The Associations Between Socio-economic Status and Metabolic Syndrome Among General Population in Nanjing, China: a Cross-sectional Study

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Abstract

Background

We aim to investigate the association between socioeconomic status (SES) and metabolic syndrome (MetS) among general population in Nanjing, China.

Methods

A cross-sectional study was conducted in 2017 among adults aged 18 years or older in Nanjing, China. Participants were selected using multistage sampling approach. Diagnosed MetS was the outcome variable. Education and monthly family average income (FAI) was used to separately indicate SES. Mixed-effects models were used to calculate the association between SES and MetS.

Results

The prevalence of MetS was 19.7% (95%CI=19.0%, 20.4%) among overall sample population. After controlling for covariates, educational attainment was negatively associated with MetS prevalence in women. As for men, the most well-educated subjects were at the lowest risk (OR=0.72, 95%CI=0.57, 0.92) of having MetS compared to the least educated subjects. Relative to those who from lower FAI sub-group, participants from upper tertile were less likely to have MetS for both genders (OR=0.73, 95%CI=0.617, 0.87; OR=0.85, 95%CI=0.73, 0.99). Among all participants, higher education level predicted lower waist circumference, triglycerides, systolic and diastolic blood pressure, and fasting glucose concentration. Higher FAI was associated with lower waist circumference and systolic and diastolic blood pressure in women, and with lower systolic and diastolic blood pressure in men.

Conclusions

Education and family average income each was inversely related to MetS and its components prevalence in Nanjing, China in 2017. It has important public health implications that the tailored prevention strategies should be implemented for people with different socioeconomic status.

Background

Metabolic syndrome (MetS) is a cluster of several physiological and biochemical disorders including impaired glucose metabolism, elevated blood pressure, dyslipidemia, and central obesity(1). The prevalence of MetS is increasing worldwide and becoming a serious public health challenge(1, 2). China, the most populous country and the second-largest economy in the world has seen rapid increase of MetS over the last few decades. The prevalence of MetS is 24.2% in 2013 among Chinese adults aged 18 years above (3). Studies have shown that MetS is responsible for a twice increased risk for cardiovascular disease, which is the leading cause of death worldwide(4, 5). It also increases the risk of diabetes and some cancers(6, 7).

Socio-economic status (SES) is associated with the presence of the MetS and its component factors both in high-income countries (HICs) and low-and-middle income countries (LMICs)(8–21). SES is not an easy concept to grasp, with no 'gold standard' measurement(22). It can be understand in several ways and measured by different indicators including participants' income, education(14). Family average income(FAI) that reflects the material wealth of a household has been shown to be a sensitive measure of SES(23), and education level is another major indicator of SES(24).

The current evidence shows that MetS is more prevalent among the low-income groups in HICs(9, 11, 25, 26). However, in LMICs, there is positive association between MetS and SES(19). In China, the evidence is mixed. Studies have shown that the link between SES and MetS remains positive in many less developed areas (12, 13), but negative associations have been found in some more developed areas such as Beijing and Taiwan (14, 24).

With the economic development, the relationship between SES and MetS may act in opposite directions in the same setting at different stage. Accordingly, a better understanding of the relationship between SES and MetS is critical for informing the development of population-level preventive strategies, so that the public health interventions can be tailored for different SES groups. In the present study, we aim to investigate the association between SES and MetS in Nanjing and the heterogeneity by gender in 2017.

Method

Study design and participants

This study was based on a population-based, and cross-sectional survey (Chronic Diseases and Risk Factors Survey in Nanjing) performed in Nanjing, China, from January 2017 to June 2018. A multistage sampling strategy was used to select a representative sample of adults aged 18 years or older. First, 5 districts were randomly selected according to the social and economic development level. Then, 4 urban streets or rural townships were randomly chosen from the selected districts. Next, 3 urban residential communities or rural village communities were randomly selected from the urban streets or rural townships, respectively. Finally, all of the permanent households within the communities were included to participate in our survey. 14348 households were identified and only one member in each household was invited for the survey.

We obtained the basic demographic information from the China residence registration system(23). We excluded individuals who had been locally registered less than 5 years, and who were pregnant or disabled for physical examinations and interviews. Informed consent was obtained from each participant before each survey. Among the identified households, 14348 individuals were invited to participate the survey. The response rate was 92.6%. A total of 13287 participants completed the survey and were included in this study. There were no differences in socio-demographic characteristics between respondents and non-respondents in this study. This study was approved by the Academic and Ethical Committee of Nanjing Municipal Center for Disease Control and Prevention (Nanjing CDC).

