Quantifying the Contribution of Public Parks to Physical Activity and Health

Introducing SOPARC

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Quantifying the Contribution of Public Parks to Physical Activity and Health: Introducing SOPARC

Summary

Because public parks contribute to health and well-being, primarily by serving as an important venue for physical activity, it is in the best interests of park administrators to have a method to measure this contribution. Physical activity is one of the most important routine behaviors that reduces chronic diseases and improves health outcomes for all age groups. Nearly 11 percent of all deaths and a significant proportion of chronic conditions, including heart disease, diabetes, and cancer, among Americans are directly attributable to physical inactivity. While parks offer health benefits beyond physical activity, physical activity can be objectively measured and is an excellent way to demonstrate the value of parks.

This paper introduces the System for Observing Play and Recreation in Communities (SOPARC), a reliable, valid, and easy-to-use tool for quantifying park use and park-based physical activity. SOPARC requires mapping parks into distinct target areas and establishing a systematic way to rotate through the park so that all persons in every target area can be counted by gender, age group, and activity level. When done multiple times during the week on different days and at different times, the results can be aggregated to provide a generalizable picture of park use and the level of moderate-to-vigorous physical activity that occurs within the park boundaries. Repeating these assessments over time can allow park administrators to evaluate the impact of policies, programs, and park improvements on park use, capturing the number, characteristics, and activity level of park users who visit parks but do not formally enroll in park-sponsored programs. SOPARC also assesses the characteristics of the activity spaces in the parks, providing insights into park features that can attract users and support physical activity. Park administrators should understand how to use SOPARC so that they can collect data that justifies expenditures in parks and recreation departments. Toward that end, we lay out in some detail what SOPARC is and how it is used, as well as providing background information on the importance of physical activity to health.

Introduction

Urban green space and public recreation areas, or “parks,” are often viewed as key factors in increasing physical activity, thereby preventing obesity and reducing the incidence of chronic medical conditions, not to mention improving mental health and overall quality of life. Parks may also improve public health by increasing social interaction, reducing stress through exposure to nature, and more. Being able to show the positive outcomes of investment in public parks is useful for municipal park departments that depend on local funds for their programs, infrastructure, and activities.

This paper begins with a brief discussion of the evidence that links physical activity to improvements in health (Section 1). In Section 2, we describe ways that parks contribute to health, focusing on physical activity.

Given the need for park administrators to document the role of parks in physical activity, Section 3 introduces the System for Observing Play and Recreation in Communities (SOPARC), a reliable, valid, and easy-to-use tool for quantifying park use and park-based physical activity. Park administrators can use SOPARC to collect data that justify expenditures in parks and recreation departments. To that end, in Section 4 we provide detailed instructions and examples of its use.

Appendix A describes standard economic approaches that could be used to assess the value of parks and other venues in improving physical activity. Appendix B includes a table summarizing the results of a review of multiple studies showing the relationship between physical activity and health care savings.

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1. The Link Between Physical Activity and Health

Unfortunately, most Americans do not spend enough time being physically active, increasing their risk for multiple chronic diseases and injuries from weak muscles and fragile bones. While approximately one-half of all American adults *report* meeting the national physical activity guidelines, a national study measuring physical activity with accelerometers indicated that less than 5 percent of adults, 9 percent of adolescents, and 42 percent of children actually met recommended guidelines (Troiano et al., 2008). Current adult physical activity guidelines call for at least 150 minutes per week of moderate-to-vigorous physical activity (MVPA)—an intensity of exercise equivalent to a brisk walk (about 4 mph). Sixty minutes of MVPA daily are recommended for children and teens.

Failure to engage in sufficient physical activity has potentially serious consequences. Indeed, an estimated 10.8 percent of all deaths in the United States is attributable to physical inactivity (Lee et al., 2012). Physical inactivity is responsible for 6.7 percent of U.S. deaths from coronary heart disease (Lee et al., 2012). Physical activity affects multiple systems in the body, particularly the circulatory and musculoskeletal systems. Fully one-third of all U.S. adults over age 20 have hypertension, a cause of both heart disease and stroke. This number is even higher among African Americans, among whom 44 percent are affected (Go et al., 2014).

Osteoporosis has also been linked to physical inactivity. Among those with osteoporosis, the bones become weak and are more likely to break, especially those in the hip, spine, and wrist. Bones strengthen in response to weight-bearing physical activity and weaken without it. In the United States, more than 40 million people either already have osteoporosis or are at high risk due to low bone mass (National Institutes of Health, 2011).

Colon and breast cancers are also common in the United States; an estimated 96,830 new cases of colon cancer and 235,030 new cases of breast cancer are expected in 2014 (American Cancer Society, 2014). Physical inactivity is considered responsible for 12.4 percent of deaths from breast cancer and 12 percent of colon cancer deaths (Lee et al., 2012).

Physical inactivity is the underlying cause of 8.3 percent of deaths from type 2 diabetes (Lee et al., 2012). Currently 29.1 million people, or 9.3 percent of the U.S. population, have diabetes.

