

Original Article

# Prevalence of active and passive tobacco smoking among Beijing residents in 2011

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## Abstract

**Objectives:** This study was aimed to investigate the prevalence of active and passive tobacco smoking among Beijing residents in 2011. **Methods:** A cross-sectional survey was conducted, using a stratified multistage cluster random sampling method to select a representative sample of 20,242, among Beijing residents aged 18–79 years. Active and passive tobacco smoking information was collected by a standardized and validated questionnaire in a face-to-face interview. All estimates of prevalence and numbers were weighted by the 2010 Beijing Population Census data and the sampling scheme.

**Results:** Among Beijing residents aged 18–79 years, the overall prevalence of ever smokers and current smokers were 33.13% and 30.18%, respectively. The prevalence in males was much higher than that in females (60.75% vs. 3.75% for ever smokers, and 55.53% vs. 3.21% for current smokers, respectively). For overall current smokers, 14.12 cigarettes were consumed per day. However, only 8.91% of ever smokers quit smoking at the time of the survey, and 2.44% of ever smokers quit smoking in recent two years. Furthermore, 44.74% of overall nonsmokers and former smokers, with 47.03% of males and 43.63% of females, reported exposure to secondhand smoke for at least 15 minutes per day and at least one day per week.

**Conclusions:** Tobacco smoking prevalence is still extremely high in Beijing. Nonsmokers do still suffer from secondhand smoke critically. Further urgent efforts for tobacco control are warranted in Beijing.

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**Keywords:** Tobacco smoking; Passive tobacco smoking; Prevalence

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## Introduction

Tobacco smoking is a major public health challenge worldwide due to its high prevalence, consolidated role in jeopardizing human health and extraordinary economic burden.<sup>1–5</sup> Aiming to counteract the health and economic issues caused by tobacco, World Health Organization (WHO) developed the Framework Convention of Tobacco Control (FCTC), which is a landmark comprehensive policy encouraging countries to cure the epidemic of tobacco, in 2003. China has been the largest tobacco producer and consumer all over the world. In 2010, according to the Global Adult Tobacco Survey (GATS), there were 28.1% of adults being current smokers and 72.4% of non-smokers exposed to secondhand smoke (SHS) in China.<sup>6</sup> Furthermore, tobacco smoking caused a total of 673,000 deaths in 2005 in China,<sup>7</sup> and the number is expected to project to 2 million by 2030 and 3 million by 2050, respectively.<sup>8</sup> However, China does not have a national comprehensive tobacco control policy up to now.

Beijing, the capital and one of the leading socio-economic developed cities of China, also faces the same challenge from tobacco smoking. Fortunately, Beijing Municipal Government has caught sight of the harm of tobacco and issued serials of tobacco control rules since 1995.<sup>9</sup> However, the control of tobacco smoking seemed ineffective, with 29.0% of adults being current smokers and 43.4% of nonsmokers exposed to SHS in 2008.<sup>10</sup> After 2008, new legislations, including raising tobacco tax,<sup>11</sup> changing and adding notification on cigarette packaging,<sup>12</sup> have been implemented. Particularly, the strictest law up to now, which bans tobacco smoking in all indoor public and working places, came to effect on June 1st 2015.<sup>13</sup> However, the tobacco smoking prevalence has not been well evaluated since 2008.

Therefore, we conducted this cross-sectional survey among 18–79 years old adults in 2011 to investigate the prevalence of active and passive tobacco smoking, to evaluate the previous tobacco control rules by delineating prevalence trend, and to provide basic information for the future evaluation of the newest and strictest tobacco control law.

## Methods

### *Participants*

This study was based on the Beijing Chronic Diseases Survey conducted from September to November

2011 in the general population aged 18–79 years in Beijing. A stratified multistage cluster random sampling design was employed to select a well representative sample. Firstly, the population was divided into 36 groups according to the district division (18 old districts) and employed status (on-post staff, and off-post and retired people). Secondly, as to the on-post staff, we selected the worksites with the method of probability proportional to size (PPS) from each district, then selected participants from the worksites by systematic sampling method. Besides, as to the off-post and retired people, we selected towns, residential committees/villages, and population groups orderly with the method of PPS from each district, then selected households from the population groups by simple random sampling method. Kish Grid table was used to select only one participant, who aged 18–79 years and being off-post or retired, from each household.<sup>14</sup> The ratio of on-post to off-post and retired participants was 3:1, and the overall participants accounted for 1/850 of total Beijing 18–79 adults. At last, 20,297 participants took part in the survey out of 22,130 participants (91.72%). A total of 20,242 participants aged 18–79 years were included in the current analysis eventually.

