

Correlates of Habitual Walking and Sports/Leisure-time Physical Activity in Older Persons in Singapore: Interaction Effects Between Educational Attainment and Gender

C H Wong,^{*}*MRCP (UK)*, S F Wong,^{**}*FAMS, MRCP (UK)*, L Shen,^{***}*MSc (Stats)*

Abstract

Introduction: We examined for demographic and psychosocial correlates on the participation of habitual walking and sports/leisure-time physical activity (LTPA) among older persons in Singapore. **Materials and Methods:** In an observational study, 177 Chinese, community/urban-dwelling, ambulant, non-disabled participants ≥ 50 years old were recruited from a health promotion programme. The main outcome measures were self-reported participation in habitual walking and sports/LTPA. Variables examined include highest educational attainment, demographic and health characteristics, social contact and health knowledge. Interaction between gender and educational attainment was also examined. **Results:** The mean age of participants was 62.5 ± 7.8 years. The effects of educational level were significant on habitual walking ($P = 0.02$), while that of age, self-rated health and interaction between gender and educational level were significant for sports/LTPA ($P = 0.012$, $P = 0.002$ and $P = 0.019$, respectively). Men with higher education had a higher self-reported sport/LTPA, while in women; those with lower education attainment had a higher participation. **Conclusion:** Unlike findings from Western developed nations, previous studies done in Japan and Singapore found that educational level and health behaviours may not be positively associated. In this study, there is a negative correlation between educational attainment and participation in habitual walking and sports/LTPA, especially among older Singaporean women.

Ann Acad Med Singapore 2003; 32:801-6

Key words: Educational status, Gender, Sports, Walking

Introduction

Physical inactivity has been identified as a major cause of morbidity and mortality secondary to cardiovascular disease, diabetes mellitus and hypertension. It contributes to the loss of physiological and psychological capabilities that result in overall reduction in function and independent living.¹ Participation in regular physical activity, on the other hand, has been shown to improve posture, prevent sarcopaenia and disability and protect against hip fracture. It has also been reported that physical activity is important in maintaining cognition, quality of life and independence in activities of daily living in an older person.² Physical activity has been considered as one of the health behaviours most likely to alter health.

Much of the current knowledge about the determinants of physical activity comes from studies on younger and middle-aged persons. Less is known about older individuals. The World Health Organization (WHO) had reported that,

by 2025, more than 800 million people in the world will be over 65 years old.³ In Singapore, the number of older persons above the age of 65 years is projected to increase from 6.8% in 1995 to 20% by the year 2030.⁴ As there is very little information on this aspect in an older Asian population, it is important to find correlates of physical activity for its implications on possible preventive interventions and to validate prior studies in the West.

Determinants of physical activity in adults can be classified into 5 categories: demographic or health characteristics; knowledge, attitudes and beliefs including self-efficacy; psychological and behavioural attributes; available exercise programme factors; and environmental factors.⁵

Previous studies done in Canada (for older adults) and Denmark had reported that important variables for participation in physical activity include gender, age, educational attainment, marital status, chronic medical conditions, smoking status and health perception.^{6,7}

^{*} Registrar

^{**} Consultant

Department of Geriatric Medicine

Alexandra Hospital

^{***} Biostatistician

Clinical Trials and Epidemiology Research Unit

Address for Reprints: Dr Wong Chek Hooi, Department of Geriatric Medicine, Alexandra Hospital, 378 Alexandra Road, Singapore 159964.

However, these studies have been done on a single parameter: leisure-time physical activity (LTPA).

Evidence from the Nottingham Longitudinal Study of Activity and Ageing for older persons indicated that for both men and women, participation in some activities (e.g. walking) are independent of participation in others (e.g. sports). Thus, older persons are not generally active or inactive but appear to be selectively active/inactive within certain task specific domains. Hence, an activity inventory that differentiates habitual walking and LTPA rather than a single parameter of LTPA is more reflective of an older persons activity and fitness level.⁸ Habitual activity may be more important in the longer term through engendering of improved fitness or a greater physiological activity and energy turnover, especially in older adults. There is growing interest in the role of habitual walking and LTPA in the maintenance of physical fitness and health in the older person.⁹ Therefore, we investigated the demographic, socioeconomic, psychosocial and health status correlates on the participation of habitual walking and LTPA in older persons in Singapore.

