

Canada's physical activity guide recommendations are a low benchmark for Manitoba adults

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Abstract: Canada's Physical Activity Guide to Healthy Active Living (CPAG) is the national reference for messaging on physical activity for health benefits, yet few studies have examined population activity levels in relation to its recommendations. As part of the province-wide *in motion* initiative, we obtained a baseline measurement of the physical activity levels of adult Manitobans. Physical activity levels were benchmarked against CPAG recommendations and were compared with criteria used in previous surveys. A stratified random sample of adults from the 9 Regional Health Authorities outside of Winnipeg, and from the 12 Community Areas within the Winnipeg Health Region, was surveyed by telephone. Respondents ($n = 6536$) reported all light, moderate, and vigorous physical activity of 10 min or more in the previous week. Intensity levels were corrected to reflect standard MET equivalents, using the Ainsworth Compendium. A total of 69.5% of respondents met the minimum CPAG requirements; however, only 29.1% of those did so with vigorous activity. Relative to energy expenditure, 18.3% were classified as inactive ($<1.50 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{day}^{-1}$ (KKD)), 16.4% as moderately active (1.50 to 2.99 KKD), and 65.3% as active (≥ 3.00 KKD). When assessed against the CPAG recommendations, which promote integration of physical activity into one's daily routine, a higher proportion of Manitobans met recommended physical activity levels than that reported in previous surveys, which focused on leisure activity. Given the corresponding increase in levels of obesity and chronic disease, and equivocal nutrient intake data, we recommend that the CPAG recommendations be reviewed, especially with respect to the inclusion of routine baseline activities of daily living.

Key words: community-level interventions, *in motion*, physical activity guidelines, physical activity surveillance, public health.

Résumé : Le Guide d'activité physique canadien pour une vie active saine (CPAG) est le document de référence au Canada concernant les directives en matière d'activité physique pour des gains sur le plan de la santé. Cependant, peu d'études se sont attardées aux niveaux de pratique de l'activité physique de la population en fonction des recommandations contenues dans le guide. Dans le cadre de la stratégie provinciale intitulée *in motion*, nous avons obtenu des mesures de base au sujet des niveaux de pratique de l'activité physique des adultes au Manitoba. Les niveaux de pratique de l'activité physique sont comparés aux critères du CPAG et à d'autres inclus dans des enquêtes antérieures. Une enquête par communication téléphonique est menée auprès d'un échantillon aléatoire stratifié d'adultes résidant dans les neuf Régions régionales de la santé à l'extérieur de Winnipeg et dans les douze communautés de la région sanitaire de Winnipeg. Les répondants ($n = 6536$) disent avoir fait de l'activité physique d'intensité légère, modérée ou vigoureuse durant 10 min et plus la semaine précédente. Les niveaux d'intensité de pratique sont transposés en valeurs équivalentes au MET au moyen du compendium d'Ainsworth. Parmi les répondants, 69,5 % suivent les recommandations minimales du CPAG et 29,1 % de ces derniers le font au moyen d'activités physiques vigoureuses. En fonction de la dépense énergétique, 18,3 % sont classés inactifs ($<1,50 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{jour}^{-1}$ (KKD)), 16,4 %, modérément actifs (de 1,50 à 2,99 KKD), et 65,3 %, actifs ($\geq 3,00$ KKD). Quand on évalue ces pratiques en fonction des recommandations du CPAG, notamment en ce qui concerne l'intégration de l'activité physique dans les habitudes de la journée, une plus grande proportion de Manitobains se conforme aux recommandations concernant les niveaux de pratique de l'activité physique comparativement aux résultats rapportés dans les dernières enquêtes qui s'intéressaient particulièrement aux activités de loisir. À la lumière de l'augmentation des niveaux d'obésité, de maladies chroniques et des résultats équivoques concernant l'apport alimentaire, nous recommandons une révision des recommandations du CPAG notamment au sujet de l'incorporation d'activités physiques de base dans le quotidien.

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Introduction

The health benefits of physical activity are well documented, and include the primary prevention of a number of chronic diseases (Warburton et al. 2006; Macera et al. 2003; US Department of Health and Human Services 1996). Given that 51% of Canadian adults were categorized as inactive in the 2004–2005 Canadian Community Health Survey (CCHS) (Canadian Fitness and Lifestyle Research Institute 2005), the corresponding potential for direct and indirect savings in health care costs by increasing population physical activity levels is substantial (Katzmarzyk and Janssen 2004). However, controversy remains over the amount of physical activity necessary to achieve health benefits (Warburton et al. 2006), and it has proven difficult to determine the minimum physical activity dose on which to base a public health recommendation (Blair et al. 2004). The dose–response relationship between the frequency, intensity, and duration of exercise and risk reduction varies considerably by outcome or disease, and by population (Haskell et al. 2007; Warburton et al. 2006; Macera et al. 2003). For sedentary adults, 30 min or more of moderate exercise on most days of the week is related to many health benefits, and the accumulation of higher amounts (Blair et al. 2004) or more intense activity (Swain and Franklin 2006) is believed to confer additional benefits (US Department of Health and Human Services 1996). From a public health perspective, the greatest benefits are realized when the large inactive segment of the population becomes somewhat more active (Haskell 1994; Pate et al. 1995). Moderate physical activity is deemed to be broadly accessible and safe; thus, the recognition of its many benefits has led to new public health initiatives, ranging from community-based programs, to population-based promotional campaigns, to the implementation of organizational and governmental policies.

