**Original Article**

# Socio-economic and Psychosocial Determinants of Smoking and Passive Smoking in Older Adults*

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**Abstract**

**Objective** To determine the associations of socio-economic and psychosocial factors with active and passive smoking in older adults.

**Methods** Using a standard interview method, we examined random samples of 6071 people aged ≥ 60 years in 5 provinces of China during 2007-2009.

**Results** World age-standardised prevalence for current and former smoking in men was 45.6% and 20.5%, and in women 11.1% and 4.5%. Current smoking reduced with older age but increased with men, low socioeconomic status (SES), alcohol drinking, being never-married, pessimistic and depressive syndromes. Former smoking was associated with men, secondary school education, a middle-high income, being a businessman, being widowed, less frequencies of visiting children/relatives and friends, and worrying about children. Among 3774 never-smokers, the prevalence of passive smoking was 31.5%, and the risk increased with women, low SES, alcohol drinking, being married, having a religious believe, and daily visiting children/relatives. There were sex differences in the associations, and an interaction effect of education and income on smoking and passive smoking.

**Conclusion** Older Chinese had a higher level of smoking and passive smoking than those in high income countries, reflecting China's failures in controlling smoking. The associations with low SES and different psychosocial aspects and sex differences suggest preventative strategies for active and passive smoking.

**Key words:** Smoking; Second-hand smoke; Socio-economic; Psychosocial; Older adults

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## INTRODUCTION

As the most preventable cause of premature death and disability, cigarette smoking is one of the most important public health challenges worldwide[1]. It not only directly damages the smoker's health, but also increases varying types of morbidities and mortality among non-smokers via passive smoking or second-hand smoking (SHS)[2-4]. Smoking and passive smoking have been recognised to impose a huge burden on individuals, communities and health services. Many high income countries, such as the UK, have set up education campaigns and regulation to control smoking and passive smoking, with their prevalence rates declining[1].

China is the world's largest producer and consumer of tobacco. A 1996 national survey showed that the prevalence rate for ever smokers was 66.9% for men and 4.2% for women over the age of 15 years, and of the non-smokers, 53.5% were regularly exposed to passive smoking[5]. In 2002, ever-smoking rates in males and females aged 15 and over were 66.0% and 3.1%, respectively. The level of passive smoking exposure was however not improved, with the prevalence of passive smoking in non-smokers 51.9%[6].

There is evidence that smoking and passive smoking in later life increase the risk of mortality and chronic diseases[4], including dementia[7-8]. Cutting smoking after the age of 65 years would benefit older people for their health and survival[9]. However, previous studies of investigating behaviours of smoking and passive smoking exposure were predominately undertaken in young and middle aged populations, and few studies have been done in older people. The associations of socio-economic status (SES) and psychosocial factors with smoking and passive smoking exposure in older people are unclear. Studying the patterns of smoking and passive smoking in an older population will offer applicable insights into the control of smoking and passive smoking exposure.

Using a standard method, we carried out a multicentre study of older people's health in China, characterising details of smoking and passive smoking, and SES and psychosocial factors[8,10]. In this study, we aimed to examine the associations of socio-economic status and psychosocial factors with smoking and passive smoking exposure.

## METHODS

### *Study Population*

The participants were derived from a 4-province study of dementia[10], and to increase the study power, also from participants in the 3rd wave survey of the Anhui study[11].

***The Four Provinces Study*** The methods have been fully described elsewhere[10]. In brief, in 2008-2009 we selected one rural and one urban community from each of 4 provinces (Guangdong, Heilongjiang, Shanghai, and Shanxi) as the study fields, trying to recruit no fewer than 500 participants in each community. We employed a cluster random sampling method to choose residential communities from each of 4 provinces (detailed location data on request). The target population consisted of those residents aged ≥60 years who had lived in the areas for at least 5 years. Ethical approval for the study was obtained from the Research Ethics Committee, University College London, UK, and the Ethics Committee of Anhui Medical University in China. Based on the residency list of the committees of the village and the district, we recruited a total of 4314 participants, with an overall response rate of 93.8%. Permission for interview and informed consent were obtained from each participant or, if that was not possible, from the closest responsible adult. The participants were interviewed at home by each local survey team from Guangzhou, Harbin, and Shanxi Medical Universities, and School of Public Health of Fudan University. The main interview materials included the Geriatric Mental State (GMS) questionnaire[12], other components of the 10/66 algorithm dementia research package[13-14], and a general health and risk factors record[15]. According to standard procedures[16-17], we measured systolic and diastolic blood pressure, height, weight, and waist circumference for all participants.

***The 3rd Wave Survey of the Anhui Study*** This was based on our Anhui cohort, which was set up in 2001 with a long-term follow up[11]. The methods of the Anhui cohort study have been fully described before[10-11]. In brief, in 2001-2003 we examined a random sample of 3 336 residents aged ≥60 years in Anhui province (*wave 1*) using the standard interview method of GMS-AGECAT[18]. One year after the baseline investigation we re-examined 2608 cohort members (*wave 2*)[19-20]. In 2007-2009 we carried out the 3rd wave of the survey within the cohort, successfully interviewing 1757 participants with a response rate of 82.4% of surviving cohort members[11]. The *wave 3* interview protocol was similar to that in the 4-province study above.

### *Measurements of Socio-economic and Psychosocial Factors*

In the general health and risk factors questionnaire, we recorded participant's socio-

demographic data, including educational level, main occupation status, annual personal and family incomes and whether they lived in a rural or urban area (rural people had much lower levels of education, occupation, and income[21]). Psychosocial aspects were characterised, including social network and support and relationships[15]. We employed a computer program-assisted diagnosis, the Automated Geriatric Examination for Computer Assisted Taxonomy (AGECAT)[18], to analyse the information from the GMS to assess depressive syndromes in the study participants. The GMS-AGECAT diagnosis methods were fully described in our previous publications[12,15,19-20] . In brief, AGECAT was developed using a theoretical model and tested against its success at replicating diagnoses on samples diagnosed by psychiatrists. It first attempts to replicate the process by which a psychiatrist achieves a syndromal diagnosis followed by a differential diagnosis. GMS symptoms are coalesced into 150 'symptoms components'. The symptom components are brought together into groups that typify the major symptom areas of each diagnostic syndrome. The scores on these individual groups determine the final syndromal level of 'confidence of diagnosis'. Thus the system uses both quantitative and qualitative measures when allocating subjects to levels of confidence, and required for its construction, many hundreds of clinical decisions on the placement of groups of symptom components on the syndrome levels. Individual participants are allocated to levels of confidence of diagnosis (0-5) on each of the eight diagnostic syndromes: organic disorder, depression, mania, schizophrenia and paranoid, obsessional, phobic, hypochondriacal, and general anxiety[20].