Of these, 21 million know they have diabetes while an estimated 8.1 million (27.8 percent of people with diabetes) do not (Centers for Disease Control and Prevention, 2014). The prevalence of diabetes is greatest among minorities, with 13.2 percent of Hispanics, 12.8 percent of African Americans, 9.0 percent of Asians, 7.6 percent of Non-Hispanic Whites, and 15.9 percent of American Indians/Alaska Natives affected. Furthermore, an estimated 86 million Americans have pre-diabetes, a condition in which individuals have high fasting blood sugar and an increased risk of developing type 2 diabetes, heart disease, and stroke (Centers for Disease Control and Prevention, 2014). The Diabetes Prevention Program, a large prevention study of people at high risk for diabetes, showed that lifestyle interventions leading to weight loss and increased physical activity can prevent or delay the onset of type 2 diabetes and, in some cases, return blood glucose levels to within the normal range (Ratner et al., 2005).

In addition, low physical activity is often associated with depression, a common and treatable mental disorder characterized by little interest or pleasure in doing things and feelings of sadness or hopelessness. Currently 9.1 percent of Americans are estimated to be suffering from depression, with minorities at greater risk than non-minorities (*Morbidity and Mortality Weekly Report*, 2010).

At the individual level, epidemiological studies have calculated the relative risks of contracting chronic diseases for those who remain physically inactive. Table 1 lists the relative risks for a variety of chronic diseases among those who are physically inactive or who engage in only mild or moderate activity compared to highly active individuals—those who exercise vigorously for one hour or more daily (Danaei et al., 2009). Although the highly active individuals always have the lowest disease risk, even those who only meet the activity levels recommended by national physical activity guidelines have lower risk than those who do not. Additionally, those who are only mildly active have lower risk for chronic diseases than those who are completely inactive. For example, the probability (i.e., risk) of developing ischemic heart disease is 16 percent lower for insufficiently active individuals than for completely inactive individuals (1.66 versus 1.97).

Table 1. Relative Risk of Specific Disease Outcomes from Physical Inactivity

		Relative Risk Attributed to Physical Inactivity			
Disease	**Age Group**	**Highly Active*****	**Moderately Active****	**Insufficiently Active***	**Inactive**
Ischemic heart disease	30–69	1	1.15	1.66	1.97
Ischemic stroke	30–69	1	1.12	1.23	1.72
Breast cancer	30–44	1	1.25	1.41	1.56
Breast cancer	45–69	1	1.25	1.41	1.67
Colon cancer	30–69	1	1.07	1.27	1.80
Type 2 diabetes	30–69	1	1.21	1.50	1.76

Source: Danaei et al., 2009.
***Highly active = more than 1 hour of vigorous activity/week AND an activity equivalent to nearly 1 hour of walking at 4 mph every day.
** Moderately active = 150 minutes of MVPA/week (recommended level).
* Insufficiently active = less than 150 minutes of MVPA/week.

2. How Parks Contribute to Health

Parks help improve population health through a number of pathways.

Given the evidence linking physical activity and health, the most obvious way parks might contribute to improving population health is by providing a venue for physical activity. Although the evidence connecting parks with higher levels of physical activity is sparse, some tentative estimates have been made of how much physical activity can be attributed to parks (Han, Cohen, and McKenzie, 2013).

A second pathway by which parks may affect health has been through the role that parks can play in building collective efficacy, a construct that combines social cohesion and mutual trust among neighbors with informal social control—i.e., the tendency of neighbors to intervene on behalf of one another to cope with problems and threats shared by the community. Neighborhood parks have the potential to function as a nucleus of neighborhood activity, where residents can gather for social events, recreational activities, and meetings about community issues, increasing social interaction (Maas et al., 2009). While physical activity–related health benefits are realized at the individual level, collective efficacy could even affect individuals who are not park users themselves.

A third pathway by which parks might affect health, particularly psychological health, is through the opportunities they provide for exposure to nature (Frumkin and Fox, 2011). Contact with nature has been linked to a greater ability to cope with life stressors, improved work productivity, reduced job-related frustration, increased self-esteem, enhanced capacity to pay attention, and greater life satisfaction.

Finally, use of parks during daylight hours increases sun exposure, which is important for producing Vitamin D, necessary for bone health, and possibly for preventing a variety of health conditions, including asthma and heart disease (McGreevy and Williams, 2011; Hill, Graham, and Divgi, 2011; McCurdy et al., 2010). However, the ability of humans to convert sunlight to Vitamin D requires exposed skin surfaces (i.e., wearing a bathing suit) and also depends on the park's latitude. In some northern parts of the United States, the sun can contribute to Vitamin D production only in the summer (Time for more vitamin D, 2008).

Obtaining strong data based on objective measures of park use and linking these data to health measures will be key to demonstrating which of these potential pathways connect the use of parks and/or particular elements of parks to improved health.

3. Linking Park Use to Physical Activity

Connecting park use and park-based physical activity with individual health requires identifying how much time a person spends at parks, as well as the percentage of the person's total physical activity that occurs in parks. At the population level, it requires measuring the percentage of residents who use local parks and how much of their total physical activity occurs there.

Studies investigating where people exercise have repeatedly shown that many people use their neighborhood parks. Nevertheless, studies have also shown that parks are relatively underutilized, meaning that many, if not most, areas in a park have no visitors when observed throughout the week at different times (Han, Cohen, and McKenzie, 2013). This low utilization of parks likely reflects the relatively sedentary lifestyle of most Americans. Across the United States, about 25 percent of the population reports that they engage in no leisure-time physical activity (Moore et al., 2012).

