. Black (=0)	11.80	0.47, 23.14	0.042	6.23	-0.38, 12.84	0.064
Latino/Hispanic (=1) vs. Black (=0)	-2.25	-14.26, 9.76	0.704	-0.73	-7.75, 6.29	0.834
Non-Hispanic White (=1) vs. Black (=0)	-0.22	-8.95, 8.51	0.959	3.99	-1.14, 9.11	0.123
Missing/Multiracial/Other/Unknown (=1) vs. Black (=0)	7.76	-1.04, 16.57	0.082	2.77	-2.43, 7.96	0.285
Tennis level						
Intermediate/Advanced (=1) vs. Beginner (=0)	14.17	4.36, 23.97	0.006	3.10	-2.67, 8.86	0.282
Past STEC participation						
First time participant (=1) vs. Returning player (=0)	-4.26	-12.38, 3.86	0.293	-0.80	-5.58, 4.00	0.737
School year participant (=1) vs. Not school year participant (=0)	11.28	3.43, 19.14	0.006	3.46	-1.17, 8.09	0.137
Weather						
Percent deviation from annual temperature	0.08	-0.17, 0.33	0.523	0.08	-0.01, 0.17	0.080
Total precipitation	-1.73	-9.43, 5.97	0.657	1.07	-1.73, 3.87	0.453
Dew point	-0.16	-0.64, 0.33	0.519	-0.17	-0.34, 0.01	0.067

*Models are adjusted for nesting of days within participants.

Chapter 2: Are we having fun yet? Evaluating the impact of modifiable determinants of activity enjoyment in a youth tennis camp

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Abstract

Physical activity enjoyment is linked to physical activity adherence throughout the life course. After identifying modifiable activity characteristics at a tennis camp, we hypothesized that children would experience higher enjoyment when the activity 1) was competitive, 2) had an active line or no line, 3) involved active coaches, 4) posed challenge, or 5) required skill. Over two weeks, we observed 246 activities, collecting 465 enjoyment assessments for 40 children. Enjoyment scores were higher for competitive vs. non-competitive activities (0.37, $P < 0.001$) and those with higher perceived challenge (0.13, $P < 0.001$) and skill (0.47, $P < 0.001$). By contrast, no significant effects were seen for active lines (0.03, $P = 0.732$) or active coaches (0.05, $P = 0.524$). Integrating challenging, competitive, and skill-building activities into sports camps is relatively simple, yet may have broad effects on children's relationship with physical activity during childhood and later in life.

Introduction

Regular physical activity and participation in sports can help control childhood obesity, reduce cardiovascular disease risk by increasing physical fitness, and encourage youth to develop healthier habits^{1,2}. Enjoyment of physical activity has been linked to intrinsic motivation to be active, physical activity adherence, self-efficacy, and engagement in physical activity programs³⁻⁸. Although public health research has demonstrated that regular physical activity can lead to better health outcomes, further research is needed to more thoroughly understand what predicts physical activity enjoyment³⁻⁹.

This paper seeks to identify characteristics of activities that may lead to greater enjoyment for children in a summer tennis camp. The objective of this study was to measure children's perceived enjoyment of observed activities that take place over two weeks of a youth summer tennis program and identify whether pre-selected activity characteristics are associated with level of activity enjoyment. We worked with administrators and coaches at Sportsmen's Tennis and Enrichment Center (STEC) in Dorchester, MA, to establish a list of modifiable activity characteristics that were of interest to the Center and would be relevant to other sports-focused camps:

Is the activity competitive? To date, the literature on the role of certain sports-related activity characteristics in predicting enjoyment is limited. Some research suggests that when an activity is competitive, participants experience greater enjoyment^{10,11}. However, no known studies have specifically aimed to capture children's enjoyment levels immediately after both competitive and non-competitive activities. Increasing our understanding about the effects of competition on physical activity enjoyment is relevant not only to other tennis camps, but any physical activity or physical education program that features competitive games.

Do participants wait in line? Past research has demonstrated that having children wait in line for turns is associated with increases in sedentary behavior^{12,13}. Recommendations and guidelines for youth physical activity development note the importance of limiting “waiting in line” or encouraging movement even when waiting in line cannot be avoided^{14,15}. However, no studies have investigated how physical activity enjoyment may be impacted by waiting in line. How children spend their time between active participation in activities, which is inevitable in sports such as tennis, may be an underestimated predictor of physical activity enjoyment.

Is the coach actively participating? Some research reports that coaches’ feedback and modeling behaviors influence youth development. For example, coaches who provide behavior-contingent praise and informational feedback, along with low disciplinary responses, are associated with participants reporting higher enjoyment and continued physical activity participation¹⁶. While a coach’s physical activity level during an activity may be interpreted as a form of behavior modeling, the connection between coaches’ participation levels and children’s physical activity enjoyment, to our knowledge, rarely has been explored in research literature. Given that the presence of coaches is common across numerous children’s sports, it is imperative to expand knowledge about the impacts of coach participation using analysis of empirical data.

Do the participants feel challenged by the activity? Do they perceive themselves to be skilled at the activity? Flow theory, developed by psychologist Mihaly Csikszentmihalyi, predicts greater enjoyment when activities both require skill and present challenge^{17,18}. “Flow” is characterized by a feeling of full focus and involvement, and relies upon the consideration of challenge-skill balance¹⁸⁻²⁰. In other words, the optimal enjoyable experience occurs when one perceives oneself as both optimally challenged and confident in his/her skill for the activity^{18,19}.

This “challenge-skill balance” has been explored in past enjoyment research, but, to our knowledge, has not been measured among children participating in a sports camp ^{17,18}.

This study used an activity-contingent Ecological Momentary Assessment method to capture enjoyment levels of children by administering enjoyment assessments immediately following the conclusion of activities observed by research staff over the course of two weeks. A major advantage of Ecological Momentary Assessment is that processes and phenomena (such as feelings of enjoyment) can be studied in participants’ “natural habitats,” where their typical, everyday environmental and interpersonal factors are at play ²¹. With 465 enjoyment assessments given immediately following 246 different observed activities among 40 children over 10 days, there is considerable data within each participant to assess the potential impact of different activity characteristics on enjoyment scores (see Figure 2.1). The specific hypotheses we test are:

Hypothesis 1: Competitive activities have higher enjoyment scores than non-competitive activities.

Hypothesis 2: Activities during which players actively stand in line or do not stand in line have higher enjoyment scores compared to activities during which they passively stand in line.

Hypothesis 3: Activities during which the coach actively participates actively have higher enjoyment scores than those activities during which the coach does not participate or is passive.

Hypothesis 4: Activities that require higher levels of skill of the participant have higher enjoyment scores compared to those requiring lower levels of skill.

Hypothesis 5: Activities that presented higher levels of challenge to the participant have higher enjoyment scores compared to activities with lower levels.

Methods

Sample and Setting

The study sample includes children who participated in a summer tennis camp in Dorchester, Massachusetts, from July 7 – July 18, 2014 at Sportsmen’s Tennis and Enrichment Center (STEC). Founded in 1961, STEC was the first non-profit tennis club built to provide tennis training, academic programs, and social enrichment for low-income children. STEC is now one of more than 500 National Junior Tennis and Learning chapters of the United States Tennis Association²². Like its similar centers across the country, STEC focuses on improving educational, physical, and cultural opportunities in predominantly minority and low-income communities.

