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Prevalence and risk factors of physical inactivity among middle-aged and older Chinese in Shenzhen: a cross-sectional study

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ABSTRACT

Objective Investigations on physical inactivity are common around the world; however, little is known about the status of physical inactivity in mainland China. The aim of this study was to examine the prevalence and risk factors associated with physical inactivity in Shenzhen in Southern China.

Design A community-based, cross-sectional study.

Setting A multistage-stratified, random cluster survey was conducted in Xixiang Street, Bao'an District of Shenzhen in Southeast China.

Participants 3920 adults aged 40 years or more were recruited to the study and completed the International Physical Activity Questionnaire Short Form between 1 March 2015 and 30 July 2016.

Main outcome measures Physical inactivity was defined as engaging in physical activity levels insufficient to reach the current guidelines. Bivariate and multivariate analyses were undertaken to assess the prevalence and risk factors associated with physical inactivity.

Results The prevalence of physical inactivity was 63.1% for all participants, 63.9% for women and 61.9% for men, respectively. Participants who were older (OR=1.31, 95% CI 1.11 to 1.54), who were female (OR=1.22, 95% CI 1.04 to 1.43), who had higher education experience (OR=1.38, 95% CI 1.19 to 1.61), who are under economic pressure (OR=2.17, 95% CI 1.48 to 3.17), who ever smoked a cigarette (OR=1.44, 95% CI 1.13 to 1.82) and drank alcohol (OR=1.42, 95% CI 1.14 to 1.77), and participants in the lowest body mass index category (OR=1.40, 95% CI 1.03 to 1.89), were more likely to report physical inactivity.

Conclusions These findings indicate that physical inactivity is prevalent in Southern China. Interventions and programmes aimed at increasing physical activity among middle-aged and older Chinese adults may also be tailored to participants under economic pressure and those with unhealthy behaviours such as smoking and drinking.

Strengths and limitations of this study

- ► Information about differences in physical inactivity levels and associated variables in general Chinese population is limited.
- ► The design of this cross-sectional study allowed the objective assessment of the prevalence and risk factors associated with physical inactivity in Shenzhen in Southern China.
- ► Physical inactivity was measured by the International Physical Activity Questionnaire, which provided convenience for international scholars to evaluate global physical inactivity levels.
- ► The study enrolled only community residents in Shenzhen, limiting the generalisability of findings to other geographical regions.

INTRODUCTION

Physical inactivity, defined as insufficient levels of activity to meet recommendations,[1] is now identified as the fourth leading risk factor for global mortality. Scientific evidence shows that physical inactivity increases the risk of many adverse health conditions, including major non-communicable diseases.[1 2] Worldwide, it is estimated that physical inactivity caused approximately 20% of the burden of disease from breast and colon cancers, 7% of type 2 diabetes and 6% of coronary heart disease.[3] The WHO Member States in World Health Assembly (WHA66.10)[4] have agreed on a voluntary global non-communicable chronic disease target for a reduction of 10% in physical inactivity by 2025.

Despite compelling evidence for a causal association between physical inactivity and various health outcomes,[3] the number of studies showed that physical inactivity is common all over the world. Data from 122 countries showed that 31.1% of adults (aged 15 years or older) were physically inactive, with a range of 4.7% (Bangladesh) to 71.9% (Malta).[5] In Brazil, a population-based, cross-sectional study among 3182 adults aged 20 years or more revealed that the prevalence of physical inactivity was 41.1%.[6] In USA, a

survey of adults (aged 18 years and older) reported that 48.4% did not engage in physical activity sufficient to meet the aerobic activity guideline.[7]

In Taiwan, a study of 15 390 adults found that approximately 4 out of 5 individuals failed to reach the goal of being physically active (expending 750 kcal/week).[8] Ku *et al*[9] draw data from four national surveys comprising 29 226 people and revealed that 86.0% of Taiwanese adults did not meet the national recommendations (at least 90 min/week spent in exercise/sports). Pan *et al*[10] reported that, among 4018 Taiwanese older adults, 47.8% of the respondents had a high probability of being physically inactive (<90 min/week). Elsewhere in mainland China, Lee *et al*[11] conducted a study focused on 61 582 urban men in Shanghai and found that 10.7% did not engage in regular exercise/sports (at least once a week for at least 3 months). Hu *et al*[12] conducted a study of 3976 people in urban areas of Tianjin and found that more than 60.0% of the participants reported an absence of physical activity during the preceding 30 days (<1 time per month).