Park use varies by city, season, day, and time of day, and depends on the available facilities, staffing, and programming (Cohen et al., 2012). In one study of neighborhood parks in four cities (Philadelphia, PA; Columbus, OH; Albuquerque NM; and Chapel Hill, NC), residents living within one-half mile of a park reported visiting their local park, on average, between 0.5 and 1.0 time per week (Cohen et al., 2012). Among these same residents, most reported getting exercise in locations other than parks. Among those who reported engaging in exercise, on average, 21 percent reported exercising at home, 17 percent on the streets and sidewalks, and 24 percent in health clubs or fitness centers. Parks were the main venue for exercise for 8.8–17.3 percent of residents surveyed.

In the City of Los Angeles, where the weather is temperate most of the year, 28 percent of residents report that parks are the main place they exercise. It was estimated that every week Los Angeles' 201 neighborhood parks receive 1.1 million hours of use, 660,000 visits, and 404,000 visitors; every week 378,000 hours of park use time are spent in MVPA (Han, Cohen, an McKenzie, 2013). While one could say that 378,000 hours of MVPA is tantamount to 151,200 adults meeting the national physical activity guidelines, the MVPA minutes are not actually distributed that way. Yet the aggregate numbers do provide a benchmark for overall use and establish a starting point from which to compare and understand future park use and park investments. These numbers cannot directly explain health care costs or disease prevalence, but

they do shed light on the potential of Los Angeles neighborhood parks to contribute to the health of its nearly four million local residents.

Past Physical Activity Surveillance Efforts

Ample scientific support demonstrates that physical activity benefits health in general; thus, a direct, objective, and defensible measure of the health contribution of parks would be to simply measure the number of park users and the number who engage in MVPA in the parks. Counting the number of park visitors is in itself an important measure that indicates how well the park is serving the community, since people in parks are likely to engage in some physical activity, even if it does not meet the MVPA criteria. Even insufficient physical activity confers some benefits compared to no physical activity. Parks that are empty cannot contribute to physical activity or any other benefit that could be gained from being in a park.

Just as other government departments track the outcomes of their activities (e.g., police count violations and arrests and measure crime rates, and fire departments count the number of calls and fires extinguished), park administrators can quantify the use of park resources. Numbers are highly useful in justifying budgetary expenditures as well as providing a rationale for greater investments. Such measurements can also be used to compare the contributions among different parks and changes of use within a single park. The total number of park users and the number of those users who engage in MVPA are reasonable indicators that provide an objective measure of a park's contribution to health. These two measures can also indicate the number of people who might be benefiting from exposure to nature and sunlight, as well as opportunities to interact with each other.

While modern technology is evolving and may eventually be able to provide counts of park users and park conditions automatically, no available technological methods have been able to capture the details of park use that would be most valuable for park administrators. Surveillance cameras could record the people in a park, but to summarize the number of users and their type and level of use would still require viewing, counting, and classifying users. Facial-recognition software is not sufficiently advanced for this purpose. Even were such software available, many communities may be uncomfortable with surveillance cameras. An alternative method is to have trained observers visit parks on multiple occasions to manually record what they see—as visual snapshots of park use.

Questionnaires (as opposed to observation) have often been used to assess physical activity. But multiple validation studies have shown that self-report of physical activity is usually highly inaccurate (Craig et al., 2003). Self-report of park use has been shown to have moderate validity, but to make use of questionnaire data, large numbers of a local population would need to be sampled.

The **System for Observing Play and Recreation in Communities (SOPARC)** is a direct observation tool to assess physical activity, general park use, and contextual factors in community parks and recreation centers. SOPARC has been validated and found to be a reliable indicator of park use (Cohen et al., 2013). SOPARC, which can be learned and used easily, is a low-tech way to track park use and to establish benchmarks.

SOPARC was designed to obtain direct information on community park use, including relevant characteristics of parks and their users. It provides an assessment of park users' physical activity levels, gender, activity modes/types, and apparent age and race/ethnicity. Additionally, it provides information on individual park activity areas, such as their levels of accessibility, usability, supervision, and organization (McKenzie et al., 2006). SOPARC methodology analyzes park use through momentary assessment, counting the number and type of park users and cataloging their activities at a single point in time. With multiple assessments, the aggregated observations provide an estimate of weekly park use or park use over seasons or across the entire year.

Examples of Findings from SOPARC Measurements

In a recent national study, we visited 172 parks in 25 cities. Local data collectors mapped these parks using satellite imagery from Google Maps. Figure 1 is a picture of one park in San Francisco with 12 target areas. The bar charts in Figure 2 summarize what was observed on the four days and times the parks were visited. This information represents a snapshot of park use.