Children were considered eligible for data collection if they were between the ages of 9-17 and were planning to attend the camp for at least four out of five days of the week during the data collection period. Out of 52 eligible campers, 41 (79%) consented. Of those, 40 (98%) decided to remain in the study. Participants had a mean age of 11.5 (SD = 2.2). These participants completed enjoyment pencil-and-paper assessments multiple times per day for one week (5 days), immediately following the conclusion of observed camp activities.

Longitudinally following children as they moved in and out of different activities throughout the day at STEC, this repeated measures design used one dependent variable (enjoyment), five predictor variables (competitive, active/no line, active coach, skill, challenge), and four covariates (age, sex, race/ethnicity, and tennis level).

Data Collection and Measures

Study staff designed an activity observation assessment tool that included start and end time of each activity, checkboxes for activity characteristics of interest, and a general description of the activity (see Figure 2.2). One week prior to the data collection period, research assistants observed camp activities as part of their activity observation training to increase the reliability of the observation assessments. During the data collection period, research assistants were strategically stationed in different areas of the camp, directly observing as many activities as possible and tracking them in the daily activity observation log. Research assistants filled out one form per activity with a goal of observing 8-10 activities per day.

Research assistants administered to campers the activity enjoyment assessment with paper and pencil during random times throughout the day (immediately after the completion of an activity), with the goal of each camper taking 2-3 (half-day attendees) or 3-4 (full-day attendees) assessments per day (see Figure 2.3). The activity enjoyment measure took approximately one to two minutes to complete and included five questions, the first three of which measured enjoyment by asking how interesting, exciting, and fun the activity was. Past research has effectively utilized this type of assessment to measure the quality of subjective experiences of particular activities throughout the course of one's day ^{20,23}.

Dependent Variable

Enjoyment. We conceptualize physical activity enjoyment as a positive affective response that reflects feelings of fun, excitement, and interest at a particular time in a particular space, and influenced by the perceived challenge of the activity and the perceived skill of the participant, as well as intrapersonal factors such as age, sex, and race/ethnicity. Following each observed activity, participants were asked to think about the activity they just completed, then circle a number from 1 (not at all) to 5 (very) to indicate how interesting, exciting, and fun the

activity was. These items were averaged during the analysis phase to create a composite enjoyment score. In past studies, versions of this three-item composite enjoyment scale have been commonly used and have shown high reliability ($\alpha=.88$)^{19,24}. In the current study, reliability for this scale also was high ($\alpha=.88$; $\alpha=.93$ for girls; $\alpha=.84$ for boys). Although construct validity has not been tested, this scale does demonstrate content validity, as it fully reflects our conceptual definition of physical activity enjoyment.

Predictor Variables

Competitive. Each activity was classified by the researchers via direct observation as competitive/goal-oriented or not. Although competitive activities can be carried out in many different ways, inherent in this characteristic is that there is some element of achieving success (*i.e.*, reaching the goal, hitting the target, or winning the game). This core defining feature of competition has been substantiated in other children's physical activity research¹¹. Activities were considered competitive or goal-oriented if they involved scorekeeping or a pre-established goal or target, set by the coach and/or player. Examples of each type of activity are as follows. **Competitive game:** Two players keep track of singles points and the first to get to seven points (winning by two) wins. **Not competitive:** Two players hit back and forth without keeping score. **Goal-oriented:** Players hit serves and aim to knock over a cone in the service box with the ball. **Not goal-oriented:** Players hit three balls received from a coach and then get back in line.

Active Coach. Each activity was classified by researchers via direct observation as "playing in" (active), "feeding balls" (somewhat passive), or "observing" (passive). Coaches were considered "active" if they were playing tennis (*i.e.*, points) with the participants. Examples of activities representing levels of coach participation are as follows. **Active:** A coach plays out a "live ball" point with a player. **Somewhat passive:** A coach hits ("feeds") a "dead

ball” to a player, then either steps out to let players hit the ball back and forth or feeds another ball. **Passive:** A coach observes two players playing a match and offers occasional feedback and guidance.

Active/No Line. Each activity was classified by researchers via direct observation as having an active line, no line, or passive line. Activities were defined as having an “active line” if participants were engaging in physical activity while waiting their turn to play, “no line” if every player on the court was engaged in the activity without having to wait in line, and “passive line” if players were standing still while waiting in line. Examples of activities with these characteristics are as follows. **Active in line:** Participants are doing push-ups or jumping jacks while waiting for their turn. **Passive in line:** Players stand or sit in line until their turn comes up. **No line:** There is no line and all players on the court are active.

Perceived Challenge and Perceived Skill. Perceived challenge is the self-reported difficulty of the activity, while perceived skill is the self-reported proficiency of the individual completing the activity. These variables were measured in items 4 and 5 of the activity enjoyment assessment. Single items to assess perceived challenge and perceived skill have been used effectively in past enjoyment research^{17,19}. The wording for these two items was adjusted from wording used in previous research in order to be more readable and understandable for a younger audience. Following each observed activity, participants were asked to think about the activity they just completed, then circle a number from 1 (not at all) to 5 (very) to indicate how hard the activity was (challenge) and how good at the activity they were (skill) (see Figure 2.3).

Covariates

Participant age, sex, and race/ethnicity were reported by parents and coaches on consent forms in response to open-ended questions. Level of camper (beginner or intermediate/advanced), was reported to study staff by STEC coaches.

Statistical Analysis

First, we coded variables based upon our conceptual understanding of them. An activity was coded as competitive if it involved scorekeeping or if it included some type of goal or target. Also, because we were interested in whether increased activity (via instructing participants to be active in line or eliminating the line altogether) was associated with higher enjoyment scores, we combined “active in line” and “no line” in the analysis phase, dichotomizing the variable as “active/no line” or “passive”. Finally, for the “active coach” variable, we were most interested in determining whether active coaches were associated with higher player enjoyment, so we combined “somewhat passive” and “passive” in the analysis phase, dichotomizing the variable to “active coach” or “passive coach”.

Analyses were conducted with SAS (Version 9.3; SAS Institute, Cary, NC). After computing descriptive statistics for study variables, multivariable linear regression was used to assess which activity characteristics (competitive, active/no line, active coaches, higher challenge, and higher skill) were associated significantly with higher enjoyment scores, controlling for age, sex, race/ethnicity, and playing level. We used the procedure PROC MIXED to estimate a multilevel model accounting for the clustering of activities within days within children. Each participant had, on average, 12 repeated measurements. Over the 10 days, 465 complete enjoyment assessments were collected for 246 observed activities.

Results

Participants. Out of 52 eligible participants, 41 (79%) provided parental consent and assent, and 40 (77% of eligible) decided to remain in the study. Participants' average age was 11.5 years, and they provided a multi-racial/ethnic sample, with the largest proportion being black (43%). There were more boys (55%) than girls and more intermediate/advanced players (53%) than beginners. Descriptive statistics for demographics and tennis level are shown in Table 2.1.

Activities. We observed 246 activities, with an average of 25.06 minutes (SD=15.35). The majority of activities were competitive (52%), involved an active line or no line (60%), and involved a passive coach (58%). Descriptive statistics for observed activities are shown in Table 2.2.

Enjoyment, challenge, and skill scores. There were 465 completed enjoyment assessments. The mean enjoyment assessment score, an average of the three enjoyment scale items (1=low, 5=high), was 3.96 (SD=1.02), while the mean challenge score was 3.01 (SD=1.28) and the mean skill score was 3.87 (SD=0.93).

