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## Development of a Detailed Log Booklet for Social Ecological Physical Activity Research

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**Abstract:** To advance social ecological research, tools are required to better assess the contextual nature of physical activity outcomes. This study describes the development of a detailed log booklet to capture relevant episode-specific data, including location and purpose, about participants' free-living activity patterns. The log was developed using definitions and questions from existing physical activity questionnaires as well as measures designed to elicit more specific and detailed information relevant to social ecological studies of physical activity. Utility of the log was tested with 580 community residents over seven days. It was found to be practical and feasible for use in community-based physical activity research, and yielded a wealth of episodic information about intensity, duration, location, purpose, and co-participants, among other details.

**Keywords:** built environment, physical activity, research design, measurement

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## Introduction

The connection between health and physical activity (PA) is well-documented and the contexts in which people live are now increasingly recognized as a critical factor shaping their health behaviors and overall quality of life.<sup>1-3</sup> With the frequent adoption of social ecological models, greater attention has been placed not only on the frequency, intensity, and duration with which people engage in physical activities, but also on the built and social environments in which these activities occur.<sup>1,4,5</sup> Much of our understanding of environmental influences on PA has been facilitated by significant advances in methods for measuring the features of communities and neighborhoods that may shape active living behaviors such as walking or biking for recreation or transportation.<sup>6</sup> Unfortunately, however, it might be argued that measurement of PA itself for social ecological research has not evolved at the same pace. For example, despite calls for increased specificity in ecological PA research, most studies of built and social environments continue to examine neighborhood or community attributes in relation to an aggregated measure of PA that ignores location and other details about that activity.<sup>5,7,8</sup> Giles Corti et al.<sup>7</sup> lamented that “most research examining environmental correlates uses context-free behavioral outcome measures” (p. 176–177) Humpel et al.<sup>9</sup> used findings from their study of walking for different purposes to conclude that “by exploring behavior as specifically as possible, and not using total or generic measures of activity, more can be learned about the environment-behavior relationship” (p. 123). Finally, others have argued that “there is little information ... about how people, in fact, act in or use their environment. While a person may live near a walking trail, what is the frequency and manner in which that trail is used?”<sup>10</sup>

These arguments suggest the need for refinements in the way PA is measured in studies emphasizing a social ecological approach. To date, the most commonly-used and easily-applied method is through self-report questionnaires. Other options that have been used in built environment and PA research include electronic monitoring devices such as pedometers<sup>11</sup> and accelerometers.<sup>12</sup> Pedometers are relatively inexpensive but do not usually record any detail beyond step counts. Accelerometers capture data related to intensity, frequency, and duration, but the high cost of purchasing them is often prohibitive for larger, community-based stud-

ies. Further, accelerometers also fail to accurately record many types of common activities (eg, cycling, swimming) that may be influenced by environmental attributes (unless supplemented by an activity log) and they provide no additional detail about the purpose (eg, recreation, transportation) or location of activity bouts. Indeed, another key issue in identifying the impact of the built environment on PA involves understanding where such activity occurs. Global positioning systems are starting to be used in ecological PA research to document locations, but their cost is still largely out of reach for population-level studies and, when used in isolation, they do not provide information about PA.<sup>13,14</sup>

Conversely, self-report PA measures allow one to collect data from a large number of people at a low cost and to assess all the dimensions of PA (eg, type, intensity, duration, purpose, etc.). As well, researchers can gather both quantitative and qualitative information and the PA data collected can often be adapted or converted to estimate information (eg, energy expenditure) captured by other methods of PA assessment.<sup>15,16</sup> On the other hand, the possibility for social desirability bias can lead to over-reporting of PA; although self-reports can provide reliable and valid estimates of *relative* PA (including for relating to other predictor variables), they may lead to overestimates of *absolute* PA.<sup>16</sup> Despite this and other limitations, self-report remains the predominant means of measuring PA, especially in non-clinical settings and including within ecological built environment research. However, major existing self-report PA questionnaires<sup>17,18</sup> each fail to capture the full range of experience of study participants by excluding important contextual information, such as the type of activity or its intensity, purpose, or location.<sup>16</sup> This notion is summarized nicely by Satariano and McAuley<sup>10</sup> who state:

“Traditional measures of physical activity are typically based on questions that ask respondents to indicate mode [activity], frequency, duration, or intensity level of activity ... Although such measures are very useful, it is necessary to have additional information about the circumstances of the physical activity. In addition to these standard questions, it would be useful to ask when, where, and with whom an individual engages in physical activity. This information will place an individual’s physical activity into a broader social and environmental context”.



Consequently, the purpose of the present paper is to describe the development and use of a detailed self-report PA log booklet for social ecological research that permits collection of valuable location data for episodes, as well as other useful contextual information such as the purpose, duration, intensity, and experience of the activity.

## Methods

### Study setting and data collection

The Physical Activity in the Community Study (PAITC) was conducted in August and September 2006 in Waterloo, Ontario, Canada. Further details about the sampling methods and respondents can be found elsewhere.<sup>19</sup> As part of the study, four research assistants delivered study packages to randomly-selected households in four neighborhoods. The materials included a comprehensive (16-page) questionnaire about a variety of individual and environmental PA correlates and a 7-day log booklet (described below). Upon completion of any materials, participants were provided with \$5 compensation (which they were advised of in advance). A total of 960 study packages were distributed and completed study materials were retrieved from 585 residents for a response rate of 60.9%. The study was approved by the Institutional Review Board at the University of Waterloo and residents provided informed consent prior to participation.

### Development of physical activity log booklet

To overcome some of the limitations of existing questionnaires (at least as they relate to the PAITC and social ecological research on PA), a comprehensive log booklet was developed that captured most of the forms of PA data collected by other established instruments by asking participants to record detailed information about each episode they engaged in for a period of seven days. After the cover page, two pages of detailed *instructions* were provided on how to fill out the log booklet (see Fig. 1). These instructions included a definition of PA and guidelines on where (separate page for each episode), how long (7 days), and how frequently (at least once per day) to record PA episode information. Of note, PA was defined as “any activity that requires you to expend energy”<sup>20</sup>

and it was noted that activity episodes engaged in for exercise, transportation, at work, and around the house were all relevant to the study. Instructions were also provided for specific sections of the log page that might require some explanation, many of which are described below.

Following the instructions, a *map* (not shown) of the participant’s neighborhood was provided on two pages spanning a single  $8\frac{1}{2} \times 11$  page (joined left side and right side). The neighborhood depicted was based on the municipal planning district in which the participant lived, which were the same area units from which households were sampled for inclusion in the study. The map depicted labelled streets and parks in the planning district and some of the surrounding area (eg, approximately  $\frac{1}{4}$  mile outside the planning district boundaries).

Next, four *sample log pages* were provided that demonstrated potential PA episodes (two of which are shown in Fig. 2). The remainder of the booklet was comprised of blank log pages. As shown in Figure 2 and described in Figure 1, for each PA episode, participants were asked to indicate the date and start time of the activity, type of activity, duration and intensity of participation, location where the activity took place, point of origin, method of transportation (if applicable), co-participants, purpose of the activity, as well as responses to two 2-item scales measuring “flow” (challenge, skills) and situational involvement (pleasurable, enjoyable) that were specific to some of the PAITC study’s research questions. Collection of such comprehensive, disaggregated information about each episode facilitated almost any type of detailed analysis/description about what, when, where, why, how, and for how long participants engage in PA. Brief descriptions of some of the log page sections are discussed below.

Participants were asked to indicate the *date and start time* of each episode (Fig. 2). Some forms of PA for certain populations may be temporally (ir)regular or may be influenced by weather or other temporal/seasonal variables. Information about the timing of individual episodes is easily collected with the log booklet and may facilitate investigations of when certain groups choose to exercise and how individual (eg, work schedule), interpersonal (eg, perceptions of safety), or environmental (eg, facility availability) factors affect such decisions.