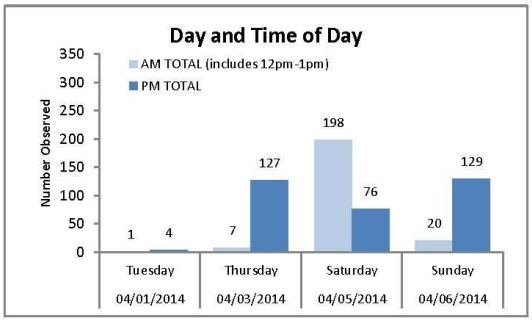
Figure 1. Target Area Map of Carl Larson Park, San Francisco, Spring 2014

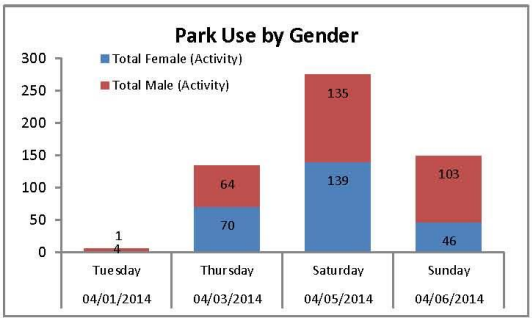
Figure 2. Summary of Use of Carl Larson Park, San Francisco, Spring 2014

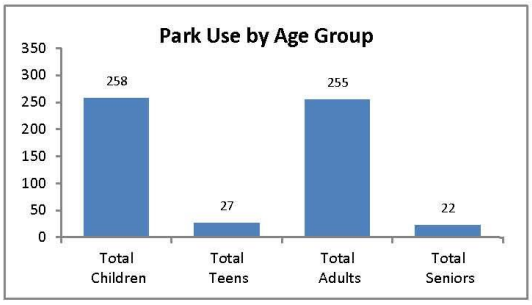
National Study of Neighborhood Parks (NSNP) - Snapshot of Park Use

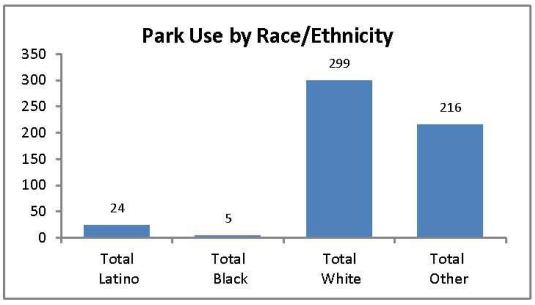
San Francisco

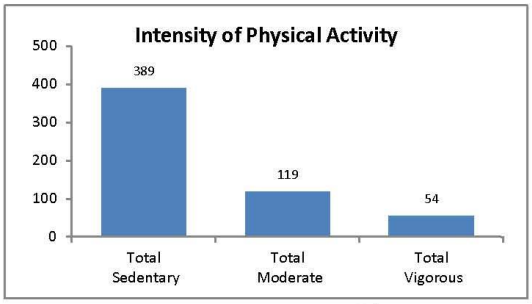
sf02 **Carl Larsen Park** Total in park (exclude wp): 562 Pop (sqmi): 11,806 %Poverty: 4%

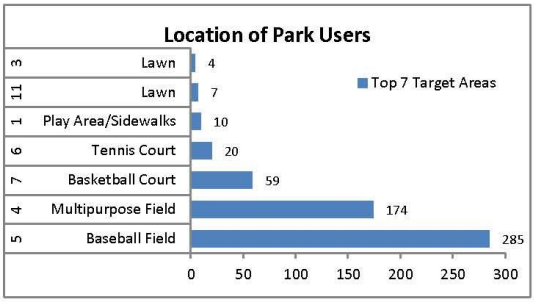












Park Acres: 6.6

Total number on walking path: NA

Number of Target Areas (excluding wp): 12

Number of Target Areas observed: 169

Target Area Conditions:	N	%
Organized	18	10.7
Supervised	17	10.1
Empty	103	60.9
Accessible	169	100.0
Usable	169	100.0
Equipped	18	10.7

Number of Days Conditions Observed: 4

Vendors(in) (yes)	0	Dogs off Leash	3
Vendors(out) (yes)	0	Homeless	1
Weather Windy (yes)	3	Events (yes)	0
Weather Pleasant (yes)	3	Staff (yes)	0
Weather Too Cold (yes)	1	Litter moderate to a lot	0
Weather Too Hot (yes)	0		
Noise Level (noisy)	4	Graffiti moderate to a lot	0
Construction (yes)	0		
Physical Conflict (yes)	0		
Intimidating Groups (yes)	0		

Preliminary Results.
Not Cleared for Release. Do Not Circulate.

HD235/1000
Run Date: 7/17/2014

Comparing Park Improvements and Park Use Over Time

Figure 3 illustrates how SOPARC was used to assess the impact of park improvement on park use over time. In this park, a new gymnasium was added in 2007 and park use immediately increased by over 50 percent and continued to grow substantially over time. When measured in the July 2009, we counted 1,891 park users. After a new walking path and fitness zone equipment were added in 2010, park use more than doubled (3,973 park users). These numbers represent only those counted during four observation hours per day on seven days of the week (28 observations each period). The true number of park users was probably three times higher than what was observed, but the relative increase alone provides an indication of the impact of these new park assets. Being able to show the impact of investments is very useful for park departments that depend on local funds for their programs, infrastructure, and activities.

Figure 3. Changes in Park Use Over Time, Adding a Gym, a Walking Path, and Fitness Equipment

Section 4 describes the use of SOPARC in detail.