Differences in enjoyment scores. The adjusted analysis (see Table 2.3) indicates that STEC campers experienced higher enjoyment scores during competitive vs. not competitive activities (0.37, $P < 0.001$, 95% CI = 0.20, 0.53). Consistent with our theoretical conceptualization of enjoyment, higher enjoyment scores were associated with higher perceived challenge scores (0.13, $P < 0.001$, 95% CI = 0.06, 0.20) and perceived skill scores (0.47, $P < 0.001$, 95% CI = 0.37, 0.56). No significant differences in enjoyment scores were found between active vs. passive lines (0.03, $P = 0.732$, 95% CI = -0.13, 0.19) or between active vs. passive coaches (0.05, $P = 0.524$, 95% CI = -0.11, 0.22). Analyses revealed no significant differences between enjoyment scores on participants' age, sex, race/ethnicity, or tennis level.

Crude analysis (models with no additional covariates) showed that perceived skill alone predicted enjoyment (0.52, $P < 0.001$, 95% CI = 0.43, 0.61), while perceived challenge did not (0.01, $P = 0.772$, 95% CI = -0.06, 0.08). Perceived challenge predicted enjoyment independent of perceived skill (challenge: 0.09, $P = 0.008$, 95% CI = 0.02, 0.15; skill: 0.54, $P < 0.001$, 95% CI = 0.45, 0.63).

Discussion

Enjoyment can be a key mechanism for the adoption and sustainment of physical activity, especially within the context of youth sports activities¹⁰. However, past research has been very limited at identifying characteristics of activities that may lead to greater enjoyment. The objective of this paper was to ascertain whether certain activity characteristics increased children's enjoyment in a tennis camp. Because the focus of this study is on activity characteristics that are modifiable, recommendations about the structure of activities can be made based upon the results of this study and can have real implications at tennis camps, as well as other sports-oriented summer camps and physical education programs.

In this sample, competitive activities resulted in much higher enjoyment scores compared to non-competitive activities. As we expected, incorporating some kind of competitive or goal-oriented element into an activity results in greater enjoyment—about one third of a standard deviation on the assessment scale. Incorporating competition into camp activities is a relatively easy task that could result in a large payoff. However, competitive or goal-oriented activities should be well-thought-out in order to be effective.

By contrast, we saw little impact of active lines on enjoyment scores. We suspect that this construct was confounded by an unmeasured variable. For example, we did not control for the number of children on the court during an activity. An activity with 10 children on the court, for

instance, may require the presence of a line (it would be difficult to have all 10 children playing on a tennis court at the same time). However, children may enjoy the social element of being in a larger group. The presence of a line may give them a chance to talk with friends, meet new people, or watch others engage in the activity, each of which would impact their enjoyment level. The effect of standing in a line with a large group may be especially strong in this particular study because tennis is an individual sport, and those who play are accustomed to being “alone” on the court, facing only their opponent on the other side of the net. Researchers conducting similar studies in the future may be interested in measuring this social effect, and perhaps may wish to look for differences between individual and team sports.

Our results also did not show evidence that coaches’ active involvement influences enjoyment scores. Because we did not control for the particular coach running the activity, the relationship between coach activity and enjoyment may have been confounded. We hypothesized that coaches who were physically more involved would impact children’s enjoyment of activities. However, perhaps physical involvement is only one piece of a fuller picture; that is, the construct we measured did not encompass other key aspects of coaching. For example, an effective coach can stand completely still while engaging and challenging players with motivating words or creative games. Past research suggests that coaches are important influencers in terms of the quality of children’s sports experiences and skill development, but it is unclear what particular characteristics of coaches have the most influence on children ¹⁶. Future research could work to disentangle these characteristics.

Additionally, there were no differences in enjoyment scores between different groups of children, suggesting that STEC activities do not appeal more to one group over the other, and

that STEC is effectively offering activities that children can find enjoyable regardless of their race/ethnicity, age, sex, or tennis level.

As we see in the results, enjoyment is associated with a child's self-assessed skill and challenge. Interestingly, perceived challenge only predicted enjoyment when perceived skill was controlled in the analysis. This suggests that both variables are needed in order to make sense of the enjoyment scores; consistent with flow theory, higher skill and higher challenge together are associated with optimal enjoyment. Therefore, coaches should be cognizant of presenting a variety of challenging opportunities so that children with different skill sets can see success. The findings of this paper do not mean that non-competitive skill-building activities should be eliminated. However, they do suggest that children may engage more with skill-building activities when those activities include some type of goal or target. We suspect that these results would be consistent in other sport camp milieus, but future research could collect similar data from different populations and settings. The three activity characteristics examined are relevant to almost any sports-focused program, so this research can be informative to not only tennis camps, but any program that offers activities with coach involvement, lines, and competition.

There are some limitations to the study. For example, we used a convenience sample to collect data from only one summer camp in Dorchester, MA. Children who attend this summer camp may be different from those who attend other summer camps, so generalizability may be limited. However, the high response rate (77%) and diversity of the study participants suggest that the sample is representative of the population of interest (children who attend STEC summer camp) and may be generalizable to other similar tennis camps, such as those held at other National Junior Tennis and Learning chapters of the United States Tennis Association. Further,

because the camp “assigned” children to courts based upon age and level, the participants could not self-select into activities.

Our sample size of 40 children may have hindered our ability to see some differences between sexes or races/ethnicities. For example, all Asians in the study were male, while all Latino/Hispanic participants were female, thus race/ethnicity may have been confounded by sex. We did not detect any differences in enjoyment by playing level, which we may have seen if we had a larger sample. However, our repeated measurements resulted in 465 enjoyment assessments, giving us ample power to detect differences between activity characteristics, our primary objective.

This paper focuses on physical activity characteristics and how they may impact physical activity enjoyment. It is outside the scope of this project to discuss how physical activity characteristics may impact other outcomes that a tennis camp may attempt to achieve, such as improving one’s backhand or enhancing fitness level. Future research may investigate other factors that could have affected children’s enjoyment of activities. For example, we did not measure sleep patterns, attitude, or personality traits, each of which could impact one’s experience of an activity. Another question that may have been interesting to explore is to what extent enjoyment in one session may be influenced by enjoyment in the prior session. However, we control for the potential of non-independence through random survey assignment throughout the day, thus do not have information on sequential activities. The effect of one activity on another may be an interesting area for future enjoyment research.

One of the major strengths of our study is that we clearly define our concepts, and our definitions are consistent with our measures. Most youth-focused sports research has defined enjoyment as “a positive affective response to sport experience that reflects generalized feelings

such as pleasure, liking, and fun”^{10,25}. The primary limitation of this definition is that enjoyment is expressed merely as a positive affective response and does not take into account the challenge of the activity or the skill of the individual performing the activity. To deal with this shortcoming, some researchers have referred to enjoyment being one and the same as the concept of Csikszentmihalyi’s “flow”²⁵. While it may be too simplistic to define enjoyment as merely a positive affective state, it may be too restrictive to define enjoyment as only flow. Further, both types of definitions, although heuristically useful, fail to include social factors, such as race/ethnicity (*e.g.*, being white may mean access to resources that could enhance one’s skill at an activity). A major strength of this paper is that we address these definitional limitations by using a multilevel social determinants conceptualization and operationalization of enjoyment to more completely examine the influence of activity characteristics on enjoyment among youth STEC participants. Our conceptualization of physical activity enjoyment situates the concept within multiple levels of influence.