Materials and Methods

This study was conducted in a geriatric day hospital, from April 2001 to November 2001. All community-dwelling, ambulant, non-disabled participants aged 50 years or older attending a health promotion programme were recruited and their written informed consent to participate in the study was obtained. Of the 216 eligible participants, 177 (82%) were included in the analysis. Thirty-nine (18%) subjects were excluded of whom 28 (13%) did not submit the questionnaire and 11 (5%) refused to give consent. This study was approved by the hospital's ethics committee.

The questionnaire is a one-stage, retrospective, recall-based series of structured questions administered by trained interviewers. Levels of habitual walking and LTPA were assessed using a detailed activity inventory, modelled after the Nottingham Longitudinal Study of Activity and Ageing which was used and validated by Morgan et al¹⁰ for older adults. Habitual activities are defined as those with a probable minimum energy cost of 2 kcal/min, performed continuously for at least 3 minutes, at least weekly, for the previous 6 weeks.¹⁰ Participants were asked about their walking (any purposeful walking defined as walking with a purpose such as to the grocery store, market, bus-stop done outside house or garden, excluding running or jogging); leisure-time or sports activities (such as swimming, running or jogging, racquet games, tai chi or qigong, golf, bowling, dancing, and others). These were recorded if the activities met the criteria for being habitual. The duration and frequency of each reported activity were scored as minutes per day and the number of days per week. They were later

scored in average minutes per week.

The extent of walking the day before (walking yesterday) for the estimation of walking activity was done. The question had previously been validated against a pedometer.¹¹ If the previous day had been atypical, then another was selected (up to a maximum of 6 days previously). It was scored as minutes per typical day.

The basic demographic factors, health characteristics and socioeconomic status included were gender, age, employment, living arrangement, marital status, type of dwelling, previous hospitalisation in the last 1 year, self-rated health, smoking, number of medical problems (nominal) and highest educational attainment. Social contact, health knowledge [based on a 7-item series of questions (nominal)] and perception of body weight were also included for analysis (Tables I and II).

TABLE I: BASIC CHARACTERISTICS OF THE STUDY GROUP

	No. of participants (%)
Age	
Median (Range)	63 (50-81) years
Mean (SD)	62.5 (7.8) years
Gender	
Male	58 (32.8)
Female	119 (67.2)
Marital Status	
Never married	25 (14.1)
Married	118 (66.7)
Divorced/Separated	1 (0.6)
Widowed	31 (17.5)
Others	2 (1.1)
Type of dwelling	
1- to 2-room public flat	4 (2.3)
3-room public flat	27 (15.3)
4-room public flat	37 (20.9)
5-room public flat/HUDC	40 (22.6)
Private flat/House	69 (39.0)
Living arrangement	
Alone	22 (12.4)
With spouse only	34 (19.2)
With spouse, children or grandchildren	85 (48.0)
With children or grandchildren but no spouse	15 (8.5)
With others	21 (11.9)
Employment	
Employed (Full time)	22 (12.4)
Employed (Part time)	25 (14.1)
Unemployed/Retired	126 (71.2)
Others	4 (2.3)
Highest educational attainment	
Never attended school	11 (6.2)
Primary	20 (11.3)
Secondary	88 (49.7)
Post-Secondary/Tertiary	58 (32.8)

TABLE II: PARTICIPANTS' SELF-ASSESSMENT OF HEALTH AND HEALTH HABITS

	No. of participants (%)
Self-rated health	
Very poor	0 (0)
Poor	9 (5.1)
Fair	68 (38.4)
Good	89 (50.3)
Excellent	11 (6.2)
No. of medical problems	
Median (Range)	2 (0-9)
Hospitalisation for the past 1 year	
Yes	16 (9.0)
No	161 (91.0)
Smoking*	
Never smoked	157 (89.2)
Ever smoked and stopped	16 (9.1)
Currently still smoking	3 (1.7)
Perception of body weight	
Overweight	70 (39.5)
Just right	93 (52.5)
Underweight	14 (7.9)
Social contact	
Yes	160 (90.6)
No	17 (9.6)
Health knowledge	
Median	4
Range (Min-Max)	1-7

*There is 1 missing data (n = 176) for smoking.