### *Definition of Smoking and Passive Smoking Exposure*

In the general health and risk factors record, we asked the participants for information on smoking habits and passive smoking exposure, using a similar questionnaire to the Scottish MONICA surveys [17,22]. The methods of defining smoking and passive smoking have been described in previous papers[8,17,22]. In brief, the current smokers were those who gave a positive answer to "*Do you smoke cigarettes now*?". If yes, we asked additional information including the number of cigarettes smoked daily, maximum number smoked daily in the last 2 years, and duration of smoking habit. If not currently smoking, participants were asked about their smoking history and related information. We defined 'never-smokers' as those who gave negative answers to both enquiries. After giving details of smoking status, all participants were required to provide the answers '*yes*' or '*no*' relating to exposure to passive smoking. Three sources of passive smoking exposure were given (home*,* workplace, and other places) and respondents were given three choices: *no, none at all; yes, some;* or *yes, a lot*. Duration of exposure to each of the three sources of passive smoking was recorded in number of years.

### *Statistical Analysis*

The 4-province data was combined with the Anhui *3rd* wave survey data (*waves 1* and *2* did not have passive smoking data available) for analysis. The prevalence rates of smoking and passive smoking (with 95% confidence intervals-CIs) were calculated and standardised against the world population of 2007-09 (www.census.gov) by the age ranges: 65-69, 70-74, 75-79, and ≥80 years. Distributions of demographic, socio-economic and psychosocial factors among current, former and never smoking were tested by Chi-square. Instead of a logistic regression model analysis we employed proportional hazards regression models to calculate a prevalence rate ratio (PRR) of increased active and passive smoking among participants with different socio-economic and psychosocial factors, according to the methods which we used in previous studies[23-24]. Compared to a prevalence odds ratio in the logistic model, PRR would generate more conservative findings of the associations between risk factors and smoking and passive smoking due to robust variances adjusted in the models[25-26]. Since there were some differences in socio-economic indicators or other variables of interest among 5 provinces we included the 5-province geographic areas data to account for clustering in the estimation of the models. All analyses were performed in STATA, version 11 (Stata, College Station, Texas).

## RESULTS

Of 6071 participants, 5962 (98.2%) reported smoking status; 1438 current smokers and 737 former smokers. World age standardized prevalence of current smoking was 45.6% (95% CI 42.6%-48.6%) in men and 11.1% (9.87%-12.3%) in women, and of former smoking 20.5% (18.6%-22.4%) and 4.49% (3.73%-5.26%) respectively.

Table 1 gives the numbers, frequencies and relative risk for basic characteristics, socio-economic

**Table 1.** Distribution of Risk Factors and Relative Risk of Smoking in the 5 provinces Health Study of Older Adults, China

| Variable | Smoking Status | | | | | | | Age-sex Adjusted Relative Risk | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Current- | | Former- | | Never- | | | Current-smoking | | | Former-smoking | | |
| | *n*=1438 | (%) | *n*=737 | (%) | *n*=3787 | (%) | *P* Value | RR† | (95% CI) | *P* Value | RR† | (95% CI) | *P* Value |
| **Age groups (years)** | | | | | | | | | | | | | |
| 60-64 | 295 | 30.3 | 100 | 10.3 | 579 | 59.4 | <0.001 | 1.00 | | | 1.00 | | |
| 65-69 | 337 | 29.6 | 106 | 9.3 | 696 | 61.1 | | 0.97 | (0.90-1.05) | 0.501 | 0.90 | (0.78-1.04) | 0.156 |
| 70-74 | 316 | 22.4 | 180 | 12.7 | 916 | 64.9 | | 0.72 | (0.64-0.81) | <0.001 | 1.20 | (0.81-1.80) | 0.362 |
| 75-79 | 252 | 20.9 | 180 | 14.9 | 776 | 64.2 | | 0.65 | (0.59-0.71) | <0.001 | 1.35 | (0.97-1.89) | 0.071 |
| ≥80 | 236 | 19.4 | 171 | 14.1 | 809 | 66.5 | | 0.61 | (0.49-0.74) | <0.001 | 1.29 | (0.84-1.97) | 0.240 |
| **Sex** | | | | | | | | | | | | | |
| Men | 1084 | 41.5 | 581 | 22.2 | 950 | 36.3 | <0.001 | 1.00 | | | 1.00 | | |
| Women | 353 | 10.6 | 156 | 4.7 | 2833 | 84.8 | | 0.25 | (0.11-0.55) | 0.001 | 0.21 | (0.10-0.44) | <0.001 |
| **Urban/rurality** | | | | | | | | | | | | | |
| Urban | 350 | 12.6 | 344 | 12.4 | 2084 | 75.0 | <0.001 | 1.00 | | | 1.00 | | |
| Rural | 1088 | 34.2 | 393 | 12.3 | 1703 | 53.5 | | 2.50 | (2.25-2.77) | <0.001 | 1.00 | (0.69-1.45) | 0.987 |
| **Educational level** | | | | | | | | | | | | | |
| College/University | 34 | 10.6 | 58 | 18.0 | 230 | 71.4 | <0.001 | 0.58 | (0.33-1.01) | 0.056 | 1.27 | (0.93-1.74) | 0.129 |
| High Secondary School | 95 | 17.2 | 67 | 12.1 | 391 | 70.7 | | 1.00 | | | 1.00 | | |
| Secondary school | 202 | 24.0 | 136 | 16.2 | 504 | 59.9 | | 1.29 | (1.15-1.49) | <0.001 | 1.31 | (1.09-1.60) | 0.004 |
| Primary school | 458 | 30.2 | 202 | 13.3 | 858 | 56.5 | | 1.81 | (1.47-2.23) | <0.001 | 1.25 | (0.85-1.82) | 0.253 |
| Illiterate (or no school) | 648 | 23.8 | 272 | 10.0 | 1798 | 66.2 | | 2.07 | (1.78-2.39) | <0.001 | 1.18 | (0.74-1.87) | 0.491 |
| **Main occupation** | | | | | | | | | | | | | |
| Official/teacher | 157 | 16.9 | 173 | 18.6 | 599 | 64.5 | <0.001 | 1.00 | | | 1.00 | | |
| Businessman | 7 | 17.5 | 12 | 30.0 | 21 | 52.5 | | 1.25 | (0.75-2.09) | 0.399 | 2.62 | (2.18-3.16) | <0.001 |
| Others | 85 | 20.4 | 47 | 11.3 | 284 | 68.3 | | 1.51 | (1.04-2.18) | 0.031 | 0.85 | (0.51-1.42) | 0.532 |
| Manual labourer | 170 | 16.4 | 124 | 11.7 | 743 | 71.6 | | 1.19 | (0.97-1.48) | 0.101 | 0.89 | (0.65-1.22) | 0.471 |
| Peasant | 967 | 31.7 | 358 | 12.0 | 1727 | 56.6 | | 2.21 | (1.78-2.75) | <0.001 | 0.85 | (0.63-1.16) | 0.308 |
| House wife | 51 | 10.6 | 22 | 4.6 | 408 | 84.8 | | 1.75 | (1.33-2.30) | <0.001 | 0.81 | (0.53-1.25) | 0.344 |
| **Annual personal income (RMB Yuan)** | | | | | | | | | | | | | |
| ≥20 000 | 206 | 17.7 | 185 | 15.9 | 773 | 66.4 | <0.001 | 0.79 | (0.56-1.14) | 0.207 | 0.97 | (0.78-1.20) | 0.763 |
| 10 000-19 999 | 317 | 18.5 | 207 | 12.0 | 1194 | 69.5 | | 1.00 | | | 1.00 | | |