Another important strength of this paper is the data collection approach and enjoyment measurement tool, which could be implemented easily in other sports settings, as well as in communities, schools, or worksites that seek to strengthen participant enjoyment. In addition, this study employs a community-engaged research approach, which addresses community needs (*i.e.*, asks research questions that have been developed with the help of STEC community representatives) and focuses on community capacity-building. Having the community invested throughout every stage of the study increases the likelihood that the results will translate into action. Especially when implemented with a community-engaged approach, Ecological Momentary Assessment also has major scientific benefits. For example, real-time assessments can increase accuracy and minimize retrospective bias. Second, repeated measurements can

reveal changing processes over time. Finally, assessments in real-life situations and settings can enhance generalizability²⁶, especially ecological validity (generalizability across settings) because it minimizes the reactive effects of experimental arrangements—that is, there is no artificiality because children are in a natural environment for one week.

These findings have practical implications for anyone involved in children’s physical activity offerings. Parents, coaches, and practitioners should recognize that 1) competition is an important component in children’s experience of sport participation, 2) when children feel challenged, they may experience greater enjoyment, and 3) it is important to offer activities during which children can develop existing skills and learn new ones. Our research expands upon enjoyment research not only by using well-defined measures, but also by providing a deeper understanding of how activity characteristics may influence physical activity enjoyment. Our findings lay the groundwork for coaches and camp organizers as they reevaluate existing programs and develop new ones, while considering how certain activity components may impact their campers’ experiences. Understanding the construct of enjoyment, what characteristics may predict it, and measuring it effectively is particularly useful in a setting like STEC. On a broader level, pinpointing characteristics of certain program components that drive children’s enjoyment of activities is an important step in building upon high-enjoyment activities, making recommendations for new ones, and offering activities that ultimately may be more predictive of physical activity sustainment across the life course.

Acknowledgments

We are grateful to the enthusiastic summer camp children and youth who participated in data collection, as well as to the STEC staff, coaches, and administration, especially executive director Toni Wiley, who provided their support throughout the course of the study. Research

assistants Carolyn Brooks, James Daly, and Mia Murray dedicated their time and expertise to help collect this data. This work was supported in part by the Donald and Sue Pritzker Nutrition and Fitness Initiative, the BWH Training Program in the Epidemiology of CVD (National Institute of Health T-32 Training Grant HL07575), and the Centers for Disease Control and Prevention (Prevention Research Center grant U48DP001946). The content is solely the responsibility of the authors and does not represent the official views of the National Institute of Health or the Centers for Disease Control and Prevention.

Conflict of Interest

The authors disclose no conflicts of interest.

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Table 2.1. Characteristics of Sportsmen’s Tennis and Enrichment Center (STEC) summer camp study participants: demographics (n=40)

Characteristic	n (%)
Age (yr), mean ± SD	11.5 ± 2.2
9-10 years	17 (43%)
11-12 years	9 (23%)
13-14 years	9 (23%)
15-17 years	5 (13%)
Sex	
Male	22 (55%)
Female	18 (45%)
Race/Ethnicity	
African American/Black	17 (43%)
White non-Hispanic	7 (18%)
Asian	5 (13%)
Hispanic/Latino	4 (10%)
Multiracial/Other/Unknown	7 (18%)
Level	
Beginner	19 (48%)
Intermediate/Advanced	21 (53%)

Percentages have been rounded up and may not sum to 100.

Table 2.2. Characteristics of observed activities (n=246)

Activity characteristic	n (%)
Duration in minutes (mean, (SD))	25.06 (15.35)
Presence of Competition	
Competitive	129 (52%)
Not Competitive	117 (48%)
Type of Line	
Active Line/No Line	148 (60%)
Passive Line	98 (40%)
Type of Coach	
Active Coach	83 (34%)
Passive Coach	142 (58%)
Missing or No Coach	21 (9%)

Percentages have been rounded up and may not sum to 100.

Table 2.3. Coefficient estimates from a multilevel linear model predicting enjoyment scores (n=465 assessments) for Sportsmen’s Tennis and Enrichment Center participants *

Independent Variable	Enjoyment Score		
	β	95% CI	<i>P</i>
Intercept	1.92	0.53, 3.30	0.012
Age (yr)	-0.05	-0.16, 0.06	0.409
Female (=1) vs. Male (=0)	0.24	-0.12, 0.60	0.193
Race/Ethnicity			
Asian (=1) vs. Black (=0)	0.01	-0.54, 0.55	0.982
Latino/Hispanic (=1) vs. Black (=0)	-0.04	-0.61, 0.53	0.881
Non-Hispanic White (=1) vs. Black (=0)	-0.28	-0.71, 0.15	0.208
Missing/Multiracial/Other/Unknown (=1) vs. Black (=0)	0.14	-0.30, 0.58	0.532
Tennis level			
Intermediate/Advanced (=1) vs. Beginner (=0)	0.10	-0.37, 0.56	0.681
Activity characteristics			
Competitive (=1) vs. Non-competitive	0.37	0.20, 0.53	< 0.001
Active/No Line (=1) vs. Passive Line	0.03	-0.13, 0.19	0.732
Active Coach (=1) vs. Passive Coach	0.05	-0.11, 0.22	0.524
Skill score	0.47	0.37, 0.56	< 0.001
Challenge score	0.13	0.06, 0.20	< 0.001

*Adjusted for nesting of days within participants

Figure 2.1. Explanation of study levels and variables at each level

n	Description of level	Variables collected at level	How variables were collected
40	Participants (children)	Age Sex Race/ethnicity Tennis level	Self-report and coach-report
246	Observed activities	Competitive Active/no line Active coach	Direct observation by research staff
465	Enjoyment assessments	Enjoyment Challenge Skill	Assessments completed by participants (children) immediately after observed activity

Figure 2.2. Activity observation form

ACTIVITY OBSERVATION

Fill out the information about all activities you observe during the day (one table for each activity).

Goal: 8-10 activities/day

DATE: _____

ACTIVITY #: (start count over each day)

Start time:	End time:	Inside <input type="checkbox"/>	Outside <input type="checkbox"/>		
Level observed (check one)	Green (9-10 yrs) <input type="checkbox"/>	USA (11-15 yrs) <input type="checkbox"/>	High performance (11-17 yrs) <input type="checkbox"/>		
General description of activity (what do you see happening?)					
Who's on the court? (if it varies, note the average)	# players/court: _____		# coaches or volunteers/court: _____		
What's the (primary) coach doing?	Playing in (returning balls, hitting back to players) <input type="checkbox"/>	Feeding balls (hitting one ball at a time to players) <input type="checkbox"/>	Observing <input type="checkbox"/>		
Characteristics of the activity (check all you think apply)	Warm-up <input type="checkbox"/>	Competitive/ game (keeping score) <input type="checkbox"/>	Skill/technique-focused <input type="checkbox"/>	Fitness training <input type="checkbox"/>	Not tennis/Other (describe below) <input type="checkbox"/>
	A goal is set (e.g., hit a target, get 10 in a row) <input type="checkbox"/>	Stations (players are moving from one activity to another) <input type="checkbox"/>	Some players are standing still/sitting while waiting for their turn <input type="checkbox"/>	Kids are active while waiting for their turn (e.g., jumping jacks) <input type="checkbox"/>	

Other characteristics observed or other notes about this activity:

Figure 2.3. Activity enjoyment, challenge and skill assessment

ID # _____ Your coach during the last activity: _____

Think about the activity you just completed. Then, circle a number to tell us what you thought about the activity.