The number of medical problems score from 0 (no health problem) to 13, covering the presence or absence of medical comorbidities (hypertension, diabetes, heart conditions, high cholesterol, asthma/chronic lung diseases, arthritis, stroke, eyesight problems, urinary incontinence, frequent falls/ use of walking stick, foot problems, hearing problems, others), adapted from Fried and Guralnik's list of chronic disease states that have been associated with physical disability in older populations.¹² Self-rated health was rated in a 5-point response format of very poor, poor, fair, good and excellent. Highest educational attainment was recorded as never attended school, primary, secondary and post secondary/tertiary education. Social contact is defined by the question, 'Do you get together with close friends, relatives or neighbours at least once a week?' with a response of yes or no.

Prior to recruitment, a pilot study was conducted to assess the questionnaire in terms of administration and acceptability to older respondents. Most completed the questionnaire in 20 minutes.

The use of the questionnaire introduced an element of self-reporting bias. The question on walking yesterday that was previously validated against a pedometer is highly correlated with reported walking in the past fortnight

(Pearson's coefficient 0.737; $P = 0.01$). This lends some reliability to self-reported walking¹¹ and other self-reported measures of physical activity. The participants were interviewed at the point of entry into the health promotion programme and not compensated for their participation, so as to reduce possible bias on completion of the questionnaire.

Statistical Analysis

Multivariate linear regression with backward model selection, with a 0.1 removal rate, was carried out to evaluate the effects of each variable on levels of self-reported habitual walking and LTPA/sports. Interaction effects between highest educational attainment and gender were also considered due to previous studies on their effects on health and health behaviours. To increase the power of analysis, variables were recorded as follows: marital status to never married, married or divorced/separated/widowed/others; type of dwelling into 1- to 2-room public flats, 3- to 4-room public flats or 5-room public flat/Housing and Urban Development Corporation (HUDC) flats/private flat/house; living arrangement to alone or others; employment to employed full/part time or unemployed/retired/others; self-rated health into very poor/poor, fair or good/excellent; smoking status into never smoked or ever/current smokers. All analyses were done on SAS (SAS Institute, Inc., Cary, NC) version 8 for Windows. P values <0.05 were considered to be statistically significant.

Results

Basic demographic factors, health characteristics, socioeconomic factors, social contact and health knowledge of the participants are summarised descriptively (Tables I and II). The mean age of participants was 62.5 ± 7.8 years. The median self-reported walking was 127.5 min/week (range, 0 min/week to 2100 min/week), while the median self-reported sports/LTPA was 62.5 min/week (range, 0 min/weeks to 1680 min/week).

We found that only the effects of education level was significant on walking ($P = 0.02$). Age, self-rated health and the interaction between gender and education level were significant on the levels of LTPA/sports ($P = 0.012$, $P = 0.002$ and $P = 0.019$, respectively). The median (range) and mean (standard deviation) values are given in Table III (for time spent on habitual walking and LTPA/sports).

Effect of Highest Educational Attainment on Habitual Walking

Participants with low educational attainment spent more time on habitual walking than those with higher educational levels. Participants who never attended school or had a primary school education spent 172.59 minutes more on walking every week than those who had post-secondary or

TABLE III: AVERAGE TIME SPENT ON HABITUAL WALKING AND LTPA/SPORTS

Variables	Habitual walking		LTPA/sports	
	Median (Range)	Mean (SD)	Median (Range)	Mean (SD)
<u>Highest education attained</u>				
Nil/Primary (n = 31)	225 (1030)	295.86 (236.94)	150 (1680)	255.83 (421.26)
Secondary (n = 88)	105 (2100)	197.18 (330.84)	60 (1110)	139.25 (199.55)
Post-secondary/ Tertiary (n = 58)	85 (1050)	123.12 (151.66)	60 (1620)	162.76 (271.95)
<u>Self-rated health</u>				
Very poor/poor (n = 9)	150 (420)	200 (149.83)	0 (420)	113.33 (165.53)
Fair (n = 68)	135 (1080)	170.62 (200.62)	10 (710)	85.76 (136.48)
Good/Excellent (n = 100)	112.5 (2100)	199.86 (319.32)	120 (1680)	225.50 (331.17)
<u>Gender</u>				
Men (n = 58)	150 (1080)	196.64 (203.91)	125 (1620)	209.66 (294.62)
Women (n = 119)	105 (2100)	185.09 (302.31)	60 (1680)	145.90 (262.38)

