Twenty-year Trends in Physical Activity Among Canadian Adults

Cora L. Craig, MSc¹

Storm J. Russell, PhD²

Christine Cameron, BA¹

Adrian Bauman, PhD³

ABSTRACT

Objective: Physical inactivity is associated with increased risk of mortality and chronic diseases, yet trend information is lacking in most countries. This investigation examines physical activity levels of Canadian adults aged 18 years and older.

Methods: Data were collected in six national surveys between 1981 and 2000. Sample sizes ranged from 2,500 to 18,000. Prevalences were tested using Chi-square and Student's t-tests. Socio-demographic correlates were examined using odds ratios adjusted for age, sex, education and income.

Results: Physical activity increased in the 1980s and 1990s among men and women and for all age, education and income groups ($p < 0.01$). Although education differentials narrowed over the period, age differentials widened and income differentials emerged.

Discussion: The positive trend in Canada is consistent with Finland, but contrary to recent trends for Australia, England and the United States. Despite increases, sedentary living remains a public health issue particularly among women, older adults and lower income groups.

La traduction du résumé se trouve à la fin de l'article.

1. Canadian Fitness and Lifestyle Research Institute, Ottawa, ON

2. SJR Research Consultants, Ottawa, ON

3. University of New South Wales, Sydney, Australia

Correspondence and reprint requests: Cora L. Craig, Canadian Fitness and Lifestyle Research Institute, 201-185 Somerset St. W., Ottawa, ON, K2P 0J2, E-mail: ccraig@cflri.ca

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Physical inactivity is associated with increased risk of mortality and chronic diseases, particularly coronary heart disease, stroke, colon cancer, and non-insulin-dependent diabetes.^{1,2} Currently, there is a general lack of information on physical activity trends in most countries. While the population active at least twice weekly increased in Finland,³ the population meeting the U.S. Surgeon General's guideline has reached a plateau in the United States⁴ and has recently decreased in Australia.⁵ In England, the proportion active at least 30 minutes a week decreased from 1994 to 1998.⁶

Canadian population data provide the opportunity to examine long-term physical activity trends. The Canada Fitness Survey (CFS) was established in 1981 with repetitions planned every five years. Due to fiscal constraints, subsequent surveys occurred in 1988 and 1995. In 1997, the federal, provincial and territorial governments set a goal to reduce physical inactivity and established an annual monitoring program.⁷ Accordingly, Canada has amassed physical activity data across a 20-year period. The purpose of this study is to provide information relevant to targeting public health policy: by examining changes in the physical activity level of Canadian adults from 1981 to 2000; identifying whether changes occurred among population segments including those typically known to be the most sedentary; and by determining whether recent trends differ from earlier trends for various population segments.

METHODS

This investigation is based on data collected over a 20-year period: 1981, 1988, 1995, 1998, 1999, and 2000. Participants provided written consent for in-house data collection or verbal consent for telephone interviews according to the policies of the Canadian Fitness and Lifestyle Research Institute and the Ethics Review Board of York University. Key to monitoring trends, the studies shared common characteristics: all were nationally representative samples of Canadian adults; all were conducted between early spring and late fall; all employed adaptations of the Minnesota Leisure-Time Physical Activity Questionnaire (MLTPAQ);⁸ and all used identical scoring methods. Differences between the studies are discussed below.

1981 and 1988

The CFS employed a complex multi-stage sampling design of the non-institutionalized household population yielding a sample of 18,348 adults.⁹ As provincial estimates were not required in 1988, a random sample of families from the 1981 cohort were selected and all individuals included ($n=3,333$). Low immigration and emigration rates and high tracing (93%) and response rates (82%) meant that the 1988 panel was representative of non-institutionalized Canadian citizens, excluding new immigrants and people re-entering the household population from long-term institutions. Respondents in 1981 and 1988 completed self-administered questionnaires during household visits.

1995, 1998, 1999 and 2000

Sample sizes of these independent cross-sectional surveys ranged from about 2,500 to 4,500. Compared to 1981 and 1988, response rates to these surveys were lower (Table I). However, non-response bias from this may be minimal since prevalence rates among those responding and those converted from refusals did not differ ($p=0.9$). Unlike the earlier surveys, total annual occasions for activities were asked directly by telephone interviews rather than using monthly prompts as in the self-administered questionnaires. Like the high associations reported elsewhere,¹⁰ we found that a difference in data collection mode had a negligible impact on prevalence rates,¹¹ permitting investigation of trends.