Thank you for taking the time to share your daily physical activities with us. Please carefully review both instructions pages and refer back to them as necessary when recording your physical activities throughout the course of the week. **Please be as accurate and honest as possible in completing the booklet pages.** What we can learn about Waterloo residents' physical activity patterns and the conclusions we can draw depend heavily on the quality of the data we receive from these log booklets.

**Each episode of physical activity should be recorded on a separate page in the log book.** If you require additional pages, feel free to photocopy a booklet page, create a readable, rough draft on a blank piece of paper, or visit the study website at [web address] to print additional pages. You can also call or email the study director and we will be happy to drop off another booklet.

**All episodes of physical activity that are greater than 10 consecutive minutes in length should be recorded in the log booklet.** Physical activity includes any activity that requires you to expend energy. This means that we are not just interested in physical activity that you do for exercise, but also physical activity that occurs during the course of your daily life, including for transportation, recreation, at work, and around the house. If you are unsure as to whether an activity should be included in the log, record it to be on the safe side.

**The physical activity log pages should be completed for a total of 7 consecutive days.** In order to ensure comparable data across participants, we need to have a full 7 days of records for each person.

**Please record your physical activities on the log pages at least once per day.** One option is to keep this booklet with you and record activities as you do them. Another option is to record your day's physical activities (if any) before you go to sleep at night. The key is to make sure you record activities within a maximum of 12 hours after they were completed (ie, on the same day) so that details about the episodes don't get mixed together.

The following sections provide instructions specific to each of the sections on the physical activity log page.

#### Activity

What type of physical activity were you doing? Please describe the **primary form of physical activity** that you were engaged in for that episode. If you were engaged in multiple activities, do not fill out two different pages for the same time period (just use the primary activity for that time period).

#### Duration

You only need to record episodes of physical activity that are **10 consecutive minutes or greater** in length. When reporting the duration, **please subtract out time that was spent not engaged in the activity.** For example, if you went for a walk for half an hour, but stopped to talk to a neighbour for 5 minutes, please record only 25 minutes of activity for that episode.

#### Intensity

Using the following definitions, please indicate **how hard you were participating for the majority of that episode** (to help you, think about whether the activity you were doing was similar to the examples):

<b>Mild:</b>	Minimal effort, no perspiration	eg, easy walking, yoga, bowling
<b>Moderate:</b>	Not exhausting, light perspiration	eg, brisk walking, easy swimming, recreational sports
<b>Strenuous:</b>	Heart beats rapidly, sweating	eg, jogging, hard biking, competitive sports

#### Location

For our analyses, we need to be able to locate (by exact address) where people are engaging in physical activity, so **please be as specific as possible.** To assist you, the map on the following page indicates the names of several common physical activity locations in your area (eg, parks, facilities, etc.). **If you went to a specific location** and know the name of the facility or park where you engaged in the activity, please record it in the location box for that episode. If more than one location exists in Kitchener-Waterloo for that facility name, please indicate something that would allow us to determine the exact address. Similarly, if you don't know the name of a facility or park, but you can describe the address or location, please record that information.

**If you engaged in PA on your own property,** please simply indicate "at home." **If your physical activity occurred on streets, trails, or parks** (eg, during a walk or bike ride), **please list the streets, trails, parks, etc.** We are especially interested in study participants' use of parks, trails, and recreation facilities for physical activity, so please be sure to record this information if applicable.

#### Point of origin

Sometimes we depart to engage in physical activity from home, work, school, or other places. If you went somewhere (eg, walking from home; working out at lunch break), please **indicate where you started from and give a specific location or address whenever possible.** If you were already at the location where the physical activity took place, simply put "already there."