Understanding the factors associated with physical inactivity can help us take pertinent interventions on targeted populations and increase the levels of physical activity. Although previous studies found that physical inactivity was associated with demographic variables (such as gender, age, weight, education)[13–15] and health behaviours (such as smoking and drinking),[16] little is known about how physical inactivity varies across a number of factors among middle-aged and older Chinese adults. Therefore, we conducted this cross-sectional study to examine the prevalence and determinants of physical inactivity among community residents aged above 40 years in Shenzhen, China.

METHODS

Patient and public involvement

This community-based, cross-sectional study was conducted between 1 March 2015 and 30 July 2016, in Xixiang Street, Bao'an District of Shenzhen in Southeast China. The reasons for selecting Xixiang Street were written by the China National Stroke Prevention Project.[17] Xixiang Street had 33 communities. We selected three communities (TaoyuanJu, Liutang, Xixiang) that met the following eligibility criteria: (1) medical staffs in community health service centre had high enthusiasm of participation in health education programmes; (2) health records were well presented; and (3) in the national chronic disease comprehensive prevention and control demonstration zone or national disease surveillance spot. Then, in each community, a multistage-stratified, random cluster survey was conducted. At the first stage of sampling, a total of 4202 households in three communities were randomly chosen using a computer program. Households were involved in participation if family members met the following criteria: (1) permanent residents (living in this district for at least 6 months each year) who could be contacted and aged 40 years and above; and (2) participants without mental disorders and agreed to attend in this survey. At the second stage of sampling, one eligible participant was randomly selected in each contacted household to act as the respondent for the interview. Finally, all eligible participants were registered at the local government and informed to do physical and laboratory examinations in community health centres at a specific time. Participants were allowed to obtain the results from the community health centres 2 weeks later.

Data collection

Following the study protocol, the investigators were trained by the Health Bureau of Bao'an District and Shenzhen Second People's Hospital. Then the data were collected by trained investigators in the community health centre, using a standardised questionnaire during face-to-face interviews. The questionnaires covered demographic characteristics, physical activity levels, health status and health risk factors. After the interview, a series of physical measurements including weight, height, blood pressure and fasting plasma glucose (FPG) were recorded for each participant by trained technicians.

Measuring physical activity

In this study, the translated Chinese International Physical Activity Questionnaire (IPAQ) short version was used to assess physical activity levels. Detailed descriptions of the translated Chinese IPAQ short version have been previously reported.[18] The number of hours spent in undertaking four types of physical activity (vigorous physical activity, moderate physical activity, walking and sitting) per week was recorded in the IPAQ Short Form. Definitions of vigorous (such as heavy lifting, digging, aerobics or fast bicycling) and moderate activities (such as carrying light loads, bicycling at a regular place or tennis doubles) were provided to the respondents. Only those physical activities for more than 10 min at a time were included. The IPAQ Short Form also assessed the time spent sitting (sedentary time) on a weekday during the previous week.

Explanatory variables

Most of the variables were self-explanatory, but a few needed explanation. Age groups were defined based on age decades. The question 'Is your monthly income sufficient to cover all your basic needs' was asked to identify whether participants were under economic pressure. Mental stress was defined as a yes or no response to a question asking whether the participant experienced any stress in the workplace or daily life. Smoking was defined as having smoked at least one cigarette per day in the last 3 months. Alcohol intake was defined as drinking ≥100 mL spirit alcohol more than three times per week in the last 3 months based on self-report. Body mass index (BMI) was calculated as weight in kilograms divided by height in metres squared (kg/m^2). Based on the WHO BMI classification for adults,

participants were classified as underweight (BMI<18.5 kg/m^2), normal weight (18.5≤BMI<25.0 kg/m^2), overweight (25.0≤BMI<30.0 kg/m^2) or obese (BMI≥30.0 kg/m^2). Hypertension was defined as resting systolic blood pressure ≥140 mm Hg and/or diastolic blood pressure ≥90 mm Hg, or use of antihypertensive drugs. In our study, diabetes mellitus was defined as FPG≥7.0 mmol/L or use of medication for diabetes.