Data collection

The questionnaire was administered by trained interviewers at local community health service centres using a structured questionnaire. Information was collected on participants' demographic characteristics (age, gender, marriage), socioeconomic characteristics (education, occupation and FAI), lifestyle risk factors (smoking, drinking status, leisure-time physical activity and dietary habits) and their past medical history.

Physical examination included anthropometric and blood pressure (BP) measurement. Height and weight were measured to the nearest 0.1 cm and 0.1 kg respectively with the subject standing barefoot in light clothes. Waist circumference was measured to the nearest 0.1 cm at the mid-point between the inferior margin of the last rib and the iliac crest in a horizontal plane. Body mass index (BMI) was calculated by dividing body weight (kg) by the height (m) squared. BP was measured three times using an electronic sphygmomanometer (OMRON HBP-1300, Japan) by trained professionals after the participants rested for 5 minutes in the seated position. The average of the second and third BP measurements was used for the analysis.

Blood samples were collected from all the participants after an overnight fasting. Concentration of fasting blood glucose (FBG) was measured enzymatically using a glucose oxidase method. Serum lipids, including total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C) were measured using an auto analyzer (Abbott Laboratories, Illinois, USA).

Definition of MetS and SES

The MetS was defined based on the "harmonized definition", which was proposed by the International Diabetes Federation (IDF), National Heart, Lung and Blood Institute (NHLBI), American Heart Association (AHA) in 2009, along with the waist circumference values for Chinese (1, 27). More specifically, MetS is defined as the presence of three or more of following: 1) waist circumference (WC) $\geq$ 90 cm in males and $\geq$ 85 cm in females; 2) triglycerides (TG) $\geq$ 150mg/dL(1.7mmol/L); 3) high-density lipoprotein cholesterol (HDL-C) < 40 mg/dL(1.0mmol/L) in males and < 50mg/dL(1.3mmol/L) in females; 4) systolic blood pressure (SBP) $\geq$ 130 mmHg and/or diastolic blood pressure (DBP) $\geq$ 85 mmHg; and 5) fasting blood glucose (FBG) $\geq$ 100 mg/dL. We used a binary indicator for MetS, with individuals coded as 1 is they had MetS.

We used two indicators for SES: educational level and FAI. Educational attainment was grouped into three categories: elementary school or lower (year of schooling < 7 years), middle or high school (7–12 years), and college or higher (> 12 years). FAI was defined as household monthly income per capita, which was computed as the total monthly household income divided by the total number of family members. FAI was categorized into tertiles: lower, middle or higher.

Statistical analysis

Firstly, differences in MetS and its components prevalence between SES were examined with logistic regression models. Then, the associations between SES indicators and MetS were analyzed using mixed-effects logistic regression models, with study sites treated as random effects. There were two models constructed: an unadjusted uni-variate regression model; and a multivariate model with adjustment for the age, gender, residence, education, occupation, marital status, FAI, cigarette smoking, drinking and physical activities. Odds ratios (ORs) with 95% confidence interval (95%CI) were presented. Finally, we used linear mixed model to investigate the associations between SES indicators and different MetS components (WC, TG, HDL-C, SBP, DBP, FBG). Data were analyzed using SPSS 20.0 (IBM Corp, Armonk, NY, USA).

Results

Table 1 shows the statistic summary of the study population. The median age of the sample is 51.0 years (inter-quartile range 34.0–62.0). There were 6176 males and 7120 females. The prevalence of MetS was 24.6% for men and 15.5% for women.