#### Method of transport

If the physical activity occurred at another location (eg, park, gym), please describe how you got there (eg, car, bus, bike, walk, etc.). If you didn't go anywhere to participate in the physical activity or if the physical activity was the method of transportation (eg, walking to the store; biking home from work), please check the box labeled "n/a" (not applicable).

#### Co-participants

Was anyone (including a pet) participating in the activity with you for the majority of the time you recorded for that episode? If not, simply put "none" in the co-participants box. If someone was participating with you for the majority of the time, please list spouse, children, friend, parent, co-worker, pet, etc.

#### Purpose

People often undertake physical activities for different reasons. Please review the definitions of each category of physical activity and **choose one of the following options for the purpose of each episode.** If you engaged in the activity for multiple reasons, please indicate the **primary purpose.**

<b>Household:</b>	Unpaid physical activity in and around your home (eg, gardening, home maintenance).
<b>Job-Related:</b>	Physical activity that occurs during paid jobs, farming, volunteer work, course work, and any other unpaid work you did outside your home (remember that unpaid work around the home should be classified as household).
<b>Transportation:</b>	Physical activity that occurs when travelling from place to place, including to places like work, school, stores, movies, and so on.
<b>Recreation:</b>	Physical activity that was done for recreation, sport, exercise, or leisure.

Figure 1. Physical activity log booklet instructions.





Figure 2. Sample log booklet page.

An open-ended box was provided for participants to list the primary *activity* they were engaged in for each episode (Fig. 2). The mode or type of activity is often of interest in PA research, especially that which focuses on social or cultural influences.<sup>21</sup> Further, if desired and as is commonly done in studies of free-living activities, MET values for specific activities can be applied to individual episodes via the widely-used Compendium of Physical Activities.<sup>22</sup>

Other sections on the log page captured the duration and intensity of the activity (Fig. 2). For *duration*, to be consistent with current PA recommendations, participants were directed by staff and in the booklet instructions to include in their log booklet all episodes of PA that were 10 or more minutes in length (Fig. 1).<sup>3</sup> To minimize over-reporting, when describing the duration of their activity episodes, participants were directed to include only the amount of time spent in movement.<sup>22</sup> With respect to *intensity*, respondents were asked to indicate how hard they were participating for the majority of the episode using the options of mild, moderate, or strenuous (Fig. 2). Definitions and examples identical to those used in the validated Godin-Shephard Leisure Time

Exercise Questionnaire<sup>18</sup> were provided for each intensity level based on exertion and physiological symptoms and common types of activities that would fall into each category (see Fig. 1). This data can be useful to researchers who wish to simply examine if participants are meeting PA recommendations based on a minimum number of episodes or amount of activity in each intensity category (eg, 30 minutes of moderate activity on 5 or more days in the week). More precisely, collecting data on level of intensity permits imputation of average MET values for each episode if an estimate of total energy expenditure is desired. For example, some studies use values of 2.5 to 3.0 METs for mild activity, 4.5 to 5.0 for moderate activity, and 7.0 to 9.0 for strenuous activity.<sup>18,23,24</sup> Additionally, using self-reported intensity level potentially overcomes limitations associated with applying activity MET values that are not adjusted for height and weight and resultant difficulty performing the activity.<sup>22</sup>

The log page for each episode also provided a significant amount of space for participants to describe the *location* where their activities occurred (Fig. 2). Respondents were instructed to be as specific as



possible, to record exact addresses where known, and to indicate the exact route taken if the PA episode involved multiple streets, trails, parks, or other destinations (Fig. 1). The sample pages in the log booklet provided an example of a trip that traversed a park and several streets as well as another example which simply occurred “at home” (Fig. 2). Although collecting and coding location data is a challenging task, gathering information on PA settings is especially critical for social ecological research that attempts to draw logical associations between environmental attributes and specific PA behaviours.<sup>8,10</sup> For example, as is discussed further below, it would be more sensible to compare neighborhood characteristics to a measure of neighborhood-based (rather than global) PA, or to examine how park- or trail-based PA, specifically, is influenced by the attributes of those settings.<sup>7</sup>