Canada's Physical Activity Guide to Healthy Active Living (CPAG) is the current national reference for health messaging on physical activity for health benefits (Health Canada 1998; Tremblay et al. 2007a). It recommends 60 min of light activity daily, 30 to 60 min of moderate activity 4 days a week, or 20 to 30 min of vigorous activity 4 days a week. It also encourages Canadians to progress from light to moderate activities. Few studies have examined population activity levels in relation to the CPAG recommendations (Anderson et al. 2007; Canadian Fitness and Lifestyle Research Institute 1998). The Integrated Pan-Canadian Healthy Living Strategy calls for a 20% increase by 2015 in the proportion of Canadians who participate in moderate to vigorous physical activity for 30 min per day (Health Canada 2005). Many provincial and local initiatives are directed toward this goal. The *in motion* health promotion strategy, first launched in Saskatoon in 2000 and subsequently launched in Manitoba in October 2005, is one example of a comprehensive community-level initiative that aims to support increased physical

activity levels for health benefits. Population-level goals and interventions such as these require accurate measurement and tracking of physical activity levels, similar to other public health surveillance systems (Macera and Pratt 2000). Canada has monitored national physical activity levels semi-regularly since 1981 (Craig et al. 2004; Bruce and Katzmarzyk 2002); however, discrepancies in methodologies, reporting, and physical activity cut-points for health benefits limit the usefulness of this information. Moreover, although current guidelines recommend building physical activities into the daily routine, the majority of surveys consider only leisure-time physical activity. This lack of consensus on standard measures and guidelines hinders the application of physical activity survey results to public health initiatives (Katzmarzyk and Tremblay 2007).

The purpose of our research was 3-fold: to obtain a baseline measurement of adult Manitobans' physical activity levels, compared with the minimum recommended for health benefits in the CPAG; to determine whether Manitobans meet the CPAG recommendations for vigorous, moderate, or light activity; and to compare physical activity levels benchmarked against CPAG recommendations with levels reported in previous surveys using energy expenditure criteria.

Materials and methods

Sampling

The study was approved by the University of Manitoba Education and Nursing Research Ethics Board. Random sampling, stratified by region, was used to survey 400 Manitobans from each of the 9 Regional Health Authorities outside of Winnipeg and 400 from each of the 12 Community Areas within the Winnipeg Health Region. Children ($n = 797$) and teens ($n = 821$) were included to reach the 400 per area, but were analyzed and reported separately. Additional sampling requirements specified inclusion of at least 800 Manitobans of Aboriginal ancestry and 800 people aged 55 years and older. Canada Survey Sampler was used to generate a random sample of telephone numbers for each of the 21 areas based on postal code. A total of 47 020 calls were made, with a response rate of 35% (13 498 cooperative contacts out of 38 401 eligible phone numbers). As participants were recruited at the same time for a separate survey of children and teens, many potential adult respondents were disqualified if their regional sample quota was complete. After elimination of those who were disqualified (6579), and those with missing (346) or erroneous (37) physical activity data, the final sample size was 6536 adults. Based on the population of Manitoba, the theoretical error rate is $\pm 1.6\%$, 19 times out of 20. After extensive pretesting and monitoring by University researchers, the survey was conducted by Prairie Research Associates Inc. in May and June 2005, using a computer-aided telephone interviewing system.

Physical activity survey

The survey was developed by the *in motion* Research Committee, using a modified version of the Minnesota Leisure-Time Physical Activity Questionnaire (MLTPAQ) (Taylor et al. 1978). The reliability and validity of the MLTPAQ have been extensively examined (Jacobs 1997) and have been found to be acceptable for a variety of adult populations and applications. Our survey was adapted from the Saskatoon *in motion* survey; however, it was more comprehensive, in that it collected information on physical activity accumulated not only during sport and exercise, but during work, transportation, housework, and yardwork as well. Participants were first asked to indicate the amount of physical activity (none, some, lots) they got in a number of categories (on the job, going places, playing sports, other exercise (e.g., biking or jogging), other leisure activities (e.g., walking or gardening), day to day activities (e.g., yardwork or housework)). These questions were asked in this order, and the categories were self-defined. Further research is needed to determine the reliability and validity of the revised version of the MLTPAQ.

Survey respondents were then asked to report and classify all physical activities done in the previous week. The interviewer defined light, moderate, and vigorous activity in the following way: light activity is activity that causes you a slight increase in breathing, heart rate, and body temperature; moderate activity is intense enough to cause you a moderate increase in breathing, increased heart rate, and body temperature; and vigorous activity is intense enough to cause you heavy breathing, a rapid heart rate, and sweating. Respondents were then asked to indicate whether they perceived each of the activities they had reported doing as being light, moderate, or vigorous in intensity, and to report the frequency (times per week) and the duration (minutes per session) of each activity. Participants were also asked to identify all chronic health conditions or disabilities that had been diagnosed by a doctor, and that had lasted for more than 6 months.

Determination of physical activity levels

Only activity sessions of 10 min or more in duration were included in the physical activity analyses. Several of the self-reported activity responses were grouped together to aid in the data analysis and interpretation (e.g., categories for cardiovascular machines, resistance training, and martial arts were created from numerous more specific responses), for a total of 67 activity categories. Reported frequencies and durations were checked manually, and those with notable errors were removed from the study (37 cases). These were defined as unreasonable physical activity data as identified by a trained data analyst, for example walking for 120 min, 15 times per day.

Meeting the CPAG recommendations

To reduce the error commonly associated with people's perceptions of physical activity intensity, we applied corrections to correspond with standard intensity classifications (Ainsworth et al. 1993, 2000). First, we defined intensity level using metabolic equivalents (METs). Light activities were defined as those requiring <3.0 METs, moderate activities were defined as those requiring 3 to 6 METs, and vigorous activities were defined as those requiring >6 METs

(Pate et al. 1995; Haskell et al. 2007). We then reviewed the intensity reported by respondents for each activity against the range of MET levels assigned to that activity in the Ainsworth Compendium (Ainsworth et al. 2000). For example, if a respondent reported vigorous bowling, we determined the Ainsworth MET value for bowling (3.0), and reclassified the activity as moderate. If someone reported light badminton, we determined the Ainsworth value for badminton (from 4.5–7.0 METs), and reclassified the activity as moderate. In all, 55% of activities were reclassified, most notably those self-reported as light or vigorous yet deemed moderate using the Ainsworth criteria. If the total number of minutes engaged in vigorous activities was ≥ 80 , and the total weekly frequency of these activities was ≥ 4 , the individual was designated as meeting the CPAG recommendation for vigorous activity. Taking the rest of the dataset, the total number of vigorous minutes was added to total number of moderate minutes, and the total frequency of vigorous activities was added to the total frequency of moderate activities. If this totaled ≥ 120 min, and if the frequencies totaled 4 or more, the individual was designated as meeting the CPAG recommendation for moderate activity. Taking the remaining group, a sum of vigorous, moderate, and light minutes was computed, as was a sum of vigorous, moderate, and light frequencies. If the minutes totaled ≥ 420 , and if the frequencies totaled 7 or more, the individual was designated as meeting the CPAG recommendation for light activity. All remaining individuals were categorized as not meeting the CPAG recommendations.