1. How interesting was it?

not at all interesting 1-----2-----3-----4-----5 very interesting

2. How exciting was it?

not at all exciting 1-----2-----3-----4-----5 very exciting

3. How fun was it?

not at all fun 1-----2-----3-----4-----5 very fun

4. How hard was it?

very easy 1-----2-----3-----4-----5 very hard

5. How good were you at it?

very bad 1-----2-----3-----4-----5 very good

(For researcher to complete) RA name: _____ Date: _____ Activity #: _____

Chapter 3: Where's the Fun in This? Taking Serious Steps to Integrate Children's Physical Activity Enjoyment into Public Health Research

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Abstract

Physical activity engagement during childhood is associated with positive health outcomes in adulthood. Exercise and sport science research links physical activity enjoyment with physical activity adoption and maintenance, among other positive health behaviors. However, public health researchers rarely measure enjoyment or discuss its role in interventions or theory. In this paper, we present the rationale for bringing enjoyment to the forefront of public health dialogue and action to increase physical activity in children and across the life course. We outline five potential explanations for the lack of physical activity enjoyment research in public health, and offer solutions and action steps for each.

Introduction

There is a strong body of evidence in public health research demonstrating that regular physical activity for children leads to positive health outcomes, such as an increase in physical fitness, a reduction in cardiovascular disease risk in adulthood, and the development of overall healthier habits.^{1,2} Unfortunately, fewer than half of all children in the United States meet physical activity guidelines, which recommend that children accrue at least one hour of moderate or vigorous physical activity each day.³⁻⁶ Furthermore, there is strong evidence that children's physical activity significantly declines as they enter adolescence.^{5,7} It is no surprise that this trend continues through adulthood; less than 5% of U.S. adults meet the national recommendation to obtain 30 minutes of physical activity per day.⁵

The study of children's physical activity enjoyment provides a tremendous opportunity to influence physical activity uptake and maintenance on multiple levels, inspiring positive behaviors that impact lifelong health. Research in the field of sport and exercise psychology often cites physical activity enjoyment as an important predictor of physical activity adoption and maintenance. Enjoyment of physical activity has been linked to intrinsic motivation to be active, physical activity adherence, self-efficacy, and sustained engagement in physical activity programs.⁸⁻¹³ In one national study of students in fourth through 12th grade, physical activity enjoyment was one of the variables with the strongest and most consistent evidence of association with youth physical activity, across all age and sex subgroups.¹⁴ Another study provided evidence that physical activity enjoyment—just like physical activity—declines with age.¹⁵ We need more research on enjoyment to determine whether this relationship is more than a correlation.

Physical activity enjoyment also influences other positive health behaviors. Findings from a recent experiment showed that when people perceived an activity as “fun” (for example, when the activity was framed as a scenic nature walk vs. an exercise walk), they consumed less dessert and chose healthier snacks.¹⁶ The mere perception of physical activity as fun positively influenced study participants’ subsequent food choices, suggesting that participation in activities that are framed as enjoyable can help prevent compensation through unhealthy food consumption.¹⁶ The literature suggests that facilitating physical activity opportunities for children in a way that encourages physical activity enjoyment can have broad effects on physical activity sustainment and other positive health behaviors through adolescence and adulthood.

Unfortunately, while public health research has demonstrated that regular physical activity can lead to better health outcomes, it rarely measures or prioritizes physical activity enjoyment, despite the fact that enjoyment has been linked to regular physical activity. When we searched the archives of the *American Journal of Public Health* for articles from 1911 through 2015, we found only five that contained the word “enjoy” in the title (none contained “enjoyment”), the most recent being from 1961. A broader search of the PubMed database of the National Library of Medicine indicated similar results. Out of articles published through 2015, 68,819 contained the term “physical activity” in the abstract or title, but only 446 of those also contained enjoyment. To put these results in context, self-efficacy, another predictor of physical activity, yielded 1,922—over four times more articles.

Steps should be taken to better incorporate enjoyment research into public health theory, dialogue, and action. In this paper, we outline five challenges that we believe have limited physical activity enjoyment research to date in the public health sphere, provide examples, and offer solutions for each.

Challenge 1

Enjoyment is difficult to define. One challenge in enjoyment research is clearly defining the concept, and differences in opinion exist among researchers about the proper definition of enjoyment.¹⁷ Most youth-focused sports research has defined enjoyment as “a positive affective response to sport experience that reflects generalized feelings such as pleasure, liking, and fun.”¹⁷ However, this definition is limiting in that it expresses enjoyment merely as a positive affective response, failing to take into account two variables that have been shown to be strong predictors of enjoyment: the challenge of the activity and the skill of the individual performing the activity.^{18–20} To address this shortcoming, some researchers have referred to enjoyment being one and the same as the concept of “flow.”²¹ Proposed by psychologist Mihaly Csikszentmihalyi, flow is a psychological state of operation in which a person performing an activity feels cognitively efficient, motivated, and happy.^{18,20} Flow is characterized by a feeling of full focus and involvement, and relies upon the consideration of challenge-skill balance.^{18–20} In other words, the optimal enjoyable physical activity experience occurs in a state of equilibrium when one perceives oneself as both optimally challenged and confident in his/her skill for the activity.^{18,19} While it may be too simplistic to define enjoyment as merely a positive affective state, it also may be too restrictive to define enjoyment as only flow. Both definitions fail to include social factors, such as socioeconomic status (*e.g.*, being poor may affect access to resources that could enhance one’s skill), and neither places enjoyment within the context of time (*e.g.*, the perceived challenge of an activity may be different from one day to the next, or may change with practice).

Solution 1

Clearly define the concept of enjoyment in research projects, and consider multiple levels of influence. Researchers studying physical activity enjoyment should be transparent about how they define the concept. Public health research could borrow from pre-established definitions, but then should situate enjoyment within multiple levels of influence and across time and space. For instance, one might imagine that peak physical activity enjoyment would take place when challenge and skill optimally intersect, but in public health, we recognize that this intersection depends upon the influence of intrapersonal issues, social environment, built environment, and time.

Our proposed definition of enjoyment sits at the intersection of the common sports research definition and the psychology-based definition of enjoyment as “flow.” As discussed in our paper on children’s enjoyment of physical activity at a summer tennis camp, we conceptualize physical activity enjoyment as a positive affective response that reflects feelings of fun, excitement, and interest at a particular time in a particular space. Furthermore, we assume that enjoyment is influenced by the perceived challenge of the activity and the perceived skill of the participant, as well as intrapersonal factors such as age, sex, and race/ethnicity (Barnett EY, Ridker PM, Okechukwu CA, Barrett JL, Gortmaker SL, unpublished data, 2016). This definition establishes enjoyment as both a positive affective response *and* a function of the skill-challenge balance of the individual performing the activity, while maintaining a public health perspective by acknowledging that context matters.

Challenge 2

Enjoyment is perceived as being difficult to measure. Enjoyment is an intangible state that cannot be observed directly. However, public health research has successfully taken on the task of measuring other latent variables such as depression or anxiety. Arguably, the same

approach to measurement and scale development used to measure phenomena such as these can be used to measure enjoyment.

