

# PHYSICAL ACTIVITY OF ABORIGINALS WITH TYPE 2 DIABETES: AN EXPLORATORY STUDY

Given the magnitude of the diabetes epidemic among Canadian Aboriginals and the corresponding need to develop physical activity interventions, the aims of this study were to: 1) examine the meaning of physical activity; 2) assess physical activity behavior levels; and 3) examine the association of key Social Cognitive Theory (SCT) constructs with physical activity behavior. Thirty-four Aboriginals with diabetes completed a survey composed of questions regarding: 1) the perceived meaning of physical activity; 2) physical activity behavior; and 3) SCT constructs. An emerging theme revealed that some participants perceived physical activity leisure-time activities as appropriate across the lifespan, while the majority perceived leisure-time activities to be only for youth. Based on the reported energy expenditure estimates, 61.5% of participants were categorized as sedentary. However, when occupational and household activities were taken into account, 33.0% were categorized as sedentary. Bivariate correlations revealed that no SCT constructs were significantly associated with energy expenditure scores. Results suggest that specific SCT construct items may help understand physical activity behavior change. (*Ethn Dis.* 2005;15:256–266)

**Key Words:** Aboriginals, Diabetes, Physical Activity, Social Cognitive Theory

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## INTRODUCTION

By the year 2010, more than 220 million people in the world are anticipated to be living with diabetes.<sup>1</sup> More than 2 million Canadians have been diagnosed with diabetes, and this number is expected to grow to more than 3 million by 2010.<sup>2</sup> Type 2 diabetes has become a serious public health problem for the population at large;<sup>3</sup> however, prevalence rates are two to six times greater in Aboriginal populations compared to non-Aboriginal populations.<sup>4–10</sup>

Physical activity is a key behavioral strategy to prevent and manage type 2 diabetes.<sup>11–12</sup> Research has shown that participation in regular physical activity decreases fasting blood glucose levels and decreases insulin or hypoglycemic requirements.<sup>13</sup> In addition to physical activity's important role in diabetes management and glycemic control, it also confers several psychological (eg, improved self-esteem, increased sense of well-being, enhanced quality of life), and other physiological (eg, decreases in resting pulse rate, cardiac work, and low-density lipoprotein concentrations) benefits.<sup>14–15</sup>

Although recommendations advise physical activity participation to manage and prevent diabetes among Aboriginals, low leisure-time physical activity rates have been reported among Aboriginal populations.<sup>16–17</sup> One study described that only 43% of Inuits and 38% of Dené participated in physical activity three or more times per week for at least 15 minutes.<sup>18</sup> Low levels of activity were also reported among British Columbia Aboriginals (Penticton band, Spallumcheen band, and Okanagan band) with diabetes, with only 37% participating in "sweat-producing activities" at least three times a week.<sup>19</sup> In a more recent study in Sandy Lake, Kriska

and colleagues reported that men participate in 6.9 hours of leisure-time activity per week while women only engage in 1.5 hours.<sup>13</sup>

To ensure the development of culturally relevant assessment tools and related physical activity interventions and program materials, the cultural meaning of physical activity needs to be examined.<sup>20–23</sup> Henderson and Ainsworth explored how Native women perceived physical activity across their lifespan.<sup>23</sup> Through interviews, the researchers noted participants commonly defined physical activity in terms of daily tasks such as household, childcare, and work-related tasks. In another study, sociocultural perspectives of physical activity among older American-Aboriginal women from the Pueblos and Navajo Nation of New Mexico were explored.<sup>22</sup> Physical activity was reported to be part of their traditions (eg, physical activity in dancing). To effectively change behavior, the authors emphasize the importance of examining the sociocultural meaning of physical activity.<sup>22</sup>

To intervene effectively on health-promoting behaviors (eg, physical activity), scholars and health professionals have focused considerable efforts on understanding the process of individual behavior change and maintenance. One major theory is the Social Cognitive Theory (SCT).<sup>24</sup> The SCT attempts to understand, predict, and change volitional behavior by using several key constructs, including self-efficacy, behavioral capability, observational learning, outcome expectancies, outcome expectations, environment, situation, self-control, emotional coping responses, reinforcements, and the environment. Among the general population, the literature has reported significant evidence supporting the association of various

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*More than 2 million Canadians have been diagnosed with diabetes, and this number is expected to grow to more than 3 million by 2010.<sup>2</sup>*

SCT constructs in relation to physical activity behavior.<sup>25-34</sup>

The role of self-efficacy in the initiation and maintenance of health behaviors has been firmly established in large population- and community-based samples.<sup>28,30</sup> For example, self-efficacy was the strongest ( $\beta=.22$ ) social-cognitive determinant of exercise behavior in a 24-month longitudinal study of 1739 adults testing the SCT.<sup>30</sup> Moreover, a recent review of the literature concluded that self-efficacy is the most consistent and strongest social-cognitive correlate/predictor of physical activity behavior.<sup>33</sup> Other SCT constructs (ie, barriers, physical environment, social support) have frequently been reported to have significant associations ( $\beta=.06$  to  $\beta=.20$ ) with physical activity.<sup>30</sup> For example, social support's strong association with physical activity has been identified in a variety of contexts and settings (ie, support from one's spouse,<sup>34</sup> friends,<sup>25,29,30,34</sup> family,<sup>25,29,30,34</sup> school peers,<sup>32</sup> and workplace peers<sup>32</sup>).