Meeting energy expenditure criteria

Energy expenditure was estimated as per national Canadian surveys, including the CCHS (Katzmarzyk and Tremblay 2007), and adapted to 1 week:

$$AEE = \frac{\sum(N_i \times D_i \times METs_i)}{d}$$

where AEE equals average daily energy expenditure (measured in $\text{kcal}\cdot\text{kg}^{-1}\cdot\text{day}^{-1}$; KKD), N_i is the number of times the activity was performed, D_i is the average duration of the activity (in hours), $METs_i$ is the estimated energy cost of the activity ($\text{kcal}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$) equaling the lowest Ainsworth Compendium value assigned to that activity, and d is the number of days in the recall period (7).

Once this sum of energy expenditure was obtained, the variable was collapsed into categories: inactive (KKD < 1.50), moderate (KKD of 1.50 to 2.99), and active (KKD of ≥ 3.00).

Data analysis

PRA Inc. provided basic coding and data cleaning. The investigators performed all data analyses using standard statistical software (SPSS, version 11.0 for Mac OSX). Descriptive statistics were calculated for each variable, and the significance of differences between variables was determined using χ^2 analysis and t tests. A p value of 0.05 or less was considered significant for all statistical tests.

Results

Respondents

Characteristics of the sample ($n = 6536$) are presented in

Table 1. Respondents were more likely to be female and under 65 years of age. Although generated randomly, the sample cannot be considered truly representative as participants were recruited primarily to fill regional sample quotas. When asked if they exercised regularly, 67.9% of respondents answered yes. One or more chronic health conditions were reported by 35.9% of participants. Conditions most commonly cited were musculoskeletal (14.6%), cardiovascular (8.7%), metabolic endocrine (6.5%), and respiratory (3.7%).

Physical activity levels of Manitobans

Types of activities

More individuals reported getting some or lots of activity from their jobs, doing yardwork or housework, or going places than from participating in sport and exercise (Fig. 1). Aboriginal respondents were significantly more likely to be active on the job and going places than other respondents. Males were significantly more likely to participate in sports than females, most notably in the younger 2 age groups. More than 75% of women aged 35 years and over reported never participating in sport. Although women were more likely to get physical activity through exercise, participation rates were lower than for males across all age groups. The most frequently mentioned activities were walking (moderate, 41.1%; light, 25.6%), yardwork (moderate, 14.8%; light, 8.4%), and housework (moderate, 11.4%; light, 12.3%). Jogging was the most common vigorous activity (7.5%).

Relation to CPAG requirements

When all self-reported physical activity of 10 min duration or longer was included, 69.5% of respondents met the minimum physical activity requirements specified by the CPAG. Of those who met the CPAG requirements, 29.1% did so via vigorous activity (>6 METs), 52.2% via moderate activity (3–6 METs), and 18.7% via light activity (<3 METs). The proportion of Aboriginal respondents who met CPAG recommendations did not differ from the total sample. Males and females were equally likely to meet CPAG recommendations; however, there were significant sex differences when examined by intensity (Table 2). The likelihood of meeting CPAG recommendations declined significantly with age, as did the proportion of those meeting the CPAG vigorous activity guideline. The proportion of respondents meeting CPAG recommendations increased significantly as education and income levels increased. Only 62.6% of those who did not finish high school met the CPAG requirements, compared with 71.7% of those who had completed postsecondary studies. Similarly, while 66.1% of those with household incomes between \$10 000 and \$29 999 met the physical activity recommendations, this increased to 75.5% of those who earned more than \$120 000. Employment status was also significantly related to the likelihood of meeting the CPAG guidelines. Of respondents who worked for pay, 70.9% met the guidelines, compared with 67.7% and 65.7%, respectively, of those who did not work for pay and of those who were retired. Those who reported chronic respiratory or mental or emotional

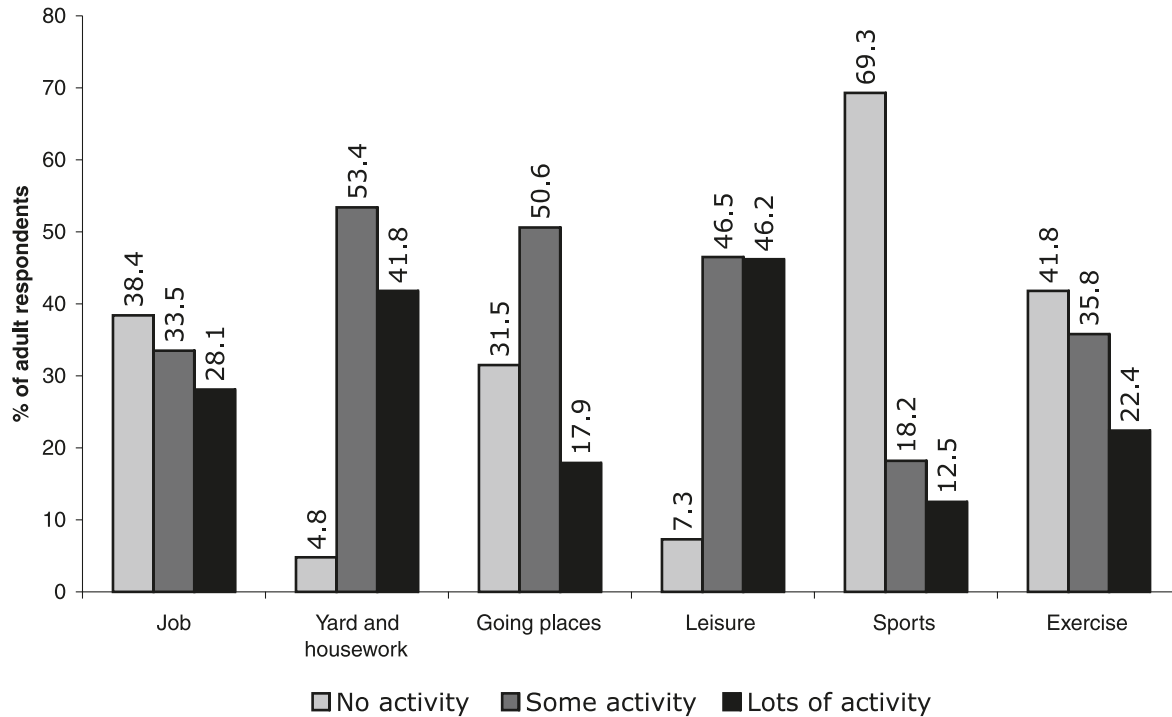
Table 1. Characteristics of adult respondents.