Statistical analysis

All statistical procedures were performed using the SPSS V.18.0 software. The prevalence of physical inactivity was presented and χ^2 test was conducted to test the differences between groups. Both unadjusted and adjusted logistic regression analyses were performed to identify the determinants of physical inactivity. The unadjusted method used only the key factors of interest as independent variables in the analysis, while the adjusted method added all of the possible confounders listed in table 1 as covariates in the logistic models. ORs and 95% CIs for each variable were calculated. Tests for interaction were conducted by adding interaction terms of gender and the covariate in the final model. Statistical significance was accepted at p<0.05.

RESULTS

The main characteristics of the participants are presented in table 1. A total of 4202 participants were investigated in this study, and data from 282 questionnaires were excluded due to missing information. Finally, 3920 (2447 women, 62.4%) eligible participants were included in the analysis, with a mean age of 54.28 years and a mean BMI of 24.70. Overall, the prevalence of physical inactivity was 63.1%. Notably, participants who were young, who had lower education experiences, who were under economic pressure and mental stress, and who had slightly higher BMI had a higher level of physical inactivity.

Unadjusted and adjusted ORs and 95% CIs for the results of logistic regression are presented in table 2. Unadjusted logistic regression showed that participants who were older (OR: 1.37, 95% CI 1.16 to 1.61), who were female (OR: 1.20, 95% CI 1.02 to 1.41), who had higher education experience (OR: 1.41, 95% CI 1.21 to 1.64), who were under economic pressure (OR: 2.22, 95% CI 1.52 to 3.25), who had smoked cigarettes (OR: 1.45, 95% CI 1.15 to 1.84) and drank alcohol (OR=1.40, 95% CI 1.13 to 1.75) were more likely to report physical inactivity. After adjusting for history of hypertension, diabetes and stroke, the only difference was with BMI status. Participants in the lowest BMI category were more likely (OR: 1.40, 95% CI 1.03 to 1.89) to report physical inactivity than participants in the highest BMI category.

Additional information regarding the effects of gender on physical inactivity is shown in online supplementary table S1. Most of the results on the factors associated with physical inactivity for women were consistent with that of the factors associated with physical inactivity for men.

Table 1 Sociodemographic characteristics of the studied population (n=3920)

Characteristics	Total (%)	Physical inactivity (%)	P values*
Age group (years)			<0.001
40–49	1426 (36.4)	966 (67.7)	
50–59	1346 (34.3)	829 (61.6)	
60+	1148 (29.3)	680 (59.2)	
Gender			0.219
Female	2447 (62.4)	1563 (63.9)	
Male	1473 (37.6)	912 (61.9)	
Ethnicity			0.668
Han nationality	3825 (97.6)	2417 (63.2)	
Non-Han nationality	95 (2.4)	58 (61.1)	
Education level			0.012
≤6 years†	1263 (32.4)	830 (65.7)	
>6 years	2631 (67.6)	1620 (61.6)	
Marital status			<0.001
Married	3753 (95.7)	2341 (62.4)	
Unmarried/widow/divorced	167 (4.3)	134 (80.2)	
Economic pressure			<0.001
Yes	580 (14.8)	477 (82.2)	
No	3340 (85.2)	1998 (59.8)	
Mental stress			<0.001
Yes	634 (16.2)	504 (79.5)	
No	3286 (83.8)	1971 (60.0)	
Smoking status			<0.001
Ever	448 (11.4)	240 (53.6)	
Never	3448 (88.0)	2219 (64.4)	
Unknown	24 (0.6)	16 (66.7)	
Alcohol drinking			<0.001
Ever	461 (11.8)	238 (51.6)	
Never	2808 (71.6)	1718 (61.2)	
Unknown	651 (16.6)	519 (79.7)	
BMI (kg/m^2)			0.007
<25.0	2038 (52.0)	1239 (60.8)	
25.0–29.9	1653 (42.2)	1084 (65.6)	
30.0+	229 (5.8)	152 (66.4)	
History of hypertension			<0.001
Yes	858 (21.9)	471 (54.9)	
No	3058 (78.1)	2000 (65.4)	
History of diabetes‡			<0.001
Yes	324 (8.3)	174 (53.7)	
No	3593 (91.7)	2299 (64.0)	
History of stroke			0.002
Yes	135 (3.4)	68 (50.4)	
No	3785 (96.6)	2407 (63.6)	

Continued

Table 1 Continued

Characteristics	Total (%)	Physical inactivity (%)	P values*
Communities			0.488
TanyuanJu	1307 (33.3)	830 (33.5)	
Liutang	1307 (33.3)	837 (33.8)	
Xixiang	1306 (33.3)	808 (32.6)	

*χ^2 test of heterogeneity.
†Defined as illiterate or having only finished primary education.
‡Confirmed diagnosis of type 1 or 2 diabetes mellitus on admission.
BMI, body mass index.