Table 1

Demographic and anthropometric characteristics of the study population

Variables	Total (N = 13287)	Men (N = 6167)	Women (N = 7120)	*p*-value
Social-demographic				
Age-group (years), n (%)				< 0.001
18–34	3348 (25.2)	1492 (24.2)	1856 (26.1)	
35–59	6043 (45.5)	2733 (44.3)	3310 (46.5)	
60 +	3896 (29.3)	1942 (31.5)	1954 (27.4)	
Marital status, n (%)				< 0.001
Single/never married	1009 (7.6)	569 (9.2)	440 (6.2)	
Married	11559 (87.0)	5390 (87.4)	6169 (86.6)	
Other (Separated/divorced/Widowed)	719 (5.4)	208 (3.4)	511 (7.2)	
SES				
Family monthly income per capita (¥/m)	3183.39 (2929.90)	3333.13 (3114.48)	3053.70 (2753.71)	< 0.001
Education level, n (%)				< 0.001
< 7 years	1541 (11.6)	436 (7.1)	1105 (15.5)	
7–12 years	6781 (51.0)	3159 (51.2)	3622 (50.9)	
> 12 years	4965 (37.4)	2572 (41.7)	2393 (33.6)	
Occupation†, n (%)				< 0.001
Blue collar	3953 (29.7)	1999 (32.5)	1954 (27.4)	
White collar	3943 (29.7)	2131 (34.6)	1812 (25.4)	
Unemployed/retired/student	5391 (40.6)	2037 (32.9)	3354 (47.2)	

† Blue collar: including farmer, factory worker, forestry worker, fisher, salesperson, houseworker and vehicle driver; White collar: including office worker, teacher, doctor, academic researcher and government official.

BMI: body mass index, WC: waist circumference, SBP: systolic blood pressure, DBP: diastolic blood pressure, FBG: fasting blood glucose, TG: triglycerides, HDL-C: high density lipoprotein-cholesterol.

Variables	Total (N = 13287)	Men (N = 6167)	Women (N = 7120)	*p*-value
Outcomes				
BMI (kg/m^2)	24.14 (3.32)	24.67 (3.11)	23.69 (3.43)	< 0.001
WC (cm)	82.63 (9.69)	86.39 (9.21)	79.38 (8.88)	< 0.001
SBP (mmHg)	125.78 (16.52)	128.29 (14.82)	123.61 (17.58)	< 0.001
DBP (mmHg)	78.49 (11.71)	80.30 (12.60)	76.93 10.63)	< 0.001
FBG (mmol/L)	5.49 (1.71)	5.62 (1.97)	5.37 (1.42)	< 0.001
TG (mmol/L)	1.55 (1.23)	1.67 (1.43)	1.44 (1.01)	< 0.001
HDL-C (mmol/L)	1.46 (0.47)	1.39 (0.48)	1.52 (0.46)	< 0.001
Metabolic syndrome, n (%)	2619 (19.7)	1514 (24.6)	1105 (15.1)	< 0.001

† Blue collar: including farmer, factory worker, forestry worker, fisher, salesperson, houseworker and vehicle driver; White collar: including office worker, teacher, doctor, academic researcher and government official.

BMI: body mass index, WC: waist circumference, SBP: systolic blood pressure, DBP: diastolic blood pressure, FBG: fasting blood glucose, TG: triglycerides, HDL-C: high density lipoprotein-cholesterol.

Table 2 shows the prevalence of MetS and its components by SES and by gender. The prevalence of MetS steadily decreased with each indicator of SES among women, and the trend was the same for abdominal obesity, high total cholesterol, high blood pressure, and high blood glucose. This trend was also found in MetS, high blood pressure, and high blood glucose in men. We have not found significant differences between the prevalence of low high-density lipoprotein cholesterol and different SES groups both in men and women.

Table 2
Prevalence of metabolic syndrome and its component by gender and by socioeconomic status

Variables	Metabolic syndrome (95%CI)	Metabolic syndrome components (95%CI)				
		Abdominal obesity	High TG	Low HDL-C	High BP	High FBG
Women						
Education level						
< 7 years	29.7 (27.0, 32.4)	45.1 (42.1, 48.0)	32.1 (29.4, 34.9)	9.6 (8.0, 11.4)	69.0 (66.2, 71.6)	28.3 (25.7, 31.0)
7–12 years	18.1 (16.9, 19.4)	27.9 (26.5, 29.4)	27.9 (26.4, 29.4)	9.7 (8.7, 10.7)	53.1 (51.5, 54.7)	19.8 (18.5, 21.1)
> 12 years	5.0 (4.2, 5.9)	13.7 (12.3, 15.1)	18.3 (16.7, 19.8)	8.8 (7.7, 10.0)	18.3 (16.8, 19.9)	6.6 (5.7, 7.6)
p for trend	< 0.001	< 0.001	< 0.001	0.347	< 0.001	< 0.001
Family average income						
Lower	18.8 (17.3, 20.4)	31.7 (29.9, 33.5)	26.6 (25.0, 28.4)	8.7 (7.6, 9.8)	52.0 (50.1, 53.9)	20.3 (18.8, 21.9)
Middle	17.4 (15.9, 19.0)	27.1 (25.3, 28.9)	26.1 (24.3, 27.9)	10.7 (9.4, 12.0)	48.2 (46.1, 50.2)	17.9 (16.3, 19.5)
Upper	9.9 (8.8, 11.2)	18.0 (16.4, 19.6)	23.0 (21.3, 24.8)	8.9 (7.7, 10.1)	30.6 (28.7, 32.5)	11.4 (10.2, 12.8)
p for trend	< 0.001	< 0.001	0.004	0.763	< 0.001	< 0.001
Men						
Education level						
< 7 years	33.3 (28.9, 37.8)	39.4 (34.9, 44.1)	30.7 (26.5, 35.2)	17.2 (13.9, 20.9)	76.8 (72.7, 80.6)	32.3 (28.1, 36.8)

