Original Article

Population attributable risks of cigarette smoking for deaths of all causes, all cancers and other chronic diseases among adults aged 40-74 years in urban Shanghai, China

Ying-Ying Wang[1,2]*, Wei Zhang[2]*, Hong-Lan Li[2], Jing Gao[2], Yu-Ting Tan[2], Yu-Tang Gao[2], Xiao-Ou Shu[3], Wei Zheng[3], Yong-Bing Xiang[2]

[1]School of Public Health, Fudan University, Shanghai 200032, China; [2]Shanghai Cancer Institute, Renji Hospital, Shanghai Jiaotong University School of Medicine, Shanghai 200032, China; [3]Division of Epidemiology, Department of Medicine, Vanderbilt Epidemiology Center, Vanderbilt-Ingram Cancer Center, Vanderbilt University School of Medicine, Nashville, TN 37232, USA

*The authors contributed equally to this work.

Correspondence to: Prof. Yong-Bing Xiang. Shanghai Cancer Institute, Renji Hospital, Shanghai Jiaotong University School of Medicine, Shanghai 200032, China. Email: ybxiang@shsci.org.

Objective: To evaluate the population attributable risks (PARs) between cigarette smoking and deaths of all causes, all cancers, lung cancer and other chronic diseases in urban Shanghai.

Methods: In total, 61,480 men aged 40-74 years from 2002 to 2006 and 74,941 women aged 40-70 years from 1997 to 2000 were recruited to undergo baseline surveys in urban Shanghai, with response rates of 74.0% and 92.3%, respectively. A Cox proportional hazards regression model was used to estimate relative risks (RRs) and 95% confidence intervals (95% CIs) of deaths associated with cigarette smoking. PARs and 95% CIs for deaths were estimated from smoking exposure rates and the estimated RRs.

Results: Cigarette smoking was responsible for 23.9% (95% CI: 19.4-28.3%) and 2.4% (95% CI: 1.6-3.2%) of all deaths in men and women, respectively, in our study population. Respiratory disease had the highest PAR in men [37.5% (95% CI: 21.5-51.6%)], followed by cancer [31.3% (95% CI: 24.6-37.7%)] and cardiovascular disease (CVD) [24.1% (95% CI: 16.7-31.2%)]. While the top three PARs were 12.7% (95% CI: 6.1-19.3%), 4.0% (95% CI: 2.4-5.6%), and 1.1% (95% CI: 0.0-2.3%), for respiratory disease, CVD, and cancer, respectively in women. For deaths of lung cancer, the PAR of smoking was 68.4% (95% CI: 58.2-76.5%) in men.

Conclusions: In urban Shanghai, 23.9% and 2.4% of all deaths in men and women could have been prevented if no people had smoked in the area. Effective control programs against cigarette smoking should be strongly advocated to reduce the increasing smoking-related death burden.

Keywords: Population attributable risk (PAR); smoking; mortality; cohort study; all causes death; cancer death; lung cancer

Submitted Dec 12, 2014. Accepted for publication Feb 09, 2015.
doi: 10.3978/j.issn.1000-9604.2015.02.08
View this article at: http://dx.doi.org/10.3978/j.issn.1000-9604.2015.02.08

Introduction

Cigarette smoking is a major risk factor for deaths from any cause and has led to 5 million deaths currently worldwide (1-3). An estimated about 15.8% deaths in men and 3.3% deaths in women were attributable to cigarette smoking in Asia (4).

Cigarette smoking is highly prevalent and is associated with substantially increased morbidity and mortality as well as economic development in China (5,6). As the biggest country of tobacco production and consumption in the world, China produces about 2.66 million tons of tobacco leaves each year, which accounts for one-third of the world's

tobacco leaf production per year (7). In addition, about 30% of the world's cigarettes are consumed in China (8). It is estimated that China has an estimated 350 million smokers by 2002 (9). The third national retrospective sampling death survey shows that, cardio-cerebrovascular disease, cancer and respiratory disease are the top three causes of death in China (10), and cigarette smoking was responsible for 12.9% deaths for men and 3.1% deaths for women (11). The smoking rates are increasing among the young population and women (12). The World Health Organization (WHO) predicts that China's annual tobacco-related deaths could rise to 2 million by the year 2025, and smoking-related mortality will be significantly increased (13).

