Indicators for Community Action: Built Environment and Community Health

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Abstract

Recently a collaborative project between a university, a provincial statistical agency, and a non-profit service organization worked to identify built environment indicators for local action and planning around community health. The research involved developing appropriate built environment indicators for active recreation and transportation, and testing them for community usefulness and data availability in several communities in Nova Scotia, Canada. The indicators will be added to an online community database managed by the provincial government. By making province-wide indicator data easily and publicly available, governments have the potential to facilitate local initiatives to improve community health and well-being. This paper describes a process of identifying indicators that would let communities identify whether their built environment promotes active recreation and active transportation.

1.0 The Built Environment and Community Health

Since the US Surgeon General released a study on the relationship between physical activity and health (USDHHS 1996), planners have paid increasing attention to the possible links between the built environment (*i.e.*, the human-constructed elements of the environment) and human activity patterns. Communities that are compact, with a mix of uses, and with safe and attractive places for people to walk or cycle offer greater opportunities for residents to become and stay active. Many contemporary community design movements, like new urbanism (Duany *et al.* 2000), avidly advocate a pedestrian-friendly built environment.

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Health researchers have long recognized physical inactivity as a significant determinant of ill health contributing to increased levels of heart disease, stroke, hypertension, type-2 diabetes, colon cancer, breast cancer, osteoporosis, obesity, depression, anxiety, and stress (Ewing *et al.* 2003; Jackson and Kochtitzky 2001). Recent studies demonstrate that even small amounts of moderate physical activity confer significant health benefits. As a result of such findings the Public Health Agency of Canada has shifted its health promotion focus away from high-intensity activities towards regular moderate-intensity activities such as brisk walking or bicycling. Canada's physical activity guidelines (PHAC 2005) now recommend that people accumulate 60 minutes or more per day of moderate-intensity physical activity in minimum bouts of at least 10 minutes. It has been estimated that approximately two-thirds of the Canadian adult population do not meet these recommendations (Craig *et al.* 1999).

Nova Scotia features the second highest levels of physical inactivity in Canada. A 1997 national survey of Canadians' physical activity patterns (Craig *et al.* 1999) showed that 72% of Nova Scotia residents are too inactive to reap the health benefits of physical activity. Not surprisingly, Nova Scotia has one of the highest rates of obesity in Canada (Colman 2000). For these reasons, a team of researchers at Dalhousie University began a project working with community groups, government agencies and non-profit organizations to investigate opportunities for improving health outcomes. The project component reported here focussed on evaluating the contribution of the built environment to enabling greater community health.

Until recently, health research has focused principally on identifying individual determinants of physical activity. This approach has been criticized because it places undue emphasis on the individual and fails to consider the social and physical environment within which health behaviour takes place (McLeroy *et al.* 1988; Stokols 1992). Public policy needs to take a more comprehensive approach (Milio 1986; Tesh 1988; Stevenson and Burke 1992). There is little point, for instance, for government to encourage people to walk, jog, or cycle unless communities provide safe or adequate places to pursue such activities.

Contemporary health promotion advocates have an interest in "community health": that is, creating conditions in communities to improve health outcomes. The Capital District Health Association in Nova Scotia describes the community health approach in these terms:

> The creation of health goes beyond the treatment of disease and illness. It is about having an adequate income, a safe and secure place to live, a good education, social support networks and more. We also believe that health is everyone's responsibility. Our staff work with individuals, groups, organizations, and municipal and provincial governments to put in place supports that are necessary for our communities to be healthy places in which to live [sic] work and play (CDHA 2005: online)

As a result of earlier critiques, a new generation of physical activity research within the health professions (Barnes and Schoenborn 2003; Powell 2002; Rutten *et al.* 2001; Sharpe *et al.* 2004; Vojnovic *et al.* 2006) and within urban and planning studies (Frank *et al.* 2003; Miller *et al.* 2002) has taken a broader ecological approach to the relationship of health and environment. Several studies

have identified the range of elements that may enable or inhibit individuals in meeting recommended physical activity levels (Bauman *et al.* 2002; Buchner and Miles 2002; Sallis *et al.* 1998). These varied elements comprise three broad categories: individual, social, and physical environment (natural and built) factors. Each type of factor interacts with the others in multiple and complex ways. Nevertheless, some researchers (Frank *et al*. 2003) suggest that changes to the built environment hold the greatest promise for increasing physical activity levels within communities. While a supportive built environment may not be *sufficient* to increase community physical activity levels, it is a *necessary* or *facilitating* condition for supporting active transportation and active outdoor recreation. For instance, reducing the distance between home and work does not guarantee that a person will commute by foot. However, if the distance between home and work remains significant (*e.g.* greater than 2.5 km), then walking will not be an option. Thus, while social, individual, and policy factors all play a role in health promotion, a supportive built environment is fundamental to enabling increased levels of certain types of physical activity, especially walking and cycling.