Time is measured in minutes per week

LTPA: leisure-time physical activity

tertiary education ($P = 0.006$; 95% Confidence interval (CI), 50.42 min to 294.77 min). Those with secondary school education spent 74.06 minutes more on walking compared to those who attained post-secondary or tertiary education ($P = 0.106$; 95% CI, 15.93 min to 164.06 min).

Effect of Self-rated Health on Sports/LTPA

Participants whose self-rated health is poor/very poor when compared with those with good/excellent rating spent 178.91 minutes less in sports/LTPA every week ($P = 0.053$; 95% CI, 360.12 min to 2.31 min). Those who had a fair self-rated health spent 146.51 minutes less ($P = 0.0007$; 95% CI, 230.17 min to -62.88 min). Poorer self-rated health status correlated with lower levels of sports/LTPA.

Effect of Gender on Sports/LTPA

When the effects of gender were analysed, fewer women participated in sports/LTPA with less time spent. Only 59.8% of women engaged in some form of sports/LTPA, the median time spent was only 60 min/week (range, 0 min/week to 1680 min/week). In comparison, 70.7% of men did so and the median time spent was 125 minutes/week (range, 0 min/week to 1620 min/week).

Ninety-four per cent of women reported habitual walking with a median time spent of 105 min/week (range,

0 min/week to 2100 min/week) while 94.8% of men reported habitual walking with a median time spent of 150 min/week (range, 0 min/week to 1080 min/week).

Effect of Interaction between Gender and Educational Level on Sports/LTPA

When the effects of gender and highest educational attainment was taken into consideration for sports/LTPA, women with secondary education spent 25.97 minutes more per week ($P = 0.65$; 95% CI, 86.65 min to 138.58 min); women who did not receive any education or had only primary education spent 217.79 minutes more per week ($P = 0.002$; 95% CI, 79.35 min to 356.21 min) than those with post-secondary or tertiary education. Women with lower educational level spent more time in sports/LTPA.

In contrast, men with post-secondary or tertiary education spent 120.48 minutes more per week on sports ($P = 0.08$; 95% CI, 14.40 min to 255.35 min); men with secondary education spent 70.53 minutes more per week ($P = 0.3$; 95% CI, 62.08 min to 203.14 min) than those who did not receive any education or only had primary school education. Comparatively, men with higher education reported more time in sports/LTPA.

Effect of Age on Sports/LTPA

Interestingly, time spent in sports/LTPA increased by 6.75 minutes a week ($P = 0.012$; 95% CI, 1.52 min to 11.97 min) for every year increase in age.

Discussion

Many studies in the West have reported sedentary behaviour among older persons to be more prominent in the less educated, and that higher educational levels predicted levels of physical activity especially vigorous physical activity or LTPA.^{6,7} Less is known about the role played by educational level in determining healthy behaviours in the levels of LTPA and habitual walking in an older Asian population.

In this study, educational level correlated negatively with LTPA and habitual walking. When the interaction of gender with educational level was included in the model; educational level correlated positively with levels of physical activity in men but showed a negative correlation in women.

Previous studies done in Japan and Singapore found that higher educational level may not be correlated with higher levels of physical activity. In a study of 52,000 people aged 40 to 79 years in Miyagi prefecture in Japan, Anzai et al¹³ found that health practices in women defined as smoking, alcohol consumption and exercise, were not correlated with educational level. In Singapore, middle-aged women (35 to 60 years) with lower educational level were more likely to fulfill the WHO's recommendation on physical activity when compared to those with higher educational

level.¹⁴ It had used the 7-day recall questionnaire (7DRQ) which measures all aspects of physical activity, including household activity and LTPA. This suggests that educational level in Asian women may have a different effect on levels of physical activity.