### *Data collection*

A standardized and validated questionnaire was administered by the trained research staff to collect the information about sociodemographic characteristics, lifestyle factors (tobacco smoking, drinking, diet, physical activity) and chronic diseases in a face-to-face interview. The questionnaire contains structured questions about smoking status, amount of smoking, age at smoking initiation, quitting smoking status, and passive smoking status. All the interview and data collection were conducted under stringent quality control.

### *Variables and definitions*

Ever smokers included persons who have consumed at least 100 cigarettes or 100 grams of tobacco during their lifetime, while the others were nonsmokers. Current smokers were ever smokers who have smoked in 30 days prior to the survey. Daily smokers were current smokers who smoked at least 1 cigarette daily, and heavy smokers smoked at least 20 cigarettes daily. Prevalence of ever smokers, current smokers, daily smokers, and heavy smokers were the proportion of corresponding smokers among the total population, respectively.

Former smokers were ever smokers who have not smoked at least 30 days prior to the survey. Quit proportion was the proportion of former smokers among the ever smokers and the complete quit proportion was the proportion of former smokers who have given up smoking for at least 2 years prior to the survey among ever smokers.<sup>15,16</sup> Passive smokers were non-smokers and former smokers who have been exposed to SHS for at least 15 minutes per day and at least one day per week. Prevalence of passive smokers was the proportion of passive smokers among non-smokers and former smokers. Pack-years were an estimation of lifetime exposure to tobacco, which was the product of packs of cigarettes per day and years of smoking.

According to the educational level, we divided the participants into three groups, which were low group (illiteracy and primary school), middle group (junior and senior middle school), and high group (college and above).

The institutional review boards of Fuwai hospital and Beijing Center for Disease Prevention and Control have approved this study. Written informed consent was got from each participant.

#### Statistical analysis

All the estimates of prevalence and numbers were weighted and matched to total Beijing population. The comprehensive weight was calculated based on the 2010 Beijing Population Census data and the sampling scheme. In addition, the complex survey design was taken into account to the variance was computed by the method of Taylor series linearization. Furthermore, Beijing 2000 population<sup>17</sup> was used as standard population to compare the estimates of current study with that of previous studies. All analyses were conducted using SAS statistical software, version 9.2 (SAS Institute, Inc., Cary, North Carolina, USA).

## Results

Among 20,242 participants aged 18–79 years, there were 9179 males and 11,063 females with the average age of 44.17 and 44.54, respectively. A total of 64.73% participants came from the urban area. The proportion of participants in the high education group was 35.33% and that for the low education group was 7.78%. In addition, males and females shared the similar proportions in location and education groups as overall sample (Table 1).

Overall, 33.13% of the adults aged 18–79 years were ever smokers in Beijing. The prevalence of ever

Table 1  
Baseline characteristics of the study participants.

Items	Overall ( <i>n</i> = 20,242)	Male ( <i>n</i> = 9179)	Female ( <i>n</i> = 11,063)
Age, mean ± SD (years)	44 ± 13	44 ± 13	44 ± 13
Location, %			
Urban	64.73	65.01	64.50
Suburban	35.27	34.99	35.50
Education, %			
Low group	7.78	5.36	9.78
Middle group	56.90	62.38	52.35
High group	35.33	32.26	37.87

SD: standard deviation.

smokers for males (60.75%) was extremely higher than that of females (3.75%) (Table 2). The prevalence of current smokers was 30.18% overall, 55.53% for males, and 3.21% for females, respectively. Males aged 40–59 years had the highest prevalence of current smokers. The prevalence increased with increasing age among females. The prevalence of suburban area (57.12%) was higher than that of urban area in males (54.44%). Furthermore, there were 53.58% and 2.85% of male and female adults being daily smokers, and 21.57% and 0.71% of male and female adults being heavy smokers. The prevalence of daily and heavy smokers shared the same distribution features in age, location and education groups as current smokers for both genders.