In fact, reliable and valid measures of physical activity enjoyment do exist. For example, the 18-item PACES (Physical Activity Enjoyment Scale) consistently has been validated among children and adults.⁸⁻¹¹ The Sport Enjoyment Scale, often used in sport and exercise science studies, has demonstrated construct validity and good reliability in various studies.^{22,23} Furthermore, a simple three-item scale asking participants to circle a number from 1 (not at all) to 5 (very) to indicate how interesting, exciting, and fun the activity was, has shown high reliability ($\alpha=.88$).^{19,24} Although construct validity has not yet been tested, this scale demonstrates content validity, as it was designed to reflect the conceptual definition of physical activity enjoyment. This scale only takes approximately one to two minutes to complete, and has the additional advantage of being readable and understandable for younger audiences. In one of our studies assessing enjoyment levels of 9-17 year olds during activities held at a summer tennis camp, the reliability for this scale also was high ($\alpha=.88$; $\alpha=.93$ for girls; $\alpha=.84$ for boys) (Barnett EY, Ridker PM, Okechukwu CA, Barrett JL, Gortmaker SL, unpublished data, 2016). (See Figure 3.1.)

Solution 2

Make measurement advances by further validating existing measures and developing new ones. Measurement is one of the most important areas to pursue in enjoyment research because if it is not measured well (or at all), we cannot know its significance. Certainly, a major challenge in enjoyment research is identifying the most reliable, precise, reproducible, and valid ways to measure it. Although some validation studies have been conducted on existing physical activity enjoyment measures, additional studies assessing the reliability and validity of self-

reporting enjoyment instruments would give researchers more clarity and confidence regarding the tools available to them for enjoyment research. Studying the temporal aspects of measurement (*e.g.*, when did the enjoyment assessment take place— during or after the activity?) may help establish guidelines for which measures are most relevant for specific times. Good measures of enjoyment do exist, but so does the opportunity to create new ones. For example, physiological measures of enjoyment are uncharted territory. While the actual release of endorphins (like the ones believed to contribute to “runner’s high”) is difficult to study, some proxies for endorphin release exist.^{25,26} Validated measures would make enjoyment more accessible to researchers and would increase enjoyment’s research popularity.

As with any approach to measurement, the conceptualization must match the operationalization. Future research must always clearly define how enjoyment is being conceptualized. In our study on physical activity enjoyment at a youth summer camp, our definition of enjoyment included how “fun, exciting, and interesting” participants perceived an activity to be, and thus we measured perceived fun, excitement, and interest (Barnett EY, Ridker PM, Okechukwu CA, Barrett JL, Gortmaker SL, unpublished data, 2016).

Challenge 3

Major health behavior theories have not conceptually included enjoyment. Health behavior theories do not explicitly include enjoyment as a determinant of physical activity adoption and maintenance. Many health behavior theories underscore the importance of self-efficacy, which is the belief in a person’s capability to produce given attainments.²⁷ In fact, self-efficacy is one of the most studied constructs in physical activity research, which has demonstrated a consistent relationship between self-efficacy and physical activity behavior.^{28,29}

While self-efficacy is a cognitive factor that influences behavior through beliefs in personal capabilities, enjoyment is an affective response that impacts behavior through the experience or expectation of pleasure, liking, or fun.^{17,27,30} Self-efficacy shows up in many popular health behavior theories, while enjoyment is discussed in sport and exercise psychology theories. For example, self-determination theory, a popular theory in sport psychology literature, asserts that when someone is intrinsically motivated to exercise, the person experiences feelings of enjoyment, excitement, and personal accomplishment; exercise may be performed for the associated enjoyment alone or for the challenge of participating in it.³¹ Self-efficacy and enjoyment are related in that an increase in one may result in an increase in the other, which then impacts physical activity behavior.³⁰ However, self-efficacy is not the same as enjoyment. Standard ways to assess self-efficacy might include items like “How confident are you that you can perform 30 minutes of physical activity per day?” People may feel confident that they can exercise, but this does not necessarily translate to enjoyment. Some research suggests that enjoyment is an even stronger predictor of physical activity behavior than self-efficacy.³⁰ The exclusion of enjoyment is a huge limitation in health behavior theory.

Solution 3

Incorporate the concept of enjoyment into existing health behavior theories. To conduct relevant and significant public health research and to produce successful and evidence-based public health interventions, we need to carefully ground our research in relevant theory.³² However, enjoyment research cannot be grounded in health behavior theory if enjoyment is an excluded concept. Future studies should find a place for enjoyment in existing theories, then attempt to test theoretical assumptions regarding the effects of enjoyment on physical activity adoption and maintenance.

In order to integrate enjoyment into health behavior theory, it must be clearly defined. Following our comprehensive definition of physical activity enjoyment—a positive affective response that reflects feelings of fun, excitement, and interest at a particular time in a particular space, and influenced by challenge, skill, and interpersonal factors— we propose a multi-level understanding of the concept that could be incorporated into existing health behavior theories. For example, we know from public health research that socio-environmental context, such as one’s neighborhood characteristics or the social support received from parents or peers, greatly impact health behaviors.^{17,33} Likewise, these layers impact one’s experience and enjoyment of physical activity. If enjoyment is to have a place in health behavior theory, it should be regarded within multiple layers of influence (see Figure 3.2). According to our proposed conceptualization and consistent with other ecological models referenced in public health research, each level both influences and is influenced by other levels.

This understanding of enjoyment builds upon the “circuit of body-reflexive pleasures,” as proposed by Wellard, who asserts that the experience of pleasure lies within the context of social, physiological, and psychological processes, all of which can occur at any level of influence, across time and space.³⁴ Wellard notes that feelings such as enjoyment or pleasure occur as part of a process in terms of how something can *become* pleasurable. The dimension of time in our model addresses this same idea: experiences of enjoyment may shift over time, for a variety of reasons (*e.g.*, the biological effects of aging, changing population trends in physical activity behavior, skill enhancement as a result of practicing the activity over time, boredom, etc.). For example, an activity may become more (or less) enjoyable as one engages in it more frequently.

To ascertain how exactly enjoyment could fit into particular health behavior theories, further development of the understanding of the concept is necessary. Future studies could explore particular pathways to enjoyment or specific mechanisms that connect physical activity enjoyment to physical activity adoption and maintenance. We have specified our conceptualization of enjoyment to help public health researchers begin to consider how and where it could be inserted into health behavior theory. For example, enjoyment could be integrated into social cognitive theory, a theory of human motivation that emphasizes the dynamic, reciprocal interplay between behavior, personal factors, and the environment.³⁵ Some existing constructs of social cognitive theory are loosely related to enjoyment. For instance, the construct of “emotional coping response” gets at mood states (*e.g.*, anxiety) that can limit a person’s ability to carry out a behavior. Enjoyment, on the other hand, would tap into *positive* mood states that can *facilitate* a person’s ability to carry out a behavior. The inclusion of enjoyment as a construct is a small change that would make a substantial difference in the availability of useful frameworks with which to understand physical activity behavior and enjoyment.