4. SOPARC Use and Validation Studies

Observer Training

To ensure that data collection is accurate and reliable, field staff need to undergo training that includes background on physical activity and direct observation, as well as multiple supervised practice sessions in a park in which they are challenged to count large numbers of active individuals in target areas. Several training videos are available:

SOPLAY/SOPARC PART 1-INTRODUCTION (15:26)
https://www.youtube.com/watch?v=hNHAcdSogTk

SOPLAY/SOPARC PART 2-CODING PRACTICE (5:47)
https://www.youtube.com/watch?v=dW5LkMIAYzE

SOPLAY/SOPARC PART 3-ASSESSMENT (4:54)
https://www.youtube.com/watch?v=rrDa287nyXg

Reliability and Validity

Reliability and validity are two measures that describe the quality of a particular measurement tool. Reliability is a measure of agreement, for example, whether two people using the same tool get the same answer or whether one person gets the same answer each time he or she uses it. Validity tell us whether the tool actually measures what it purports to measure.

- **Reliability.** Multiple assessments of SOPARC have shown that it is reliable when applied by trained observers. To examine the reliability of activity counts made by different assessors, intra-class correlations were computed as a means to see whether different observers counted the same number of people doing the same level of physical activity. Correlations were high for sedentary girls (.98) and walking girls (.95), although lower for counts of vigorous girls (.76). For boys, correlations were high for sedentary (.98), walking (.98), and vigorous (.97) behavior. All inter-observer agreements (IOA) and intra-class correlations met acceptable criteria (IOA = 80%, R = .75) (Cohen et al., 2011).
- **Validity.** Validity of the activity codes used by SOPARC has been established through heart rate monitoring (McKenzie, 1991; Rowe, Schuldheisz, and van der Mars, 1997) and accelerometry (Ridgers, Stratton, and McKenzie, 2010). These provide support for the initial construct validity of SOPARC. When measures of physical activity are taken frequently and at random, momentary time sampling techniques have been shown to yield representative and valid samples. Because only brief episodes are recorded, response and recording occur simultaneously, with observations occurring at an approximate rate of one person per second. SOPARC observations have been shown to provide a robust estimate of park-user characteristics and their physical activity engagement (Cohen et al., 2011).

Preparing to Use SOPARC: Mapping a Park

Before data collection, parks should be mapped in detail (see Figures 4 and 5). The goal of mapping is to identify well-defined target areas that can be scanned from left to right without encountering visual obstructions and that are of a manageable size so that all individuals can be counted accurately. A map also establishes a way to systematically observe the park so it can be done the same way at each and every observation.

The number of target areas depends on the size of the park and the features it contains. Each target area usually has a unique functionality (e.g., playground, tennis court). Target areas should be ordered so that observations are done exactly the same way each time a park is observed.

Figure 4. Example of a Park Map Divided into Target Areas

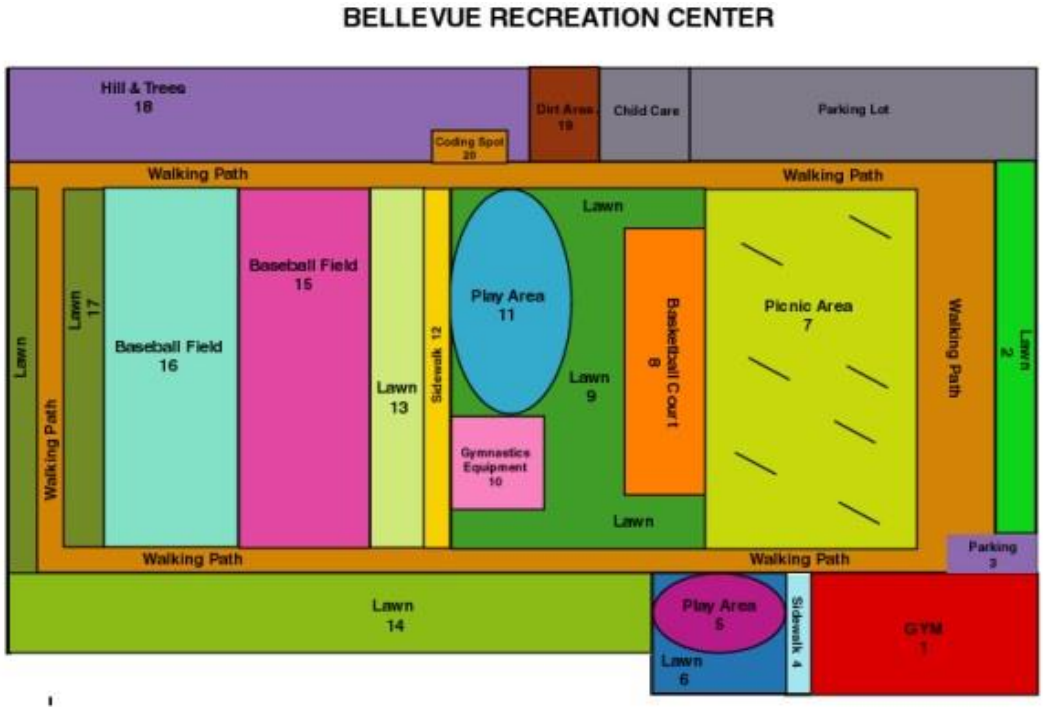


Figure 5. Example of Park Map Using Satellite Imagery

Outline of Scanning Procedures

SOPARC is based on momentary time sampling techniques in which systematic and periodic scans of individuals and contextual factors within pre-determined target areas in parks are made. Relevant target areas within a park (non-overlapping areas that cover all space designed for public use) are first identified and mapped. Assessors then visit the target areas for designated periods and in a set sequence, based on the intent of the study. For greatest validity, SOPARC observations should be made throughout the day, and should include specified times in the morning, midday, afternoon, and evening.