With respect to the overall current smokers, 14.12 cigarettes were consumed per day, with 14.35 for males and 9.83 for females (Table 3). Among 18–69 years old adults, the amount of cigarettes consumed per day increased with age for both genders. In addition, for both genders, the amount of cigarettes consumed per day was higher in suburban than that in urban area and decreased with increasing education level. Furthermore, the average age at smoking initiation was 17.92, 24.97, and 18.28 years for males, females, and overall adults, respectively. Among current smokers, the average number of pack-years of cigarette smoking increased with age as expected, with overall values of 18.58 for males and 15.03 for females.

Among the ever smokers, only 8.91% has not smoked for at least 30 days prior to the survey, with a higher proportion in females (14.35%) than that in males (8.6%). The quit proportion increased with age in males, but not in females (Figs. 1 and 2). However, only 2.44% of ever smokers quitted smoking in recent two years. On the other hand, 41.92% of current smokers reported they intended to quit smoking,

Table 2  
Prevalence of tobacco smoking among adults aged 18–79 years: Beijing, 2011.

Items	Overall, % (SE, n = 20,242)			Male, % (SE, n = 9179)			Female, % (SE, n = 11,063)					
	Ever	Current	Daily	Heavy	Ever	Current	Daily	Heavy	Ever	Current	Daily	Heavy
Overall	33.13 (0.41)	30.18 (0.40)	29.00 (0.40)	11.46 (0.27)	60.75 (0.63)	55.53 (0.64)	53.58 (0.64)	21.57 (0.50)	3.75 (0.21)	3.21 (0.20)	2.85 (0.19)	0.71 (0.09)
Age, years												
18–29	29.24 (0.92)	27.80 (0.91)	26.34 (0.89)	5.82 (0.48)	54.64 (1.44)	52.05 (1.44)	49.66 (1.44)	11.17 (0.91)	2.04 (0.39)	1.85 (0.37)	1.38 (0.34)	0.10 (0.07)
30–39	33.27 (0.86)	31.10 (0.85)	29.89 (0.84)	10.67 (0.58)	60.69 (1.28)	56.79 (1.30)	54.82 (1.30)	19.93 (1.04)	2.56 (0.35)	2.33 (0.34)	1.97 (0.32)	0.30 (0.10)
40–49	38.59 (0.72)	35.30 (0.72)	33.97 (0.71)	17.59 (0.59)	69.80 (1.00)	64.05 (1.04)	61.85 (1.06)	32.75 (1.02)	3.19 (0.31)	2.69 (0.28)	2.34 (0.27)	0.38 (0.10)
50–59	38.01 (0.83)	34.11 (0.81)	33.32 (0.80)	17.57 (0.66)	70.23 (1.08)	63.05 (1.14)	61.89 (1.15)	33.43 (1.14)	5.16 (0.61)	4.61 (0.57)	4.18 (0.55)	1.40 (0.32)
60–69	30.11 (1.47)	24.17 (1.41)	23.46 (1.40)	11.89 (1.16)	55.37 (2.34)	44.36 (2.38)	42.90 (2.38)	22.17 (2.16)	6.60 (0.93)	5.37 (0.86)	5.37 (0.86)	2.33 (0.56)
70–79	24.67 (1.72)	18.26 (1.55)	17.63 (1.53)	5.66 (0.95)	39.99 (2.98)	29.26 (2.72)	28.11 (2.69)	9.40 (1.78)	10.81 (1.58)	8.29 (1.47)	8.16 (1.46)	2.27 (0.76)
Location												
Urban	32.01 (0.50)	29.33 (0.49)	28.10 (0.48)	10.13 (0.30)	59.20 (0.78)	54.44 (0.78)	52.44 (0.78)	19.32 (0.56)	3.75 (0.25)	3.24 (0.24)	2.80 (0.22)	0.59 (0.10)
Suburban	34.82 (0.71)	31.45 (0.70)	30.37 (0.69)	13.47 (0.5)	63.02 (1.07)	57.12 (1.08)	55.25 (1.08)	24.88 (0.90)	3.74 (0.39)	3.16 (0.36)	2.93 (0.35)	0.89 (0.17)
Education												
Low group	26.98 (1.34)	22.14 (1.26)	21.57 (1.25)	9.88 (0.90)	53.87 (2.58)	44.54 (2.55)	43.75 (2.54)	21.03 (2.05)	11.03 (1.14)	8.85 (1.06)	8.42 (1.05)	3.28 (0.66)
Middle group	39.81 (0.56)	36.85 (0.55)	35.59 (0.55)	14.84 (0.40)	67.15 (0.78)	62.31 (0.79)	60.43 (0.80)	25.74 (0.67)	4.41 (0.33)	3.88 (0.31)	3.42 (0.30)	0.73 (0.11)
High group	25.43 (0.66)	22.88 (0.64)	21.69 (0.63)	7.25 (0.38)	51.74 (1.13)	46.57 (1.12)	44.33 (1.11)	15.07 (0.76)	1.20 (0.20)	1.06 (0.19)	0.84 (0.16)	0.06 (0.04)