In order to meet Canada's recommended exercise target, individuals may participate in a variety of physical activities (*e.g.* soccer, cycling, baseball, swimming, yoga, weight-lifting, walking, aerobics). Some of these activities require more time, energy, money and skill than others. Some are more difficult to adhere to on a regular basis. Some, like basketball, are undertaken in leisure time for recreational purposes. Others, like walking and cycling, serve recreational purposes (*e.g.* weekend strolls, bicycle touring) as well as utilitarian purposes (*e.g.*, cycling to work, running an errand). According to Frank *et al.* (2003), activities that require lower levels of physical exertion, demand less time, money, equipment and skill, and have some practical purpose have distinct advantages over other types. Walking and bicycling meet these criteria: they are moderately intense, they present few barriers to participation, and they occur in the course of carrying out other useful tasks (such as traveling to work or running errands). Walking and cycling represent forms of leisure-time exercise, or "active recreation," as well as means of utilitarian travel, or "active transportation."

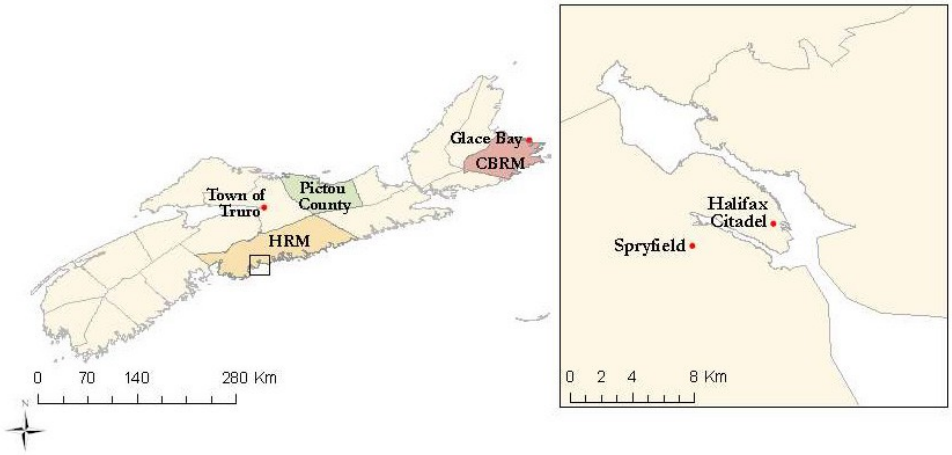
Based on two decades of conducting physical activity surveys, the Canadian Fitness and Lifestyle Research Institute argues that people are more likely to become and remain active if they participate in easily accessed activities that can fit into their daily schedules, that they feel competent to do, and that they find enjoyable (Craig *et al.* 1999). Walking and cycling fulfill these criteria. Because exercise can be a by-product of carrying out other useful tasks like commuting to work, buying groceries, or visiting friends, active transportation may offer one of the best ways for people who lack time, energy, skills, money or motivation to get exercise on a regular basis.

In addition to physical activity and health benefits, increasing levels of active transportation can reduce automobile use, which decreases air pollution and greenhouse gas emissions, lessens reliance on increasingly scarce and expensive fossil fuels, and moderates neighbourhood traffic congestion and noise. Promoting and facilitating active transportation thus has great potential to improve overall community health and contribute to quality of life.

Because the literature in this field is relatively new, studies have not yet established conclusive causal relationships between urban form and physical activity. While the largely American literature aids understanding of the broader

concepts in this emerging field, it proves less useful for analyzing the particular situation in Nova Scotia. For instance, a recent survey (CFLRI 2002) found that Canadians living in small communities (of less than 10,000 residents) are unlikely to report many available places to walk and bicycle. They know of few recreational trails, and are not satisfied with the opportunities for physical activity in their area. Aside from the urban communities of Halifax Regional Municipality, Cape Breton Regional Municipality and the Town of Truro, most of Nova Scotia comprises small communities (Figure 1). The built environment of much of Nova Scotia poses significant challenges to those who would promote active transportation and active recreation.