Continued

| Variable | Smoking Status | | | | | | | Age-sex Adjusted Relative Risk | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Current- | | Former- | | Never- | | | Current-smoking | | | Former-smoking | | |
| | *n*=1438 | (%) | *n*=737 | (%) | *n*=3787 | (%) | *P* Value | RR† | (95% CI) | *P* Value | RR† | (95% CI) | *P* Value |
| 2000-9999 | 528 | 31.1 | 200 | 11.8 | 968 | 57.1 | | 1.66 | (1.40-1.97) | <0.001 | 1.01 | (0.74-1.38) | 0.942 |
| <2000 | 387 | 28.0 | 145 | 10.5 | 852 | 61.6 | | 1.72 | (1.26-2.34) | 0.001 | 0.93 | (0.67-1.31) | 0.694 |
| **Average annual income per one family (RMB Yuan)** | | | | | | | | | | | | | |
| ≥20 000 | 380 | 16.9 | 280 | 12.5 | 1588 | 70.6 | <0.001 | 0.86 | (0.67-1.10) | 0.228 | 0.87 | (0.80-0.95) | 0.002 |
| 10 000-19 999 | 213 | 18.5 | 145 | 12.6 | 795 | 69.0 | | 1.00 | | | 1.00 | | |
| 2000-9999 | 414 | 32.2 | 169 | 13.2 | 701 | 54.6 | | 1.62 | (1.15-2.28) | 0.006 | 1.01 | (0.69-1.47) | 0.975 |
| <2000 | 431 | 33.8 | 143 | 11.2 | 703 | 55.1 | | 1.83 | (1.26-2.68) | 0.002 | 0.88 | (0.50-1.53) | 0.640 |
| **Drinking alcohol** | | | | | | | | | | | | | |
| No | 915 | 18.2 | 569 | 11.3 | 3545 | 70.5 | <0.001 | 1.00 | | | 1.00 | | |
| Yes | 522 | 56.4 | 167 | 18.0 | 237 | 25.6 | | 1.89 | (1.77-2.01) | <0.001 | 0.93 | (0.74-1.17) | 0.536 |
| **Having a religious belief** | | | | | | | | | | | | | |
| No | 1284 | 25.7 | 651 | 13.0 | 3061 | 61.3 | <0.001 | 1.00 | | | 1.00 | | |
| Yes, with activity | 91 | 20.1 | 54 | 8.2 | 512 | 70.4 | | 0.78 | (0.54-1.12) | 0.185 | 0.97 | (0.87-1.08) | 0.614 |
| Yes, without ctivity | 59 | 13.9 | 28 | 9.5 | 207 | 77.9 | | 0.94 | (0.52-1.70) | 0.838 | 0.96 | (0.77-1.19) | 0.703 |
| **Marital status** | | | | | | | | | | | | | |
| Married | 1070 | 25.6 | 531 | 12.7 | 2575 | 61.7 | <0.001 | 1.00 | | | 1.00 | | |
| Widow | 300 | 18.7 | 178 | 11.1 | 1128 | 70.2 | | 1.11 | (0.95-1.29) | 0.188 | 1.15 | (1.04-1.26) | 0.004 |
| Divorced | 13 | 44.8 | 3 | 10.3 | 13 | 44.8 | | 1.31 | (0.82-2.08) | 0.255 | 0.77 | (0.24-2.45) | 0.653 |
| Never married | 54 | 37.2 | 24 | 16.6 | 67 | 46.2 | | 1.17 | (1.07-1.28) | 0.001 | 1.03 | (0.86-1.23) | 0.784 |
| **Living with** | | | | | | | | | | | | | |
| Nobody | 74 | 22.7 | 142 | 11.8 | 409 | 65.4 | | 1.00 | | | 1.00 | | |
| Family members/others | 662 | 24.2 | 1292 | 12.4 | 3375 | 63.3 | 0.581 | 0.95 | (0.79-1.15) | 0.612 | 1.00 | (0.80-1.25) | 0.997 |
| **Visiting children or relatives** | | | | | | | | | | | | | |
| Everyday | 138 | 23.9 | 361 | 9.1 | 1011 | 67.0 | | 1.00 | | | 1.00 | | |
| 1-3/ week | 251 | 24.0 | 459 | 13.1 | 1203 | 62.9 | | 0.94 | (0.78-1.13) | 0.498 | 1.29 | (0.99-1.69) | 0.064 |