However, men who smoked cigarettes and drank alcohol had a higher level of physical inactivity; nevertheless, such associations were not found in women (p<0.05 for interaction; online supplementary table S1).

DISCUSSION

We assessed the status of physical inactivity and associated variables among community residents in Shenzhen, China, indicating that the overall prevalence of physical inactivity in community residents aged more than 40 years was 63.1%. Since the definitions of physical inactivity might vary by country and region, we just included relevant literatures that used a similar definition of physical inactivity for comparison. Physical inactivity was defined as not meeting any of the three criteria: 30 min of moderate-intensity physical activity on at least 5 days every week, 75 min of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination. Our results showed that the prevalence of physical inactivity was higher than previously reported in other countries. In Americas,[5] Brazil,[6] Thailand[19] and Mexico,[20] the prevalence of physical inactivity was 43.3%, 41.1%, 26.0% and 19.4%, respectively.

The findings of our study revealed that there was a moderate association between older age and physical inactivity, which was in line with the findings of previous studies,[6 16 21] but was inconsistent with other studies.[22] It is likely that older people may have higher comorbidities which may limit their participation in physical activity.[23] Similar to some studies,[24 25] our data revealed that individuals with higher education experience were more likely to report physical inactivity. One possible explanation was that higher educated individuals were primarily engaged in brainwork or light manual labour, and sedentary behaviours are given priority in their life. Moreover, several studies had shown that the populations with lower socioeconomic status tended to have lower physical inactivity level.[6] Our results showed that participants under economic pressure were 2.17 times more likely to report physical inactivity than those without economic pressure. Lower socioeconomic status generally implies poorer life opportunities. People with lower socioeconomic status might live in more deprived neighbourhoods with fewer exercise facilities[26] and have fewer chances to improve or maintain one's health.

A considerable number of studies have examined the relationship between BMI and physical inactivity, but the results remain equivocal. Sorkin *et al*[27] found that all types of self-reported physical activities were associated with lower BMI, and Schneider and Becker[21] showed that overweight people were significantly less likely to engage in physical activity. However, Steele *et al*[28] reported no relationship between moderate physical activity and BMI or fat mass index in British children. In our analysis, we found that normal-weight or underweight people had a higher level of physical inactivity, which may be due to the fact that weight management was influenced by energy intake and energy expenditure, and both important components should be considered simultaneously.[29] Additionally, one of the benefits of physical activity for older adults is a healthier body mass and composition according to WHO.[1] Thus, more educational programmes and intervention measures for reducing the prevalence of physical inactivity should be targeted to the obese group and also to the general population.

It has been reported that lifestyle behaviours are interrelated and that unhealthy behaviours tend to occur together.[24] In this study, we found that people who smoked cigarettes or drank alcohol were more likely to report physical inactivity than people who did not smoke cigarettes or drink alcohol, which was in line with published literatures.[21 24 30] To our knowledge, physical inactivity is more common in women than in men in most countries.[19] We did the gender–covariate interactions tests to explore whether there were different risk factors among men and women, and found that smoking cigarettes and drinking alcohol were significantly associated with physical inactivity level in men but not in women. The possible reason for this finding may be that the proportion of women who smoked cigarettes and drank alcohol in China was relatively lower than men. In this study, the proportion of women who smoked cigarettes and drank alcohol was 0.8% and 5.0%, respectively, while the proportion of men who smoked cigarettes and drank alcohol reached up to 29.1% and 23.0%, respectively. These results suggest that health education activities on tobacco smoking control and moderate alcohol drinking are needed to achieve healthy lifestyle behaviours.

The major strength of our study was that we assessed physical inactivity using the IPAQ Short Form, which was developed as a standardised process for participants to assess the prevalence of physical inactivity and provided convenience for international scholars to evaluate global physical inactivity levels. Our study also has some limitations. First, although the IPAQ Short Form included vigorous physical activity, moderate physical activity, walking and sitting, individuals were not prompted to answer separately about each category (leisure time, work, transportation and household), and therefore some activities could be omitted.[31]

Table 2 Logistic regression model of potential determinants of physical inactivity