Although the empiric association of SCT constructs with physical activity promotion among Aboriginals with diabetes appears to be non-existent, a review of the literature shows descriptive support for the association with some of the SCT constructs (eg, social and perceived environment) with physical activity behavior among Aboriginals.<sup>9,21,35-37</sup> Eyler and colleagues assessed the association of physical activity with social support among middle- and older-aged American Aboriginals/Alaskan Natives.<sup>21</sup>

As the researchers hypothesized, sedentary individuals were more likely to have low physical activity social support. Native Americans of New Mexico with diabetes commented on how the "lack of access to aerobics classes (eg, no transportation or lack of availability in the community), safety issues (eg, loose dogs, no bike or pedestrian paths away from traffic), or lack of childcare" influenced their physical activity participation.<sup>37</sup> In another study, surveys collected from Lakota adults residing on a reserve in South Dakota noted similar issues with their environment (eg, lack of facilities, weather, and safety), which they claimed influenced their physical activity behaviors.<sup>35</sup>

In summary, although complete social-cognitive theories have not been applied to Aboriginals in the physical activity domain, SCT may have merit in this regard.<sup>24</sup> A review of the literature shows that certain SCT constructs may be associated with physical activity among Aboriginals.<sup>21,35,37</sup> Further, cumulative and consistent evidence supports relationships between SCT constructs and physical activity behavior in the general population. Moreover, from a health promotion perspective, the environment must be taken into account in understanding behavior, and SCT considers the influence of the environment to be a crucial dimension in promoting physical activity behavior.

This study is significant because of the diabetes epidemic among Canadian Aboriginals and the corresponding need to develop physical activity interventions. Findings from existing SCT research in the general population cannot be generalized to Aboriginal populations because of the uniqueness of Aboriginal peoples' culture and values. The aims of the present study are therefore to: 1) examine the meaning of physical activity; 2) report the levels of this behavior among Aboriginals with type 2 diabetes; and 3) examine the association of key SCT constructs with physical activity behavior among Aboriginals with type 2

diabetes. We hypothesize that key SCT constructs (ie, self-efficacy, behavioral capability, observational learning, outcome expectations, and environments) will be significantly associated with leisure physical activity behavior; however, key SCT constructs will not be significantly associated with non-leisure activities.

## METHODS

### Sample and Procedure

To qualify for the study, participants met five inclusion criteria: 1) Aboriginal ancestry; 2) 18 years of age or older; 3) adequate English skills; 4) not be infirm; and 5) not have gestational diabetes. Data collection consisted of two samples.

#### Sample One

This sample was composed of individuals from an Aboriginal reserve in Alberta, Canada, the "prairie" region of Canada. The reserve is home to a Cree community of almost 4500 people with another 1700 individuals living off the reserve. The community is easily accessible year-round by road and rail. Most residents speak both English and Cree, with many of the elders speaking only Cree.

Following Band Council approval, the researcher participated in community activities to develop a better understanding of Aboriginal culture and to familiarize herself with the community over a five-month period. The subsequent recruitment procedure consisted of two strategies: 1) identification of eligible individuals from the onsite health unit's diabetes registry; and 2) referrals from the community health representative. The community health professional suggested names from both these recruitment strategies to ensure a representative sample of her community. Of the 96 eligible participants, 20 names were recommended. Eighteen agreed to participate in the study, and 2 refused because of recent injuries. During the

**Table 1. Demographics of Aboriginal Reserve (sample one), Alberta Province (sample two), and combined sample**

Variable	Aboriginal Reserve Sample One (N=18)		Alberta Province Sample Two (N=16)		Combined Sample (N=34)		P Value	
	Mean	(SD)	Mean	(SD)	Mean	(SD)		
Age	58.4	(10.8)	55.6	(10.8)	57.1	(10.7)	0.7	NS
BMI	33.0	(11.8)	31.9	(6.8)	32.5	(9.7)	0.8	NS
	<i>N</i>	(%)	<i>N</i>	(%)	<i>N</i>	(%)	$\chi^2$	
Sex								
Male	9	(50.0)	6	(40.0)	15	(42.9)	0.5	NS
Female	9	(50.0)	9	(60.0)	18	(54.3)		
Marital status								
Never married	1	(5.6)	1	(6.7)	2	(6.1)	6.0	NS
Married/common-law	12	(66.7)	10	(66.7)	22	(66.7)		
Divorced	1	(5.6)	1	(6.7)	2	(6.1)		
Widowed	4	(22.2)	3	(20.0)	7	(21.1)		
Occupation								
Home	7	(38.9)	4	(26.7)	11	(34.4)	1.9	NS
Office	5	(27.8)	6	(40.0)	11	(34.4)		
Manual	1	(5.6)	0	(0)	1	(3.1)		
Retired	4	(22.2)	5	(33.3)	9	(28.1)		

NS=not significant.

spring, summer, and fall of 2002, the questionnaire was interview-administered to recruited community members with type 2 diabetes living on the reserve; the questionnaire took between 40 minutes and two hours to complete. The sample consisted of 18 people (9 men, 9 women) between the ages of 40 and 83 years (mean=58.4; standard deviation [SD]=10.7).