Physical activity questions

Physical activity (LTPA) was calculated in MET-hours per week by summing the products of the metabolic cost of each activity, its duration in hours and the average occasions per week across the 12-month period. The metabolic costs of activities were developed by an expert panel in 1981 and expressed as multiples of basal resting energy (METs).¹² These values are conservative, being around one MET-unit lower than those published in the Ainsworth Compendium.¹³

Analysis

To examine relationships in the context of population risk monitoring, a criterion level for 'sufficient activity' for health (3+ MET-hours daily or 1260 MET-minutes

TABLE I

Trends in Prevalence of Physical Activity Among Canadian Adults

% accumulating an average of 3.0+ MET-hours of leisure-time physical activity daily

	1981	1988	1995	1998	1999	2000
Sample size	18,348	3,333	2,418	4,509	4,105	3,697
Response rate						
Household	88%					
Individual	77%	82%	63%	58%	58%	52%
Total 18+	20.6	28.5†	36.7	36.7	36.3	41.1†,‡
Men	23.9	35.7†	39.7	40.6	41.8	49.2†,‡
Women	17.5	21.8†	33.9	33.0	33.0	32.9†
Age Group						
18-24	29.6	38.1†	54.1	56.3	52.0	57.5†
25-44	19.5	26.7†	36.6	34.8	36.6	43.7†,‡
45-64	17.0	25.1†	32.4	35.9	33.1	32.7†
65+	18.8	30.4†	24.3	21.3	31.6	30.7†,‡
Education						
<Secondary	15.6	23.7†	26.9	31.0	28.2	31.4†
Secondary	22.5	28.0*	35.8	36.1	37.0	40.0†
College	24.2	30.7†	36.6	39.0	38.4	42.6†
University	27.2	32.9*	44.6	38.6	41.9	47.9†
Income						
Lowest	21.8	27.8*	35.6	33.6	30.8	33.1†
Low	22.6	25.2	31.5	34.5	29.7	34.8†
Middle	19.5	26.9*	33.7	35.5	38.0	37.1†
High	21.6	27.2†	40.4	38.6	35.1	43.3†,‡
Highest	25.2	32.8†	43.9	48.2	46.8	55.3†,‡

* Student's t significant comparing year to 1981, $p<0.05$

† Student's t significant comparing year to 1981, $p<0.01$

‡ Chi-square significant for the trend 1995 to 2000, $p<0.01$

Figure 1. Population distribution of leisure-time energy expenditure, 1981-2000

per week) was established in 1988.¹⁴ This amount is equivalent to walking for an average of one hour daily over the whole year. Income groups were created so that 20% of the population was categorized at the highest and lowest income levels. Weighting was used to reflect differences in sample design and was standardized using a post-stratification adjustment for differences in the distribution of age, and sex (mean weight = 1).

Given the skewed distribution of estimates, non parametric Chi-square tests for independent samples were conducted to

assess changes in the distribution. Student's t tests with an appropriate design effect were used to compare prevalences to those of 1981 and Chi-square tests were used to test trends from 1995 to 2000.¹⁵ Differences in activity levels between population segments were computed using odds ratios, adjusted for age, sex, education and income.¹⁶

RESULTS

Physical activity increased significantly among Canadian adults in the 1980s and

TABLE II

Socio-demographic Correlates of Physical Activity

Odds of accumulating an average of 3.0+ MET-hours of leisure-time physical activity daily
Reference groups OR = 1.0

	1981		2000	
	Odds*	C.I. (odds)	Odds*	C.I. (odds)
Total, age 18+				
Men	reference		reference	
Women	0.64	0.61 - 0.72†	0.54	0.46 - 0.64†
Age Group				
18-24	reference		reference	
25-44	0.56	0.50 - 0.63†	0.44	0.35 - 0.51†
45-64	0.54	0.47 - 0.62†	0.31	0.24 - 0.39†,‡
65+	0.68	0.58 - 0.81†	0.35	0.26 - 0.46†,‡
Education, age 25+				
< Secondary	reference		reference	
Secondary	1.49	1.29 - 1.72†	0.95	0.71 - 1.28
College	1.70	1.49 - 1.93†	1.34	0.99 - 1.81
University	1.99	1.71 - 2.31†	1.41	1.05 - 1.89†
Income				
Lowest	reference		reference	
Low	0.96	0.82 - 1.12	1.21	0.89 - 1.65
Middle	0.80	0.69 - 1.92	1.19	0.91 - 1.56
High	0.87	0.75 - 1.01	1.56	1.17 - 2.08†,‡
Highest	0.97	0.83 - 1.14	2.39	1.77 - 3.23†,‡