Characteristic	Adult responders (n = 6536), %
Sex	
Female	65.5
Male	34.5
Age group (y)	
18–34	25.4
35–49	35.6
50–64	25.4
65–79	11.2
≥80	2.4
Education level	
Less than high school	12.2
Finished high school	23.2
Some postsecondary	23.5
Finished postsecondary	33.8
Professional–graduate school	7.2
Employment status	
Works for pay (full- or part-time)	72.0
Does not work for pay	11.1
Retired	16.9
Household income	
Under \$10 000	3.4
\$10 000–\$29 999	20.6
\$30 000–\$49 999	26.5
\$50 000–\$69 999	20.9
\$70 000–\$89 999	11.3
\$90 000–\$119 999	10.2
Over \$120 000	7.1
Aboriginal descent	
No	88.3
Yes	11.7

health conditions were noticeably less likely to meet CPAG recommendations than other respondents (61.8% and 63%, respectively). Although the survey did not directly match each activity response to activity type, for comparative purposes we also calculated results after excluding all self-identified or obvious (e.g., construction, farming) employment, housework, yardwork, and shopping activities. Based on activities done for 10 min or longer, 53% of Manitobans met the minimum CPAG recommendations with this analysis.

Relation to energy expenditure requirements

When physical activity levels were estimated relative to energy expenditure, 18.3% of respondents were classified as inactive (<1.5 KKD), 16.4% as moderately active (1.5–2.9 KKD), and 65.3% as active (≥3 KKD). Age and sex differences were similar to the results related to the CPAG requirements (Table 3). Comparison of those who met the CPAG recommendation for the energy expenditure cut-points showed that 0.8% were inactive, 10.6% were moderately active, and 88.6% were active. After excluding all self-identified or obvious employment, housework, yardwork, and shopping activities, classifications based on the energy

Fig. 1. Self-reported physical activity by category reported by Manitobans.**Table 2.** Physical activity levels of Manitobans, according to age group and sex, classified by Canada's Physical Activity Guide to Healthy Active Living (CPAG).

Age groups	CPAG recommendations not met, %*	CPAG recommendations met with light activity, % ^{†,‡,§}	CPAG recommendations met with moderate activity, % [†]	CPAG recommendations met with vigorous activity, % ^{†,‡}
Females (y)				
18–34	28.0	13.8	29.3	28.9
35–49	29.5	13.6	36.1	20.8
50–64	32.3	14.5	38.9	14.3
65–79	31.7	13.9	45.8	8.6
≥80	45.5	14.5	34.5	5.5
Males (y)				
18–34	20.9	8.5	37.6	33.0
35–49	29.4	11.4	37.2	22.0
50–64	34.0	11.9	37.7	16.4
65–79	38.8	14.2	35.3	11.6
≥80	57.8	17.8	20.0	4.4

Note: Post hoc analysis by intensity category (light, moderate, vigorous) excludes those who did not meet CPAG recommendations.

*Significant difference (CPAG not met vs. met) between age groups overall and between age groups within sexes ($p < 0.05$).

[†]Significant difference (vs. the other 2 intensity levels) between sexes ($p < 0.05$).

[‡]Significant difference between age groups overall ($p < 0.05$).

[§]Significant interaction effect between age and sex ($p < 0.05$).

^{||}Significant difference between males and females within age group ($p < 0.05$).

expenditure requirements were 33.2% for inactive, 20.4% for moderately active, and 46.4% for active.

Discussion

National data indicate that leisure-time physical activity levels have increased considerably since 1981 (Bruce and Katzmarzyk 2002; Craig et al. 2004); however, discrepan-

cies in survey methodologies and inconsistencies in cut-off points for recommended activity levels limit the interpretation and application of these findings (Katzmarzyk and Tremblay 2007). Recent objective measures from the United States also indicate that self-reported physical activity data may be substantially overestimated (Troiano et al. 2008). Since 1998, the CPAG has been considered the national guideline for physical activity recommendations (Health

Table 3. Physical activity levels of Manitobans, according to age group and sex, classified by energy expenditure.

Age groups	Inactive (<1.5 KKD), %* [†]	Moderately active (1.5 – 3 KKD), % ^{†,‡}	Active (≥ 3 KKD), %* ^{†,‡}
Females (y)			
18–34 [§]	17.5	18.6	63.9
35–49 [§]	16.6	19.2	64.3
50–64	19.6	15.8	64.6
65–79	19.1	17.2	63.7
≥ 80	37.3	14.5	48.2
Males (y)			
18–34 [§]	12.4	11.3	76.2
35–49 [§]	17.6	13.9	68.5
50–64	19.7	14.7	65.6
65–79	22.4	14.2	63.4
≥ 80	35.6	22.2	42.2

Note: Overall differences by age and sex are significant ($p < 0.05$). KKD, kcal·kg⁻¹·d⁻¹.

*Significant difference between age groups overall ($p < 0.05$).

[†]Significant interaction effect between age and sex ($p < 0.05$).

[‡]Significant difference (vs. the other 2 intensity levels) between sexes ($p < 0.05$).

[§]Significant difference between males and females within age group ($p < 0.05$).

