Age and Sex Differences in Physical Inactivity Among Ontario Teenagers

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ABSTRACT

Research on physical activity and fitness indicates their importance in the prevention of disease and promotion of health. However, levels of physical activity have been shown to vary significantly by age, sex and a wide range of additional factors. This paper examines age and sex differences in physical inactivity among 13 to 19 year olds participating in the 1990 Ontario Health Survey. Findings from the bivariate analysis suggest a major increase in physical inactivity between ages 15 and 16. When logistic regression is used to examine the adjusted effects of predictor variables on physical inactivity, the effects of age remain significant. However, the odds of inactivity at one year increments are not significant. There are significant increased odds of inactivity associated with such factors as sex, friends' (activity) participation, perceived future health problems, and perceived health status. The public health implications of the findings suggest that those responsible for developing programs and policies to increase physical activity among teenagers should consider the critical years of decreased activity and the factors that might explain why this decline occurs.

ABRÉGÉ

Les recherches faites sur l'activité physique et le conditionnement physique montrent l'importance de celles-ci pour la prévention de la maladie et la promotion de la santé. Toutefois, on sait que les niveaux d'activité physique varient grandement en fonction de l'âge et du sexe ainsi que d'un grand nombre d'autres facteurs. Dans cet article, nous examinons les différences d'inactivité physique en fonction de l'âge et du sexe chez les individus âgés de 13 à 19 ans qui ont participé à l'Enquête sur la santé en Ontario de 1990. Les résultats de l'analyse à deux variables semblent indiquer que l'inactivité physique augmente sensiblement entre 15 et 16 ans. Même en faisant une analyse de régression logistique pour examiner les effets ajustés des variables prédictives sur l'inactivité physique, les effets de l'âge demeurent importants. Toutefois, les risques d'inactivité sur une année de plus ne sont guère importants. Il y a davantage de risques importants d'inactivité associés à des facteurs tels que le sexe, la participation des amis (aux activités physiques), la perception de problèmes de santé ultérieurement, et la perception de l'état de santé. Au plan de la santé publique, les résultats indiquent que les responsables de l'élaboration des programmes et des politiques ayant pour but d'accroître l'activité physique des adolescents devraient se pencher sur les années critiques de baisse de l'activité physique ainsi que sur les facteurs qui pourraient l'expliquer.

Regular, moderate to vigorous physical activity has been shown to benefit both performance-related and health-related fitness[1,2] as well as to have positive effects on a large number of physical, biological, and physiological systems of the body.[3] Additionally, physical activity and fitness have been linked empirically to the prevention of several diseases and conditions, and to the enhancement of physical and mental health.[4-7]

Several studies and reviews have indicated physical activity's importance in the growth, maturation, and development of children and adolescents,[8-10] and its role in providing potential social, psychological, and academic benefits.[11-13] Although it has yet to be demonstrated that patterns of physical activity carry over into adult life, it is believed that regular physical activity in childhood and adolescence is central to the establishment of long-term positive health-related attitudes and behaviours.[14] Given the many benefits of physical activity and fitness, it is important to understand the demographic, social, and health-related factors influencing physical activity among youth.

Both cross-sectional and longitudinal studies of the determinants of physical activity among adolescents and young adults indicate that activity is lower among older age groups and females.[15-20] In the case of teenagers, it is often contended that the major decline in activity occurs upon leaving school[21] or when physical education ceases to be a required subject.[2] Although broad age groupings confirm such a decline, a focus on leaving school as the key factor ignores the possible importance of within age-group differences in activity levels. Similarly, most reports dealing with physical activity patterns do not examine sex differences in participation within specific age-groups. This article examines such age and sex differences in physical inactivity by teenagers. We also examine the adjusted odds of inactivity for age and sex when socioeconomic status, social, and health factors are included in the analysis.

METHODS

The data were derived from the Ontario Health Survey, conducted between January and December 1990. A multi-stage cluster sample design was used to select a representative sample of Ontarians residing in households.[22] For each selected household, two components of data collection were deployed: first, a face-to-face interview with a designated respondent to report on the health status of household members, and second, a self-administered questionnaire completed by all household members aged 12 or over.

Measures

The Physical Activity Index, a composite measure based on frequency, duration, and an estimate of intensity, was used as the

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dependent variable for this analysis. On the basis of similar measures used in the Canada Fitness Survey and the Minnesota LTA Questionnaire,[16,23] respondents were asked, "Have you participated in the following physical activities during the month?" From a list of 20 activities respondents indicated the number of times (frequency) and time spent on each occasion (duration) for the activities participated in. The Physical Activity Index represents the calculation of energy expenditure of the combined activities.[24] Respondents were subsequently classified as active (those who averaged 3.0+ kcal/kg per day of energy expenditure), moderate (average of 1.5-2.9 kcal/kg per day), or inactive (energy expenditure below 1.5 kcal/kg per day). For the analysis, the Physical Activity Index was recoded into a dichotomous variable — physical activity level — with those classified as active and moderate actives coded as actives, and inactives remaining an intact category.