* adjusted for age, sex, income and education

† significant compared to reference group

‡ significant difference from 1981 odds ratio

Figure 2. Physical activity trends, 1981-2000

* Source: Ref. 6

† Source: Ref. 3

‡ Source: Ref. 5

§ Source: Ref. 4

1990s. At baseline, the distribution of physical activity was skewed, with 19% reporting none (Figure 1). By 2000, there was a significant shift in the distribution, with increases in median LTPA and reductions in those reporting no LTPA. Figure 2 shows significant increases in the sufficiently active population over the period. Canadian adults were 1.6 times as likely (95% C. I. 1.5 – 1.7) to be sufficiently active in 1988 compared to 1981, and 1.2 times as likely (95% C. I. 1.1 – 1.3) to be sufficiently active in 2000 compared to 1995.

The proportion of sufficiently active men and women increased during the 1980s and 1990s, as did the proportion in all age groups except older adults. Although the sufficiently active population increased among older adults in the 1980s, no change was observed in the 1990s. Age-sex interactions were not significant. During this period, the sufficiently active population generally increased for every education level and income quintile (Table I).

Despite overall increases, differential trends emerged among some sub-population

groups in recent years. The prevalence of sufficiently active men increased between 1995 and 2000, yet that for women remained unchanged. Over the same period, the sufficiently active population increased among adults aged 25-44 years and among those aged 65 years and older. However a 'middle-aged slump' occurred, with adults aged 45-64 years being no more likely to be active than they were in 1995. The recent change in physical activity among adults with college education was significant only for the 25-44 year age group ($p=0.007$) and the change among those with secondary education was significant only among those 65 years and older ($p=0.001$). Finally, changes in the 'sufficiently active' population appear to have 'stalled' among most income groups, with a significant increase being observed only among the highest income earners between 1995 and 2000.

Table II shows socio-demographic correlates of sufficient physical activity among adult Canadians. Men were significantly more likely to be active compared to women, in both 1981 and 2000. Age differentials widened slightly – compared to the youngest age group in 1981, other ages were about half as likely to be active, but by 2000, all these age groups were 31% to 44% as likely to be active as those aged 18-24 years. Educational differences narrowed slightly between 1981 and 2000, perhaps due in part to higher rates of secondary school or college graduation in 2000 compared to 1981. However, there was evidence of widened differentials by income; in 1981, there were no income gradients in physical activity, but in 2000, those with the higher two levels of income were significantly more likely to be active, compared to the lowest income level.

DISCUSSION

The proportion of 'sufficiently' physically active Canadian adults increased during the 1980s and 1990s. Overall, the 1995-2000 increase is corroborated by increasing trends observed in comparing the 1994/1995 to the 1998/1999 National Population Health Surveys (NPHS). However, the NPHS observed increases among both males and females whereas we observed this only for men.¹⁷ The NPHS measure has a ceiling of "60 minutes or

more" for duration, which lowers overall prevalences relative to our study and accentuates male-female differences due to lower participation rates among women in activities of longer duration (i.e., golfing, team sports, skiing, etc.).

Unlike the 1981 and recent surveys which represent the household-based population, the 1988 panel represented non-institutionalized Canadian citizens, excluding new immigrants and people recently leaving institutions. This may introduce a non-coverage bias in comparing the 1988 data to other years. Being based on self-reports, responses were subject to recall error, but measurement error was non-differential over the period as the questions were comparable. Self-reported LTPA may over-estimate prevalences if non-active time is included and may over-estimate differences between groups compared to estimates combining leisure-time and chores.¹⁸ Although definitive population estimates of physical activity may be difficult to obtain, comparable methods and instruments permit the assessment of changes over time. Furthermore, although leisure-time represents only one domain, such discretionary activity may be more amenable to population change strategies than activity within work and chore domains.