Ever: ever tobacco smokers; current: current tobacco smokers; daily: Daily tobacco smokers; heavy: Heavy tobacco smokers; SE: standard error.

especially among 18–30 years old adults (50.39% of males and 70.91% of females).

Among overall nonsmokers and former smokers, the total prevalence of passive smokers was 44.74% (Table 4). The proportion of passive smokers in males (47.03%) was higher than that in females (43.63%), while the estimated number of males (1,784,732) was much less than that of females (3,386,315). Most of the male nonsmokers reported that they were exposed to SHS at workplace (32.46%), while most of the female nonsmokers reported at home (28.92%). In addition, 57.62% of total passive smokers reported exposure to SHS more than 5 days per week, and 36.48% reported exposure to SHS every day.

### Discussion

To the best of our knowledge, this study is the latest representative survey of tobacco smoking prevalence in Beijing since 2008. The current study indicated that, among Beijing adults aged 18–79 years, 60.75% of males and 3.75% of females were ever smokers, and 55.53% of males and 3.21% of females were current smokers. A great majority of current smokers were daily smokers. Furthermore, among nonsmokers and former smokers, nearly half of them reported being exposed to SHS. Even worse, more than half of passive smokers reported being exposed to SHS for at least 5 days per week. Therefore, Beijing still critically suffered from high active and passive tobacco smoking prevalence after the implementation of serials of tobacco control rules.

Consolidated evidence from observational and experimental studies has demonstrated that tobacco smoking is the causal risk factor for many diseases, including cancer, cardiovascular diseases, and serious respiratory diseases.<sup>18–20</sup> Tobacco smoking is also one of the leading factors contributing to great disease burden in China.<sup>21</sup> Being convinced of the increasing problems caused by tobacco smoking, China has begun tobacco control efforts since the late 1980s. Beijing, the capital of China, acts as the demonstration city of tobacco control and has implemented the first tobacco control rules entitled “Rules for No Smoking in Public Places in Beijing” since 1995.<sup>9</sup> In addition, several surveys have been employed to monitor the tobacco smoking progress by Beijing Center for Disease Prevention and Control in 1996, 2002, 2005, and 2008, respectively.<sup>10,22–24</sup> The sample sizes for the above four studies were 6000 adults aged 15–79 years in 1996, 30,402 adults aged ≥15 years in 2002, 19,216 adults aged 18–92 years in 2005, and 22,261 adults

Table 3

Amount, age of smoking initiation and pack-years of tobacco smoking among adults aged 18–79 years: Beijing, 2011.