Several studies have estimated the burden of deaths due to cigarette smoking in Chinese population (11,14-18), however, almost these studies used a less-than-optimal statistical method or relative risk (RR) and smoking exposure rates were derived from other studies in one study. In the present study, we used the accurate statistical method to estimate population attributable risks (PARs) of cigarette smoking on deaths of all causes, all cancers, lung cancer and other certain specific chronic diseases in two large prospective cohorts: the Shanghai Men's Health Study (SMHS) and the Shanghai Women's Health Study (SWHS).

Materials and methods

Study population

The SMHS and the SWHS are both population-based, prospective cohort studies conducted in urban Shanghai, China. Previous publications have described the designs and methods in detail (19,20). Briefly, the SMHS recruited 61,480 men aged 40-74 years from 2002 to 2006, with a participation rate of 74.0% (19). The SWHS recruited 74,941 women aged 40-70 years from 1997 to 2000, with a participation rate of 92.3% (20). For the present analysis, we excluded 377 cases whose diagnosis of cancer could not be confirmed (170 in men and 207 in women); 19 cases who were lost to follow-up (14 in men and 5 in women); 91 cases who were diagnosed with cancer *in situ* (10 in men and 81 in women); 1,598 cases who were diagnosed with cancer at baseline interviews in women; and 1 participant who had incomplete smoking data in men. Ultimately, 134,335 participants were included in the analysis (61,285 in the SMHS and 73,050 in the SWHS).

Data on demographic characteristics, physical activity, personal habits, family cancer history, diet, and other characteristics were acquired in-person interviews with the use of a standard questionnaire administered by trained interviewers at baseline. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Cigarette smoking was defined as at least one cigarette per day for more than 6 months continuously. Alcohol drinking was defined as at least three times per week for more than 6 months continuously. Physical activity was defined as at least once a week for more than 3 months continuously.

Outcome ascertainment

To obtain the information on the causes of death among study subjects, a combination of annual record linkage with the Shanghai Cancer Registry and the Shanghai Vital Statistics databases and active follow-up surveys conducted every 2-3 years was used. For cohort members who were diagnosed with cancer, medical charts from the diagnostic hospital and detailed information on the pathology characteristics of the tumor were collected to verify the diagnosis. The present study included 8,270 deaths (3,506 men and 4,764 women) diagnosed between the date of baseline enrollment and September 2013. All of the causes of death were classified according to the International Classification of Diseases (ICD-9) coding scheme. We divided the deaths into cancer (ICD codes from 140 to 208), cardiovascular disease (CVD) (ICD codes from 390 to 459), respiratory disease (ICD codes from 460 to 519), and diabetes (ICD code is 250).

Statistical analysis

A Cox proportional hazards regression model was used to examine age-adjusted and multivariable-adjusted RRs and their 95% confidence intervals (95% CIs) of deaths associated with cigarette smoking. The confounders adjusted included age at baseline (continuous), BMI (it was categorized into quartiles based on the distribution of alive population: ≤21.67, ~23.67, ~25.68, and >25.68 kg/m^2 for men; ≤21.60, ~23.63, ~26.00, and >26.00 kg/m^2 for women), education (primary school or less, middle school, high or technical school and professional education or above), income level (low, middle and high), physical activity (yes or no), and alcohol drinking (yes or no). We estimated RRs and 95% CIs of smokers compared with nonsmokers.