TG: triglycerides, HDL-C: high density lipoprotein-cholesterol, BP: blood pressure, FBG: fasting blood glucose.

Variables	Metabolic syndrome (95%CI)	Metabolic syndrome components (95%CI)				
		Abdominal obesity	High TG	Low HDL-C	High BP	High FBG
7–12 years	29.2 (27.6, 30.8)	38.2 (36.5, 39.9)	34.4 (32.7, 36.0)	17.4 (16.1, 18.8)	66.5 (64.9, 68.2)	28.2 (26.7, 29.8)
> 12 years	17.3 (15.9, 18.8)	30.5 (28.7, 32.3)	29.7 (28.0, 31.5)	17.1 (15.6, 18.6)	41.6 (39.7, 43.6)	13.6 (12.3, 15.0)
p for trend	< 0.001	< 0.001	0.011	0.787	< 0.001	< 0.001
Family average income						
Lower	26.0 (24.1, 28.0)	35.0 (32.9, 37.2)	31.8 (29.8, 33.9)	17.0 (15.4, 18.7)	62.6 (60.5, 64.7)	25.3 (23.4, 27.3)
Middle	26.1 (24.2, 28.0)	36.5 (34.4, 38.6)	32.8 (30.8, 34.9)	17.3 (15.7, 19.0)	60.2 (58.1, 62.3)	25.0 (23.2, 26.9)
Upper	21.7 (20.0, 23.5)	33.7 (31.7, 35.7)	31.9 (30.0, 33.9)	17.5 (15.9, 19.1)	48.3 (46.2, 50.5)	17.2 (15.7, 18.9)
p for trend	0.001	0.351	0.954	0.701	< 0.001	< 0.001

TG: triglycerides, HDL-C: high density lipoprotein-cholesterol, BP: blood pressure, FBG: fasting blood glucose.

Table 3 displays the ORs and the corresponding 95% CI for the association of SES categories and MetS using mixed-effects logistic regression models for women and men, respectively. After adjustment for age, gender, residence, education, occupation, marital status, FAI, cigarette smoking, drinking, physical activities, and potential clustering effects by study areas, we found a negative association between education level and the presence of MetS in women. As for men, the most well-educated subjects were at the lowest risk (OR = 0.72, 95%CI = 0.57, 0.92) of having MetS compared to the least educated subjects. Relative to those who from a lower FAI sub-group, participants from upper tertile were less likely to have MetS for both genders.

Table 3
Associations of socioeconomic status and metabolic syndrome by gender

Variables	**MetS prevalence n (%)**	**Model 1†**		**Model 2 ‡**	
		OR (95%CI)	***p*-value**	**OR (95%CI)**	***p*-value**
Women					
Education level					
< 7 years	328 (29.7)	1.0		1.0	
7–12 years	657 (18.1)	0.52 (0.42, 0.61)	< 0.001	0.78 (0.66, 0.92)	0.003
> 12 years	120 (5.0)	0.12 (0.10, 0.15)	< 0.001	0.35 (0.27, 0.45)	< 0.001
Family average income					
Lower	482 (18.8)	1.0		1.0	
Middle	395 (17.4)	0.92 (0.79, 1.07)	0.257	0.94 (0.81, 1.10)	0.447
Upper	228 (9.9)	0.48 (0.40, 0.57)	< 0.001	0.73 (0.61, 0.87)	0.001
Men					
Education level					
< 7 years	145 (33.3)	1.0		1.0	
7–12 years	923 (29.2)	0.83 (0.67, 1.04)	0.099	0.90 (0.72, 1.12)	0.354
> 12 years	446 (17.3)	0.43 (0.34, 0.54)	< 0.001	0.72 (0.57, 0.92)	0.009
Family average income					
Lower	508 (26.0)	1.0			
Middle	543 (26.1)	1.04 (0.90, 1.20)	0.565	1.06 (0.92, 1.22)	0.444

† univariate analysis with socioeconomic status indicator as main effects and study sites as random effects.