Figure 1. Map of Nova Scotia



2.0 A Research Project: Indicators for Community Health

In 2003, the Atlantic Health Promotion Research Centre at Dalhousie University coordinated a large-scale interdisciplinary research project with a focus on illness and injury prevention. The research seeks to identify the root causes that undermine or enable health (Shookner 2005). "What do we know about the factors in social and physical environments (*i.e.* workplace, school, community) that contribute to the health status of Atlantic Canadians? What environmental assessment tools must be designed and/or activated? Who should be receiving and acting on these data?" (Lyons 2003: 12a).

One component of the research explores the role of the built environment in enabling community health. An interest in developing indicators that could help community members identify whether their spaces could facilitate health promotion led researchers from the School of Planning to focus on active recreation and transportation. A system of built environment indicators that clearly illustrates the scale and the nature of the challenge of facilitating active recreation and transportation would help local administrations identify their needs, guide possible interventions, and evaluate achievements. Researchers interested in studying built environment and health relationships have tended to rely on subjectively collected assessments of built form for small study areas. Objectively measured, province-wide urban form indicators would greatly facilitate research and action. Providing communities -- especially distressed communities -- with the

tools to gather factual information about their own physical environments allows them to make more effective claims and better advocate their needs to decision-makers. Community indicators can be empowering and may contribute to neighbourhood development.

Finally, indicators communicate wider societal values about what is important to measure. The provincial government may say that active living is important and may promote non-motorized travel. However, only with indicators in place to measure the quality of the built environment and the results on physical activity can decision-makers and the general public make fully informed decisions about policy and priorities.

One of the partners in the indicator development project is Nova Scotia's Department of Finance. In 2004, the Department launched "Community Counts," a new division established to develop a statistical infrastructure system of information about Nova Scotia communities. Community Counts' core service is an online database that provides easy public access to comprehensive socio-economic and health data for Nova Scotia communities. Indicators in the database are organized under the following topics: households, social, income, health, labour, production, demographic, education, resource, and natural environment (see Figure 2).

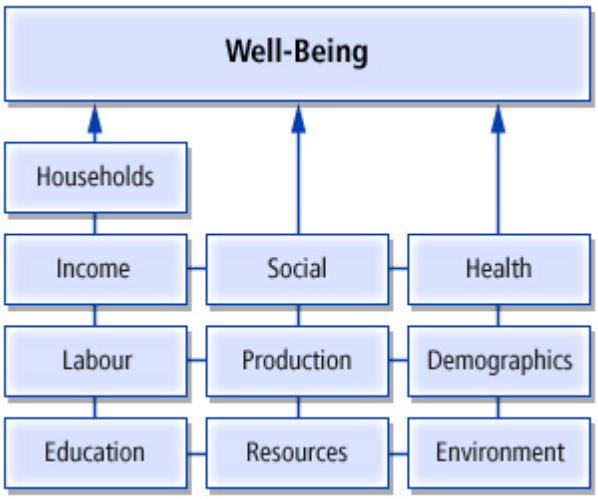


Figure 2 – Topics Listed on the Community Counts Web Site.

Source: Province of Nova Scotia,
Http://www.gov.ns.ca/finance/communitycounts/topic.asp, used with permission.

Given the influential role that built form plays in enabling or undermining community health, Community Counts recognized the need to include more comprehensive data on the built environment in its database. The research group worked with Community Counts on a pilot project to identify built form indicators to support opportunities to facilitate active transportation and active recreation.

Boarnet (2004) identifies several challenges to the exercise of indicator development: for instance, it requires making effective use of data from various

sources collected to address different questions. The researchers also recognized the need to develop indicators general enough to be useful to the wide range of users of Community Counts but specific enough to capture relevant and useful data to answer particular questions.

Maclaren (1996) describes the extensive discussion around selection criteria in the social, environmental, and sustainability indicators literature. Miller (2004) recommends a purposeful approach to formulating indicators that considers the roles that they will play. Community Counts indicators should contribute to future scientific research, inform decision-making and program administration, and empower communities by helping people to more effectively advocate their positions to decision-makers.