### Sample Two

As part of a larger longitudinal study, a random sample of Aboriginal adults aged 18 years and older residing in Alberta with type 1 or type 2 diabetes were recruited from: 1) the Canadian Diabetes Association Registry; and 2) a randomized digit dialing protocol.<sup>38</sup> While Aboriginals living on a reserve were surveyed in sample one, these recruitment strategies assisted toward the representativeness of off-reserve Aboriginals. The Population Research Laboratory at the University of Alberta posted a self-administered questionnaire to 4000 Albertans with diabetes. Those who identified themselves as Aboriginals

at the study's baseline assessment were sent a questionnaire identical to the one received by sample one participants. Sixteen Aboriginal individuals (6 men, 10 women) between the ages of 40 and 80 years (mean=55.6; SD=10.8) with type 2 diabetes completed the questionnaire.

### Combined Sample

Student *t* tests and chi-square analyses were performed between the two groups on age, body mass index (BMI), sex, present marital status, present occupation, disability, and SCT constructs (defined below). These analyses revealed no statistical differences on any of the variables ( $P<.05$  level) between the two groups. Data from both samples were therefore combined to enhance qualitative comprehensibility and to increase statistical power for quantitative analyses. The combined sample ( $N=34$ ) was composed of 15 men and 19 women between the ages of 40 and 83 years (mean=57.1; SD=10.7). The demographic details for the two subsamples

and combined sample are presented in Table 1.

## Measures

### Development Phase

A literature review was conducted to develop a pool of potential items that could be used to measure SCT constructs.<sup>25,32,38</sup> From this pool, a draft questionnaire was developed. To ensure the questionnaire was culturally appropriate and comprehensive, a team of experts composed of a physician, an occupational therapist, and an Aboriginal community health educator—all of whom had employment and/or research experience with Aboriginals with diabetes—reviewed the questionnaire. The questionnaire items were revised by confirming, clarifying, adding, and modifying the items in relation to culture. The instrument was then piloted to assess language, comprehensibility, and content appropriateness on a small sample ( $N=5$ ) of the community members with diabetes. For pre-selected sections, open-ended questions were used to so-

licit content for scale items. As a second step, individuals were asked their opinion regarding the salience of pre-set items and the comprehensibility of these items. During these interviews, which were conducted in the workplace and at peoples' homes, the researcher was accompanied by the community health representative who assisted in translation when appropriate.

**Meaning of Physical Activity.** To assess the perceived meaning of physical activity, respondents were asked: What does physical activity mean to you?

**Energy Expenditure and Physical Activity Measure.** These measures were similar to the National Health Interview Survey, however, a comprehensive list of leisure and occupational activities specific to Aboriginal culture were listed.<sup>39</sup> Space was also provided for other activities that were not listed. Participants provided self-reported answers to the types of activities, the frequency of exercise bouts, approximate duration of each session over the previous two weeks, and average intensity of activity bouts. From these reported activities, energy expenditure estimates were calculated. The metabolic equivalent (MET) scores used for leisure activities were based on Ainsworth and colleagues' compendium of physical activities composed of 605 specific activities.<sup>40</sup> The specific physical activities listed in the compendium exceeded the detail utilized for this study. To address this issue, a similar protocol as earlier studies was employed.<sup>41,42</sup> For each activity listed in this study's survey, MET scores for corresponding activities from the compendium were assigned to three categories according to Pate and colleague's classification (ie, light  $\leq 3$  METs, moderate = 3–6 METs, and vigorous  $> 6$  METs).<sup>43</sup> Based on these categories, an average MET score was computed for each activity, producing three MET values for each activity (one for each of the intensity categories). The MET score averages were between 2.4 and 8.2 for the various activities, and these averages

were then used to compute energy expenditure. Separate energy expenditure variables were calculated to represent: 1) leisure-time energy expenditure; 2) non-leisure-time energy expenditure (ie, occupational/household); and 3) total energy expenditure (ie, leisure and non-leisure). Participants were classified as being sedentary (0.0–1.4 kcal/kg/day), moderately active (1.5–2.9 kcal/kg/day), or very active (3.0 or more kcal/kg/day) based on their individual estimates.<sup>44</sup>

Public health recommendations focus on the accumulated time spent engaging in physical activity in a week.<sup>43</sup> Canadian and American organizations claim the recommended levels of physical activity are associated with enhanced physical fitness, improved mental health, and reduced risk for several chronic diseases. In Canada, the recommended duration is a minimum of 120 minutes of moderate-intensity activity per week accumulated by 30 minutes of activity on four or more days each week. In the United States, 150 minutes or more per week accrued by 30 minutes of activity on five or more days each week is specified.<sup>43</sup> The accumulated minutes of leisure and total activities were also assessed to determine if the participants were meeting the recommended Canadian and American public health guidelines.