Contextual Factors: Although SOPARC primarily focuses on park users, the tool also measures the conditions of each target area—for example, the area's accessibility and usability, presence of supervision and equipment, and presence and classification of organized activities. SOPARC is only used on clement days, but it is possible to add notes, as needed, about other conditions that may influence park use. For example, information about the temperature or whether the park has a special event or some ongoing construction can help evaluators understand why the number of park users and their levels of physical activity may be particularly high or low.

Coding Physical Activity: Next, the activity of each individual is coded as one of three options: as sedentary (i.e., lying down, sitting, or standing), moderate (e.g., walking, shifting weight from foot to foot), or vigorous (i.e., intensity greater than a walk). Separate scans are made for females and males. Summary counts describe the number of participants by gender, activity modes and levels, and apparent age and race/ethnicity groupings. The instrument permits physical activity level comparisons to be made between different settings or within the same setting over different periods.

Intensity of physical activity can be expressed as the amount of energy expended and can be calculated based on previously validated assessments of energy expenditure for each level of

activity (Ainsworth et al., 2000). Although estimates can be expressed in calories expended—for example, Kcal/kg/min—a simpler metric called METs (or metabolic equivalent) has been developed. One MET is equal to the energy spent by a person at complete rest. One MET-hour is the energy expended at rest for a period of one hour. Based on measures of energy expenditure, sedentary behavior is roughly the equivalent of 1.5 METs, moderate physical activity is 3 METs, and vigorous activity 6 METs. To assess how much physical activity a park engenders, it is possible to aggregate the individual physical activity levels. The formula for aggregating METs across park users is:

Total METs = # Sedentary x 1.5 METS + # Moderate x 3 METS + # Vigorous x 6 METS.

Quantifying the total number of park users and MET-hours expended in a park creates a benchmark to assess performance in the future or to compare target areas or parks and their services within and across jurisdictions. Sometimes, the interest may be only in the number of people involved in MVPA, since at least a moderate level of activity is required for the national physical activity guidelines. In this case, improvements in MVPA can be made not only by increasing the number of people in the park, but also by getting people who are already there to change their activity level from sedentary to moderate or vigorous. The more minutes spent in MVPA, the greater the potential risk reduction for the population. Although it is likely that the actual accrual of minutes per person is highly varied, aggregation provides a way to understand the total contribution of parks to their local populations.

Frequency of Observation Days and Times per Day

While SOPARC provides only a snapshot of park users and may duplicate counts of park users who stay for extended times, we found that as few as 12–16 observations over a week appears to produce sufficiently robust estimates that approximate the same results obtained from 96 hourly measurements of park use and physical activity over a week's time, as long as at least one of the days observed is on a weekend (Cohen et al., 2011). Because use varies from weekend to weekday, it is important to observe parks on weekdays and weekend days, at three to four specified times each day.

If the interest is in estimating park use over a longer period, the same time sampling method can be applied to sample days and times of days over many months and seasons. Logistically, this may take more effort, as it would require that data collectors schedule these times far in advance and may need to re-familiarize themselves with the park and its target areas if the visits are far apart in time. However, if the observers are park employees who are fully familiar with the parks, spreading observations throughout the year may yield a more accurate measure of park use than conducting all the observations in one week.

For a recent national study of 172 neighborhood parks, we used the observation schedule shown in Table 2 (between late spring and early summer of 2014). Observations were made within each park on at least four days of one week during clement weather. If it was raining or weather precluded park use, the observations were rescheduled to the next clement day occurring on the same day of the week (usually one week later).

Table 2. Example Observation Schedule for SOPARC

Tuesday	Thursday	Saturday	Sunday
8 am	12pm	9am	11 am
11 am	3pm	12pm	2 pm
2pm	6pm	3pm	5 pm

In another study of local parks, we spread observations over six months, where one day was randomly selected every month, such that we observed three weekend days and three weekdays over this period.

Choosing Individual Characteristics for Observation

The characteristics for observation should be chosen depending on what is of most interest. The levels of physical activity are the most important to health. Gender and age group are usually of interest, as park administrators may need to target their programming by age and/or gender. Race and ethnicity may be of interest for those concerned about health disparities or equitable distribution of resources. SOPARC is flexible and any of these variables can be chosen (or not selected) for observation.

Because data collectors are people, observations are subject to judgment error and other sources of human error. We found that the reliability of MVPA observations were poorer than those pertaining to race/ethnicity and age group. (Because movement changes very rapidly, it is sometimes difficult for observers to agree on whether a person is in moderate or vigorous physical activity, since they may be observing the active person at slightly different moments.) Judging gender has the smallest measurement error. In our experience, measurement errors associated with the SOPARC protocol are reasonably small. In one study using SOPARC, observers actually interviewed the park users after observation and compared their judgments of apparent gender, age group, and race/ethnicity. Agreement between observed and self-reported characteristics was over 98 percent (Whiting, Larson, and Green, 2012).

SOPARC is flexible in that it is possible to add a variety of variables to what is observed. It is possible to record, for example, whether park users are with dogs, on bicycles, etc. The final selection should be chosen based on what will address issues that the evaluators care about.