Continued

| Variable | Smoking Status | | | | | | | Age-sex Adjusted Relative Risk | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Current- | | Former- | | Never- | | | Current-smoking | | | Former-smoking | | |
| | *n*=1438 | (%) | *n*=737 | (%) | *n*=3787 | (%) | *P* Value | RR† | (95% CI) | *P* Value | RR† | (95% CI) | *P* Value |
| ≤1/ month | 348 | 24.3 | 613 | 13.8 | 1560 | 61.9 | <0.001 | 0.98 | (0.78-1.24) | 0.879 | 1.44 | (1.25-1.65) | <0.001 |
| **Contact with friends in the local community** | | | | | | | | | | | | | |
| Everyday | 225 | 23.0 | 456 | 11.4 | 1301 | 65.6 | <0.001 | 1.00 | | | 1.00 | | |
| 1-3/ week | 273 | 26.0 | 620 | 11.4 | 1494 | 62.6 | | 1.12 | (0.92-1.35) | 0.250 | 0.98 | (0.83-1.16) | 0.839 |
| ≤1/ month | 237 | 22.8 | 357 | 15.1 | 975 | 62.1 | | 0.97 | (0.69-1.38) | 0.888 | 1.29 | (1.07-1.55) | 0.007 |
| **Visiting neighbour** | | | | | | | | | | | | | |
| Everyday | 240 | 24.1 | 497 | 11.7 | 1323 | 64.2 | <0.001 | 1.00 | | | 1.00 | | |
| 1-3/ week | 232 | 27.5 | 511 | 12.5 | 1118 | 60.1 | | 1.13 | (0.98-1.30) | 0.092 | 1.02 | (0.94-1.12) | 0.581 |
| ≤1/ month | 265 | 21.0 | 424 | 13.1 | 1329 | 65.9 | | 0.85 | (0.63-1.14) | 0.277 | 1.07 | (0.76-1.50) | 0.710 |
| **Participating in senior community activity in leisure time** | | | | | | | | | | | | | |
| No | 643 | 24.6 | 1303 | 12.1 | 3351 | 63.3 | 0.039 | 1.00 | | | 1.00 | | |
| Yes | 91 | 20.4 | 131 | 14.2 | 420 | 65.4 | | 0.76 | (0.60-0.98) | 0.034 | 1.08 | (0.82-1.42) | 0.605 |
| **Optimistic** | | | | | | | | | | | | | |
| Yes | 630 | 26.5 | 1162 | 10.1 | 3124 | 63.3 | | 1.00 | | | 1.00 | | |
| No | 104 | 23.6 | 272 | 12.8 | 649 | 63.5 | 0.020 | 1.21 | (1.04-1.39) | 0.011 | 0.85 | (0.65-1.11) | 0.235 |
| **Worrying about children** | | | | | | | | | | | | | |
| No | 644 | 23.7 | 1232 | 12.4 | 3325 | 63.9 | 0.115 | 1.00 | | | 1.00 | | |
| Yes | 91 | 27.1 | 199 | 12.4 | 444 | 60.5 | | 1.21 | (0.96-1.53) | 0.103 | 1.16 | (1.02-1.31) | 0.026 |
| **Depression syndromes (level)** | | | | | | | | | | | | | |
| 0 | 1243 | 23.6 | 642 | 12.2 | 3375 | 64.2 | 0.040 | 1.00 | | | 1.00 | | |
| 1-2 | 107 | 29.7 | 49 | 13.6 | 204 | 56.7 | | 1.52 | (1.06-2.18) | 0.023 | 1.31 | (0.82-2.07) | 0.257 |
| ≥3 | 87 | 26.0 | 45 | 13.4 | 203 | 60.6 | | 1.40 | (0.98-1.98) | 0.061 | 1.43 | (0.88-2.33) | 0.150 |

and psychosocial factors for current- and former-smoking in older adults in China. Risk of current smoking reduced with older age, but increased with male sex, living in a rural area, low levels of education, occupation, and personal and family incomes, drinking alcohol, being divorced/never-married, not participating in senior community activity, being pessimistic and having depressive syndromes. It was not significantly associated with having a religious belief, living with family members, frequencies of visiting children/relatives/neighbours and contacting friends, and worrying about children (Table 1).

The data analysis for male participants showed similar associations to those in the whole data, but additionally, the risk of current smoking increased with living alone, daily visiting children/relatives/neighbours and having middle level of depressive syndromes (Table 2). For women, the significant association was only with low socioeconomic status, less frequencies of visiting children/relatives and friends, worrying about children and having depressive syndromes (Table 2).

**Table 2.** Age-adjusted Relative Risk of currently Smoking in Men and Women in the 5-provinces Health Study of Older Adults, China

| Variable | Current Smoking | | | | | |
|---|---|---|---|---|---|---|
| | Men | | | Women | | |
| | RR† | (95% CI) | *P* Value | RR† | (95% CI) | *P* Value |
| **Age groups (years)** | | | | | | |
| 60-64 | 1.00 | | | 1.00 | | |
| 65-69 | 0.97 | (0.86-1.10) | 0.672 | 0.97 | (0.61-1.55) | 0.901 |
| 70-74 | 0.71 | (0.63-0.80) | <0.001 | 0.74 | (0.48-1.14) | 0.167 |
| 75-79 | 0.63 | (0.51-0.79) | <0.001 | 0.69 | (0.40-1.20) | 0.188 |
| ≥80 | 0.63 | (0.48-0.83) | 0.001 | 0.53 | (0.21-1.32) | 0.173 |
| **Urban/rurality** | | | | | | |
| Urban | 1.00 | | | 1.00 | | |
| Rural | 2.19 | (1.59-3.03) | <0.001 | 3.80 | (1.83-7.88) | <0.001 |
| **Educational level** | | | | | | |
| College/University | 0.48 | (0.29-0.80) | 0.004 | 1.80 | (0.44-7.31) | 0.412 |
| High secondary school | 1.00 | | | 1.00 | | |
| Secondary school | 1.29 | (1.13-1.47) | <0.001 | 1.19 | (0.55-2.55) | 0.659 |
| Primary school | 1.63 | (1.35-1.95) | <0.001 | 3.43 | (1.27-9.26) | 0.015 |
| Illiterate | 1.97 | (1.63-3.38) | <0.001 | 3.18 | (0.84-12.1) | 0.089 |
| **Main occupation** | | | | | | |
| Official/teacher | 1.00 | | | 1.00 | | |
| Businessman | 1.22 | (0.67-2.24) | 0.518 | 1.49 | (0.39-5.62) | 0.559 |
| Others | 1.53 | (1.41-1.65) | <0.001 | 1.59 | (0.37-6.77) | 0.530 |
| Manual labourer | 1.23 | (1.01-1.49) | 0.036 | 1.17 | (0.68-2.01) | 0.567 |
| Peasant | 2.15 | (1.61-2.87) | <0.001 | 2.68 | (1.37-5.27) | 0.004 |
| House wife | NA | | | 2.07 | (1.50-2.84) | <0.001 |
| **Personal income per year (RMB Yuan)** | | | | | | |
| ≥20 000 | 0.73 | (0.51-1.05) | 0.088 | 1.06 | (0.68-1.65) | 0.792 |
| 10 000-19 999 | 1.00 | | | 1.00 | | |
| 2000-9999 | 1.49 | (1.26-1.75) | <0.001 | 2.37 | (2.06-2.73) | <0.001 |
| <2000 | 1.61 | (1.41-1.85) | <0.001 | 2.14 | (1.04-4.41) | 0.039 |
| **Average family income per year (RMB Yuan)** | | | | | | |
| ≥20 000 | 0.88 | (0.75-1.02) | 0.091 | 0.76 | (0.41-1.41) | 0.382 |
| 10 000-19 999 | 1.00 | | | 1.00 | | |
| 2000-9999 | 1.46 | (1.19-1.79) | <0.001 | 2.16 | (0.86-5.42) | 0.101 |
| <2000 | 1.75 | (1.43-2.14) | <0.001 | 2.11 | (0.66-1.73) | 0.208 |