It has been suggested that by determining an educational level, one was able to locate an individual's place in a society's stratification system. The process by which resources are differentially distributed is what is meant by social stratification. Being at the top of the system meant prospects of having access to more resources like material and social rewards such as a higher pay, better occupation and a higher level of self-determination.¹⁵ These rewards, in turn, change patterns of morbidity like lack of physical activity in a favourable direction.

However, sociologically, it is more accurate to conceptualise educational attainment together with age and gender as distinct dimensions of social stratification. The interaction effect of educational attainment on the uptake of physical activity has to be considered with these variables.¹⁶

The geographical, social and cultural variations in the formulation of aetiological hypothesis concerning educational attainment and levels of physical activity in the Singapore may be different from the populations in the West. The difference between older men and women suggests that other psychosocial factors, like the nation's or family's educational policies, may play more important roles in gender differences. Women may have fewer educational opportunities.¹⁷

In terms of social stratification, there are reported distinct characteristics in Asians. Studies in Japan have found that family factors, like parental income, education and occupation, exert greater influence on educational attainment compared to the United States and Britain¹⁶ (Fig. 1).

Levels of physical activity, deemed as part of healthy behaviour, are influenced not only by educational level and demographic factors but also by other factors such as personal factors (beliefs, attitudes, self-efficacy and health status). Self-rated health, as a global self-evaluation of health, was significantly correlated with LTPA. It has been suggested that psychological wellbeing is an important factor for staying physically active among older adults.¹⁸ There are two interpretations of self-rated health: it is a spontaneous assessment of one's health status and health practices, and it is an aspect of one's enduring self-concept.¹⁹ As such, self-rated health may be regulated by an older person's efforts to achieve important health-related goals like regular physical activity. It has also been suggested that health status and levels of physical activity may be mediated by self-efficacy.²⁰

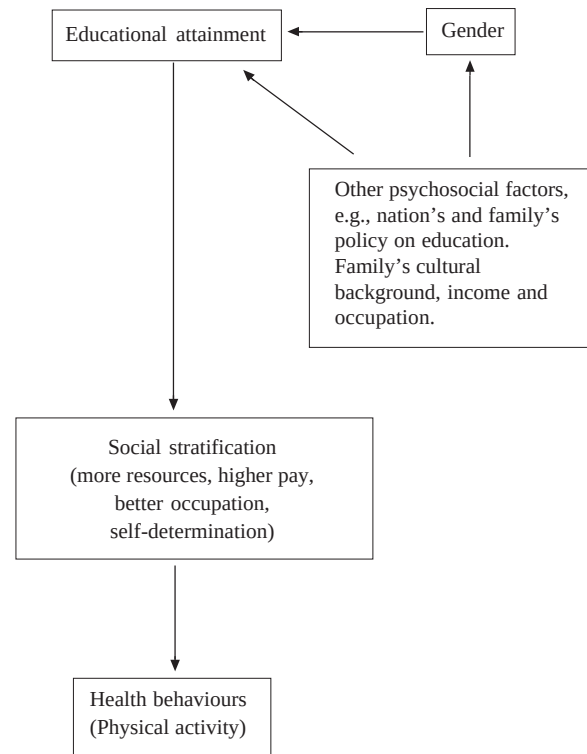


Fig. 1. Aetiological hypothesis on healthy behaviours and interacting variables in older persons.

The limitations of this study include the small number of participants; they are more likely to be self-selected, healthy and interested in physical activity. The older participants actually spent more time doing sports/LTPA than the younger subjects. They were also predominantly Chinese. The possibility of a cohort effect may have limitations in generalisability to the population. However, 2 previous larger studies done in Singapore and Japan had shown that educational attainment may not be positively correlated with levels of physical activity compared to studies done in the West.^{13,14}

In 1995, the Centers of Disease Control and Prevention and the American College of Sports Medicine, classified older adults as a special population, in whom physical inactivity is prevalent and special efforts are required to target this population to increase their levels of physical activity.² This is also in line with the Inter-Ministerial Committee (IMC) on Ageing population recommendation on the emphasis on health promotion and disease prevention in our ageing population. Hence, more research is needed to find the determinants of physical activity especially psychological and behavioural attributes in older Asian men and women in order to design specific interventions that will promote physical activity. There is also mounting evidence that regular physical activity improves physiological and performance measures in older persons.⁹

Acknowledgements

The study was supported by the National Medical Research Council of Singapore. We are grateful to all participants and volunteers from Nanyang Polytechnic involved in this programme.