‡ multivariate analysis with adjustment for age, gender, residence, education, occupation, marital status, family average income, smoking, drinking and physical activities, in addition to Model 1.

Variables	MetS prevalence n (%)	Model 1†		Model 2 ‡	
		OR (95%CI)	*p*-value	OR (95%CI)	*p*-value
Upper	463 (21.7)	0.80 (0.69, 0.93)	0.004	0.85 (0.73, 0.99)	0.035
† univariate analysis with socioeconomic status indicator as main effects and study sites as random effects.					
‡ multivariate analysis with adjustment for age, gender, residence, education, occupation, marital status, family average income, smoking, drinking and physical activities, in addition to Model 1.					

Table 4 summarizes the variation of waist circumference, triglycerides, high-density lipoprotein cholesterol, systolic and diastolic blood pressure, and fasting glucose concentration within SES categories. Among all participants, higher education level predicted lower waist circumference, triglycerides, systolic and diastolic blood pressure, and fasting glucose concentration after adjustment for covariates. As to FAI, higher FAI was associated with lower waist circumference and systolic and diastolic blood pressure in women, and with lower systolic and diastolic blood pressure in men.

Table 4

Associations of socioeconomic status and the components of metabolic syndrome in women and men†

Variables	Metabolic syndrome components					
	Waist circumference (cm)	**TG (mmol/L)**	**HDL-C (mmol/L)**	**SBP (mmHg)**	**DBP (mmHg)**	**FBG (mmol/L)**
Women						
Education level						
β (95%CI)	-2.46 (-2.80, -2.12)	-0.07 (-0.11, -0.32)	0.01 (-0.02, 0.02)	-4.60 (-5.24, -3.95)	-2.89 (-3.31, -2.47)	-0.10 (-0.16, -0.05)
p for trend	< 0.001	0.001	0.722	< 0.001	< 0.001	< 0.001
Family average income						
β (95%CI)	-0.94 (-1.19, -0.70)	-0.01 (-0.04, 0.02)	-0.02 (-0.03, 0.01)	-1.60 (-2.06, -1.14)	-1.26 (-1.56, -0.96)	-0.04 (-0.08, 0.01)
p for trend	< 0.001	0.512	0.085	< 0.001	< 0.001	0.058
Men						
Education level						
β (95%CI)	-0.48 (-0.90, -0.05)	-0.09 (-0.16, -0.02)	-0.02 (-0.04, 0.01)	-2.76 (-3.40, -2.12)	-2.31 (-2.89, -1.74)	-0.16 (-0.25, -0.07)
p for trend	0.028	0.009	0.157	< 0.001	< 0.001	< 0.001
Family average income						
β (95%CI)	0.19 (-0.09, 0.48)	-0.04 (-0.09, 0.01)	-0.01 (-0.03, 0.01)	-1.11 (-1.54, -0.68)	-1.13 (-1.52, -0.74)	-0.06 (-0.12, 0.01)
p for trend	0.188	0.078	0.062	< 0.001	< 0.001	0.077

† Adjustment for age, gender, residence, education, occupation, marital status, family average income, smoking, drinking and physical activities and potential clustering effect.

Discussion

In this study, we aimed to investigate the association between SES and MetS among adults in Nanjing, China, indicated with education and FAI. We stratify the analyses by gender because of the gender differences in the relationship between SES and MetS prevalence(11, 14). This study found that the prevalence of MetS was 19.7% in Nanjing and MetS was more prevalent in men compared to women (24.6% vs 15.1%). After controlling for covariates, we found a positive association between SES and the presence of MetS, that participants, with higher educational attainment or within higher FAI were less likely to have MetS compared to counterparts from a lower SES group. The negative associations have found between SES and components of MetS and in both genders.