Challenge 4

Most large-scale interventions do not prioritize enjoyment. A strategic focus on enjoyment research—and the theory behind it—also could have implications in public health campaigns and interventions. Large-scale, national interventions are often theory-based, and theory-based interventions are commonly informed by health behavior theories like social cognitive theory or the transtheoretical model.³⁰ Federal guidelines encourage adults to “help [children] find activities that they enjoy and that are right for their age,” yet because enjoyment is not included in these theories, it is likewise overlooked in national initiatives.³⁶ Many health

behavior theories have become widely accepted by government agencies, which are eager to fit their programs to the tenets of predominant models. As Wellard notes, one of the key issues with applying current theories of health behavior to initiatives is the compartmentalization of “types” of behaviors or “stages” of change.³⁴ As a result, national initiatives may become outcome-focused (*e.g.*, applying social cognitive theory and rewarding people with incentives when they are physically active), rather than process-focused (*e.g.*, building in enjoyable elements of physical activity so people may become more internally motivated to be physically active).³⁴

For example, the American Heart Association (AHA) established a 2020 impact goal to “improve the cardiovascular health of all Americans by 20%”.³⁷ Consequently, the AHA identified and widely circulated “Life’s Simple 7,” a compendium of lifestyle and behavioral steps that can result in improvements in health.³⁸ In this guide, enjoyment is not specified in any of the seven steps, and any information even tangentially related to enjoyment is difficult to retrieve. For instance, at three disjointed clicks away, from the “Get Active” step to the “Getting Active” sub-page, and finally to a choice of eight articles, a reader could access one that is entitled “5 Steps to Loving Exercise... Or At Least Not Hating It”.³⁹ Life’s Simple 7 fails to integrate enjoyment into its principal lessons, which would have been simple enough. What if, under the “Get Active Tips for Success,” the AHA encouraged people to learn to identify activities they enjoy, rather than to “learn your resting heart rate”?

Michelle Obama’s “Let’s Move!” campaign, which is “dedicated to solving the challenge of childhood obesity within a generation,” has a website that features specific action steps for kids.⁴⁰ The “Take Action: Kids” page calls upon children to “do their part [in solving the problem of childhood obesity], especially kids like you. By eating right and being active, you can be healthy and achieve your dreams.”⁴⁰ While the action steps for kids do not make any

reference to enjoying activity, enjoyment does surface in its recommendations for active communities: “Mayors and community leaders can promote physical fitness by... providing fun and affordable sports and fitness programs.”⁴⁰ And, in 2015, the First Lady appeared on The Ellen DeGeneres Show, promoting the “#GimmeFive challenge,” which encourages Americans to give out high-fives when they witness someone making a healthy choice. Obama promoted this initiative by performing a group “#GimmeFive” dance and encouraging people to learn the steps. She is moving in the right direction, incorporating into the promotion of her initiative an activity that seems fun (in videos of the #GimmeFive dance, people tend to be smiling and laughing). Still, the specific goals listed for children are outcome-oriented, citing minutes of physical activity needed per day and daily activity step goals, clearly focused on obesity prevention and management rather than explicitly stressing enjoyment as a fundamental reason to be active.

Solution 4

Recommend that leading health professionals and representatives highlight the role enjoyment can play in healthy living. Many public health campaigns encourage large groups to uptake exercise for a set amount of time. However, they often fail to include physical activity enjoyment.³¹ Because enjoyment is linked to physical activity sustainment, including enjoyment as a prerequisite in the intervention development stage will increase the likelihood that people will sustain the activity after the campaign ends. Health professionals should be trained to promote intrinsic participation motives that contribute to enjoyment, such as social engagement, optimal challenge, and skill development, since the presence of these motives is associated with increased physical activity and long-term maintenance.³¹

National health promotion initiatives should highlight—not obscure—the role that enjoyment can play in health behavior change. Healthy People 2020, the set of nationwide health promotion goals set by the United States Department of Health and Human Services, should incorporate enjoyment into its 10-year agenda for improving the health of Americans. Healthy People 2020, which seeks to “improve health, fitness, and quality of life through daily physical activity,” emphasizes that physical activity levels are positively influenced by 1) the built environment (*e.g.*, bike lanes and parks) and 2) legislative policies that improve access to facilities.⁴¹ Enjoyment should be added to this list. The inclusion of enjoyment would encourage program planners and legislators to think more about processes and mechanisms at play in physical activity adoption and maintenance.

National initiatives can learn from some smaller-scale interventions that have placed enjoyment at the center, and have shown evidence for positive effects of enjoyment on health behaviors. The late researcher and practitioner Antronette Yancey consistently spotlighted enjoyment in her interventions, especially in her concept of “instant recess” as a feasible, scalable, physical activity promotion model: “[Recess] connotes fun and enjoyment, placing physical exertion in a positive and appealing light—eagerly anticipated and awaited, not dreaded as an obligation—play not work!”⁴² Another intervention, the Sports, Play, and Active Recreation for Kids (SPARK) program, is a physical education curriculum that was designed to be enjoyable; it demonstrated a significant increase in physical activity and fitness over two years in the intervention vs. control group.⁴³ Tom Robinson and his research team have disseminated to school-aged children dance-based interventions, specifically created to make weight control fun.^{44,45} He calls these programs “stealth interventions,” meaning that the kids are having so much fun that they forget to notice they are exercising.⁴⁵

This “stealth” approach could be used in national interventions, for children and adults alike. A major limitation of outcome-focused interventions—those same ones that fail to include enjoyment—is they may not be appropriate for children. For example, initiatives grounded in value-expectancy theories would assume that people are rational actors in their health-related decisions, but for most children, motivation to be physically active stems from physical or emotional states (*e.g.*, feeling energized or happy), not logic (*e.g.*, health protection or weight control).⁴⁶ While an adult may be motivated to lose weight via a strict weight loss program, this approach is not appropriate for children except for those with severe obesity.³⁴ Health benefits of physical activity that adults may be aware of (weight loss, heart health, etc.) are likely not at the forefront of children’s minds. In fact, it conceivably could be detrimental for children’s long-term sustainment of physical activity if they are encouraged to play for the sake of “keeping in shape” rather than play for the sake of playing. In research and in practice, it is essential to acknowledge the influence of enjoyment in children’s initial experiences of physical activity, not only because enjoyment may improve their experience in the present state, but mainly because it plays a fundamental role in their experience of physical activity across the life course.³⁴

Challenge 5

Researching enjoyment may be seen as frivolous or confusing. Enjoyment research may be dismissed as just trivial “fun”; the term itself may delegitimize its significance and seriousness as a research topic.³⁴ Indeed, it is difficult to prioritize enjoyment of physical activity within the public health context when issues related to poverty, for instance, can preclude or encumber either physical activity or enjoyment (or both). However, physical activity enjoyment research can have large-scale implications at organizational (*e.g.*, physical education programs at schools) and public policy (*e.g.*, strategic planning for public recreational facilities)

levels. For health practitioners, teachers, coaches, parents, and others who influence and encourage children's physical activity, the emphasis may not be on enjoyment. Reaching the "elite" level of a sport often requires specialization, year-round play, national travel, and an excess of time and money, with success perhaps defined by a win-loss record, not by the level of enjoyment achieved. While the low percentage of children who play sports at a high level may go on to receive scholarships or even play professionally, the vast majority of kids would benefit from the prioritization of enjoyment in physical activity programs and sport competition. Because physical activity enjoyment is predictive of physical activity adherence later in life, shifting the focus in avenues like youth sports would be a lifelong win.