**Self-Efficacy.** Self-efficacy was assessed by using measures developed by Marcus and colleagues,<sup>45</sup> and modified by Plotnikoff and colleagues.<sup>28</sup> To establish further content validity of the scale, additional items were included from qualitative, pre-pilot interviews with individuals living with diabetes. The items employed five-point scale response options (not at all confident = 1; very confident = 5) to statements regarding each participant's confidence in his/her capabilities to organize and execute courses of actions required to participate in physical activity under a variety of circumstances. The self-efficacy scale consisted of 14 items, with six of these items specific to those with diabetes.

The items were summed and averaged to form the self-efficacy score (likewise for all other SCT constructs in this study). Cronbach's alpha for the 14-item self-efficacy scale was 0.78.

**Behavioral Capability.** This construct was assessed by asking questions regarding participants' knowledge of the role of physical activity in the management of diabetes and knowledge of the required steps to ensure safe physical activity participation. Since earlier studies have assessed behavioral capability by using dichotomous response options, the present study employed a similar format using "agree" and "disagree" as response options.<sup>46,47</sup>

**Observational Learning.** Participants were asked about the frequency with which they observed other people (eg, family, friends) participate in physical activity. Responses to these items were recorded on a 5-point scale, ranging from 1 (never) to 5 (very often). This social modeling construct initially developed by Booth and colleagues was modified to recognize Aboriginal people living with diabetes.<sup>25</sup> Cronbach's alpha for the seven-item observational learning scale was 0.77.

**Outcome Expectation.** Two proxy outcome expectation scales consisted of: 1) five general and two diabetes-specific positive items; and 2) six general and four diabetes-specific negative items. These items were assessed by asking participants how much positive (eg, regular physical activity helps me control my weight) and negative (eg, getting regular physical activity would cost too much money) statements regarding physical activity influenced his/her decision to do regular physical activity. A modified version of the Decisional Balance Questionnaire<sup>48</sup> adapted for the Canadian population<sup>28</sup> was employed. Based on pre-pilot interviews with people living with diabetes, seven items (five positive and two negative) specific to those with diabetes were added. All items employed response options ranging from 1 ("not at all") to 5 ("very much"). Positive and



negative statements were interspersed to avoid response-set behavior. Cronbach's alpha for the positive scale (seven items) was 0.68, and for the negative scale (10 items) was 0.58.

**Social Environment.** Social environments were assessed by asking participants the frequency with which others motivated them to participate in physical activity with a five-point Likert-type scale (never=1; very often=5). This construct was assessed by using a modified measure initially developed by Stahl and colleagues.<sup>32</sup> Cronbach's alpha for the 15-item social environment scale was 0.73.

**Physical Environment.** The physical environment was assessed by using measures developed by Sallis and colleagues,<sup>30</sup> which were modified for this study. These measures were composed of two environmental subscales, including the home (ie, owning physical activity equipment) and the community (ie, access to facilities in the community). Items for both the home (nine items) and community (six items) subscales employed "yes" or "no" response options to owning home equipment and accessing facilities in the community.

## Analysis

### Aim One

A content analysis was completed in order to ascertain the attitudes and beliefs associated with physical activity. This process included both coding and categorizing patterns in the data.<sup>49-50</sup> The open-ended question was coded to identify consistent words, phrases, concepts or themes, and to simplify and organize the information. Once the coding was complete, the data were again extensively reviewed to categorize any underlying patterns.

### Aim Two

Energy expenditure from the self-reported physical activity behavior of the modified National Health Interview Survey was computed.<sup>39</sup> Three energy expenditure scores were calculated: 1)

leisure energy expenditure; 2) non-leisure energy expenditure; and 3) total energy expenditure. Minutes of activity performed at moderate intensity (or greater) were also calculated to assess public health guidelines.

### Aim Three\*

Bivariate correlations were conducted between age, sex, disability, and each SCT scale with: 1) (i) leisure energy expenditure, (ii) non-leisure energy expenditure, and (iii) total energy expenditure; 2) Canadian physical activity public health recommendations of 120 minutes or more per week of moderate-intensity activity (ie, leisure activity and total activity); and 3) the American physical activity public health recommendations of 150 minutes or more per week of moderate-intensity activity (ie, leisure activity and total activity).