Another open-ended box was included on the log page for respondents to indicate the point of origin for their PA episode (Fig. 2). In many ecological studies, knowing the exact point of origin for PA episodes may be very useful. It is often assumed in research on PA and the built environment that the neighborhood around participants’ homes provides the appropriate frame of reference for studying area effects on health behaviors. However, many daily activities, including physical ones, originate from places other than one’s primary residence, such as work or school (eg, taking a walk at lunch, biking home from work, etc.). Further, some researchers may wish to track the exact route study participants take on active recreation or transportation trips, which necessitates accurate knowledge of origins and destinations.<sup>25</sup>

Likewise, information on method of transport may be valuable for studying how people get to and from PA destinations (or if the PA itself served as the method of transport). As shown in Figure 2, four common transportation options—car, walk, bike, public transit—were provided on the log page, along with a spot to list ‘other’ or to indicate ‘not applicable’ if the PA itself was the mode of transport (as directed in the instructions pages; Figure 1).

The log booklet also facilitated collection of information on co-participants for each PA episode (Fig. 2). This information could be coded for different categories of PA partners or used simply to indicate if co-participants were present or if the activity was undertaken alone. A strong body of

literature on social support as a correlate of PA suggests that knowing who people participate with (and in what activities, at what intensity, or in what locations, etc.) may be useful for adding context about their behaviours.<sup>26,27</sup>

Four options were provided for participants to indicate the *purpose* of each episode—recreation, transportation, household, or job-related (Fig. 2). These categories were taken from the IPAQ and definitions identical to those used in the IPAQ were provided on the instructions pages at the front of the booklet (Fig. 1).<sup>17</sup> Finally, the log booklet used in the PAITC collected information about respondents’ attitudinal responses to their PA episodes using four Likert scale questions found at the bottom of the page (Fig. 2). This space could easily be used to gather a variety of attitudinal or behavioral information specific to each social ecological study.

In summary, the log booklet used in the PAITC study was developed based on identified shortcomings in existing PA questionnaires, yet it employs several validated questions and definitions from those same instruments. The following section describes preliminary evidence of the log booklet’s utility. The concluding section then provides an overview of some of the findings made possible by this comprehensive approach and discusses the limitations and future directions for using a log booklet of this type in social ecological PA research.

## Results

In total, from the 585 participants who returned completed study packages, 580 completed log booklets were obtained. More women (55%) than men (45%) participated in the study, and respondents varied in age (18–39 years: 41%; 40–88 years: 59%). Participants were well educated, with two-thirds (66%) having obtained a college degree, and over three-quarters (77%) were married or living with a partner. These characteristics were largely representative of the four neighborhoods and the overall city from which the sample was drawn, with the exception that the study sample was somewhat older and had more persons living with a partner.

## Validity

Initial examinations of the log booklet’s concurrent validity were conducted by comparing the number of



mild, moderate, and strenuous episodes reported in the log booklet by each participant with his or her responses to the GSLTEQ. The GSLTEQ, which was one of the measures included in the PAITC questionnaire, asks respondents to report their weekly frequency of mild, moderate, and strenuous exercise.<sup>18</sup> It has been validated via various other PA measurement methods and has been used widely in large scale PA research.<sup>27–31</sup> In this study, significant correlations (all  $P < 0.01$ ) between the log booklet and the GSLTEQ were observed with respect to the number of reported weekly episodes of mild ( $r = 0.28$ ), moderate ( $r = 0.45$ ), and strenuous ( $r = 0.61$ ) PA.

It was also fairly evident that participants were recording their PA episodes on a regular basis over the course of the study week. For example, participants recorded at least one PA episode on an average of 5.9 out of a possible seven days. Almost half the sample (47%) recorded at least one episode on all seven days, while an additional 26% and 13% recorded at least one episode on six and five days, respectively. Therefore, it appears that participants were relatively diligent in filling out their log booklets, which adds to the credibility of the PA data obtained.