	Unadjusted logistic regression		Adjusted logistic regression*	
Variables	OR (95% CI)	P values	OR (95% CI)	P values
Age group (years)				
60+	1.37 (1.16 to 1.61)	<0.001	1.31 (1.11 to 1.54)	<0.001
50–59	1.60 (1.34 to 1.91)	<0.001	1.40 (1.16 to 1.67)	0.001
40–49	Ref	<0.001	Ref	<0.001
Gender				
Female	1.20 (1.02 to 1.41)	0.028	1.22 (1.04 to 1.43)	0.017
Male	Ref		Ref	
Ethnicity				
Han nationality	0.85 (0.55 to 1.32)	0.485	0.83 (0.54 to 1.29)	0.383
Non-Han nationality	Ref		Ref	
Education level				
>6 years†	1.41 (1.21 to 1.64)	<0.001	1.38 (1.19 to 1.61)	<0.001
≤6 years	Ref		Ref	
Marital status				
Married	1.72 (1.15 to 2.58)	0.008	1.71 (1.14 to 2.57)	0.010
Unmarried/widow/divorced	Ref		Ref	
Economic pressure				
Yes	2.22 (1.52 to 3.25)	<0.001	2.17 (1.48 to 3.17)	<0.001
No	Ref		Ref	
Mental stress				
Yes	0.82 (0.57 to 1.16)	0.263	0.81 (0.57 to 1.15)	0.235
No	Ref		Ref	
Smoking status		0.007		0.007
Ever	1.45 (1.15 to 1.84)	0.002	1.44 (1.13 to 1.82)	0.003
Unknown	1.46 (0.59 to 3.59)	0.409	1.77 (0.69 to 4.52)	0.227
Never	Ref		Ref	
Alcohol drinking		<0.001		<0.001
Ever	1.40 (1.13 to 1.75)	0.002	1.42 (1.14 to 1.77)	0.002
Unknown	0.42 (0.34 to 0.52)	<0.001	0.41 (0.33 to 0.50)	<0.001
Never	Ref		Ref	
BMI (kg/m^2)		0.072		0.009
<25.0	1.28 (0.95 to 1.72)	0.101	1.40 (1.03 to 1.89)	0.028
25.0–29.9	1.10 (0.82 to 1.49)	0.522	1.16 (0.86 to 1.58)	0.332
30.0+	Ref		Ref	
Communities		0.656		0.712
TanyuanJu	0.94 (0.80 to 1.10)	0.437	0.94 (0.79 to 1.11)	0.474
Liutang	0.93 (0.79 to 1.10)	0.419	0.94 (0.80 to 1.11)	0.477
Xixiang	Ref		Ref	

*Adjusted for all variables shown in the table plus history of hypertension, diabetes and stroke.
†Defined as illiterate or having only finished primary education.
BMI, body mass index; Ref, referent.

Second, as a self-report measure, recall bias could not be avoided and the accuracy of estimates of frequency, duration and intensity could be compromised. Thus, new technologies and device-based measures, such as pedometers and other electronic movement-sensing devices, could be used together with IPAQ to accurately assess the prevalence of physical inactivity.[32 33] Third, this study enrolled only community residents

in Shenzhen, limiting the generalisability of finding to other geographical regions.

CONCLUSIONS

In conclusion, this study suggests that the prevalence of physical inactivity in urban Chinese is high, and great efforts must be made to achieve the WHO goal for a reduction of 10% in physical inactivity by 2025. Interventions and programmes aimed at increasing physical activity among middle-aged and older Chinese adults may also be tailored to participants under economic pressure and those with unhealthy behaviours such as smoking and drinking.

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Contributors ZL, ZW, YZ and JW conceived the study and drafted the manuscript. YZ and JW searched the scientific literature, and carried out the most work including study selection, statistic analyses, and data collection and interpretation. SZ, TY, WL, JL and XZ participated in data collection and interpretation. XS and YG participated in the design of data synthesis and analysis. NM, SY and LH gave administrative, technical or material support, and made important revisions to the draft manuscript. ZL and ZW helped to resolve the disagreements and checked the data. All authors have seen and approved the final version.

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Competing interests None declared.

Patient consent Obtained.

Ethics approval This study was approved by the Research Ethics Committee in Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China.

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Data sharing statement Researchers who are interested in the data set can contact the corresponding author (ZL) (email: zuxunlu@yahoo.com; tel and fax: +86 27 83693756) or the Community Health Service Management Center in Xixiang (email: chsmc_xixiang@163.com; tel and fax: +86 755 27791243) to acquire the data for research only.

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