REFERENCES

- George BJ, Goldberg N. The benefits of exercise in geriatric women. *Am J Geriatr Cardiol* 2001; 10:260-3.
- Pate RR, Pratt M, Blair SN, Haskell WL, Macera CA, Bouchard C, et al. Physical activity and public health: a recommendation from the Centers of Disease Control and Prevention and the American College of Sports Medicine. *JAMA* 1995; 273:402-7.
- World Health Organization. The World Health Report. Life in the 21st Century: A vision for All. Geneva: World Health Organization, 1998.
- The National Survey of Senior Citizens in Singapore, 1995. Singapore: Interministry, 1996:1.
- Wilcox S, King AC. Health behaviors and aging. In: Hazzard WA, Blass JP, Ettinger WH, Halter JB, Ouslander JG, editors. *Principles of Geriatric Medicine and Gerontology*. New York: McGraw-Hill, 1999:287-302.
- Kaplan MS, Newsom JT, McFarland BH, Lu L. Demographic and psychosocial correlates of physical activity in late life. *Am J Prev Med* 2001; 21:306-12.
- Droomers M, Schrijvers CT, Mackenbach JP. Educational level and decreases in leisure time physical activity: predictors from the longitudinal GLOBE study. *J Epidemiol Community Health* 2001; 55:562-8.
- Bath PA, Morgan K. Customary physical activity and physical health outcomes in later life. *Age Ageing* 1998; 27:29-34.
- Wong CH, Wong SF, Pang WS, Azizah MY, Dass MJ. Habitual walking and its correlation to better physical function: implications for prevention of physical disability in older persons. *J Gerontol A Biol Sci Med Sci* 2003; 58:555-560.
- Morgan K. The Nottingham Longitudinal Study of Activity and Ageing: a methodological overview. *Age Ageing* 1998; 27:5-11.
- Bassey EJ, Dallosso HM, Fentem PH, Irving JM, Patrick JM. Validation of a simple mechanical accelerometer (pedometer) for the estimation of walking activity. *Eur J Appl Physiol Occup Physiol* 1987; 56:323-30.
- Fried LP, Guralnik JM. Disability in older adults: evidence regarding significance, etiology, and risk. *J Am Geriatr Soc* 1997; 45:92-100.
- Anzai Y, Ohkubo T, Nishino Y, Tsuji I, Hisamichi S. Relationship between health practices and education level in the rural Japanese population. *J Epidemiol* 2000; 10:149-56.
- Lee TW, Khor WB, Tan NW, Cheng CL, Seow A, Foo SC. A cross-sectional survey of physical activity among middle aged women in Singapore. *Singapore Med J* 1999; 40:468-76.
- Kubzansky LD, Berkman LF, Glass TA, Seeman TE. Is educational attainment associated with shared determinants of health in the elderly? Findings from the MacArthur Studies of Successful Aging. *Psychosom Med* 1998; 60:578-85.
- Liang J, Bennett J, Krause N, Kobayashi E, Kim H, Brown JW, et al. Old age mortality in Japan: does socioeconomic gradient interact with gender and age? *J Gerontol B Psychol Sci Soc Sci* 2002; 57:294-307.
- Maddox GL, Glass TA. Sociology of aging. In: Hazzard WA, Blass JP, Ettinger WH, Halter JB, Ouslander JG, editors. *Principles of Geriatric Medicine and Gerontology*. New York: McGraw-Hill, 1999:191-201.
- Rutten A, Abel T, Kannas L, von Lengerke T, Luschen G, Diaz JA, et al. Self-reported physical activity, public health, and perceived environment: results from a comparative European study. *J Epidemiol Community Health* 2001; 55:139-46.
- Bailis DS, Segall A, Chipperfield JG. Two views of self-rated general health status. *Soc Sci Med* 2003; 56:203-17.
- Clark DO, Nothwehr F. Exercise self-efficacy and its correlates among socioeconomically disadvantaged older adults. *Health Educ Behav* 1999; 26:535-46.