Items	Overall, mean (SE, <i>n</i> = 20,242)			Male, mean (SE, <i>n</i> = 9179)			Female, mean (SE, <i>n</i> = 11,063)		
	Amount, cigarettes/day	Age, years	Pack-years	Amount, cigarettes/day	Age, years	Pack-years	Amount, cigarettes/day	Age, years	Pack-years
Overall	14.12 (0.18)	18.28 (0.09)	18.40 (0.32)	14.35 (0.19)	17.92 (0.08)	18.58 (0.33)	9.83 (0.64)	24.97 (0.68)	15.03 (1.57)
Age, years									
18–29	10.52 (0.29)	16.63 (0.15)	6.62 (0.25)	10.68 (0.30)	16.54 (0.15)	6.74 (0.26)	5.58 (1.77)	20.38 (0.94)	2.72 (0.56)
30–39	13.00 (0.31)	17.70 (0.15)	12.89 (0.34)	13.19 (0.32)	17.55 (0.15)	13.10 (0.35)	7.84 (0.93)	22.59 (0.82)	7.16 (0.92)
40–49	16.60 (0.36)	18.17 (0.13)	23.12 (0.55)	16.90 (0.37)	17.93 (0.12)	23.62 (0.56)	8.47 (0.70)	24.85 (1.02)	9.82 (0.87)
50–59	17.25 (0.47)	19.30 (0.18)	29.41 (0.80)	17.66 (0.50)	18.68 (0.13)	30.34 (0.84)	11.50 (1.10)	28.51 (1.51)	16.47 (1.71)
60–69	17.29 (1.16)	20.83 (0.41)	36.65 (2.73)	17.80 (1.30)	20.17 (0.39)	38.19 (3.04)	13.40 (1.01)	26.16 (1.70)	24.84 (2.24)
70–79	12.05 (0.94)	22.59 (0.80)	29.63 (2.75)	12.00 (0.92)	22.07 (0.80)	28.99 (2.31)	12.23 (2.67)	24.32 (2.14)	31.67 (8.92)
Location									
Urban	13.54 (0.21)	18.34 (0.10)	17.16 (0.33)	13.82 (0.22)	18.07 (0.10)	17.47 (0.34)	8.63 (0.67)	23.38 (0.59)	11.70 (1.04)
Suburban	14.93 (0.32)	18.21 (0.14)	20.15 (0.63)	15.09 (0.33)	17.74 (0.12)	20.14 (0.64)	11.73 (1.26)	26.88 (1.27)	20.37 (3.70)
Education									
Low group	16.04 (0.94)	20.21 (0.56)	30.97 (2.23)	17.23 (1.13)	18.22 (0.44)	32.61 (2.49)	12.52 (1.55)	26.03 (1.42)	26.06 (4.83)
Middle group	14.48 (0.22)	18.04 (0.10)	19.11 (0.41)	14.72 (0.22)	17.72 (0.09)	19.45 (0.42)	9.45 (0.73)	25.53 (0.81)	12.03 (0.99)
High group	12.96 (0.35)	18.33 (0.15)	14.36 (0.47)	13.14 (0.35)	18.28 (0.16)	14.60 (0.48)	5.64 (0.89)	20.19 (0.74)	4.61 (0.77)

Amount: the amount of cigarettes consumed per day; age: the age of tobacco smoking initiation; SE: standard error.

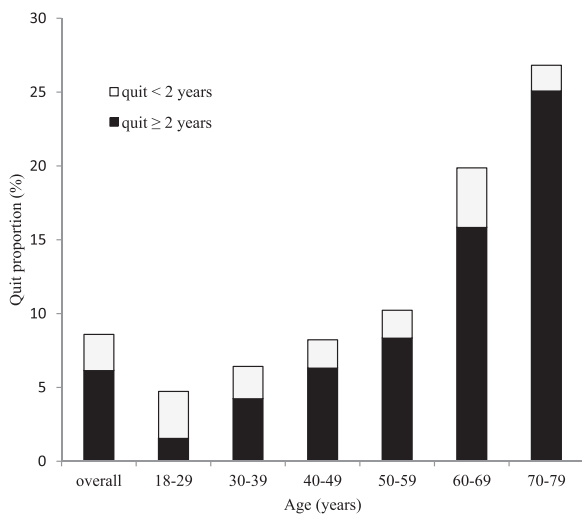


Fig. 1. The quit proportion in males. This figure shows the quit proportion in different age groups for males. The top gray part means lasting less than 2 years since quitting smoking. The bottom black part means lasting more than 2 years since quitting smoking.