Canada 1998). However, few studies have examined population physical activity levels in relation to CPAG frequency, duration, and intensity-based guidelines, or included nonleisure activities, as per its recommendations.

Physical activity levels of Manitobans

In keeping with our goal of determining physical activity levels of Manitobans benchmarked against the CPAG recommendations, our results reflect total physical activity of all types. Thus, our finding that close to 70% of adults met the CPAG recommendations, compared with the 48% of Manitobans reported to be at least moderately active in the 2002–2003 CCHS (Statistics Canada 2003), is not surprising, given that respondents were most likely to report activity in their jobs, doing household chores, or for transportation. When identifiable employment and chore-related physical activities were excluded, only 53% of our respondents met the CPAG recommendations, closely approximating the 2002–2003 CCHS results. These results still include some nonleisure activity, as work-related walking generally could not be identified. To better compare CCHS data with our data, we also calculated our results in terms of energy expenditure; we found that 16% of Manitobans were classified as moderately active (1.5–2.9 KKD) and 65% were classified as active (≥ 3 KKD). Unlike our study, the CCHS finding that 24% of Manitobans were moderately active and 24% were active was based on nonwork, nonchore activity (Statistics Canada 2003). Excluding employment- and chore-related activity results, where possible, narrows the differences between surveys, with our data indicating that 20.4% of Manitobans were moderately active and 46.4% were active.

Overall, only 29.1% of Manitobans meeting the CPAG recommendations did so with vigorous activity. Although the health benefits of moderate activity have been widely promoted, especially for the most sedentary populations (Warburton et al. 2006), the addition of vigorous activity will lead to even greater health gains (Haskell et al. 2007; Swain and Franklin 2006; US Department of Health and Hu-

man Services 1996). Public health messaging to this effect could be directed at the 36% of Manitobans who met CPAG recommendations for moderate activity. In addition, the 43% of Manitobans who did not meet the CPAG recommendations or who did so with light activity would benefit from public health messages and initiatives promoting the adoption of moderate activity. Walking, housework, and yardwork were the activities most commonly reported, indicating a need to promote a wider variety of activities of all types, including endurance, flexibility, and strength, as recommended in the CPAG. Multicomponent approaches to increasing physical activity levels, such as *in motion*, enable messages to be better tailored to different population segments.

The majority of demographic trends in our data agree with other population-based surveys; physical activity levels decrease with increasing age and with decreasing education and income levels (Craig et al. 2004). One notable exception is the lack of a sex difference in the likelihood of meeting the CPAG recommendations, compared with surveys of leisure-time physical activity. In 2000, Canadian women were only 54% as likely as men to meet the 3+MET hour physical activity criterion (Craig et al. 2004). The exclusion of household chores and other nonleisure, nonsport activities from surveys may underestimate daily energy expenditure, especially for women (Weller and Corey 1998). As with previous studies (Bruce and Katzmarzyk 2002), women were less likely to take part in vigorous activities. That 50% of respondents who indicated they did not exercise regularly met the CPAG recommendations confirms that many activities not traditionally considered exercise were reported in the Manitoba survey, and that these make a substantial contribution to total physical activity throughout the day.

Comparison to other Canadian surveys

Physical activity surveillance in Canada has been recently reviewed, and readers are referred to Katzmarzyk and Tremblay (2007) for this important discussion. Although Canada

has been a leader in conducting population surveys of physical activity for over 25 years, inconsistencies in surveillance may lead to misinterpretation of data, and ultimately to poorly informed policy and practice. Differences in methodologies (e.g., response bias, mode of data collection, scoring, reporting) and changing thresholds for physical activity and inactivity levels are problematic. Energy expenditure is estimated from reported leisure-time physical activities and, on this basis, respondents are defined as being above or below an activity threshold. Canadian surveys originally employed a criterion level of energy expenditure >3.0 KKD (Bruce and Katzmarzyk 2002; Health Canada 1999; Canadian Fitness and Lifestyle Research Institute 1995), based on the American public health recommendations (Pate et al. 1995). More recently, energy expenditure >1.5 KKD has been used to categorize those who are at least moderately active and who, thus, meet national physical activity goals (Canadian Fitness and Lifestyle Research Institute 2005). This decrease in the physical activity cut-point for health may be inflating the activity levels of Canadians and has caused confusion. Physical activity levels are also commonly reported as MET hours per day (Craig et al. 2004), MET minutes per week (Haskell et al. 2007), or METs per week (Burgess et al. 2007), with varying criterion levels suggested for health benefits.

Information about exercise intensity, frequency, and duration is generally not reported in national surveys; only the overall volume of activity is reported. However, current Canadian physical activity recommendations (CPAG and the Pan-Canadian Healthy Living Strategy) are based on frequency, intensity, and duration, parameters not currently well tracked. As noted by Katzmarzyk and Tremblay (2007), the reliance on a threshold approach precludes measuring success, as related to these goals, or monitoring total volumes of physical activity in the population. Increasing numbers of Canadians could be meeting a low physical activity threshold, despite a decrease in overall physical activity volume.

Only 1 report has examined the prevalence of Canadians meeting the CPAG recommendations. Data from the 1997 Physical Activity Monitor demonstrated that 34% of Canadians aged 25 to 55 years met the newly introduced guidelines (Canadian Fitness and Lifestyle Research Institute 1998). As with other national surveys, these data primarily reflect leisure-time physical activity. There was relatively good agreement between activity levels expressed relative to CPAG recommendations and to energy expenditure. Of those who met the CPAG guidelines, 77% were in the active category, as determined by energy expenditure >3 KKD (Canadian Fitness and Lifestyle Research Institute 1998). This is comparable to our finding that 88.6% of Manitobans who met CPAG recommendations would be classified as active using the cut-point of 3 KKD. Anderson et al. (2007) found that 39% of residents in a suburban area of British Columbia met the CPAG physical activity recommendations. This finding is considerably lower than our results for Manitoba and than the 2002–2003 CCHS finding that 58% of British Columbians are at least moderately active (>1.5 KKD) (Statistics Canada 2003). The findings of Anderson et al. (2007) are difficult to explain, given that their study used the International Physical Activity Questionnaire,

which includes all forms of activity, not just leisure-time activity. One possible explanation is the small ($n = 581$) and localized sample. As with our study, respondents could meet the CPAG recommendations via a combination of activities from the vigorous, moderate, and light categories; however, there is insufficient detail to compare methodologies.