### Physical activity by location

One of the key contributions of a diary method, and the PAITC log booklet in particular, is the ability to collect detailed information about individual PA episodes. In research addressing environmental influences on PA, location will be one of the most salient contextual variables that could and should be measured. In this study, location descriptions recorded by participants for each episode as open-ended text were manually coded as (i) at home, (ii) in the participant's neighborhood (in whole or in part), or (iii) in another location. Episodes classified as 'within the neighborhood' were determined based on the municipally-defined planning district boundaries and the described locations or streets where the episode occurred. For the present descriptions, an abridged sample of 384 participants—1 per unique household that participated in the study—was used to avoid any potential dependence among the data from participants in the same household (eg, engaging in PA in a location together).

A total of 3815 PA episodes were reported by the subsample of participants in the study and only 65 (1.7%) contained location descriptions that were

insufficient to classify the episode into one of these three categories. Overall, as described further elsewhere, approximately one-third (32.9%) of the 3750 episodes reported by the entire abridged sample of participants during the study week occurred within their neighborhood, either in whole or in part.<sup>32</sup> A significant number (28.5%) took place either inside the home or on the respondent's property, while the remaining amount (38.6%) occurred in other contexts, such as in other areas of the city or out-of-town.

Using the same episode location descriptions, it was also possible to examine the percentage of total PA episodes recorded by participants that included use of a park and/or trail and whether the park or trail was one that fell within or overlapped their neighborhood. In total, 308 of the total 3815 PA episodes (8.1%) reported by participants in the abridged sample included the use of a park. Another 97 episodes (2.5%) solely made use of a trail, while 43 (1.1%) included a park and trail. *Neighborhood* parks were mentioned in 236 or 6.2% of the total episodes, while 71 episodes (1.9%) included a neighborhood trail. Other analyses found that PA episodes in parks were more likely to be mild (42%) or moderate (45%) than strenuous (13%), while trails had a similar proportion of moderate-intensity episodes (44%) but more strenuous (20%) and fewer mild (36%) episodes. These types of analyses about particular settings were made possible by the collection of detailed location information. Numerous other opportunities for context-specific analyses, some of which are described below, are facilitated by the use of a detailed log booklet for gathering individual PA episode data.

### Discussion

To date, significant advancements have been made in measuring the social and physical environment factors thought to influence recreational and transportation-related active living behaviors, but developing context-specific methods for measuring the behaviors themselves has not received as much attention.<sup>6</sup> Certainly, objective measures of PA, such as accelerometers and pedometers, have many merits and their deployment in ecological research is increasing. However, their use remains challenging in many population-level settings and, on their own, they fail to provide valuable contextual information that is imperative in understanding how the environment





affects PA. Moreover, despite the promise of electronic monitoring for measuring PA, many issues related to their use remain unresolved (eg, inconsistent protocols for translating activity readings into minutes or energy expenditure outputs; inability to capture common activities such as swimming and cycling).

Likewise, global positioning systems (GPS) are another technological advancement which can aid efforts to understand links between environments and behaviors. Worn on the body or carried in a bag, GPS units communicate with satellites and ground stations to record positional coordinates at regular intervals.<sup>14</sup> This can provide a wealth of information about where study participants are undertaking the activities of daily life. For example, one study compared the actual routes taken to and from school by 71 primary school children—as measured by GPS tracking—to the routes which would be inferred by using the shortest street-distance function in a geographic information system (GIS).<sup>13</sup> They reported that no differences in total distance were found between the two methods, but that the students were less likely to take routes that followed and crossed busy streets compared to what the GIS method would estimate. However, despite their potential for active living research, research-quality GPS units are costly and may be inaccessible for researchers using large, community-based samples. They may also fail to record data when subjects are active in certain types of environments (eg, substantial tree cover or tall buildings).<sup>14,33</sup> Just as importantly, they do not capture multiple forms of non-geographic information that can be valuable in social ecological studies, including the purpose of the recorded movement, the experience of the activity (eg, enjoyment, co-participants), or the duration or intensity of the actions. The latter types of data can be captured by pairing GPS units with accelerometers, but difficulties can arise with accurately matching the time of spatial movements recorded on the GPS with the time of acceleratory motions recorded by the accelerometer. Certainly, such technologies are intriguing and hold great promise for active living research, but researchers also should not lose sight of the relative simplicity and utility of self-report methods for measuring PA.