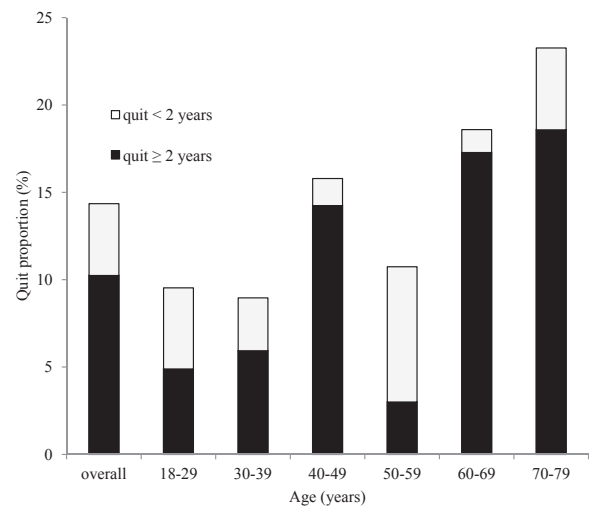


Fig. 2. The quit proportion in females. This figure shows the quit proportion in different age groups for females. The top gray part means lasting less than 2 years since quitting smoking. The bottom black part means lasting more than 2 years since quitting smoking.

aged 18–79 years in 2008, respectively. The definition of tobacco smoking used across surveys in 1996, 2002 and 2005 was the same, where current smoking was defined as having smoked for at least 6 months and keeping smoking in 30 days prior to the survey. The 2008 survey adopted the same definition as the current study. Although the different definition was used, we

could still draw the conclusion that a decline did occur on current smoking prevalence, but the prevalence was none the less exceedingly high among males (Fig. 3). Furthermore, the prevalence slightly increased from 2008 to 2011, even though several tobacco control rules came into effect during the 3 years, including updated rules based on the 1995 rules,<sup>25</sup> Notice on

Table 4  
Prevalence of passive tobacco smoking among adults aged 18–79 years: Beijing, 2011.

Items	Overall, % (SE)				
	Total	Home	Workplace	Restaurant	Recreational venues
Overalls	44.74 (0.51)	22.61 (0.42)	22.59 (0.42)	7.94 (0.28)	6.69 (0.26)
Age, years					
18–29	47.05 (1.19)	20.96 (0.95)	24.74 (1.05)	10.83 (0.71)	9.7 (0.65)
30–39	48.77 (1)	21.98 (0.83)	29.47 (0.95)	9.44 (0.57)	7.15 (0.53)
40–49	52.93 (0.83)	25.74 (0.7)	30.6 (0.78)	7.88 (0.46)	5.68 (0.38)
50–59	46.74 (1.05)	28.72 (0.97)	18.39 (0.78)	5.87 (0.46)	5.13 (0.45)
60–69	25.59 (1.46)	19.09 (1.33)	3.13 (0.55)	1.96 (0.4)	3.04 (0.55)
70–79	16.57 (1.55)	14.35 (1.47)	0.79 (0.31)	1.45 (0.5)	1.57 (0.45)
Location					
Urban	41.97 (0.61)	20.41 (0.5)	21.87 (0.51)	9.01 (0.37)	7.65 (0.35)
Suburban	49.07 (0.86)	26.04 (0.74)	23.71 (0.72)	6.29 (0.42)	5.2 (0.37)
Education					
Low	31.74 (1.57)	24.37 (1.45)	7.13 (0.82)	2.49 (0.49)	2.01 (0.4)
Middle	46.08 (0.67)	25.62 (0.58)	21.12 (0.55)	6.66 (0.36)	5.64 (0.33)
High	45.98 (0.86)	18.95 (0.67)	27.4 (0.77)	10.48 (0.5)	8.82 (0.47)
Items	Males, % (SE)				
	Total	Home	Workplace	Restaurant	Recreational venues
Overall	47.03 (0.97)	9.7 (0.61)	32.46 (0.9)	10.12 (0.61)	8.59 (0.55)
Age, years					
18–29	53.77 (2.13)	14.87 (1.47)	33.9 (2.03)	13.19 (1.48)	11.52 (1.3)
30–39	50.84 (1.99)	6.32 (0.98)	38.32 (1.91)	11.61 (1.24)	10.12 (1.21)
40–49	54.87 (1.81)	5.01 (0.76)	45.28 (1.79)	11.39 (1.13)	6.13 (0.83)
50–59	50.75 (1.92)	7.74 (1.05)	40.52 (1.87)	8.04 (1.02)	7.3 (0.95)
60–69	21.96 (2.55)	9.69 (1.97)	5.8 (1.31)	3.16 (0.91)	5.57 (1.33)
70–79	14.92 (2.54)	10.39 (2.29)	1.24 (0.63)	1.84 (0.82)	2.95 (1.01)
Location					
Urban	44.84 (1.17)	8.85 (0.73)	31.55 (1.07)	10.22 (0.76)	8.95 (0.71)
Suburban	50.46 (1.7)	11.04 (1.09)	33.89 (1.57)	9.95 (1.01)	8.04 (0.86)
Education					
Low	32.12 (3.37)	14.2 (2.84)	15.37 (2.41)	2.25 (0.89)	4.78 (1.24)
Middle	48.22 (1.34)	10.07 (0.83)	33.4 (1.21)	9.61 (0.83)	7.28 (0.7)
High	48.18 (1.57)	8.56 (0.94)	34.25 (1.49)	11.98 (1.02)	10.68 (0.96)
Items	Females, % (SE)				
	Total	Home	Workplace	Restaurant	Recreational venues
Overall	43.63 (0.59)	28.92 (0.54)	17.76 (0.47)	6.88 (0.29)	5.76 (0.27)
Age, years					
18–29	43.54 (1.42)	24.15 (1.22)	19.95 (1.19)	9.6 (0.75)	8.75 (0.73)
30–39	47.74 (1.15)	29.73 (1.07)	25.08 (1.08)	8.36 (0.59)	5.68 (0.52)
40–49	52.11 (0.91)	34.44 (0.87)	24.46 (0.79)	6.4 (0.44)	5.5 (0.41)
50–59	45.16 (1.26)	37 (1.23)	9.65 (0.72)	5.02 (0.5)	4.27 (0.51)
60–69	27.57 (1.77)	24.23 (1.72)	1.67 (0.44)	1.31 (0.36)	1.65 (0.44)
70–79	17.72 (1.94)	17.11 (1.92)	0.48 (0.29)	1.17 (0.63)	0.61 (0.31)
Location					
Urban	40.56 (0.73)	26.07 (0.64)	17.14 (0.57)	8.41 (0.4)	7.01 (0.38)
Suburban	48.4 (1)	33.36 (0.94)	18.74 (0.8)	4.5 (0.39)	3.82 (0.37)
Education					
Low	31.6 (1.76)	28.03 (1.7)	4.15 (0.68)	2.58 (0.58)	1.01 (0.3)
Middle	44.99 (0.76)	33.52 (0.73)	14.89 (0.56)	5.17 (0.35)	4.8 (0.34)
High	44.88 (1.02)	24.12 (0.88)	24 (0.89)	9.73 (0.54)	7.89 (0.51)