## RESULTS

### Aim One

Most participants associated physical activity with health benefits (see Table 2). Many were cognizant of at least one of the health benefits associated with physical activity. Physical activity was linked to maintaining health; spiritual, psychological, and physical benefits were mentioned. Participants commonly described the psychological benefits in terms of reducing stress and having a clear mind. Physical benefits were generally emphasized, including: staying fit, lowering blood sugar levels, maintaining weight, developing strength, extending life span, aging gracefully, maintaining mobility, minimizing further diabetes complications, and keeping joints mobile. Keeping healthy was the most frequently cited benefit; however, few were

**Table 2. Reported statements regarding physical activity**

Physical Activity Statements	Number of Participants
Staying fit	1
Decrease blood sugar	4
Feeling good	1
Keeping healthy	6
Controlling weight	4
Extending life	1
Stronger	1
Good physical health	1
Good mental health	2
Good spiritual health	1
Mobility	2
Aging gracefully	2
Decreasing stress	1

able to list the multiple benefits. Only four individuals described the importance of physical activity in minimizing future diabetes complications.

An emerging theme revealed most participants perceived physical activity participation varied across the lifespan, with leisure activity being reserved for youth. These study participants commonly described youth as a period that involved recreational activities and an active lifestyle and described adulthood as a time when activities focused on occupational and household duties. This view was repeatedly illustrated by the selection of household chores and child-care as the most frequent physical activities mentioned. Some individuals, however, did not share this continuum of change over the lifespan philosophy. These individuals believed that physical activity had a similar meaning across all ages, and people of all ages could participate in a wide variety of leisure activities over their lifespan.

### Aim Two

In terms of physical activity levels, participants reported a mean leisure energy expenditure of 2.3 kcal/kg/day (SD=3.9), and a total energy expenditure of 6.5 kcal/kg/day (SD=9.2). Based on the leisure energy expenditure estimates, 61.5% were in the sedentary category, 22.4% were considered mod-

\* Prior to analyses, data were screened for accuracy of input, distribution and dealing of missing data, identification and dealing of outliers, and identification of heteroscedasticity.<sup>51</sup>

**Table 3. Reported energy expenditure and physical activity behavior**

Physical Activity Levels	Total Sample (N=31)*	
	Mean (kilocalorie/day)	(SD)
Leisure energy expenditure†‡	2.3	3.9
Non-leisure energy expenditure	4.2	7.0
Total energy expenditure†	6.5	9.2
	N	(%)
Total ≥150 minutes§	11	35.5
Leisure ≥150 minutes§	7	22.6
Total ≥120 minutes§	11	35.5
Leisure ≥120 minutes§	8	25.8

\* Due to missing data and one outlier, three cases were not included in this analysis.

† The two sub-samples were significantly different (sample one had a higher mean).

‡ Calculated based on reported activities, duration, and intensity.

§ Calculated based on reported minutes of engaging in an activity at a moderate intensity or more over a week.

erately active, and 16.1% active (see Table 3). When non-leisure activities were included, respondents categorized as sedentary decreased by more than half (to 29.0%) for total energy expenditure estimates.

In regards to the Canadian public health guidelines, 35.5%† met the Canadian guidelines when total activities were recognized, with 25.8% achieving the guidelines when only leisure-time physical activity was considered (see Table 3). Similar percentages met the American guidelines; with 35.5% meeting recommendations when total activities were recognized, and 22.6% achieving the guidelines when only leisure-time physical activity was considered.

Yardwork, walking, and housework were the most frequently cited activities. Most (68.9%) of the participants reported walking for exercise at least once in the previous two weeks. Other than walking, however, few (32%) reported participating in other leisure type physical activities. Among the activities engaged in, 57.4% were classified as light-intensity activities, 31.9% were classified as moderate, and 10.6% were classified as vigorous-intensity activities.

† Two cases who performed ≥20 minutes of vigorous leisure activity, three times a week were included in this category.

### Aim Three

No significant correlations (all  $P_s > .05$ ) were seen between any of the three energy expenditure scores with the SCT constructs, rejecting the hypotheses that leisure activity would be associated with SCT constructs, but supporting the hypotheses that non-leisure activity would not be associated with SCT constructs (see Table 4). As a subsidiary and exploratory inquiry, correlational analyses were performed at the item level for each of the constructs as suggested by Rhodes and colleagues.<sup>52</sup> Given the multiple statistical tests, the Bonferroni correction procedure conservatively adjusted the alpha to the 0.01 level in order to minimize risk for making a type I error. Total energy expenditure was significantly correlated with the social environment item—*motivated to do physical activity by the community school* ( $r=0.57$ ). The self-efficacy items assessing confidence of participating in physical activity: *'when can't notice improvements'* ( $r=-0.55$ ), and *'when having diabetes problems'* ( $r=-0.55$ ) were correlated with participating in a total 120 minutes or more of moderate physical activity per week (Canadian public health criterion). These two items were also correlated ( $r_s > 0.62$ ) with participating in a total of 150 minutes or more of moderate physical activity per week (United States public health criterion).