In order to express the burden of cigarette smoking attributable to deaths, the PAR was calculated using the

following equation (21):

$$PAR = \frac{\sum_{s=1}^{S}\sum_{t=1}^{T} p_{st}RR_{1s}RR_{2t} - \sum_{s=1}^{S}\sum_{t=1}^{T} p_{st}RR_{2t}}{\sum_{s=1}^{S}\sum_{t=1}^{T} p_{st}RR_{1s}RR_{2t}}$$

$$= 1 - \frac{\sum_{t=1}^{T} p_{\cdot t}RR_{2t}}{\sum_{s=1}^{S}\sum_{t=1}^{T} p_{st}RR_{1s}RR_{2t}}$$

In which, t denotes a stratum of unique combinations of levels of all background risk factors which are not under study, t=1, ..., T, and RR_{2t} is the relative risk in combination t relative to the lowest risk level, where $RR_{2,1}$=1. As previously, s indicates an index exposure group defined by each of the unique combinations of the levels of the index risk factors, that is, those risk factors to which the *PAR* applies, s=1, ..., S, and RR_{1s} is the relative risk corresponding to combinations relative to the lowest risk combination, $RR_{1,1}$=1. The joint prevalence of exposure group s and stratum t is denoted by p_{st}, and $p.t = \Sigma_{s=1}^{s}\ p_{st}$. This partial PAR equation is preferred over other PAR equations, such as $PAR = \frac{P(RR-1)}{P(RR-1)+1}$ (22) when the set of risk factors includes some factors which cannot be modified, such as age and family history of the disease.

All analyses were conducted using SAS statistical software, version 9.2 (SAS Institute Inc., Cary, USA). SAS macro package was used for PAR point estimation and interval estimation (21). All quoted probability (P) values were based on two-sided tests.

Results

During the 1,395,486 person-years of follow-up for 134,335 cohort participants, a total of 3,506 men deaths and 4,764 women deaths were recorded. The top four deaths were cancer (1,430 men and 1,950 women), CVD (1,209 men and 1,537 women), respiratory disease (229 men and 165 women), and diabetes (143 men and 328 women). The baseline characteristics of the study population are shown in *Table 1*. Totally, 42,665 men (69.62%) and 2,028 (2.78%) women were smokers. Male smokers were younger and had a lower education, lower income and lower BMI than nonsmokers. Female smokers were older and had a lower education, lower income and higher BMI than nonsmokers. There were more drinkers and less physical exerciser in male smokers than nonsmokers, and more drinkers and physical exerciser in female smokers than nonsmokers.

Table 2 shows age-adjusted and multivariable-adjusted RRs of deaths associated with cigarette smoking in this study. Smokers had a 1.54- and 1.45-fold higher multivariable-adjusted RR of mortality from all causes compared with nonsmokers in men and women, respectively. Among the cigarette-related diseases, respiratory disease had the highest RR [2.05 (95% CI: 1.50-2.80)] in men, followed by cancer [1.77 (95% CI: 1.56-2.01)] and CVD [1.56 (95% CI: 1.37-1.78)]. While the top three RRs were 3.10 (95% CI: 2.05-4.68), 1.67 (95% CI: 1.41-1.99) and 1.24 (95% CI: 1.02-1.52), for respiratory disease, CVD and cancer in women, respectively. The RRs of lung cancer were 4.43 (95% CI: 3.27-6.01) and 2.54 (95% CI: 1.83-3.52) in men and women, respectively. There was no statistical significance for the multivariable-adjusted RRs of diabetes in our study.

Table 3 shows age-adjusted and multivariable-adjusted PARs of deaths due to cigarette smoking in this study. Cigarette smoking was responsible for 23.9% (95% CI: 19.4-28.3%) deaths in men and 2.4% (95% CI: 1.6-3.2%) deaths in women in Shanghai after multivariable-adjustment. When divided into cigarette-related sites, respiratory disease had the highest PAR in men [37.5% (95% CI: 21.5-51.6%), followed by cancer [31.3% (95% CI: 24.6-37.7%)] and CVD [24.1% (95% CI: 16.7-31.2%)]. While the top three PARs were 12.7% (95% CI: 6.1-19.3%), 4.0 % (95% CI: 2.4-5.6%) and 1.1% (95% CI: 0.0-2.3%), for respiratory disease, CVD and cancer in women, respectively. The PARs of lung cancer were 68.4% (95% CI: 58.2-76.5%) and 6.5% (95% CI: 2.4-10.7%) in men and women, respectively.