Our survey was based on the Saskatoon *in motion* Physical Activity Survey (Saskatoon Health Region, University of Saskatchewan, City of Saskatoon & ParticipACTION 2002), modified to prompt respondents to provide information on all types of physical activity. This survey was selected because Manitoba *in motion* was modeled after Saskatoon *in motion*; however, modifications were necessary, given the selection of CPAG as our major physical activity message and benchmark. The Manitoba survey collected information about the physical activities of all participants, while Saskatoon collected data only from those who reported exercising regularly (77% of all respondents over age 5 years). Although not directly comparable to our results, other western provinces have recently reported high numbers of adults sufficiently active for health. In Alberta, using a 7-day recall survey adapted from the Godin Leisure-Time Exercise Questionnaire, researchers found that 62% of adults met the criteria of 38 METs per week for men or 35 METs per week for women (Burgess et al. 2007). Ainsworth Compendium values were not used; rather, activities classified as strenuous, moderate, or light were assigned MET values of 9, 5, or 3, respectively. These findings are in contrast to data from the National Health and Nutrition Examination Survey (Centers for Disease Control 2003–2004) in the United States, which found that less than 5% of adults met the recommended physical activity level of 30 min of moderate intensity (or greater) activity at least 5 days per week when monitored using accelerometers (Troiano et al. 2008). Self-reported data from the same survey found that 51% of adults accumulated at least 150 min of moderate intensity (or greater) activity per week when recreation, transportation, and household activities were included. The authors concluded that although care must be taken when interpreting self-reported physical activity data in public health applications, it is also possible that recommended physical activity levels based on objective measurements may differ from the present recommendations based on epidemiological research.

CPAG: Sufficient for health?

Our finding that close to 70% of Manitobans met the minimum physical activity recommendations specified in the CPAG, while encouraging, raises concerns. The prevalence of diabetes is increasing (Manitoba Health 1998), and obesity rates in the province are higher than the national average (Tjepkema 2005). Katzmarzyk and Tremblay (2007) highlight the disconnect between national trends of decreasing inactivity and increasing inactivity-related disorders. Notwithstanding the survey limitations discussed above, the apparent paradox (Bruce and Katzmarzyk 2002) of a relatively high proportion of the population meeting recommended physical activity thresholds, despite increases in obesity and diabetes, suggests that the physical activity recommendations may be set too low. It is also possible that

energy intakes have increased over time; however, reliable nutrition intake data are not available. Although data comparing the 2002–2003 CCHS (Statistics Canada 2003) with the 1970–1972 Nutrition Canada Survey (Nutrition Canada 1975) suggest there has been no increase in energy intake of Canadians, methodological limitations prevent a true comparison (Garriguet 2006).

The original public health recommendation in the United States to accumulate 30 min or more of moderate-intensity physical activity on most, and preferably all, days of the week (Pate et al. 1995) has received considerable study (Blair et al. 2004). It is now recognized that additional energy expenditure is needed to prevent weight gain and obesity (Brooks et al. 2004). The American College of Sports Medicine and the American Heart Association recently updated the recommendation for physical activity and public health in the United States to address issues of dose-response and routine activities of daily living (Haskell et al. 2007). The updated recommendation specifies that all healthy adults need a minimum of 30 min of moderate-intensity activity 5 days per week, or 20 min of vigorous activity 3 days per week, or a combination thereof. Light-intensity activities are not included in the recommendation. Routine activities of daily living (e.g., casual walking or shopping) are specifically excluded from the recommendation, as are all activities less than 10 min in duration. Moderate and intense activities done as part of daily life, for more than 10 min (e.g., brisk walking, gardening with a shovel), may be counted toward the recommendation. While this was implied in the original American recommendation, it was not well communicated.

As physical activity guidelines provide evidence-based behavioural benchmarks, it is important that they be regularly reviewed (Tremblay et al. 2007b). The CPAG was introduced in 1998 to “assist inactive people to begin to improve their health” (Adams 2000, p. 2061); however, it is commonly interpreted as a “health strategy for all adult Canadians” (Bauman et al. 2005, p. 247). Low awareness of the CPAG by Canadians, especially the less active, may limit its usefulness as the national guideline for physical activity (Spence et al. 2002; Cameron et al. 2007). Only 5.2% of Canadian adults had unprompted recall of the guidelines in 2002 (Bauman et al. 2005). Although comprehensive in its recognition that time needed depends on effort (Brooks et al. 2004), the CPAG may no longer be a sufficient public health recommendation, given the new application of dose-response to varying populations, chronic conditions, and types of physical activity. A recent review of the CPAG for adults suggested that it may need to be refined to address increasing obesity, and that differentiation between minimal and optimal levels of physical activity should be explored (Tremblay et al. 2007b). A major component of the CPAG message is that better health can be achieved by making physical activity part of one’s regular routine (Cote 1998). However, when baseline activities of daily living and other nonleisure activities (commuting or active transportation, chores or personal care, occupation (Katzmarzyk and Tremblay 2007)) are included as part of total daily activity, activity levels seem high compared with physical activity criterion standards sufficient for health that are based on leisure-time physical activity. There is a disconnect between

CPAG recommendations, which are based on intensity, frequency, and duration of all physical activity, and the present surveillance system, which primarily monitors amount of leisure-time physical activity (CCHS).

Conclusions

Although assessment of physical activity by self-report has limitations (Sallis and Saelens 2000), physical activity questionnaires may be beneficial in monitoring changes in population activity levels (Shephard 2003). A focus on improving the population activity level, regardless of the true individual baseline activity level, will result in maximal health benefits for the population. Major strengths of our survey include the random sample and the regional stratification, which will enable application of the findings at the level of the local health authorities. The provincial sample size of more than 6500 is greater than the sample sizes of 2500 to 4500 found in many national surveys. As in previous telephone surveys (Anderson et al. 2007), respondents were more likely to be female than male. The response rate of 35% is a potential weakness of the study, in that respondents may have been more physically active than nonrespondents. Potential participants were told at the outset that this was a survey about physical activity, and this may also have contributed to a somewhat biased sample.