## DISCUSSION

The first aim of this study was to examine Aboriginal peoples' perceived meaning of physical activity. This issue is important because cultural assumptions regarding physical activity may influence participation in this behavior. Although this study did not extensively examine the perceptions of physical activity, results provide insight into some current beliefs related to physical activity. First, the benefits listed by the participants extended beyond the physical to also include the spiritual and psychological. This holistic approach was illustrated in murals in the Community Health Center, which describe health as: social, spiritual, physical, cultural, and mental (researcher's field notes). Second, many Aboriginals with diabetes are not aware of a number of physical activity benefits, including its attributes for diabetes management. This finding suggests more effort is required to ensure First Nations people are cognizant of the multiple benefits that can occur when being regularly physically active. Educational programs are needed to enhance the understanding of physical activity and its role in type 2 diabetes management and overall health. Third, most respondents believed recreational physical activity is only for the youth. This finding is consistent with other studies<sup>23</sup> that report recreational activities for this population are performed during childhood while adult activities are related to occupational and household duties. To help these adults gain the benefits of leisure-time physical activity, messages that encourage leisure-time activities should be promoted. Messages should also contain information on how these activities can be modified to accommodate various abilities.

Energy expenditure estimates from recreational and conditioning activities in our study (research aim two) indicate that 61.5% of the sample are sedentary. Other studies have reported similar levels of inactivity. Findings from the 1991

National Health Interview Survey reveal that 65.7% of Americans with diabetes do not participate in regular physical activity. Fisher and colleagues' examination of leisure physical activity patterns among Chippewa and Menominee Aborigines described that only 12% of women and 17% of men were active in the past year.<sup>53</sup> The prevalence of physical inactivity in our study is slightly higher than national reported averages (ie, the Canadian Fitness and Lifestyle Research Institute's 2001 Physical Activity Monitor reports that 55% of Canadians are inactive), which may be explained by the high prevalence of disability among people with diabetes.<sup>54</sup> The leisure energy expenditure estimates clearly indicate this population is in need of targeted efforts to increase leisure-time activities.

Although the benefits of leisure-time activities have been well documented,<sup>12,15</sup> research has also reported an association between participation in occupational activities, and reduced risk of cardiac disease.<sup>55</sup> A strength of this study has been the inclusion of moderate-intensity occupational and household activities. Failure to account for these activities may inaccurately estimate physical activity levels. When total energy expenditure was considered, the proportion of the study's sample categorized as sedentary decreased by more than half (61.5% vs 29.0%). Since the researcher had observed the community primarily engaging in non-volitional activities we expected that when non-leisure activities were considered the community would be considered less sedentary (researcher's field notes). Other studies among Aborigines have shown similar activity patterns as reported in our research. Ainsworth and colleagues reported that 30% of Native American women were not meeting physical activity recommendations when total physical activity behavior was considered.<sup>40</sup> Although our findings reported 29.0% of people were inactive (when considering total energy expenditure), future

**Table 4. Pearson correlations among variables and descriptive statistics**

	2	3	4	5	6	7	8	9	10	11
1	0.71**	0.92**	0.38	0.33	0.38	0.33	0.25	-0.30	-0.05	0.03
2		0.71**	0.45*	0.47*	0.45*	0.47*	0.25	-0.33	0.17	-0.10
3			0.25	0.16	0.25	0.16	0.19	-0.20	-0.09	0.10
4				0.77**	1.00**	0.77**	0.21	-0.17	-0.25	0.07
5					0.77**	1.00**	0.16	-0.04	-0.29	-0.03
6						0.77**	0.21	-0.17	-0.25	0.07
7							0.16	-0.04	-0.29	-0.03
8								0.28	0.12	
9									-0.12	0.18
10										0.39*
11										
12										
13										
14										
15										
16										
17										

\*  $P < .05$  level; \*\*  $P < .01$  level.

1. Total Energy Expenditure  
2. Leisure Energy Expenditure  
3. Non-leisure Energy Expenditure  
4. Total Canadian Public Health Guidelines  
5. Leisure Canadian Public Health Guidelines  
6. Total American Public Health Guidelines  
7. Leisure American Public Health Guidelines  
8. Self-efficacy  
9. Behavioural Capability

10. Observational Learning  
11. Outcome Expectation—Positive  
12. Outcome Expectation—Negative  
13. Social Environment  
14. Physical Environment—Home  
15. Physical Environment—Community  
16. Disability  
17. Age  
18. Gender

epidemiologic research is required to assess the specific health gains (towards diabetes prevention and management) of occupational and household activities. If such studies confirm the beneficial effects of these forms of activities, then health promotion professionals should encourage policy and environmental changes supporting this issue. This support would have positive implications on physical activity behavior over the lifespan, since studies have shown that activities that are incorporated in ones lifestyle are more likely to be maintained.<sup>55</sup>

Similar to previous studies among Aboriginal and non-Aboriginal populations, walking was the most frequently cited leisure-type physical activity;<sup>53,56</sup> this finding supports recommendations to develop walking programs.<sup>56</sup> These activities are consistent with what the researcher frequently observed while in the community (researcher's field notes). Such programs may be highly effective

given the lower dropout rates in walking than in other exercise programs.<sup>56</sup>