Continued

| Variable | Current Smoking | | | | | |
|---|---|---|---|---|---|---|
| | Men | | | Women | | |
| | RR† | (95% CI) | *P* Value | RR† | (95% CI) | *P* Value |
| **Drinking alcohol** | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 1.76 | (1.67-1.85) | <0.001 | 3.59 | (2.44-5.26) | <0.001 |
| **Marital status** | | | | | | |
| Married | 1.00 | | | 1.00 | | |
| Widow | 1.11 | (0.92-1.33) | 0.277 | 1.12 | (0.86-1.44) | 0.401 |
| Divorced | 1.38 | (1.05-1.82) | 0.021 | 0.81 | (0.10-6.55) | 0.846 |
| Never married | 1.24 | (1.12-1.36) | <0.001 | 0.64 | (0.14-2.89) | 0.562 |
| **Having a religious belief** | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes, with activity | 0.89 | (0.77-1.02) | 0.090 | 0.67 | (0.33-1.36) | 0.268 |
| Yes, without activity | 0.86 | (0.71-1.05) | 0.138 | 1.10 | (0.30-4.01) | 0.891 |
| **Living with** | | | | | | |
| Nobody | 1.00 | | | 1.00 | | |
| Family members/others | 0.85 | (0.76-0.96) | 0.007 | 1.35 | (0.77-2.38) | 0.295 |
| **Visiting children or relatives** | | | | | | |
| Everyday | 1.00 | | | 1.00 | | |
| 1-3/ week | 0.83 | (0.72-0.96) | 0.010 | 1.40 | (1.04-1.88) | 0.027 |
| ≤1/ month | 0.86 | (0.70-1.05) | 0.128 | 1.53 | (1.06-2.19) | 0.022 |
| **Contact with friends** | | | | | | |
| Everyday | 1.00 | | | 1.00 | | |
| 1-3/ week | 1.05 | (0.96-1.15) | 0.311 | 1.38 | (0.88-2.18) | 0.164 |
| ≤1/ month | 0.85 | (0.61-1.18) | 0.342 | 1.46 | (1.14-1.89) | 0.003 |
| **Visiting neighbour** | | | | | | |
| Everyday | 1.00 | | | 1.00 | | |
| 1-3/ week | 1.06 | (0.98-1.15) | 0.144 | 1.38 | (0.89-2.12) | 0.146 |
| ≤1/ month | 0.79 | (0.62-1.01) | 0.058 | 1.05 | (0.65-1.70) | 0.837 |
| **Participating in senior community activity in leisure time** | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 0.77 | (0.64-0.93) | 0.007 | 0.75 | (0.31-1.82) | 0.529 |
| **Optimistic** | | | | | | |
| Yes | 1.00 | | | 1.00 | | |
| No | 1.24 | (1.05-1.47) | 0.013 | 1.11 | (0.73-1.69) | 0.618 |
| **Worrying about children** | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 1.03 | (0.92-1.17) | 0.587 | 1.70 | (1.28-2.26) | <0.001 |
| **Depression syndromes (level)** | | | | | | |
| 0 | 1.00 | | | 1.00 | | |
| 1-2 | 1.24 | (1.10-1.40) | <0.001 | 2.21 | (1.10-4.44) | 0.026 |
| ≥3 | 1.08 | (0.92-1.28) | 0.334 | 2.01 | (1.11-3.63) | 0.021 |

Former smoking was associated with male sex, having secondary school education (compared to high school), being a businessman, middle level of family income (>1999 - <20 000 RMB), being widowed, less frequencies of visiting children/ relatives or contacting friends, and worrying about children. Other factors in Table 1 were not significantly related to former smoking. Separate data analysis by sex showed that in men the significant association was for older age [RR 1.54 (95% CI 1.14-2.06) for 75-79 years old, and 1.42 (1.00-2.00) for ≥80 years old] businessmen (2.02, 1.26-3.24), being widowed (1.08, 1.00-1.17), visiting children/relatives ≤ monthly (1.25, 1.07-1.46). In women it was associated with low levels of education (3.91, 1.50-10.2 for 2nd school, 4.25, 1.70-10.6 for illiterate), occupation (2.07, 1.44-2.99 for peasant, 8.48, 2.97-24.2 for businessman) and annual personal income (1.94, 1.07-3.54 for <10 000 RMB *vs* ≥10 000 RMB), being widowed (1.39, 1.10-1.74), less frequencies of visiting children/ relatives (2.03, 1.78-2.31 for 1-3 times per week, 2.41, 1.67-3.48 ≤ monthly) and contacting friends (1.31, 1.08-1.58 for <daily) and worrying about children (1.34, 1.04-1.73).

Among 3787 never-smokers, 3774 (99.6%) had available data for passive smoking. World age-standardized prevalence of passive smoking was 31.5% (29.5%-33.5%); 24.4% (20.6%-28.3%) in men *vs* 33.7% (31.4%-36.0%) in women. In men who experienced passive smoking, 56.7% were involved in exposure at home, 49.8% at work and 48.4% at other places, while in women the correspondent figures were 88.0%, 22.5% and 31.6% respectively.

Table 3 gives the numbers, frequencies and relative risk for basic characteristics and socio-economic and psychological factors in relation to passive smoking exposure. The risk of exposure to passive smoking increased with female sex, living in rural areas, low socio-economic status, being married (1.31, 1.03-1.66, *vs* others), drinking alcohol, having a religious belief (1.33, 1.04-1.72), and daily visiting of children/relatives (1.14, 1.02-1.25, *vs* others). Separate data analysis by sex showed that in men it was significantly associated with educational levels of ≥university (1.40, 1.04-1.88), or ≤secondary school (1.91, 1.38-2.63, *vs* high secondary school), businessman (4.21, 2.62-6.79), having a religious belief, living with family members (1.52, 1.16-2.00), ≤monthly visiting children (1.34, 1.01-1.79). In women it was increased with living in rural areas (1.57, 1.02-2.42), being illiterate (1.79, 1.09-2.95), low occupation (1.46, 1.23-1.73 for manual labourer, 2.08, 1.19-3.65 for peasant, and 1.53, 1.04-2.25 for housewife), annual personal income of <10 000 RMB (1.46, 1.09-1.97 for 2000-9999 RMB, 1.67, 1.18-2.38 for <2000 RMB, vs ≥10 000 RMB), being married, drinking alcohol, having a religious belief and daily visiting children/relatives.