Some of the most popular self-report PA questionnaires include the Godin-Shepard Leisure Time Exercise Questionnaire (GSLTEQ), the Seven-Day Physical

Activity Recall (7DAY PAR), the International Physical Activity Questionnaire (IPAQ), and the Minnesota Leisure-Time Physical Activity Questionnaire (MLT-PAQ). Although each of these instruments has proven useful for capturing a variety of PA-related information, they are insufficiently-detailed in different ways for social ecological research. For example, the GSLTEQ simply assesses frequency of four general intensity categories of activities, without regard for type of activity, total duration, or context of the activity (ie, location, purpose). The 7DAY PAR provides somewhat greater detail in recording, via a semi-structured interview, the amount of moderate, hard, and very hard PA during the morning, afternoon, and evening on each of seven consecutive days.<sup>34,35</sup> Again, however, the type, location, and duration of individual PA sessions are left unknown. The IPAQ was developed by a large, international team of researchers to facilitate international comparisons and global surveillance of PA levels.<sup>17</sup> In its “long format” (the more comprehensive version), the IPAQ asks respondents to indicate the number of days in the past week and the usual number of hours on those days that they engaged in vigorous, moderate, and walking activity. These three intensities of activities are assessed for four domains of activity: (i) job-related, (ii) transportation, (iii) housework, house maintenance, and caring for family, and (iv) recreation, sport, and leisure-time. A fifth section, as well as part of the transportation section, also asks about time spent sitting. While the IPAQ provides additional information about the context/purpose of respondents’ PA (in addition to the usual intensity, frequency, and duration data), like all of the other available questionnaires, only limited information is collected about the location where the PA took place. Finally, the MLT-PAQ gathers activity participation information for a list of 63 individual activities, including which months they were engaged in, the average number of times per month, and the amount of time per participation occasion.<sup>36</sup> Again, however, location data are not collected and the 63 activities may not comprise an exhaustive list for the participants in this study.

As another example, Giles-Corti et al.<sup>8</sup> recently described the development of the Neighborhood Physical Activity Questionnaire that differentiates between recreational and transport-related walking undertaken within and outside the neighborhood during a usual week. Despite also collecting





information about minutes spent walking to specific transport-related and recreational destinations, the instrument is relatively simple to administer and demonstrated sufficient levels of test-retest reliability. However, some potential weaknesses include a focus strictly on walking behaviors, unacceptable levels of test-retest reliability that were observed for minutes spent walking to certain destinations, the absence of additional contextual details (including perceived intensity), and the loss of information as a result of aggregating individual PA episodes within individuals to a weekly total. Nevertheless, this tool represents a significant advancement over existing self-report PA questionnaires with respect to capturing data on location and purpose of walking. In the present study, however, we employed a somewhat more labor-intensive data collection procedure (for both respondents and the research team) to capture even greater context about a broad range of participants' active behaviors.