Despite other Aboriginal studies<sup>22,35,37</sup> showing promise for SCT, the constructs tested in our study's third aim did not demonstrate significant relationships with leisure-time physical activity. These earlier studies, however, did not employ statistical tests (eg, correlations, regression analyses) to establish the associations of these constructs with behavior but instead used qualitative and/or descriptive methods.<sup>22,35,37</sup> For example, Harnack and colleagues described the barriers that Lakota residents encounter when undertaking physical activity, which may not necessarily be correlated with actual physical activity behavior.<sup>35</sup>

The exploratory findings from the item-level correlational analyses between leisure-time physical activity behavior and SCT items suggest that specific SCT construct items may help understand physical activity behavior change

**Table 4.** Extended

12	13	14	15	16	17	18	Mean (SD)
-0.25	0.10	0.15	0.26	0.17	0.08	0.18	6.49 (9.17)
0.01	0.23	0.08	0.18	0.18	-0.11	0.08	2.30 (3.94)
-0.34	-0.02	0.16	0.25	-0.35	0.16	0.18	4.19 (6.97)
0.17	-0.17	0.07	0.11	-0.20	-0.05	0.14	N/A
0.14	-0.11	0.21	0.11	-0.26	-0.20	0.21	N/A
0.17	-0.17	0.07	0.11	-0.20	-0.05	0.14	N/A
0.14	-0.11	0.21	0.11	-0.26	-0.20	0.21	N/A
0.04	0.04	0.11	0.19	-0.32	0.20	-0.13	2.99 (0.70)
-0.03	-0.13	-0.30	-0.20	0.37*	-0.26	0.18	4.28 (0.77)
0.29	0.50**	-0.37*	-0.64**	-0.04	-0.14	-0.47**	2.61 (0.84)
0.23	0.27	-0.23	-0.36*	-0.05	0.03	0.12	4.01 (0.56)
	0.45*	-0.14	-0.20	0.33	-0.01	-0.11	2.18 (0.56)
		-0.16	-0.20	0.03	0.08	-0.05	2.46 (0.70)
			-0.65**	0.03	-0.22	-0.15	2.94 (2.23)
				0.06	-0.30	0.10	2.93 (1.96)
					0.41*	0.10	1.15 (1.15)
						0.08	57.06 (10.68)

among Aboriginals with diabetes. The results showed significant correlations between a social environment item (ie, school) and two self-efficacy items (ie, when not noticing improvements, when having diabetes problems) with physical activity. These findings may guide appropriate strategies needed for community interventions by operationalizing these belief items.

Although our study provides limited support for SCT as a robust framework for explaining physical activity behavior in Aboriginal people with diabetes, it should not be eliminated as a potential theory for explaining physical activity and operationalizing programs to promote physical activity behavior change in this population. This limitation is due to two main reasons. First, because of the small sample, significance may not have been obtained because of the lack of statistical power. Although correlations were not statistically significant with energy expenditure, the magnitude of a number of the positive associations with leisure-time physical activity reached levels of potential practical/clinical significance. Cohen classifies correlations from 0.1 to 0.3 as small and >0.3 to 0.5 as moderate.<sup>57-58</sup> The results revealed that self-efficacy ( $r=0.25$ ), observational learning ( $r=0.17$ ), and so-

cial environment ( $r=0.23$ ) were positively correlated with leisure-time physical activity, and these constructs may have meaningful practice and research utility. Second, although modifications of construct items were conducted following pilot work, the core scale items were initially developed on non-Aboriginal populations and may not be appropriate for this population.

### Research Process

Research in Aboriginal communities entails a unique set of challenges. The lessons generated from this study should prove helpful for future groups initiating research with Aboriginal communities. We do not intend to claim the homogeneity of all Aboriginal communities but to provide insight into what Aboriginal research entails.

A significant barrier to conducting research with Aboriginals research is the known historical and scientific exploitation of these people in health research.<sup>59</sup> Although researchers are not necessarily in a position to change the social structure, they can make significant contributions to the quality of research by partnering with communities. For quite some time, Aboriginal people have been concerned of how outsiders have inappropriately defined their

needs, thought about their problems, and employed incongruent theoretical models to improve the health of the community.<sup>59</sup> The current study was conceived as an examination of the meaning and behavior levels of physical activity and an exploration of the key SCT constructs with physical activity behavior, rather than an intervention project based on community-directed solutions. Although the project's goals and general methods were outlined by the researcher, as much latitude as possible was given to the community. Concentrated efforts are needed to cooperate and create authentic partnerships with native communities.

Prior to beginning any form of research activity on an Aboriginal reserve, support and approval must be obtained from the reserve's Chief and Council. This approval is ethically necessary and beneficial in developing and promoting such research projects in the community. Although support from the Chief and Council in our study facilitated the research, this support did not automatically lead to community approval. Additional efforts were therefore required to attain community-wide approval that included researcher visibility, constant communication, and acceptance by the community.