**Table 3.** Distribution of Risk Factors and Age-sex Adjusted RR of Passive Smoking in the 5 provinces Study Health of Older Adults, China

| Variable | Passive Smoking | | | | | Age-sex Adjusted Relative Risk | | |
|---|---|---|---|---|---|---|---|---|
| | Yes | | No | | *P* Value | | | |
| | *n*=1160 | (%) | *n*=2614 | (%) | | RR | (95% CI) | *P* Value |
| **Age groups (years)** | | | | | | | | |
| 60-64 | 190 | 32.9 | 388 | 67.1 | 0.165 | 1.00 | | |
| 65-69 | 232 | 33.4 | 462 | 66.6 | | 1.02 | (0.83-1.24) | 0.862 |
| 70-74 | 278 | 30.4 | 637 | 69.6 | | 0.94 | (0.84-1.06) | 0.323 |
| 75-79 | 216 | 28.0 | 555 | 72.0 | | 0.87 | (0.73-1.04) | 0.123 |
| ≥80 | 242 | 30.1 | 563 | 69.9 | | 0.93 | (0.71-1.22) | 0.606 |
| **Sex** | | | | | | | | |
| Men | 218 | 23.1 | 727 | 76.9 | <0.001 | 1.00 | | |
| Women | 941 | 33.3 | 1884 | 66.7 | | 1.44 | (1.19-1.73) | <0.001 |
| **Urban/rurality** | | | | | | | | |
| Urban | 498 | 42.9 | 1585 | 60.6 | <0.001 | 1.00 | | |
| Rural | 662 | 57.1 | 1029 | 39.4 | | 1.59 | (1.07-2.35) | 0.022 |

Continued

| Variable | Passive Smoking | | | | *P* Value | Age-sex Adjusted Relative Risk | | |
|---|---|---|---|---|---|---|---|---|
| | Yes | | No | | | | | |
| | *n*=1160 | (%) | *n*=2614 | (%) | | RR | (95% CI) | *P* Value |
| **Educational level** | | | | | | | | |
| College/University | 54 | 23.5 | 176 | 76.5 | <0.001 | 1.28 | (0.93-1.77) | 0.130 |
| High secondary school | 75 | 19.2 | 316 | 80.8 | | 1.00 | | |
| Secondary school | 110 | 21.9 | 393 | 78.1 | | 1.11 | (0.85-1.45) | 0.438 |
| Primary school | 270 | 31.8 | 580 | 68.2 | | 1.56 | (1.16-2.08) | 0.003 |
| Illiterate | 650 | 36.2 | 1146 | 63.8 | | 1.78 | (1.14-2.80) | 0.012 |
| **Main occupation** | | | | | | | | |
| Official/teacher | 108 | 18.1 | 490 | 81.9 | <0.001 | 1.00 | | |
| Businessman | 6 | 28.6 | 15 | 71.4 | | 1.42 | (0.92-2.19) | 0.112 |
| Others | 60 | 21.2 | 223 | 78.8 | | 1.10 | (0.61-1.97) | 0.753 |
| Manual labourer | 200 | 27.0 | 542 | 73.0 | | 1.40 | (1.18-1.66) | <0.001 |
| Peasant | 664 | 38.6 | 1056 | 61.4 | | 1.96 | (1.28-3.01) | 0.002 |
| House wife | 122 | 29.9 | 286 | 70.1 | | 1.46 | (0.98-2.17) | 0.066 |
| **Personal income per year (RMB Yuan)** | | | | | | | | |
| ≥20 000 | 166 | 21.5 | 606 | 78.5 | <0.001 | 1.00 | | |
| 10 000-19 999 | 328 | 27.6 | 861 | 72.4 | | 1.19 | (0.89-1.61) | 0.228 |
| 2000-9999 | 343 | 35.6 | 620 | 64.4 | | 1.52 | (1.23-1.87) | <0.001 |
| <2000 | 323 | 38.0 | 527 | 62.0 | | 1.62 | (1.26-2.10) | <0.001 |
| **Average family income per year (RMB Yuan)** | | | | | | | | |
| ≥20 000 | 459 | 29.0 | 1126 | 71.0 | <0.001 | 1.00 | | |
| 10 000-19 999 | 204 | 25.9 | 585 | 74.1 | | 0.87 | (0.70-1.08) | 0.206 |
| 2000-9999 | 226 | 32.3 | 473 | 67.7 | | 1.07 | (0.94-1.22) | 0.291 |
| <2000 | 271 | 38.7 | 430 | 61.3 | | 1.27 | (0.97-1.68) | 0.086 |
| **Marriage** | | | | | | | | |
| Married | 842 | 32.8 | 1722 | 67.2 | <0.001 | 1.00 | | |
| Widow | 298 | 26.4 | 829 | 73.6 | | 0.76 | (0.60-0.96) | 0.023 |
| Divorced | 1 | 7.7 | 12 | 92.3 | | 0.23 | (0.02-2.20) | 0.209 |
| Never married | 19 | 28.4 | 48 | 71.6 | | 0.91 | (0.59-1.41) | 0.672 |
| **Drinking alcohol** | | | | | | | | |
| No | 1070 | 30.3 | 2465 | 69.7 | 0.007 | 1.00 | | |
| Yes | 90 | 38.3 | 145 | 61.7 | | 1.49 | (1.06-2.09) | 0.022 |
| **Having a religious belief** | | | | | | | | |
| No | 873 | 28.6 | 2182 | 71.4 | <0.001 | 1.00 | | |
| Yes, with activity | 210 | 41.3 | 298 | 58.7 | | 1.37 | (1.00-1.87) | 0.053 |
| Yes, without activity | 77 | 37.2 | 130 | 62.8 | | 1.27 | (1.09-1.48) | 0.002 |