Another issue that precludes researchers from tackling enjoyment may be that enjoyment is not outcome-specific. This could be confusing for those interested in studying it. Enjoyment of physical activity can lead to a range of positive health consequences, and thus is not usually pinpointed as a predictor of one particular outcome. Although much public health attention has been allotted to physical activity's effect on childhood obesity, little focus has been given to predictors of physical activity adoption, which also can lead to prevention of excess weight gain and improved overall health. In fact, the growing emphasis on specific outcomes such as obesity (*i.e.*, the "obesity epidemic") perhaps further undermines enjoyment research because it shifts the focus from physical activity as recreation to physical activity as a structured weight loss program. The fact that enjoyment could be studied as a predictor or an outcome may further confuse researchers. For example, our study on children's physical activity enjoyment found that activities that involve skill, challenge, and competition significantly predict an activity's enjoyment score (Barnett EY, Ridker PM, Okechukwu CA, Barrett JL, Gortmaker SL, unpublished data, 2016). So, where should researchers start—with a question asking what leads

to enjoyment, or one asking what results from it? All areas of enjoyment need to be researched further in public health. We view this not as a dilemma but as an opportunity.

Solution 5

Strategically include enjoyment in the public health research agenda to begin documenting its antecedents and consequences. Incorporating physical activity enjoyment research into the public health agenda is a proposition that could dramatically improve health outcomes. Physical activity enjoyment research can have wide-ranging implications at multiple levels.

In order to further develop an understanding of enjoyment's impact on health behavior, we need to diversify the portfolio of enjoyment studies. First, enjoyment can and should be studied as both a predictor and an outcome. That is, we should ask not only how enjoyment leads to sustained physical activity, but also ask what leads to enjoyment. Second, while quantitative studies are necessary to test interventions and assess measurement techniques, qualitative studies should not be discounted and may be especially helpful in studying enjoyment as an outcome. Qualitative approaches such as ethnographies could help clarify attitudes around physical activity and enjoyment. Children need opportunities to experience different types of physical activities so that they can make their own judgments about what feels enjoyable to them; as this happens, researchers should be ready to capture individual stories, which can help explain some of the details and nuances that quantitative studies may miss.

Third, we need to utilize various types of quantitative study designs. We should embark upon straightforward randomized controlled trials to begin to collect evidence that enjoyment really matters. One recent study randomized participants to either "fun" or "exercise."¹⁶ The "fun" group was told the purpose of the activity was to do something fun, while the "exercise"

group was told that the purpose was to exercise, but both groups were assigned to follow the same one-mile walking route. In this study, researchers found that the framing of exercise as fun positively influences subsequent healthier eating and snacking. The lessons from the study, as well how the study was designed, could serve as an example for research investigating other health outcomes, such as physical activity sustainment. Interventions with a long-term follow-up would be beneficial in assessing how enjoyment of physical activity in childhood impacts physical activity levels in adulthood. We should develop intervention evaluation research that demonstrates the effects when physical activity is accompanied by enjoyment. Further, with a well-executed longitudinal study, researchers could detect developments or changes in the population's enjoyment of physical activity, and may build a better picture of how enjoyment shifts across the life course. For example, how might enjoyment levels change from developmental stage to developmental stage (*e.g.*, childhood to adolescence)? Longitudinal studies that quantify enjoyment levels and follow them over time to see whether change takes place can have real impacts on physical activity uptake, adherence, and long-term maintenance.

Conclusion

There is plenty of evidence for the health benefits of physical activity. Given the decline in physical activity from childhood to adolescence and through adulthood, strategies should be developed to cultivate and facilitate regular physical activity participation. Enjoyment research not only fills a gap in public health literature, but also is a crucial piece of the health behavior change puzzle.

Enjoyment research can have significant and positive impacts in public health and in clinical settings. For instance, enjoyment research could better inform how clinicians “prescribe” physical activity for their patients. As research continues to demonstrate the importance of

enjoyment in physical activity behavior, clinicians may be more thoughtful about physical activity prescription, helping their patients identify which types of activities resonate with them. They may ask questions such as, “What does physical activity mean to the patient?” and “What activities does the patient report enjoying?” Prescribed exercise is generally not associated with physical activity for enjoyment, such as hiking, playing sport, or dancing.³¹ If options like these are not considered worthwhile in the eyes of the clinician—and patients instead are relegated to activities they do not enjoy—exercise prescription is less likely to impact physical activity adoption and maintenance. Enjoyment research may encourage medical professionals to reconsider the status quo of intake forms and questionnaires. For example, adding a simple question that asks patients about what activities they enjoy most—as well as what increases their enjoyment of certain activities (*e.g.*, listening to music or watching a TV show while on a treadmill)—would allow clinicians to better “match” patients with prescribed activities.

The problems and solutions outlined in this paper are interrelated. All need to be addressed if we wish to further the enjoyment research agenda. We cannot have a valid measure without a clear definition, and we cannot show significant impact without a good measure. We cannot create interventions without an underlying theory, and we cannot build interventions and test theoretical concepts without well-defined research objectives. It is clear that nationwide surveillance data is needed in the area of physical activity enjoyment; without systematically collecting, analyzing, and interpreting enjoyment-related data, we cannot design, implement, and evaluate enjoyment-related physical activity initiatives. This research has the potential to impact multiple levels, from individuals to schools to public sectors, and could have significant implications for various health behaviors. Physical activity enjoyment research could lead to broader enjoyment research that informs clinical and public health strategies seeking to

overcome or reduce the risk of negative health behaviors that have “enjoyable” qualities, such as smoking or overeating. Lessons learned from physical activity enjoyment research could be applied to other health promotion efforts, such as healthy eating, sun protection, and stress management. Considering the impact that enjoyment research can have on multiple health behaviors—at multiple levels—enjoyment should be at the forefront of public health research and dialogue. It’s time for public health to have some serious fun.

Acknowledgments

This work was supported in part by the Donald and Sue Pritzker Nutrition and Fitness Initiative, the BWH Training Program in the Epidemiology of CVD (National Institute of Health T-32 Training Grant HL07575), and the Centers for Disease Control and Prevention (Prevention Research Center grant U48DP001946). The content is solely the responsibility of the authors and does not represent the official views of the National Institute of Health or the Centers for Disease Control and Prevention.

Conflict of Interest

The authors disclose no conflicts of interest.

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Figure 3.1. Activity enjoyment assessment

Think about the activity you just completed. Then, circle a number to tell us what you thought about the activity.

1. How interesting was it?

not at all interesting 1-----2-----3-----4-----5 very interesting

2. How exciting was it?

not at all exciting 1-----2-----3-----4-----5 very exciting

3. How fun was it?

not at all fun 1-----2-----3-----4-----5 very fun

Figure 3.2. Conceptual articulation of levels of influence on enjoyment

Level of Influence	Examples of level-specific phenomena that relate to enjoyment	Examples of level-specific questions to ask when designing a physical activity enjoyment intervention for children
Intrapersonal	Attitudes, beliefs, physiological responses, demographic characteristics	How do children's attitudes towards the program affect their participation in it? How does one's physiology impact one's experience of the activity?
Interpersonal	Social environment, social interactions, connectedness, support	How can children's friendships and relationships enhance the intervention?
Organizational	Organizational climate, culture, resources (<i>e.g.</i> , health insurance), collective efficacy	Are school administrators supportive of this intervention? Who are the advocates and what pushback can be expected?
Environmental	Built environment, neighborhood characteristics (<i>e.g.</i> , violence, air quality, access to parks), weather	What community resources could be accessed that could impact physical activity opportunities and enjoyment?
Political	Health, economic, social, and educational policies	What are the physical education requirements and limitations set forth by the school system? What policies are in place that may impact kids' experiences of physical activity?
Temporal	Effects of aging, historical trends	How has physical activity among children changed over the past 10 years? What can we expect to happen in the future?