Discussion

Our study provides a systematic estimate of the burden of cigarette smoking on total, cancer and other cause-specific deaths observed in our two cohorts during 2002-2013 and 1997-2013 for middle aged and elderly men and women in urban Shanghai. The results indicate that cigarette smoking causes an increased risk of mortality of cancer, CVD and respiratory disease for both among men and women. To our knowledge, the results provide perhaps the best estimates of smoking-associated deaths so far in a Chinese population.

The RRs of cigarette smoking for all deaths in our study are substantially lower than those from studies conducted in Europe and North America (23-25). Among specific causes of mortality evaluated in this study, lung cancer showed the strongest association with tobacco smoking, with estimated RRs of 4.43 and 2.54 in men and women, respectively. Ezzati and Lopez estimated that the leading causes of death

Table 1 Baseline characteristics of SMHS and SWHS

Characteristics	Men			Women		
	No. of nonsmokers (%)	No. of smokers (%)	P	No. of nonsmokers (%)	No. of smokers (%)	P
Age (year, $\bar{x}\pm s$)	59.05±9.79	53.74±9.25	<0.001	52.33±8.98	58.57±9.63	<0.001
Education level			<0.001			<0.001
Primary school or less	1,678 (9.01)	3,224 (7.56)		14,446 (20.34)	1,138 (56.11)	
Middle school	4,305 (23.12)	15,974 (37.44)		26,650 (37.52)	538 (26.53)	
High or technical school	5,552 (29.82)	16,247 (38.08)		20,124 (28.33)	293 (14.45)	
Professional education or above	7,085 (38.05)	7,220 (16.92)		9,802 (13.80)	59 (2.91)	
Family income, per person per year			<0.001			<0.001
Low	8,713 (46.79)	25,019 (58.64)		19,171 (26.99)	991 (48.87)	
Middle	7,440 (39.96)	14,164 (33.20)		27,710 (39.02)	699 (34.47)	
High	2,467 (13.25)	3,482 (8.16)		24,141 (33.99)	338 (16.67)	
Ever alcohol drinker			<0.001			<0.001
No	15,574 (83.64)	25,061 (58.74)		69,646 (98.06)	1,761 (86.83)	
Yes	3,046 (16.36)	17,604 (41.26)		1,376 (1.94)	267 (13.17)	
BMI (kg/m^2)*			<0.001			<0.001
≤21.67 (≤21.60)	3,788 (20.36)	11,669 (27.35)		17,580 (24.75)	492 (24.26)	
~23.67 (~23.63)	4,779 (25.67)	10,506 (24.62)		17,611 (24.80)	378 (18.64)	
~25.68 (~26.00)	5,048 (27.11)	10,086 (23.64)		17,737 (24.97)	459 (22.63)	
>25.68 (>26.00)	5,005 (26.88)	10,404 (24.39)		18,094 (25.48)	699 (34.47)	
Regular physical activity during past 5 years			<0.001			<0.006
No	9,497 (51.00)	30,023 (70.37)		46,202 (65.05)	1,259 (62.08)	
Yes	9,123 (49.00)	12,642 (29.63)		24,820 (34.95)	769 (37.92)	

*, cut points for the quartiles of BMI are shown in parentheses for women. SMHS, the Shanghai Men's Health Study; SWHS, the Shanghai Women's Health Study; BMI, body mass index.

from smoking worldwide in 2000 were CVD, cancer and respiratory disease (26). The three leading causes of death attributable to smoking were cancer, CVD and respiratory disease in American men and CVD, cancer and respiratory disease in American women (27). Our findings among urban Shanghai populations are similar to the studies in world and America regard to three leading causes of death attributable to smoking: respiratory disease, cancer and CVD in men and respiratory disease, CVD and cancer in women. Overall, 23.9% men deaths and 2.4% women deaths were attributable to cigarette smoking. In particular, 37.5% respiratory disease and 31.3% cancer deaths in Shanghai males could have been prevented if no man had smoked in Shanghai. Our study reported a higher PAR of cigarette smoking for death of all causes in men, and a lower PAR in women than those of studies in Japanese and other Chinese population (11,18,28,29). However, previous studies did not adjust for potential confounders adequately when estimating relative risks or used the following equations to estimate PARs [$PAR=\frac{P(RR-1)}{P(RR-1)+1}$], while this equation is only used in no confounding factors existing (11,18,28,29). The PARs of deaths related to cigarette smoking may be underestimated in our study, because the length of the follow-up period of men was shorter than that of other studies (11,18,28), and due to the long latency of chronic diseases, most of the smoking-related diseases tend to occur later in life.