What information can help communities move to action, assist researchers to establish causal relationships, and help governments assess progress on meeting health promotion objectives? The study began by identifying built environment indicators linked to community health in the literature. By exploring sustainability, environmental, and quality-of-life indicators from a range of organizations researchers developed a list of built environment indicators linked to aspects of human health (McMackin 2005). Most indicators in the literature were created for large urban contexts: not all seemed equally applicable or relevant for the largely rural and small communities of Atlantic Canada. Hence the team first evaluated the indicators for suitability in the local context (Table 1).

Table 1: Criteria questions for reviewing indicators for community use

The indicators need to use data that is available. • Are they available at the neighbourhood or community level (not just at the provincial level)? • Are they readily and/or inexpensively available from existing sources (and capable of updating as necessary)?
The indicators need evaluation for local relevance. • How well do indicators developed elsewhere apply in Atlantic Canada? • How will indicators developed for cities or large urban regions apply in a range of community sizes and types? • Which indicators are especially relevant for Atlantic Canadian issues (*e.g.*, with its older communities, coastal settlements, special populations and needs, particular environmental conditions, etc.)?
The indicators need to be practical and useful. • Useful data for local communities will respond to particular needs for information. What kind of information do communities need to make decisions that promote community health? • What are local authorities doing in the way of determining and using these kinds of indicators in regional or local planning processes? Are communities currently using any indicators, or making them available? • Do government policies or programs affect choices about good indicators to use?

Several principles apply in evaluating indicators (Wood 2005a):

- *Policy Relevance*: To motivate action, users must see and understand the connection between indicators and critical decisions and policies.
- *Simplicity*: To capture interest, information presented should be easily understood by a variety of audiences.
- *Validity*: To inform decision making, indicators should accurately represent the situation.
- *Data Availability*: To ensure utility, indicators must employ good quality data that is available to communities at a reasonable cost.

The investigation of data sources in the summer of 2005 identified some of the kinds of data that were and were not available. Data assessment evaluated data source, time period of record, unit of measurement, frequency of collection, data collection method, data storage format, geographic coverage, restrictions on access, and cost. Data sources identified included existing databases and reports. Most sources came from provincial departments. Potential data sources for populating built environment indicator databases include provincial agencies (*e.g*. Service Nova Scotia and Municipal Relations, Department of Agriculture and Fisheries, Department of Natural Resources, Department of Environment and Labour), national agencies (such as Canada Mortgage and Housing Corporation), and municipalities. The criteria for including indicators in the provincial data system specified measures that remain current, are appropriate to the task, and are available to the province at minimal cost.

In the fall of 2005, the focus of investigation narrowed to the themes of active transportation and active recreation in order to identify useful and practical indicators that might be added to Community Counts as a first step to populating the Environment topics in the database. The team collaborated with the Halifax United Way, a non-profit charitable organization committed to community development activities, to conduct research in Spryfield, an area of Halifax Regional Municipality. The United Way is leading *Action for Neighbourhood Change*, a federally funded initiative to encourage community development and empowerment in disadvantaged communities (Action 2005, HRSDC 2005). Enhancing opportunities for active recreation and transportation has the potential to increase community health in Spryfield. If community members have the information they need to assess the relative availability of trails and other opportunities for active living, then they will have tools to lobby the Region more effectively for improvements to the built environment. The research involved interviews with community members or staff persons knowledgeable about the topics being examined, investigations of data sources, observations of sites, and a community workshop with residents.

3.0 On the Path to Community Health: Active Recreation

Residents and community members in Spryfield expressed an interest in pedestrian connections through trails and walking paths at a Spring Community Forum in 2005. The report, "*Our Community is on the Go!"* (Spryfield 2005), noted that residents wanted a highly walkable community. To determine appropriate active recreation indicators most useful to the public, the research team engaged civil servants and trail experts from the community (Table 2). A community workshop

followed up on the goals of the earlier forum to encourage community members to identify attributes they considered important in accessing recreational trails. Concerns such as safety, location, litter, and lighting came up often in the discussions. The workshop and consultations helped to narrow the list of indicators that residents and community groups see as useful to enable them to continue to advocate on their own behalf to improve trail access and quality.