Our survey is the first to link the physical activity recommendations of the CPAG with the criterion measurement of physical activity levels, and thus has the potential to directly affect public health initiatives. The relatively high proportion of Manitobans who met the CPAG recommendations (69.5%) was initially surprising, given the high rates of obesity and diabetes in the province. Gathering more reliable nutrition and energy intake data could help explain this apparent contradiction. Although methodology and response bias likely account for some of the discrepancies between activity and obesity levels, we believe our findings point to the need to re-examine the minimum physical activity recommendations, especially as they relate to the inclusion of light activities of daily living. This is in keeping with new physical activity guidelines just released by the American College of Sports Medicine and the American Heart Association (Haskell et al. 2007). Few Canadians are aware of the current CPAG recommendations; therefore, it will not be difficult to adapt and widely promote a revised message. As a multidisciplinary team, we have also concluded that the Canadian physical activity data are confusing to health practitioners and policy makers, and that national, provincial, and local physical activity organizations must come to a consensus about surveillance methodologies and practices.

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References

Adams, R. 2000. Shown to be useful: survey shows positive results

- for first-ever set of national physical activity guidelines. *Can. Fam. Physician*, **46**: 2061–2062. PMID:11072586.
- Ainsworth, B.E., Haskell, W.L., Leon, A.S., Jacobs, D.R., Jr., Montoye, H.J., Sallis, J.F., and Paffenbarger, R.S., Jr. 1993. Compendium of physical activities: classification of energy costs of human physical activities. *Med. Sci. Sports Exerc.* **25**(1): 71–80. doi:10.1249/00005768-199301000-00011. PMID:8292105.
- Ainsworth, B.E., Haskell, W.L., Whitt, M.C., Irwin, M.L., Swartz, A.M., Strath, S.J., et al. 2000. Compendium of physical activities: an update of activity codes and MET intensities. *Med. Sci. Sports Exerc.* **32**(9): S498–S516. PMID:10993420.
- Anderson, G.S., Snodgrass, J., and Elliott, B. 2007. Determining physical activity patterns of suburban British Columbia residents. *Can. J. Public Health*, **98**(1): 70–73. PMID:17278682.
- Bauman, A., Craig, C.L., and Cameron, C. 2005. Low levels of recall among adult Canadians of the CSEP/Health Canada physical activity guidelines. *Can. J. Appl. Physiol.* **30**(2): 246–252. PMID:15981791.
- Blair, S.N., La Monte, M.J., and Nichaman, M.Z. 2004. The evolution of physical activity recommendations: How much is enough? *Am. J. Clin. Nutr.* **79**(Suppl.): 913S–920S. PMID:15113739.
- Brooks, G.A., Butte, N.F., Rand, W.M., Flatt, J.P., and Caballero, B. 2004. Chronicle of the Institute of Medicine physical activity recommendation: how a physical activity recommendation came to be among dietary recommendations. *Am. J. Clin. Nutr.* **79**(5): 921S–930S. PMID:15113740.
- Bruce, M.J., and Katzmarzyk, P.T. 2002. Canadian population trends in leisure-time physical activity levels, 1981–1998. *Can. J. Appl. Physiol.* **27**(6): 681–690. PMID:12501004.
- Burgess, J., Berry, T.R., and Spence, J.G. 2007. Alberta survey on physical activity: a concise report. Alberta Centre for Active Living, Edmonton, Alta.
- Cameron, C., Craig, C.L., Bull, F.C., and Bauman, A. 2007. Canada's physical activity guides: Has their release had an impact? *Appl. Physiol. Nutr. Metab.* **32**(Suppl. 2E): S161–S169. doi:10.1139/H07-106.
- Canadian Fitness and Lifestyle Research Institute. 1995. 1995 Physical activity monitor. [Online.] Available from <http://www.cflri.ca/eng/statistics/surveys/pam1995.php>. [Accessed 13 January 2008.]
- Canadian Fitness and Lifestyle Research Institute. 1998. Meeting guidelines. *Progress in Prevention Bulletin* No. 31. Available from http://www.cflri.ca/eng/progress_in_prevention/index.php. [Accessed 26 January 2009.]
- Canadian Fitness and Lifestyle Research Institute. 2005. 2005 Physical activity and sport monitor. [Online.] Available from <http://www.cflri.ca/eng/statistics/surveys/pam2005.php>. [Accessed 13 January 2008.]
- Centers for Disease Control and Prevention, United States Department of Health and Human Services. National Health and Nutrition Examination Survey. 2003–2004. Available from <http://www.cdc.gov/nchs/about/major/nhanes/datalink.html>. [Accessed 26 January 2008.]
- Cote, D. 1998. Canada to welcome new guide to physical activity. *Can. J. Cardiol.* **14**(10): 1200–1203. PMID:9852934.
- Craig, C.L., Russell, S.J., Cameron, C., and Bauman, A. 2004. Twenty-year trends in physical activity among Canadian adults. *Can. J. Public Health*, **95**(1): 59–63. PMID:14768744.
- Garriguet, D. 2006. Nutrition: findings from the Canadian Community Health Survey. Overview of Canadians' eating habits 2004. Catalogue no. 82-620-XIE. Statistics Canada. p. 35.
- Haskell, W.L. 1994. Health consequences of physical activity: understanding and challenges regarding dose-response. *Med. Sci. Sports Exerc.* **26**(6): 649–660. doi:10.1249/00005768-199406000-00001. PMID:8052103.
- Haskell, W.L., Lee, I.M., Pate, R.R., Powell, K.E., Blair, S.N., Franklin, B.A., et al. 2007. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med. Sci. Sports Exerc.* **39**(8): 1423–1434. doi:10.1249/mss.0b013e3180616b27. PMID:17762377.
- Health Canada. 1998. Canada's physical activity guide to healthy active living. Ottawa, Ont. Cat. No. H39-429/1998-2E. Available from <http://www.phac-aspc.gc.ca/pau-uap/paguide/index.html>. [Accessed 13 January 2008.]
- Health Canada. 1999. Physical activity of Canadians. Cycle 2, 1996/97. Overview of results. National Population Health Survey Highlights, November (No. 2). Available from http://www.phac-aspc.gc.ca/ccdpc-cpcmc/cancer/publications/nphs_physical_e.html. [Accessed 26 January 2009.]
- Health Canada. 2005. The integrated Pan-Canadian healthy living strategy. Prepared by the Secretariat for the Intersectoral Healthy Living Network in partnership with the F/P/T Healthy Living Task Group and the F/P/T Advisory Committee on Population Health and Health Security. Cat. No. HP10-1/2005. Available from http://www.phac-aspc.gc.ca/hl-vs-strat.pdf/hls_3.pdf. [Accessed 26 January 2009.]
- Jacobs, D.R. 1997. Minnesota leisure-time physical activity questionnaire. *Med. Sci. Sports Exerc.* **29**(Suppl. 6): S62–S72.
- Katzmarzyk, P.T., and Janssen, I. 2004. The economic costs associated with physical inactivity and obesity in Canada: an update. *Can. J. Appl. Physiol.* **29**(1): 90–115. PMID:15001807.
- Katzmarzyk, P.T., and Tremblay, M.S. 2007. Limitations of Canada's physical activity data: implications for monitoring trends. *Appl. Physiol. Nutr. Metab.* **32**(Suppl. 2E): S185–S194. doi:10.1139/H07-113.
- Macara, C.A., and Pratt, M. 2000. Public health surveillance of physical activity. *Res. Q. Exerc. Sport*, **71**(Suppl. 2): S97–S103. PMID:10925831.
- Macara, C.A., Hootman, J.M., and Sniezek, J.E. 2003. Major public health benefits of physical activity. *Arthritis Rheum.* **49**(1): 122–128. doi:10.1002/art.10907. PMID:12579603.
- Manitoba Health. 1998. Diabetes: A Manitoba strategy. Diabetes and Chronic Diseases Unit, Public Health Branch, Manitoba Health, Winnipeg, Manitoba.
- Nutrition Canada. 1975. Nutrition: a national survey. A report from Nutrition Canada by the Bureau of Nutritional Sciences, Health Protection Branch, Department of National Health and Welfare. Available from <http://prod.library.utoronto.ca:8090/datalib/codebooks/nac/g0000577/nutrition70.htm>. [Accessed 26 January 2008.]
- Pate, R.R., Pratt, M., Blair, S.N., Haskell, W.L., Macera, C.A., Bouchard, C., et al. 1995. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA*, **273**(5): 402–407. doi:10.1001/jama.273.5.402. PMID:7823386.
- Sallis, J.F., and Saelens, B.E. 2000. Assessment of physical activity by self-report: status, limitations, and future directions. *Res. Q. Exerc. Sport*, **71**(2): 1–14. PMID:10763516.
- Saskatoon Health Region, University of Saskatoon, City of Saskatoon, and ParticipACTION. 2002. Saskatoon *in motion* physical activity survey. Fast Consulting, Saskatoon, Sask.
- Shephard, R.J. 2003. Limits to the measurement of habitual physical activity by questionnaires. *Br. J. Sports Med.* **37**: 197–206. doi:10.1136/bjsm.37.3.197. PMID:12782543.
- Spence, J.C., Plotnikoff, R.C., and Mummery, W.K. 2002. The awareness and use of Canada's Physical Activity Guide to