To date, use of the detailed log booklet in the PAITC has facilitated a number of studies of how the social and physical environment influence PA. For example, in one series of analyses, it was found that greater perceptions of flow and enjoyment, two feelings that can encourage prolonged participation, were more likely during PA with friends and activity-specific groups (eg, teams), while lower levels of flow and enjoyment were experienced when accompanied by spouses/partners and children.<sup>37</sup> Such findings, made possible by the collection of additional contextual information about PA episodes, can have significant implications for how PA and recreation programs are designed and delivered. In another study, it was reported that participants from the core (more walkable) area of the city reported significantly more episodes and minutes of PA *in their neighborhoods* than did participants from more suburban neighbourhoods.<sup>32</sup> Demonstrating an association between area characteristics and *area-specific* PA provides stronger theoretical evidence for linking the built environment and behaviour.<sup>7</sup>

Other studies based on the PAITC data have focused specifically on PA episodes occurring in parks. For example, Kaczynski et al.<sup>38</sup> found that the number of features in a park was more important than its size or distance from participants in predicting whether *the park* was used (versus not used) for PA. Another study examined how three variables—the number

and total size of neighborhood parks within 1 km of participants' homes as well as distance to the closest park—were associated with participants' levels of moderate-to-strenuous PA in three contexts: total, neighborhood-based, and park-based.<sup>39</sup> In general, it was found that the number and total area of nearby parks were significant predictors of PA that occurred in neighborhoods and parks, but that distance to the closest park did not play a significant role in predicting moderate-to-strenuous PA in any of the three contexts. Additionally, stronger associations were observed between park proximity and *park-based* PA rather than measures of overall PA. These studies demonstrate the additional detail which can be captured by employing a log booklet with contextual data about individual PA episodes to study active living behaviors.

### Limitations

Several limitations related to the development and use of the log booklet should be noted. For example, in this study, the PA locations recorded by participants were not verified by any external procedure. As noted above, most studies of PA and the built environment have largely avoided such concerns by employing an acontextual measure of PA. In contrast, in the detailed instructions for the log booklet, participants were told to record as much detail as possible in the large location box on each log page, and several sample pages were included at the start of the booklet that provided lengthy, descriptive examples (eg, walked down King Street, through Greenstone Park, up Queen Street to office). Nevertheless, while this paper has described the *development* and use of the log booklet in detail, future studies may wish to employ GPS monitoring with a sub-sample of participants to validate such a self-report tool.<sup>14</sup> This would seem to be a prudent step before going the much more expensive (and potentially less-informative) route of adopting emerging technologies as the primary methods of data collection.

Another limitation relates to a lack of certainty about how conscientious participants were in recording their activity episodes in the log booklet. Likewise, self-report methods, though likely best for capturing numerous contextual details simultaneously, are inherently prone to over reporting and subjectivity in participants' recordings. Accurate recall about duration, intensity, or location of PA is dependent on frequent transfer of such details to the log booklet. In this study,



preliminary analyses (described above) suggested participants were relatively diligent in filling out their log booklets such that problems of recall bias on episode locations and other details would be reduced. Indeed, some research suggests that use of PA diaries such as a log booklet can positively influence recall and reduce over reporting as compared to other self-report methods of measuring PA.<sup>15,40,41</sup> Despite these assurances, future investigators interested in knowing greater details about participants' behavioral patterns should explore ways to ensure or improve the accuracy of location and other contextual data about recorded PA behavior. As well, the present sample was well-educated, which may have influenced their willingness or ability to complete the log booklet protocol.

Finally, in addition to these reliability and validity considerations, researchers may wish to contemplate issues related to data storage and processing and how these may be aided by the use of technology. In this study, the simplistic paper-and-pencil format of the log booklet proved feasible for participants, but it required substantial entry and manipulation of the acquired data by the research team. With the advent of smart phones and other portable devices, converting this log booklet into an electronic format may prove useful and efficient for both data input by participants and data processing by researchers.

## Conclusion

This paper has described the development of a detailed log booklet to facilitate social ecological research related to PA and the built and social environments. Significant progress has been made in developing exposure measures that capture the activity-promoting characteristics of neighborhoods and communities, but less effort has been devoted to ensuring the relevance of PA outcome measures for such research. In this study, the log booklet provided an expedient means of collecting a wide variety of information with minimal participant burden or confusion. In the future, researchers may wish to adopt or adapt such a method in their efforts to advance our understanding of the complicated and contextual nature of active living behaviors.

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