The nine predictor variables included in the analysis were the following: age, sex, level of household income, friends' participation, number of health problems, visits to a health professional, perceived health status, smoking type, and future health problems. Information concerning the wording of these questionnaire items, coding, and the creation of derived variables is documented elsewhere.[22] Because of an interest in the interplay between age and sex in determining inactivity, the age-by-sex interaction was also examined.

Analysis

Bivariate analysis was conducted initially in order to examine the relationships between age, sex, and physical activity. Gamma, a measure of association for ordinal level data, was used to estimate the strength of the relationship between physical activity level and age. Logistic regression was then used to examine the multivariate relationships between physical inactivity and the independent variables. Logistic regression allows for the direct estimate of the probability of an event or condition (such as inactivity).[25]

In order to examine the progressive change in inactivity by age (in the logistic regression analysis), each age category was compared with the category preceding it, using the "repeated" contrast in SPSS/PC+ version 5.0 (SPSS Inc., Chicago). For example, the adjusted effects of age 14 on inactivity were in comparison to age 13. Indicator coding was used for the remaining categorical independent variables. The reference category selected for these remaining variables was the most active group, identified by the earlier bivariate analysis.

For the analysis, the data were weighted to reflect the Ontario population and, for statistical tests, adjusted to an effective sample size based on a design effect of 2.93.[22]

TABLE I
Physical Activity Level by Age and Sex of 13-19 Year Olds (Ontario Health Survey, 1990)

Physical Activity Index	Age, yr 13	14	15	16	17	18	19	Total
Males								
Active	84	82	85	69	70	67	59	73
Inactive	16	18	15	31	30	33	41	27
	N=354	N=327	N=379	N=370	N=403	N=449	N=395	N=2677
Females								
Active	78	72	58	58	45	48	40	56
Inactive	22	28	42	42	55	52	60	44
	N=322	N=377	N=365	N=424	N=366	N=414	N=366	N=2634
Both								
Active	81	77	72	63	58	57	50	65
Inactive	19	23	28	37	42	43	50	35
	N=676	N=704	N=743	N=794	N=770	N=863	N=761	N=5311

Underlined values are qualified because of high sampling variability.
Estimates and statistical tests based on weighted effective sample size; Ns are based on weighted data normed to the number of interviews.
Number of missing observations = 741
Gamma both = 0.30, males = 0.29, females = 0.33
Chi Square both = 84.86, males = 39.50, females = 58.73, all significant at p<0.0001

RESULTS

The overall response rate for the self-administered questionnaire component of the Ontario Health Survey was 77%. The data in this study were derived from the 6053 respondents (3139 males, 2914 females) between the ages of 13 and 19 completing the questionnaire.

Table I shows the age and sex differences in physical activity for respondents aged 13 to 19. Physical activity level had a moderate association with age for males and females together (gamma = 0.30), males (gamma =0 .29), and females (gamma = 0.33). Physical activity declined steadily with increasing age, the major decline occurring between ages 15 and 16. For males the largest decrease in physical activity occurred between ages 15 and 16, while for females the greatest decline occurred between ages 14 and 15.

A higher proportion of females (44%) were inactive, compared with males (27%). There were sex differences in activity for each age between 13 and 19, and these were most pronounced for age 15 (42% inactive females vs. 15% inactive males), age 17 (55% vs. 30%), age 18 (52% vs. 33%), and age 19 (60% vs. 41%). Examination of age and sex together revealed that the most active group was males aged 13 (84% active) and the least active group was females aged 19 (40% active).

Logistic regression was used to examine the adjusted effects of age and sex on physical inactivity. The odds of inactivity were predicted using nine independent variables, entered as follows: (1) age; (2) sex; (3) household income; (4) friends' participation, and (5) smoking status, number of health problems, perceived health status, future health problems, and number of visits to a health professional. These blocks of variables correspond conceptually to the major demographic factors of interest here (blocks 1-2), as well as socioeconomic status (block 3), social influence (block 4), and health-related factors (block 5).

TABLE II
Odds of Inactivity for Categories of the Predictor Variables

Variable	Wald χ^2	Odds Ratio	95% Confidence Interval
Age	27.38†		
13		1.0	Reference
14		0.8	0.5, 1.4
15		0.9	0.5, 1.4
16		0.8	0.5, 1.2
17		0.8	0.5, 1.2
18		1.1	0.7, 1.8
19		0.7	0.5, 1.1
Sex	29.89†		
Male		1.0	Reference
Female		2.0	1.6, 2.6
Friends' Participation	52.21†		
All		1.0	Reference
Most		1.4	0.8, 2.5
Half		2.8	1.6, 4.9
A few		3.9	2.3, 6.7
None		3.9	2.0, 7.7
Future Health Problems	38.92†		
Very unlikely		1.0	Reference
Somewhat unlikely		1.6	1.2, 2.1
Somewhat likely		2.8	1.9, 4.2
Very likely		3.7	1.9, 7.2
Perceived Health	9.44*		
Excellent		1.0	Reference
Very good		1.4	1.0, 1.9
Good		1.7	1.2, 2.4
Fair		1.3	0.6, 2.5
Poor		4.0	0.6,24.8
Household Income	5.32	NS	
Health Problems	7.54	NS	
Visits to Health Professionals	0.02	NS	
Smoking Status	1.71	NS	

Based on logistic regression analysis using the weighted effective sample size for statistical calculations. Odds ratios for non-significant variables not shown.
* $p<0.05$, † $p<0.0001$

Table II shows the results of the final model (after all the blocks of variables have been entered). The odds of inactivity for any individual category of a predictor variable took into account the effects of all of the other predictors in the analysis.