- Healthy Active Living. *Can. J. Public Health*, **93**(5): 394–396. PMID:12353464.
- Statistics Canada. 2003. Canadian Community Health Survey (CCHS) – Cycle 1.1. [Online.] Available from <http://www.statcan.ca/english/concepts/health/index.htm>. [Accessed 13 January 2008.]
- Swain, D.P., and Franklin, B.A. 2006. Comparison of cardioprotective benefits of vigorous versus moderate intensity aerobic exercise. *Am. J. Cardiol.* **97**(1): 141–147. doi:10.1016/j.amjcard.2005.07.130. PMID:16377300.
- Taylor, H.L., Jacobs, D.R., Shucker, B., Knudsen, J., Leon, A.S., and DeBacker, G. 1978. A questionnaire for the assessment of leisure-time physical activities. *J. Chronic Dis.* **31**: 741–755. doi:10.1016/0021-9681(78)90058-9. PMID:748370.
- Tjepkema, M. 2005. Adult obesity in Canada: measured height and weight. [Online.] Statistics Canada. Available at <http://www.statcan.ca/english/research/82-620-MIE/2005001/pdf/aobesity.pdf>. [Accessed 13 January 2008.]
- Tremblay, M.S., Shephard, R.J., and Brawley, L.R. 2007a. Research that informs Canada's physical activity guides: an introduction. *Appl. Physiol. Nutr. Metab.* **32**(Suppl. 2E): S1–S8. PMID:18181294.
- Tremblay, M.S., Shephard, R.J., Brawley, L.R., Cameron, C., Craig, C.L., Duggan, M., et al. 2007b. Physical activity guidelines and guides for Canadians: facts and future. *Appl. Physiol. Nutr. Metab.* **32**(Suppl. 2E): S218–S224. doi:10.1139/H07-125.
- Troiano, R.P., Berrigan, D., Dodd, K.W., Masse, L.C., Tilbert, T., and McDowell, M. 2008. Physical activity in the United States measured by accelerometer. *Med. Sci. Sports Exerc.* **40**(1): 181–188. PMID:18091006.
- US Department of Health and Human Services. 1996. Physical activity and health: a report of the Surgeon General. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Atlanta, Ga.
- Warburton, D.E., Nicol, C.W., and Bredin, S.S. 2006. Health benefits of physical activity: the evidence. *CMAJ*, **174**(6): 801–809. PMID:16534088.
- Weller, I., and Corey, P. 1998. The impact of excluding non-leisure energy expenditure on the relation between physical activity and mortality in women. *Epidemiology*, **9**(6): 632–635. doi:10.1097/00001648-199811000-00012. PMID:9799173.