Table 2. Indicators of active recreation

Indicator	Relevance to Community Interests	Recognition within the Literature	Useful for Trail Initiatives and Programs
Number of urban walking paths or hiking trails		*	*
Length of trails	*	*	*
Distance of trail km per 1,000 residents	*	*	*
Number of people in a 2.5 km radius of a trailhead		*	*
Distance traveled by trail participants to use a trail	*	*	
Design of trails (linear or loop design)	*	*	
Trail destinations	*	*	*
Number of access points per trail	*	*	
Available trail maps or signage	*	*	*
Number of light posts along a trail or at trail entrance	*	*	
Frequency of security patrols	*	*	
Frequency of garbage/recycling collection	*	*	
Community investment into trails		*	*
Number of features that contribute to the attractiveness	*	*	
Number of community trail/hiking/or walking club	*	*	*
Number of events organized around trail use	*	*	

Identifying indicators such as the distance of trail kilometres per 1,000 residents and the number of people in a 2.5 km (walking distance) radius of a trailhead may demonstrate whether an area has sufficient trails in the right places to serve the population. This information helps community groups to compare their access to trails with other areas. By drawing attention to inequities such evidence may influence infrastructure decisions at the municipal or provincial level. Communities of lower socio-economic status often face barriers such as lack of information, social support, and transportation to access and use trails (Macintyre *et al.* 1993; King *et al.* 1995; Reed *et al.* 2004). By identifying communities with lesser trail access, agencies that support trail initiatives and physical activity can provide support to encourage community engagement projects to address these issues.

Not all of the indicators desired by community members were immediately appropriate for a provincial database. The shorter list of indicators identified in Table 3 are available in many communities, can be kept current and should prove relevant to Community Counts (Wood 2005b). The statistical agency can adapt these indicators for adding to the database.

Table 3: Indicators for active recreation

Indicators suitable for including in Community Counts
• Kilometres of trail per 1,000 residents • Number of people in a 2.5 km radius of a trailhead • Community investment in trails per 1000 residents • Number of trail/hiking clubs per 1000 residents

4.0 Taking the Pulse of Active Transportation

The second part of the study examined the availability and suitability of indicators of active transportation in communities of varying sizes, including Spryfield. The research reviewed indicators that were developed to measure active transportation-related factors in the built environment and assessed them in the Nova Scotia context. The aim, as with the study of recreation, was to propose active transportation indicators for the Community Counts database.

Because transportation issues and options differ considerably in communities of varying sizes, four communities were evaluated:

- Pictou County (rural municipality)
- Glace Bay (small town/urban agglomeration)
- Spryfield (suburban)
- Halifax Citadel (urban)

The research tested the indicators and data collection techniques in the field, and provided near-complete data sets to the four case study communities.

An extensive search for relevant indicators linking active transportation and the built environment produced 121 possible indicators (Curran 2005). Some of the indicators were cited regularly in the literature, while some appeared less frequently. Most studies concur that three fundamental elements of the built environment – density, land use mix, and non-motorized network connectivity –

positively correlate with walking and cycling for utilitarian trips: that is, the greater the density, mix of uses, and connectivity, the greater the number of non-motorized trips.

To identify appropriate indicators, potential indicators were first screened through four filters before the remaining candidates were evaluated more thoroughly. The filters removed indicators that lacked strong correlation to active transportation, relied on dualistic categories, could not be objectively measured, and whose orientation was to the individual rather than the community. The remaining indicators were rated on a scale (low, medium, high agreement) for eight criteria: representativeness, data availability, data reliability, ease of collection, frequency of data collection, usefulness for policy and decision-making, attractiveness to the public, and usefulness to researchers. From this evaluation Curran (2005) proposed a set of active transportation indicators as well as potential data sources and collection methods. As it turned out, much of the required data was readily available through existing sources (such as the Canadian Census, and the Nova Scotia Civic Address File).

In consultation with Community Counts staff, the team assessed the feasibility and reliability of the proposed data collection methods for four communities. Field tests collected as much of the necessary data as possible for each of the proposed indicators in the sample communities. The testing refined and narrowed the list of potential indicators of active transportation. Based on the findings the team proposed that Community Counts include a set of 15 built environment and travel indicators broadly divided into four categories: residential density, diversity of uses, network connectivity, and travel behaviour (Table 4). In order to provide a more accurate portrayal of residential and employment densities than simple "gross" measures, the proposed indicators use GIS to draw a line around the outermost civic address points in a settlement (creating what geographers call an *ecumene*). This boundary line then defines the area for density calculations.