This study had several strengths. First is the cohorts who are followed with a well-established and tested protocol, including record linkage with multiple sources of routinely collected data and biennial home visits, are likely to provide

Table 2 Association of cigarette smoking with risk of death from all causes, cancer, lung cancer, CVD, or respiratory disease in SMHS and SWHS

Gender	Death cause	Cigarette smoking	No. of deaths	Person-year of follow-up	RR_1 (95% CI)*	RR_2 (95% CI)**
Men	All causes	Never	1,034	4,590	1.00	1.00
		Ever	2,472	10,978	1.76 (1.64-1.90)	1.54 (1.43-1.67)
	Cancer	Never	374	1,735	1.00	1.00
		Ever	1,056	4,705	2.02 (1.79-2.28)	1.77 (1.56-2.01)
	Lung cancer	Never	50	246	1.00	1.00
		Ever	375	1,632	5.50 (4.09-7.40)	4.43 (3.27-6.01)
	CVD	Never	370	1,611	1.00	1.00
		Ever	839	3,759	1.75 (1.55-1.98)	1.56 (1.37-1.78)
	Respiratory disease	Never	58	259	1.00	1.00
		Ever	171	816	2.52 (1.87-3.40)	2.05 (1.50-2.80)
	Diabetes	Never	48	228	1.00	1.00
		Ever	95	399	1.54 (1.09-2.19)	1.40 (0.97-2.02)
Women	All causes	Never	4,415	34,719	1.00	1.00
		Ever	349	2,736	1.61 (1.44-1.79)	1.45 (1.30-1.62)
	Cancer	Never	1,846	14,603	1.00	1.00
		Ever	104	813	1.30 (1.06-1.58)	1.24 (1.02-1.52)
	Lung cancer	Never	370	2,977	1.00	1.00
		Ever	44	356	2.69 (1.96-3.68)	2.54 (1.83-3.52)
	CVD	Never	1,392	11,275	1.00	1.00
		Ever	145	1,154	1.87 (1.57-2.22)	1.67 (1.41-1.99)
	Respiratory disease	Never	135	1,183	1.00	1.00
		Ever	30	263	3.93 (2.63-5.86)	3.10 (2.05-4.68)
	Diabetes	Never	304	2,202	1.00	1.00
		Ever	24	174	1.38 (0.91-2.10)	1.15 (0.75-1.75)

*, adjusted for age; **, adjusted for age, BMI, education level, family income per person per year, ever alcohol drinker, regular physical activity during past 5 years; CVD, cardiovascular disease; SWHS, the Shanghai Women's Health Study.

high follow-up rate and more credible data. Secondly, we use the relative risk of smoking and smoking exposure rate derived from our own cohorts and then to estimate PAR, theoretically, which should provide more reliable PAR estimates of disease burden due to cigarette smoking in the study population than using data from external sources, while in other studies, RR or smoking exposure rate was abstracted from external sources (11,18). Finally, we adjusted known confounding sufficiently, which ensured the potential bias of overestimating the PAR was minimized in our study. Despite the strengths, our study also had some limitations. Firstly, some estimates among women are unstable because smoking exposure rate in women was traditionally very low. Secondly, as the cohorts included in this study were conducted among adults aged 40 years old and over, we were unable to estimate the impact of tobacco smoking in people younger than 40 years old. Therefore, there is a need for continuous studies to consider these factors when estimating the burden of deaths attributable to tobacco smoking.