The results of the logistic regression analysis generally supported the bivariate analysis, with five of the nine variables being significantly related to inactivity. Although the odds of inactivity for each specific year of age, compared with the previous year, were not significant, age remained a significant predictor of physical inactivity. Thus, the effect of age on inactivity was fairly robust, and there was no evidence of a disproportional increase in inactivity between any two years of age.

Also evident in the multivariate analysis was a sizeable sex effect: females were twice as likely as males to report inactivity (odds ratio [OR] = 2.0). The absence of a significant age-by-sex interaction indicated that the effects of age and sex were independent. Friends' participation was one of the most highly significant predictors of inactivity: the odds of inactivity were greater for those with half (OR=2.8), a few (OR=3.9), or none (OR=3.9) of their friends participating, compared with those whose friends all participated.

Four variables — household income, smoking status, visits to a health professional, and number of health problems — did not significantly increase the odds of inactivity. However, two additional health-related variables did increase the odds of inactivity: the likelihood of future health problems, and perceived health status. The odds of inactivity were higher for teenagers believing that they were very likely (OR=3.7), somewhat likely (OR=2.8), and somewhat unlikely (OR=1.6) to develop future health problems, compared with those believing they were very unlikely to do so. Also, the odds of inactivity were significantly greater for those perceiving their health status to be good (OR=1.7) or very good (OR=1.4), compared with those perceiving their health to be excellent.

DISCUSSION

The findings from the bivariate analysis support our contention of age differences in physical activity patterns. Specifically, we found that a major decline in activity occurs between age 15 and 16. Findings from the logistic regression analysis, however, suggest that while age remains a significant predictor of physical inactivity, the odds of inactivity for any given age are not significant compared with the previous year of age.

Malina states that the decline in physical activity levels in adolescence is related to the social demands of this life stage as well as changing interests and the transition from school to work or college.[10] We believe there are several possible reasons for a decrease in physical activity with increasing age. The most compelling explanation is that, in Ontario, students are required to complete only one course credit in physical and health education, and many of them fulfil this requirement in grade 9 (age 14 or 15). Also, many students choose not to select physical education as an optional course in subsequent years. Another likely reason for a drop in activity is that many teenagers obtain their driver's licence at age 16, and they are likely to experience changes in lifestyle associated with that rite of passage. Additional changes that may partly explain a decline in activity include possible changes in other health-related behaviours with increasing age, such as increased cigarette, alcohol, and drug use;[26] increased emphasis on relationships, dating, and social life; and (for females) the beginning of menstruation, which may prompt modifications in the time allocated to physical activity. Furthermore, for students, there are increased demands for competing activities such as homework and part time work. Findings from the Campbell's study of physical activity and fitness in Canada indicated that lack of time was the most frequently mentioned barrier to teenagers engaging in physical activity.[17]

The analysis showed that sex differences in physical inactivity occur at each age during the teenage years. These differences may be due to personal choice, sex differences in perceived barriers, or inequities in

opportunities to engage in regular physical activity. One explanation for sex differences in behaviour, attitudes, and opportunities for physical activity is that there are different patterns of socialization between males and females. For example, males are more likely to use physical activity as a means of coping with stress than females.[27]

While the focus of the current paper is primarily on age and sex differences in physical activity participation, the findings also indicate significant differences related to social and health-related factors. One of the predictors of physical inactivity was the number of friends who were also physically active. Thus, it appears that social influences play an important part in decisions regarding physical activity, as they do for other health-related behaviours.[28,29] Perceived health status was inversely related to physical inactivity. However, we cannot determine the causal direction of this relationship because of the cross-sectional design of the survey. Similarly, we cannot establish the causal direction of the relationship between perceptions of future health problems and inactivity. Longitudinal data are needed to examine the sequence of these relationships.

IMPLICATIONS FOR PROGRAMS AND POLICIES

The findings of this analysis suggest that programs and policies directed at teenagers need to focus on the critical ages before leaving school and obtaining (or seeking) employment or further education. Further, females should be targeted for interventions designed to counteract those factors and forces that lead to inactivity.

In Ontario (and Canada) several organizations are currently promoting the importance of Quality Daily Physical Education (QDPE) in schools. Although the rationale for increased physical activity for students is strong, the larger social, economic, and political context of decisions concerning school curricula poses serious constraints on what may be attained. The findings reported here provide baseline information for comparing future levels of physical activity among teenagers, and for establishing realistic targets for promoting population health through increased physical activity.

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