Some of our findings, such as the gender difference in prevalence of MetS, differ to those from other study in China. Their results showed women had a significantly higher prevalence of MetS than men(12–14, 28), while we found that males were more likely to develop MetS compared to females, which is line with a few studies from HICs such as Korea (11). The reasons for this difference may be due to the differences in the definition of MetS, especially the option of the cut-off points of WC (< 80cm vs < 85cm for women).

This study found negative associations between individual educational level and family income per capita and MetS, which is line with a few studies from Beijing, China and Korea(10, 11, 14). However, a study in Jiangsu province, China which collected data from residents aged 35 to 74 in 2002, observed a positive relationship between FAI level and MetS(12). This variability in the risk of MetS was also documented in a study that conducted in a rural area of Shanxi province, China(13). Previous studies have found that the direction of the relationship between SES, especially FAI, and MetS differs globally depending on the stage of the social and economic development(11–14, 24). It is found that the pattern between SES and MetS changed from positive in developing areas to negative in developed societies. Our results suggested that the pattern in Nanjing were more in line with the city in developed societies.

The possible mechanisms behind the association between SES and MetS included that: (1) unhealthy lifestyles and behaviours such as unhealthy eating and insufficient physical activity; (2) inadequate access to health care resources; (3) illiteracy, and (4) psychological stress(29). It is apparent that different distributions of the risk factors across different SES groups changed at different stages of socioeconomic development. Several studies have shown that people with lower SES tend to be more likely to consume high-dense energy foods, to do insufficient physical activity and to be obese compared with their counterparts with high SES in developed societies(30–33), whereas in developing areas, compared to the residents with higher SES, those with lower SES are less likely to do these unhealthy behaviours and to be obese(34, 35). This may partly account for the different patterns of relationship between SES and MetS in different areas.

The SES disparity might change with social and economic development in developing countries, particularly in China, the most populous developing country in the world, which has been experiencing a great transition for economic and social structure. Therefore, it is necessary to well understand the SES-MetS relationship at different development stages, and this would help develop tailored public health implications for population-based MetS prevention for China and other developing countries. Then, the effectiveness of the population-based MetS prevention strategies can be conducted in vulnerable groups.

There were several strengths in this study. First, the data collection, as well as blood sample analysis, based on robust objective measures, standard methods and instruments. Second, the sample size of this study was large enough to identify sufficient cases of MetS. Third, the sensitive indicators of SES, education and FAI, were used to examine the relationship between SES and MetS. Finally, recognized potential confounders, including clustering effects by study areas, were considered in analysis.

The limitations of this study included: (1) since our study was a cross-sectional survey, no causal inferences could be drew; (2) the information about SES was self-reported, which might cause potential recall bias. However, the recall bias can be controlled to a great extent through taking a larger sample size in our study. In addition, as the indicators were categorized into thirds prior to analysis, any imprecise information provided by participants is likely to have had a minor effect on analysis.

In conclusion, education and family average income each was inversely related to MetS and its components prevalence in Nanjing, China, at the present stage of social and economic development. The findings of our study have important public health implications for population-based MetS prevention. That is, the tailored prevention strategies should be implemented for people with different socioeconomic status.

Abbreviations

MetS: Metabolic syndrome, SES: Socio-economic status, HICs-high income countries, LMICs: low-and-middle income countries, FAI: Family average income, BMI: body mass index, WC: waist circumference, BP-blood pressure, SBP: systolic blood pressure, DBP: diastolic blood pressure, FBG: fasting blood glucose, TC: total cholesterol, TG: triglycerides, LDL-C: low-density lipoprotein cholesterol ; HDL-C: high density lipoprotein-cholesterol, Nanjing CDC: Nanjing Municipal Center for Disease Control and Prevention, IDF: International Diabetes Federation , NHLBI: National Heart, Lung and Blood Institute, AHA: American Heart Association, ORs: Odds ratios, 95%CI: 95% confidence interval.

Declarations

Ethics approval and consent to participate

This study was approved by the Academic and Ethical Committee of Nanjing Municipal Center for Disease Control and Prevention (Nanjing CDC).

Consent for publication

Informed consent was obtained from each participant before each survey.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Conceived and designed the study: QY and XH. Data collection: QY, CL, TP, ZW, HY, SQ, CW, HZ, ZQ, WW, and XH. Analyzed the data: QY and XH. Wrote the paper: QY, TP and XH. Critical revision of the manuscript: QY, CL, TP, ZW, HY, SQ, CW, HZ, ZQ, WW, and XH.

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