Continued

| Variable | Passive Smoking | | | | | Age-sex Adjusted Relative Risk | | |
|---|---|---|---|---|---|---|---|---|
| | Yes | | No | | *P* Value | | | |
| | *n*=1160 | (%) | *n*=2614 | (%) | | RR | (95% CI) | *P* Value |
| **Living with** | | | | | | | | |
| Nobody | 105 | 25.7 | 303 | 74.3 | 0.011 | 1.00 | | |
| Family members/others | 1054 | 31.3 | 2310 | 68.7 | | 1.23 | (0.93-1.63) | 0.138 |
| **Worrying about children** | | | | | | | | |
| No | 1014 | 30.6 | 2304 | 69.4 | 0.209 | 1.00 | | |
| Yes | 144 | 32.6 | 298 | 67.4 | | 1.03 | (0.87-1.22) | 0.690 |
| **Visiting children or Relatives** | | | | | | | | |
| Everyday | 345 | 34.3 | 662 | 65.7 | <0.001 | 1.00 | | |
| 1-3/ week | 315 | 26.3 | 882 | 73.7 | | 0.80 | (0.72-0.87) | <0.001 |
| ≤1/ month | 497 | 31.9 | 1063 | 68.1 | | 0.95 | (0.86-1.05) | 0.320 |
| **Contact with friends** | | | | | | | | |
| Everyday | 431 | 33.2 | 866 | 66.8 | 0.035 | 1.00 | | |
| 1-3/ week | 446 | 30.0 | 1042 | 70.0 | | 0.91 | (0.71-1.17) | 0.464 |
| ≤1/ month | 277 | 28.4 | 698 | 71.6 | | 0.87 | (0.57-1.32) | 0.511 |
| **Visiting neighbour** | | | | | | | | |
| Everyday | 470 | 35.6 | 850 | 64.4 | <0.001 | 1.00 | | |
| 1-3/ week | 356 | 32.0 | 756 | 68.0 | | 0.90 | (0.77-1.07) | 0.237 |
| ≤1/ month | 330 | 24.8 | 999 | 75.2 | | 0.72 | (0.41-1.26) | 0.248 |
| **Participating in senior community activity in leisure time** | | | | | | | | |
| No | 1026 | 30.7 | 2316 | 69.3 | 0.950 | 1.00 | | |
| Yes | 128 | 30.5 | 291 | 69.5 | | 1.01 | (0.79-1.30) | 0.916 |
| **Optimistic** | | | | | | | | |
| Yes | 934 | 30.0 | 2181 | 70.0 | 0.032 | 1.00 | | |
| No | 222 | 34.3 | 426 | 65.7 | | 1.11 | (0.93-1.34) | 0.242 |
| **Depression syndromes (level)** | | | | | | | | |
| 0 | 1020 | 30.3 | 2345 | 69.7 | 0.209 | 1.00 | | |
| 1-2 | 72 | 35.6 | 130 | 64.4 | | 1.14 | (0.92-1.40) | 0.223 |
| ≥3 | 67 | 33.2 | 135 | 66.8 | | 1.06 | (0.72-1.56) | 0.779 |

Table 4 shows the risk of smoking and passive smoking exposure in combined levels of education and income. Among participants with education of ≤ primary school, smoking was associated with lower income. The risk of passive smoking increased with lower educational level in participants with an averaged family income of ≥2000 RMB, but in those with high income appeared to be for all participants regardless of educational level.

**Table 4.** Number of Passive Smoking and Relative Risk in Combinations of Family Income and Educational Level in the 5 provinces Health Study of Older Adults, China

| Educational Level | Average Income Per One Family (RMB Yuan) * | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ≥20 000 | | 10 000-19 999 | | 2000-9999 | | <2000 | |
| | N (%) | RR† (95% CI) | N (%) | RR† (95% CI) | N (%) | RR† (95% CI) | Nos (%) | RR† (95% CI) |
| **For active smoking** | | | | | | | | |
| ≥High 2nd School | 186/653 (28.5) | 1.09 (0.83-1.43) | 33/135 (24.4) | 1.00 | 31/66 (47.0) | 1.65 (1.03-2.63) | 4/21 (19.0) | 0.90 (0.57-1.43) |
| 2nd School | 139/414 (33.6) | 1.35 (1.09-1.67) | 68/217 (31.3) | 1.24 (0.99-1.57) | 88/143 (61.5) | 2.05 (1.61-2.63) | 43/68 (63.2) | 2.02 (1.31-3.11) |
| Primary school | 176/476 (37.0) | 1.54 (1.15-2.08) | 139/385 (36.1) | 1.71 (1.30-2.25) | 199/399 (49.9) | 2.09 (1.58-2.77) | 146/258 (56.6) | 2.27 (1.69-3.05) |
| Illiterate (or no school) | 157/702 (22.4) | 1.44 (0.95-2.19) | 117/412 (28.4) | 1.77 (1.22-2.58) | 265/675 (39.3) | 2.20 (1.44-3.35) | 381/929 (41.0) | 2.22 (1.33-3.72) |
| **For passive smoking** | | | | | | | | |
| ≥High 2nd School | 105/467 (22.5) | 1.66 (0.90-3.07) | 14/102 (13.7) | 1.00 | 5/35 (14.3) | 1.04 (0.42-2.57) | 5/17 (29.4) | 2.07 (0.54-7.85) |
| 2nd School | 64/275 (23.3) | 1.66 (1.06-2.60) | 24/148 (16.2) | 1.15 (0.56-2.38) | 15/55 (27.3) | 1.82 (0.80-4.14) | 7/25 (28.0) | 1.93 (0.76-4.87) |
| Primary school | 101/299 (33.8) | 2.35 (1.37-4.03) | 61/242 (25.2) | 1.69 (0.99-2.88) | 55/198 (27.8) | 1.88 (0.88-4.00) | 53/111 (47.7) | 3.22 (1.50-6.92) |
| Illiterate (or no school) | 189/544 (34.7) | 2.38 (1.19-4.75) | 104/294 (35.4) | 2.42 (1.11-5.27) | 151/410 (36.8) | 2.53 (1.33-4.78) | 206/548 (37.6) | 2.58 (1.10-6.02) |

***Note.*** † adjusted for age and sex. * similar findings for annual personal income analysis.

## DISCUSSION

In this multicentre population-based study in China, we found that the risk of smoking and passive smoking in older people was higher than those in high income countries[27-34], and increased with low socioeconomic status and psychosocial factors. Smoking rates in men was 4-5 times higher than in women. In never-smoking older adults, women experienced more passive smoking exposure than men.