Approximately one in four deaths in men and one in forty deaths in women in urban Shanghai could have been prevented if no people had smoked in Shanghai. Furthermore, the exposure rate of cigarette smoking has been continuously high in adult men and has been increasing over the last decade in women and young people (12,30). The average age of smoking initiation has been

Table 3 PAR (%) and number of deaths from all causes, cancer, lung cancer, CVD, or respiratory disease due to cigarette smoking in SMHS and SWHS

Gender	Death cause	No. of deaths	PAR_1 (95% CI)*	PAR_2 (95% CI)**
Men	All causes	3,506	0.295 (0.259-0.330)	0.239 (0.194-0.283)
	Cancer	1,430	0.366 (0.311-0.419)	0.313 (0.246-0.377)
	Lung cancer	425	0.723 (0.644-0.786)	0.684 (0.582-0.765)
	CVD	1,209	0.288 (0.228-0.347)	0.241 (0.167-0.312)
	Respiratory disease	229	0.444 (0.314-0.557)	0.375 (0.215-0.516)
	Diabetes	143	0.210 (0.023-0.382)	0.170 (–0.032-0.359)
Women	All causes	4,764	0.030 (0.022-0.038)	0.024 (0.016-0.032)
	Cancer	1,950	0.014 (0.003-0.024)	0.011 (0.000-0.023)
	Lung cancer	414	0.068 (0.035-0.100)	0.065 (0.024-0.107)
	CVD	1,537	0.048 (0.032-0.064)	0.040 (0.024-0.056)
	Diabetes	328	0.024 (–0.006-0.054)	0.011 (–0.019-0.042)
	Respiratory disease	165	0.140 (0.075-0.205)	0.127 (0.061-0.193)

*, adjusted for age; **, adjusted for age, BMI, education level, family income per person per year, ever alcohol drinker, regular physical activity during past 5 years; CVD, cardiovascular disease; BMI, body mass index; PAR, population attributable risk; SMHS, the Shanghai Men's Health Study; SWHS, the Shanghai Women's Health Study.

decreasing in past years (9,12,31,32), and the numbers of cases and deaths are expected to increase in the future. The present estimates have important public health implications, and these data guide policy-makers to make prevention and control strategies on issues of smoking. Considering the high exposure rate of smoking, effective control programs against cigarette smoking should be advocated in Shanghai to reduce the large and increasing smoking-related deaths burden.

Acknowledgements

We would like to thank the participants and the staffs from the Shanghai Women's and Men's Health Studies for their contribution to this research.

Funding: This work was supported by the funds of Key Discipline and Specialty Foundation of Shanghai Municipal Commission of Health and Family Planning and the National Key Basic Research Program "973 project" (2015CB554000), and grants from US National Institutes of Health (R37 CA070867, R01 CA82729, UM1CA173640, and UM1 CA182910).

Disclosure: The authors declare no conflict of interest.

References

1. Lopez AD, Mathers CD, Ezzati M, et al. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. Lancet 2006;367:1747-57.
2. Ezzati M, Lopez AD, Rodgers A, et al. Selected major risk factors and global and regional burden of disease. Lancet 2002;360:1347-60.
3. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med 2006;3:e442.
4. Zheng W, McLerran DF, Rolland BA, et al. Burden of total and cause-specific mortality related to tobacco smoking among adults aged ≥ 45 years in Asia: a pooled analysis of 21 cohorts. PLoS Med 2014;11:e1001631.
5. Yang G, Fan L, Tan J, et al. Smoking in China: findings of the 1996 National Prevalence Survey. JAMA 1999;282:1247-53.
6. Sung HY, Wang L, Jin S, et al. Economic burden of smoking in China, 2000. Tob Control 2006;15 Suppl 1:i5-11.
7. Wang H. Tobacco control in China: the dilemma between economic development and health improvement. Salud Publica Mex 2006;48 Suppl 1:S140-7.
8. Wipfli H, Samet JM. Global economic and health benefits of tobacco control: part 1. Clin Pharmacol Ther 2009;86:263-71.
9. Yang GH, Ma JM, Liu N, et al. Smoking and passive smoking in Chinese, 2002. Zhonghua Liu Xing Bing Xue