Six measures evaluate land use mix. The four easily understood and communicated indicators include retail jobs per area measure, percent of dwellings in walking distance of specified uses, percent of dwellings in cycling distance of specified uses, and number of types of commercial uses in an area. Two complex measures also prove useful for evaluating mix within a regional context: the entropy index and the dissimilarity index have been employed in several studies (*e.g.* Cervero 1989; Frank and Pivo 1994; Kockelman 1997). The entropy index measures the degree of similarity in land use mix between a given area and its larger regional context. A community with a land use mix mirroring that of the larger region receives a score of "1". A community with land uses that diverge from the proportions from the region would receive a lower entropy score. The entropy index measures the mix of land uses relative to the region but does not consider the type or intensity of mixing: thus the dissimilarity index provides a useful complement. The dissimilarity index first divides the study area into a grid of one-hectare squares and then assigns a predominant land use to each one. The index measures the dissimilarity of each square based on the predominant uses in its

Table 4. Proposed indicators for Community Counts

Built environment indicators for active transportation
Residential Density • The number of residents per square kilometre of inhabited area (ecumene). • The number of households per square kilometre of inhabited area. *Diversity of Uses* • The number of retail jobs per square kilometre of ecumene area. • The percentage of residential dwellings within 2.5 km (walking distance) of the following building uses: retail sales, food and beverage, business/office, neighbourhood schools and grocery stores. • The percentage of residential dwellings within 8 km (cycling distance) of the following building uses: retail sales, food and beverage, business/office, neighbourhood schools and grocery stores. • Number of different types of commercial land uses in an area • Entropy Index • Dissimilarity Index *Connectivity* • Ratio of sidewalk/path km to street center line kilometres • Motorized connectivity index • Non-motorized connectivity index *Travel Behaviour* • Journey to work – modal split • Journey to school – modal split • Non-home based trips – modal split • Home-based discretionary trips – modal split

neighbouring squares. The average of all the scores represents the land use mix of the area.

To measure network connectivity a "connectivity index" is calculated by dividing the total number of street segments (street lengths between intersections) by the total number of street nodes (intersections or dead-ends). A higher index means that travelers have increased route choice, allowing for more direct connections between any two points. A perfect grid network receives a score of "1.5". Ewing (1996) recommends a score of at least "1.4" to ensure walkability. If pedestrian and cycling routes have higher connectivity than motorized routes people may be more likely to choose transportation alternatives other than the car.

Finally, output indicators that reflect travel behaviour will allow researchers to discover any statistically significant correlations between changes to the built environment and health outcomes. Four indicators evaluate the modal split: that is, the proportion of people using alternative transportation modes for travel related to activities such as going to work or school.

The data that will populate these indicators may help measure progress towards walkable and bikeable communities. Citizens may use the data to learn more about their own communities and to advocate for the changes they want to see. Researchers interested in the relationship between built environments and physical activity would have access to sufficient data in contrasting environments to make statistically significant claims, even in jurisdictions as small and sparsely

populated as Nova Scotia. Populating these indicators with objectively collected data on a province-wide scale will enable researchers to use Nova Scotia as a living laboratory for groundbreaking physical activity, travel, and health research.

5.0 Lessons for Practice: Indicators for Community Development

This project contributes to the literature by identifying the process necessary to apply generic sustainability indicators to specific community purposes. Researchers evaluated a range of indicators developed over the last decade to identify a set of measures that could help Nova Scotia communities to assess whether their built environment conditions contribute to opportunities for community health. By applying models and evaluative frameworks from various sources the project advances the discussion about how indicators can be used in community practice.

Nova Scotia Community Counts provides a prototype for jurisdictions attempting to develop databases that communities can use to monitor and improve quality of life. This research study takes a step towards providing tools to help communities reflect on how the built environment can enhance community health. As Nova Scotians use Community Counts researchers will continue to identify gaps in the information available: research can bridge those needs in ways that enhance the potential for community action. A well-designed community can increase opportunities for residents to participate in activities that contribute to their own health and well-being.

What are the next steps for Community Counts to bring these indicators forward? With four built environment indicators of active recreation and fifteen of active transportation, Community Counts staff members have a set of potential indicators that they can use to expand the database in ways that can provide useful information for communities. Before adding the measures to the system, statisticians will go through a process of evaluating, coordinating and systematizing the data.

Good indicators can help convey complex built environment and land use information in an attractive way to engage the wider public in promoting healthy living and quality of life. Providing people with access to relevant information about the built form of their communities can be an empowering process that equips residents to participate in the political process so that they may better advocate their positions to decision-makers. Over the long term, such advocacy has the potential to significantly improve the quality of the built environment, and the health and welfare of community residents.

6. 0 Acknowledgements

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