Inferring Individual Characteristics

Although some believe that it is inappropriate to guess someone's personal characteristics by how the person looks, this is something people do automatically all the time. With experience, we learn to associate apparent features with characteristics—for example, someone wearing a dress is usually female, and someone bare-chested and sporting a crew cut is usually male. Of course there are many exceptions, but when there are hundreds of people in the park, it is not feasible to stop and interview each person to confirm what in many cases seems obvious. Moreover, doing so would interrupt or change many of the behaviors being observed.

Practical Use of SOPARC

Data Collection

Observations can be recorded on paper or on templates developed for smartphones, PDAs, or tablets. The most important thing is to find a method that will allow the observer to easily aggregate the data so that results are quickly available for use and interpretation. For this reason, digital methods are ideal, as software can be developed that can instantly summarize the data as it is entered.

The Online App: RAND has a free application available online that can be used by observers with an Internet connection. This app automatically aggregates data and allows users to download the data into an excel file. It can be accessed at http://www.rand.org/health/surveys_tools/soparc/user-guide.html. The app automatically provides bar charts that summarize the data, similar to the ones shown in Figure 2.

iSOPARC: This is a downloadable application for iPADs only. iSOPARC implements the SOPARC protocol strategies in an effort to assist the scientific community and practitioners in generating important data from the field and to store, process, and export it. It allows for separate scans for gender and age grouping. An operational Internet connection is not needed for data collection. The app is available from https://itunes.apple.com/us/app/isoparc/id626580694?mt=8

Open Data Kit: For our national study of parks, we are using Open Data Kit (ODK), a platform for data collection that allows users to record data on a tablet using an Android operating system. It allows the data to be sent to a third-party aggregator. ODK also affords options for customizing changes in the protocol to suit individual needs. Basic service is free and Internet connectivity is not needed for data collection.

There are multiple other applications, such as **Pendragon**, **EpiCollect**, and **Command Mobile**, that can be used for collecting field data. Users should choose platforms that best serve their needs.

Limitations

SOPARC can reveal how well a park serves its community and offers opportunities for health promotion. It can also provide information to support efforts to improve health promotion. However, because SOPARC only collects information on activity within parks, the results cannot convey the complete contribution of parks to all physical activity. For example, if we see more people in the park, we do not know whether they are just relocating their activity from elsewhere, rather than actually increasing their overall physical activity. In the past we have also conducted surveys of park users and local residents. This information complements the SOPARC observations and can provide an indication as to whether increases in park use may actually reflect population-level changes in physical activity; it sheds additional light on what we observe. We can directly ask park users about their usual level of physical activity, where they usually engage in physical activity, and whether they go to other parks.

The main component of SOPARC is a direct observation tool for measuring a snapshot of physical activity. Direct observations cannot give quantitative MVPA assessments (e.g., duration), but instead provide ordinal MVPA status, making it possible to see relative changes

over time in the park setting, rather than absolute amounts. The primary limitation of SOPARC is the reliance on human observers who are subject to judgment error and other types of human error.

Conclusion

Physical activity is critical to good health and parks provide a venue in which physical activity can occur. Because the traditional economic valuations of park use do not capture the data we need to understand the role parks play in fostering physical activity, an observational measure of park use such as SOPARC can be used. Measuring park use is necessary to quantify the relative contribution of parks to health and well-being. SOPARC is a tested and validated tool for providing easy-to-understand measures of park use and park-based physical activity. SOPARC can be learned easily by individuals with a variety of backgrounds and training, as the main skills are counting and observing. Potentially, SOPARC could be adopted by park staff, who are already visiting parks as a means to track park utilization and to evaluate the impact of new programs and facilities. Obtaining objective data may be very helpful to support decisions about investments in facilities, infrastructure, and programming, as well as to assess the impact of changes.

Appendix A. Economic Valuation Approaches

Traditional economic valuation methods for public goods that markets fail to provide effectively fall into two groups: revealed preferences and stated preferences (Haab and McConnell, 2002). Revealed preferences study actual behavior and try to estimate how much demand there is for the public good. One example of a way to find out what people's preferences are is to analyze their travel behavior to estimate the willingness of users to "pay" to use a park. The travel cost model requires collecting and analyzing data from park users (or better, the general population) to estimate the "costs" of going to a park—such as how much time and effort people actually spend to go to the park. (Time is money!) People living farther away are likely to go less often, but if people living far away still go regularly, it is an indication of a higher value than if use drops dramatically with distance. Questions would include the origin of the trip (so the costs of traveling can be estimated), and the number of trips in, say, the past twelve months. If only the former question is used, the method is then called zonal travel cost. Unfortunately, the value estimated by this method is extremely sensitive to how travel costs are calculated and there is no clear consensus as to which items ought to enter into the cost calculation.

A second common method is "hedonic pricing," which is based on the fact that some prices of products being sold on the market can reflect otherwise unmeasurable features of the park. For instance, New York City apartments overlooking Central Park are far more expensive than otherwise equivalent apartments without a park view. While these analyses can provide some economic measures, they have other limitations, since they cannot capture social contributions like the public health impact.