Za Zhi 2005;26:77-83.
10. Ministry of Health of the people's republic of China. Report on the Third National Retrospective Survey of Death Causes in China. Beijing: Chinese Academy of Medical Sciences and Peking Union Medical College Press, 2008.
11. Gu D, Kelly TN, Wu X, et al. Mortality attributable to smoking in China. N Engl J Med 2009;360:150-9.
12. Zhang J, Ou JX, Bai CX. Tobacco smoking in China: prevalence, disease burden, challenges and future strategies. Respirology 2011;16:1165-72.
13. World Health Organization. The world health report 1999-combating the tobacco epidemic. Geneva: World Health Organization, 1999.
14. Niu SR, Yang GH, Chen ZM, et al. Emerging tobacco hazards in China: 2. Early mortality results from a prospective study. BMJ 1998;317:1423-4.
15. Chen ZM, Xu Z, Collins R, et al. Early health effects of the emerging tobacco epidemic in China. A 16-year prospective study. JAMA 1997;278:1500-4.
16. Yuan JM, Ross RK, Wang XL, et al. Morbidity and mortality in relation to cigarette smoking in Shanghai, China. A prospective male cohort study. JAMA 1996;275:1646-50.
17. Lam TH, Ho SY, Hedley AJ, et al. Mortality and smoking in Hong Kong: case-control study of all adult deaths in 1998. BMJ 2001;323:361.
18. Liaw KM, Chen CJ. Mortality attributable to cigarette smoking in Taiwan: a 12-year follow-up study. Tob Control 1998;7:141-8.
19. Cai H, Zheng W, Xiang YB, et al. Dietary patterns and their correlates among middle-aged and elderly Chinese men: a report from the Shanghai Men's Health Study. Br J Nutr 2007;98:1006-13.
20. Zheng W, Chow WH, Yang G, et al. The Shanghai Women's Health Study: rationale, study design, and baseline characteristics. Am J Epidemiol 2005;162:1123-31.
21. Spiegelman D, Hertzmark E, Wand HC. Point and interval estimates of partial population attributable risks in cohort studies: examples and software. Cancer Causes Control 2007;18:571-9.
22. Rockhill B, Newman B, Weinberg C. Use and misuse of population attributable fractions. Am J Public Health 1998;88:15-9.
23. Jha P. Avoidable global cancer deaths and total deaths from smoking. Nat Rev Cancer 2009;9:655-64.
24. Jha P, Ramasundarahettige C, Landsman V, et al. 21st-century hazards of smoking and benefits of cessation in the United States. N Engl J Med 2013;368:341-50.
25. Pirie K, Peto R, Reeves GK, et al. The 21st century hazards of smoking and benefits of stopping: a prospective study of one million women in the UK. Lancet 2013;381:133-41.
26. Ezzati M, Lopez AD. Estimates of global mortality attributable to smoking in 2000. Lancet 2003;362:847-52.
27. National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. The health consequences of smoking: a report of the Surgeon General. Atlanta: Centers for Disease Control and Prevention, 2004.
28. Katanoda K, Marugame T, Saika K, et al. Population attributable fraction of mortality associated with tobacco smoking in Japan: a pooled analysis of three large-scale cohort studies. J Epidemiol 2008;18:251-64.
29. Gao Y, Den J, Xiang Y, et al. Smoking, related cancers, and other diseases in shanghai: a 10-year prospective study. Zhonghua Yu Fang Yi Xue Za Zhi 1999;33:5-8.
30. Ho MG, Ma S, Chai W, et al. Smoking among rural and urban young women in China. Tob Control 2010;19:13-8.
31. Giovino GA, Mirza SA, Samet JM, et al. Tobacco use in 3 billion individuals from 16 countries: an analysis of nationally representative cross-sectional household surveys. Lancet 2012;380:668-79.
32. Xu JY, Li XJ, Yao HH, et al. Study on smoking pattern and related factors among residents aged 15-69 in Shanghai. Huan Jing Yu Zhi Ye Yi Xue 2010;27:189-92.

Cite this article as: Wang YY, Zhang W, Li HL, Gao J, Tan YT, Gao YT, Shu XO, Zheng W, Xiang YB. Population attributable risks of cigarette smoking for deaths of all causes, all cancers and other chronic diseases among adults aged 40-74 years in urban Shanghai, China. Chin J Cancer Res 2015;27(1):59-65. doi: 10.3978/j.issn.1000-9604.2015.02.08