Canadian trends are consistent with findings in Finland,³ but contrast those in the United States⁴ and recently, declines in Australia⁵ and England.⁶ In Canada, the 1974 Lalonde Report recognized lifestyle – and within that, physical activity – as one of four major determinants of health.¹⁹ Glouberman concludes that this heralded a "transition period", emphasizing lifestyle as a determinant of health, identifying policies to create change and foreshadowing the establishment of infrastructure to promote physical activity.²⁰ Substantial progress has been made in implementing its policy recommendations for physical activity, including marketing programs, mobilization of various sectors and development of a home fitness test (subsequently used in the CFS). In the early 1980s, media attention legitimized activities such as gardening and policy supported promotional campaigns (e.g., ParticipACTION's "Walk a Block"²¹) and programs (e.g., Fitweek²²). The 1986 Summit on Fitness²³ sparked coordinated development of

'Blueprints' for specific target groups.²⁴ In contrast, multi-level budget cuts to recreational programs during the 1990s and the elimination of target-group secretariats to implement the Blueprints may have contributed to the lack of change among women, those in pre-retirement and low-income earners.

Compared to Canada, there appears to have been no strategy for physical activity in the United States, prior to the 1996 Surgeon General's Report.¹ Accordingly, there was no consistent use of social marketing for physical activity with high population recall, nor systematic development of target-group plans to support program delivery. Although little is known about how physical activity levels are related to national policies, one study indicates that their presence may be linked to higher prevalence rates.²⁵ Are the similar physical activity trends in Finland and Canada related to the rollout of similar policies? Do American, Australian and English policies differ from Finnish and Canadian policies, and if so, how? If the mapping of Canadian policy to physical activity trends described above is valid, then replicating such assessments in other countries would increase our understanding of the effectiveness of policies and strategies in changing population levels of physical activity.

The increases in physical activity in the 1980s and 1990s are positive public health trends, representing increases in median LTPA and normative shifts in its distribution. The 1981-1988 movement from 'none' to low levels of LTPA correspond to reductions in the proportion of adults in the highest risk categories. Subsequent shifts occurred at the moderate-to-high levels, and as such, did not represent further reductions in the proportion most at risk. Despite these shifts, physical inactivity remains a public health issue. Given concurrent increases in body mass index,²⁶ Canadians still appear to have a net positive energy balance (which contributes to obesity trends); this may be due to over-consumption of foods, as well as reduced energy expenditure, through improved technology and suburban environments favouring the automobile. Although differences in the 'sufficiently active' population by education group have diminished, the gap has widened between younger and older adults, and a significant income dif-

ferential has emerged. Environmental and policy approaches (e.g., by-laws, subsidies) may help to address inequities in opportunities and support activity where people work, live and play.²⁷ Furthermore, the recent trends suggest that targeting women, middle-aged and low-income individuals may be warranted within an overall population strategy.

REFERENCES

1. U.S. Department of Health and Human Services. *Physical Activity and Health: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996, S/N 017-023-00196-5.
2. Proceedings. Dose-response issues concerning physical activity and health: An evidence-based symposium. *Med Sci Sports Exerc* 2001;33(6):641.
3. Helkaperi S, Uutela A, Prattala R, Puska P. Health Behaviour and Health among Finnish Population, Spring 2000 National Public Health Institute. Helsinki, Finland, 2000;pp.10, ISBN 951-740-187-6.
4. Macera CA, Pratt M. Public health surveillance of physical activity. *Res Q Exerc Sport* 2000;71(2):97-103.
5. Bauman A, Armstrong T, Davies J, Owen N, Brown W, Bellew B, Vita P. Trends in physical activity participation and the impact of integrated campaigns among Australian adults, 1997-1999. *Aust N Z J Public Health* 2003;27:76-79.
6. Prior G. Physical activity. In: Erens B, Primatesta P (Eds.), *Health Survey for England: Cardiovascular Disease Vol 1*. The Stationary Office, 1999.
7. Federal-Provincial-Territorial Conference of Ministers Responsible for Fitness, Recreation and Sport. Summary of Proceeding. Clear Lake, MB, 1997.
8. Taylor HL, Jacobs Jr. DR, Shucker B, Knudsen J, Leon AS, DeBacker G. A questionnaire for the assessment of leisure-time physical activities. *J Chron Dis* 1978;31:741-75.
9. Stephens TM, Craig CL, Ferris B. Adult physical activity in Canada: Findings from the Canada Fitness Survey I. *Can J Public Health* 1986;77:285-90.
10. Vuillemin A, Oppert J-M, Guillemin F, Essermeant L, Fontvieille A-M, Galan P, et al. Self-administered questionnaire compared with interview to assess past-year physical activity. *Med Sci Sports Exerc* 2000;32(6):1119-24.
11. Craig CL, Russell SJ, Cameron C. Reliability and validity of Canada's Physical Activity Monitor for assessing trends. *Med Sci Sports Exerc* 2002;34(9):1462-67.
12. Bouchard C, Landry F, Shephard RJ, Skinner J, Godin G. Report of the work group on constructing a physical activity index. Appendix in: Stephens T, Craig CL. Fitness and activity measurement in the 1981 Canada Fitness Survey. In: National Center for Health Statistics, Drury T (Ed.), *Assessing Physical Fitness and Physical Activity in Population-Based Surveys*. Hyattsville, MD: Public Health Service, DHHS Publication No. (PHS) 89-1253, 1989;401-32.
13. Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, et al. Compendium of Physical Activities: An update of activity codes and MET intensities. *Med Sci Sports Exerc* 2000;32(9):S498-S516.