Stated preference methods use surveys about willingness-to-pay rather than using actual behavior. The most commonly used method is to ask people using a questionnaire. For example, a survey question would describe a change (e.g., opening a new park or closing an existing one) and respondents are asked how much they would pay for this desirable change (or for avoiding an undesirable change) (Garrod, 1999). In practice, such open-ended questions tend to be difficult to answer.

These two types of economic valuations rely on the traditional economic assumption that individuals make rational decisions and that they are able to value all relevant outcomes. In some cases, this may not be a good assumption. For example, individuals may not be able to assess how proximity to a park or park use could affect their health, a subtle and long-term factor. Yet parks may make a highly valuable contribution to public health. Therefore, a non-economic approach may be more useful to assess parks' contributions.

Harnik and Welle (2009) summarizes some case studies of valuations of other dimensions of parks, including property value, tourism, direct use, community cohesion, clean water, and clean air. Because this paper focuses on ways in which parks contribute to health, our major emphasis is on physical activity.

Appendix B. Summary of Studies Relating Physical Activity to Reduced Health Care Costs

The most important contribution of physical activity is to improve health-related quality of life. This is sometimes quantified by quality-adjusted life years (QALY), a measure of disease burden, which accounts for the ability of someone to live well—i.e., to have full mobility, to be able to care for oneself, to engage in usual activities (e.g., work, study, leisure activities), and to live without pain/discomfort or mental distress (Roux et al., 2008). Another measure to quantify the benefits or cost-effectiveness of a health care intervention is disability-adjusted life years (DALY), which is the number of years lost due to ill health, disability, or early death. However, to use these measures as a way to assess the value of parks, we would have to know exactly how much health a park provides.

A much less useful approach is to focus on an outcome like reduction in medical care, which at best captures a small fraction of the actual value of parks. A number of studies, summarized below, have reported associations between physical activity and health care costs. The first group of studies describes how much physical inactivity contributes to health care costs in several countries. All of them show that between 2 percent and 4 percent of annual health care costs are attributable to physical inactivity. With health care spending around $8,500 per person in 2010 in the United States, and 300 million residents, saving 2.4 percent (or $200 per person) would amount to about $60 billion dollars. By way of comparison, just a fraction of this amount is spent on parks. The Trust for Public Land surveyed 93 U.S. cities to find out how much they currently spent on parks and recreation (Trust for Public Land, 2014). Only 14 cities devoted more than $200 per capita to parks, while the remaining 79 cities spent an average of $83 per person to maintain, improve, and operate local parks.

The studies summarized here, connecting health care costs with physical activity, have all looked at different populations. The dollar figures noted may not be comparable because they have used different methods, although the qualitative conclusions are similar.

Study	Year	Population	Cost of Low Physical Activity/Inactivity
Country-wide estimates			
Colditz. Economic cost of obesity and inactivity	1999	United States	2.4% of U.S. health care expenditures
Wang et al. Physical activity, cardiovascular disease and medical expenditures in US adults	2004b	1996 Medical Expenditure Panel Survey	$23.7 billion per year in medical costs associated with inactivity
Janssen I. Health care costs of physical inactivity in Canadian adults	2012	Canada	3.8% of health care costs
Allender et al. The burden of physical activity-related ill health in the UK	2006	UK population	3% of costs morbidity and mortality attributable to physical activity, or 1.06 billion pounds
Popkin et al. Measuring the full economic cost of diet, physical activity, and obesity-related chronic disease	2006	China	$1.5 billion attributable to low physical activity
Individual-level estimates			
Wang et al. BMI, physical activity, and health care utilization among Medicare retirees	2005	42,520 U.S. retired manufacturing workers	$1,177–$1,456 lower health care costs per person per year for moderately active compared to sedentary retirees
Bland P et al. Modifiable health behaviors and short-term medical costs among health plan members	2009	10,000 members of Minnesota health plan	Sedentary health care costs averaged $1,242 more per person per year
Pratt et al. Higher direct medical costs associated with physical inactivity	2000	1987 National Medical Expenditures Survey	$330 per person saved per year for regular physical activity (30 min or more at least 3 times per week
Wang et al. Relationship of body mass index and physical activity to health care costs among employees	2004a	23,490 active employees from GM and UAW who completed a health risk appraisal	$250 lower costs per year for active employees
Brown et al. Physical activity, body mass index and health care costs in mid-age Australian women	2008	8,131 middle-aged women in Australia	$132 higher mean health care costs per year among women getting no physical activity

Study	Year	Population	Cost of Low Physical Activity/Inactivity
Yang et al. Impact of physical activity and medical care costs among the Japanese elderly	2010	483 subjects over 70 years old	$125 dollar lower costs per year for health care among active seniors
Peeters et al. Health care costs associated with prolonged sitting and inactivity	2014	Over 23,000 participants ages 55 years and older Australian Longitudinal Study on Women's Health	AU $94 difference per year in health care costs between inactive and highly active women (about $88 USD)
Garrett et al. Physical inactivity: direct cost to a health plan	2004	Minnesota Blue Cross Blue Shield members	$56 per person per year
Pronk et al. Relationship between modifiable health risks and short term health care charges	1999	5,689 adults over age 40 in Minnesota health plan	4.7% lower health care charges per person per year ($28 per person per year)
Anderson et al. Health care charges associated with physical inactivity overweight and obesity	2005	8,000 health plan members ages 40 and older	No $ benefit of physical activity for women

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