### *Cigarette Smoking in Older Adults*

In the USA, a survey in 2007[34] showed that 8.3% of older people aged ≥65 years were currently smoking. In England, the prevalence of active smoking in the ≥60 years age group is 14%; 15% for men *vs* 13% for women[33]. The findings of our study suggested a much higher prevalence of active smoking in older Chinese men, and a similar or slightly higher prevalence in women compared to those in the high income countries. This is due to the failing controls in tobacco smoking in China both currently and in the past few decades[5-6,35].

Research conducted in high income countries has identified a number of SES and psychosocial factors associated with active smoking. Those employed in manual labour, with a low household income, low education, unmarried, consuming more units of alcohol, younger in age and being male have been reported to have higher rates of active smoking across all age groups[33-34,36-37]. The findings of our study were similar, suggesting that there may be preventive strategies that can be implemented. The most interesting results in this study were the observed sex differences in the association with psychosocial factors; in men currently smoking was associated with low levels of social networks/supp-orts/activities (eg, being divorced/never-married, religion, living with family, visiting children, etc), while in women seemed to be other way around. In high

income countries, most current prevention programmes are based on the social influence approach. Following this approach targets the proximal psychosocial variables believed to promote individuals to smoke[38-39]. Our data suggested that targeting these low socioeconomic status and psychosocial factors in the Chinese population may be also effective. However, for Chinese women the education of giving up smoking should be implemented when they take part in social activities.

***Passive Smoking Exposure***

With the accumulation of scientific evidence about the harm of passive smoking[3,22], many countries have taken action to reduce passive smoking exposure through legislation and health education, and have achieved significant improvements, with a declining prevalence of passive smoking exposure[27-32]. In Canada, a recent survey showed 17% of never smokers in the ≥50 years age group reported exposure to passive smoking[40]. In a Spanish population Twose et al.[31] reported 25.4% of men and 24.7% of women ≥65 were exposed to passive smoking, with 9.8% of men and 24.7% of women being exposed at home. In the last few years, Chinese legislation has called for a ban on smoking in all public places. Progress has however been hindered by the high prevalence of smoking and a general view that smoking is acceptable[5]. In China, a recent survey suggested no reduction in the prevalence of passive smoking exposure[41]. Our study showed a higher level of passive smoking in older people in China than those in high income countries[27-32]. The high risk of passive smoking exposure in older Chinese populations is due to the high level of active smoking and failures of banning smoking in public areas in the last few decades[42], suggesting more strict control of cigarette smoking in China is urgently required.

In high income countries, investigators have demonstrated that there were similar risk factors for passive smoking exposure and smoking. A US study reported that those younger in age (<60), males, lower incomes and less than high school education were at an increased the risk of passive smoking exposure[43]. In this study we found that passive smoking exposure was associated with low SES (including rural-urban differences-people living in rural China are much poorer than their urban counterparts[12,15]), being consistent with other countries[44]. The interesting finding is that female sex was a risk factor for passive smoking in China. This may be because they were exposed to passive smoking from their husbands or relatives who smoked a lot at home and male colleagues at work. Another interesting finding was that daily activities of visiting children/relatives/friends/neighbours increased passive smoking in women only, suggesting a potential impact on women's health[45].

While social networks and activities are a protective factor for older people' health[15], our study showed that the more social activities engaged within, the higher the passive smoking exposure, mainly in women. This is due to high level of active smoking from the general population which the older adults contacted, including their children/relatives and friends. Our findings of the association between social networks and passive smoking exposure in older people may have implications in helping to control cigarette smoking in China. Educating older people to the harmful effects of passive smoking, and its association with social networks and activities, would urge them to persuade their children/relatives or other people in contact to discourage smoking, or at least not smoke in front of them. This may be an effective strategy as in Chinese culture older people are well respected and other people, particularly their children/ grandchildren value their advice[15].

***Strengths and Limitation of the Study***

The main strength of the current study was the inclusion of data of older adults across 5 provinces in China, with a high response rate and face-to-face interviews with investigators to collect information using a standardized questionnaire[3]. Apart from the employment of cluster analysis, we directly calculated the relative risk of smoking and passive smoking, avoiding an invalidated transferring from the odds ratio[46]. Thus the findings are robust. Our study has limitations. Firstly, most of the participants had low levels of education. They may have had a different understanding of survey questions, which could result in bias in collection of the information. Specifically, the knowledge and awareness of respondents may have led to differences between perceived and actual passive smoking exposure. However, this may not bring bias towards to our findings because we found that low education was associated with high level of passive smoking. Secondly, we defined passive smoking exposure using a questionnaire, rather than employing cotinine level[3,47]. Thus a few people who actually had passive smoking might be misclassified as not

being exposed to passive smoke. But the number would be expected to be small. Thirdly, there were some variations in SES and psychosocial data among samples, which may affect the study findings. For example, the rank of SES from the lowest to the highest in terms of annual personal income was Anhui, Helongjiang, Shanxi, Shanghai, and Guangzhou, probably reflecting their province levels in China. We employed the cluster analysis method to account for the effect of the geographic variations, which produced more conservative results. Thus, our findings are further robust.

### *Implication*

Campaigns for controlling smoking and passive smoking seemed to focus on younger people[48-49]. Older adults are more sensitive to political, economic and policy changes for their health. Our multicentre community-based study provides some of the first, large-scale data on smoking and passive smoking in older adults, suggesting an interaction effect of education and income on the risk of smoking and passive smoking. This is of great importance in policy-making. Results of this study call for a prevention policy aimed at older people, and strategies to reduce smoking and passive smoking. Policies should involve educating older people and other population as well about the hazards of passive smoking, associating smoking behaviour with negative rather than positive images, and in trying to demoralise smoking. These are the strategies that have proved to be effective in many other countries, and provide a superb set of strategies for China to apply as it increases its efforts to combat the single most important cause of death and disability in the world's most populous country. Particularly, campaigns for reducing passive smoking exposure in older people via delivering our research findings of the association between social activities and passive smoking may play an important role in control of cigarette smoking in China.

### *Conclusions*

This study has shown a higher level of smoking and passive smoking in older adults in China than those in high income countries. Although men smoked much more than women, women were 1.5 times higher to be exposure to passive smoking. All these reflected failures in controlling cigarette smoking and in banning smoking in public areas in China. The associations of smoking and passive smoking with low socioeconomic status and different psychosocial aspects suggest preventative strategies for controlling smoking and passive smoking exposure. The rural-urban differences in passive smoking exposure demonstrate the need to control passive smoking in rural China, where more than half of Chinese live. The observed sex differences in the associations would help guide more efficient policies. Increasing educational level and removing the poverty may help reduce smoking and passive smoking regionally, nationally, and internationally.

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## COMPETING INTERESTS

None.

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