14. Haskell WL, Montoye HJ, Orenstein D. Physical activity to achieve health-related physical fitness components. *Pub Health Rep* 1985;100:202-12.
15. SAS Institute, Inc. *SAS/STAT Software: Version 6*. Cary, NC: SAS Institute, Inc., 1994;1686.
16. SPSS Inc. *SPSS Advanced Models 10.0*. Chicago, IL: SPSS Inc., 1999;333.
17. Statistics Canada, National Population Health Survey (1994/95, 1996/97, 1998/99) CANSIM II database (online, table number 01040033), excerpt from Health Indicators, 2001(Cat No 82-221 XIE).
18. Jacobs Jr. DR, Ainsworth BE, Hartman TJ, Leon AS. A simultaneous evaluation of 10 commonly used physical activity questionnaires. *Med Sci Sports Exerc* 1993;25(1):81-91.
19. Lalonde M. A New Perspective on the Health of Canadians: A Working Document. 1981 ed. Ottawa: Minister of Supply and Services, 1974.
20. Glouberman S. Towards a New Perspective on Health Policy. Toronto: Canadian Policy Research Network, 2000, ISBN 1-896703-52-6.
21. Edwards P. Social marketing savvy: ParticipACTION celebrates its silver anniversary. *Health Prom* 1997;34(2):7-9.
22. Program Audit and Review Directorate. Evaluation of Fitness Canada: Executive Summary. Ottawa: Health and Welfare Canada, Government of Canada. 1992;8.
23. Fitness Canada. Fitness...The Future: The Canadian Summit on Fitness. Ottawa: Fitness and Amateur Sport, Government of Canada. 1988.
24. O'Brien Jewett B. Milestones in the Evolution of Fitness Canada. Technical Paper. Ottawa: Fitness and Amateur Sport, Government of Canada. 1993.
25. Stahl T, Rutten A, Nutbeam D, Kannas L. The importance of policy orientation and environment on physical activity participation-a comparative analysis between Eastern Germany, Western Germany and Finland. *Health Prom Int* 2002;17(3):235-46.
26. Craig CL, Russell SJ, Cameron C, Beaulieu A. *Progress in Prevention Series*. 1996; Bulletin no. 15.
27. McKinaly J, Marceau L. US public health and the 21st century: Diabetes mellitus. *Lancet* 2002;356:757-61.

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RÉSUMÉ

Objectif : La sédentarité a beau être associée à un risque accru de mortalité et de maladie chronique, la plupart des pays n'ont pas d'information tendancielle sur la question. Notre étude porte sur les niveaux d'activité physique des Canadiens adultes (18 ans et plus).

Méthode : Les données proviennent de six enquêtes nationales menées entre 1981 et 2000 auprès d'échantillons de 2 500 à 18 000 personnes. Les taux de prévalence ont été testés par les méthodes du khi-carré et du test t de Student. Les corrélats socio-démographiques ont été analysés à l'aide de rapports de cotes ajustés selon l'âge, le sexe, le niveau d'instruction et le revenu.

Résultats : L'activité physique a augmenté dans les années 1980 et 1990 chez les hommes et les femmes et pour l'ensemble des groupes d'âge, des niveaux d'instruction et des catégories de revenu ($p < 0,01$). Les écarts liés à l'instruction ont rétréci au cours de la période, mais ceux liés à l'âge se sont creusés, et des écarts liés au revenu sont apparus.

Discussion : La tendance haussière au Canada est conforme à celle que l'on retrouve en Finlande, mais va dans le sens contraire des tendances observées récemment en Australie, en Angleterre et aux États-Unis. Malgré les hausses, la sédentarité demeure un problème de santé publique, surtout chez les femmes, les personnes âgées, et dans les catégories de revenu inférieures.