When designing a project, one must factor in a familiarization period, which may take weeks, months, or even years. The researcher became orientated with the community by attending weekly diabetes sessions and making home visits over a five-month period. This familiarization period contributed to: 1) acquiring knowledge regarding the community's needs, traditions, culture, beliefs, and perceptions; 2) establishing mutual trust and understanding; 3) serving as a preliminary recruitment phase and promoting the project; and 4) ensuring visibility of the researchers and the project. Researchers should only proceed with the study when the community has attained a high level of comfort for such an activity. Moreover, researchers must



be non-judgmental toward individuals and their cultures.

Although the degree of involvement of the community may vary, the community should be involved in all research phases (ie, planning, implementing, and disseminating), and the community should be an equal member in the research process. Researchers must have a strong commitment toward participatory research approaches consistent with health promotion ideologies (eg, empowerment, citizen participation, and capacity building). The advantages of such involvement are: 1) to maximize participation; 2) to reduce and eliminate suspicions of research-associated abuse and exploitation; 3) to ensure that the process and the materials generated are culturally and linguistically appropriate; 4) to enhance the likelihood of the findings being integrated into the study; 5) to bring more meaningful conclusions; and 6) to ensure the validity of the findings. Within a participatory framework, defining the problem and the research objectives should begin with the specific needs and situation of the community. The use of community members in the multiple research phases led to the recruitment of more participants. In addition to building community capacity, community members' involvement permitted greater inclusion of the elderly who did not speak English. With the help of those in the community, we recommend outlining possible recruitment strategies that may include: 1) setting up booths at community socials and cultural events; 2) local radio announcements; 3) distributing flyers within the community; and 4) word of mouth. For all these strategies, community approval is important, since the community may deem some strategies inappropriate. Although in the opinion of the researcher the current project had a substantial familiarization period and community members were involved in the recruitment process, recruitment was a significant challenge.

Another recommended strategy that

may enhance the success of such projects is the provision of more immediate benefits to the community. Since the research objectives of this study began with confirming the application of the SCT in Aboriginals with diabetes, no immediate benefits were apparent. Although the examination of theories is important to the development of theory-based interventions, future investigations should focus on interventions where the immediate attributes of the involvement are apparent.

The researcher's experience repeatedly verified the need for flexibility (eg, project timelines, meetings, and deadlines). Conducting research with Aboriginal communities is a long endeavor, and is an unlimited process.

Given the nature of the study, a number of limitations need to be acknowledged. First, the questionnaire took between 40 and 120 minutes to complete, which may have limited the quality of responses by some participants. Although comprehensiveness is important to the content validity of the instrument's constructs, future investigations may try to minimize the time required for such assessments. A second limitation regarding the questionnaire was the language. While efforts were made to simplify wording and translate into Cree, some participants had difficulty understanding the meaning of some questions. This difficulty may have been in part due to language and the ethno-meaning of the questions. Although the researcher was accompanied by a community Aboriginal resident, a third limitation may be participants were not fully comfortable disclosing certain information because of the incongruent cultural identity of the researcher. A fourth limitation relates to the use of SCT measures validated for the general population. Although these measures were modified for Aboriginals with diabetes, the scales have not been extensively validated with this population. Future validation studies in this population could include work on the

ethno-meaning of the SCT items. Despite the various recruitment strategies, a fifth limitation was the small sample size, which limited the power to perform various statistical tests (eg, multiple regression techniques). A fifth limitation relates to the small sample size with an under representation of females and those under 45 years of age in comparison to national figures, where approximately 65% of Canadian Aboriginals with diabetes are 45 years of age or less, and approximately two-thirds of all Aboriginals living with diabetes are women.<sup>60</sup> Researchers however must be aware that within a large cultural group, such as Canadian Aboriginals, subgroups may have much dissimilarity.<sup>61</sup> In Canada, an estimated 598 specific Aboriginal bands across 2,284 reserves make collecting an accurate representation of all Canadian-Aboriginal reserves impossible. Although our study took a number of methodologic steps to achieve representativeness, generalizations regarding physical activity behavior and perceptions among all Aboriginals should be developed cautiously, given the uniqueness of each Aboriginal band and reserve. A final limitation was the employment of self-reported assessments of physical activity. To obtain more accurate estimates of energy expenditure, future studies should use a combination of a questionnaire and more objective assessments (eg, pedometers, direct observation). Future research may also explore an integrated chronic disease prevention approach since many of the most prevalent non-communicable diseases (eg, cancer, cardiovascular disease, diabetes, and chronic pulmonary disease) are linked by their preventable risk factors (ie, physical activity, diet, smoking). The World Health Organization recommends that action on these risk factors be undertaken in an integrated manner.<sup>62</sup>

## CONCLUSION

Diabetes is an epidemic among Canadian Aboriginals, and an urgent need

exists to develop physical activity interventions because of its potential role in preventing and managing this condition and the magnitude of the health problem. This preliminary exploration of the meaning of physical activity and its behavior and exploratory examination of the SCT in this population will hopefully guide future research and practice in this area.

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