SHS: secondhand smoke ; Home: exposed to SHS at home; Workplace, exposed to SHS at workplace; Restaurant, exposed to SHS at restaurant; Recreational venues, exposed to SHS at recreational venues; SE: standard error.

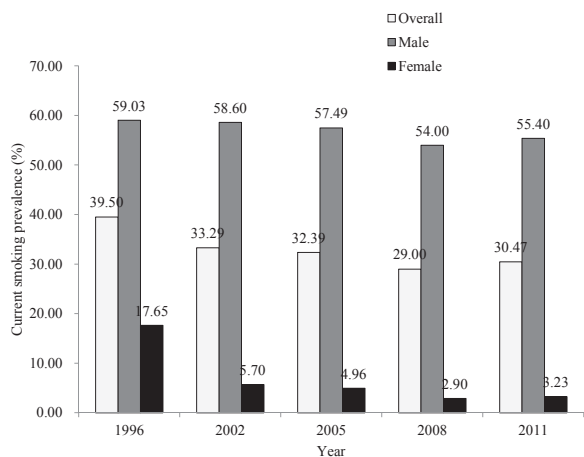


Fig. 3. Prevalence of current smokers from 1996 to 2011 in Beijing. This figure shows the prevalence of current smokers for 1996, 2002, 2005, 2008, and 2011 among Beijing general adults. The light-gray bar means total population. The dark-gray bar means males, and the black bar means females.

Domestic Packaging and Labelling of Cigarette Packaging within China,<sup>12</sup> and Notice on Adjusting Tobacco Products Excise Taxation Policies.<sup>11</sup> Even worse, the prevalence of current tobacco smoking in this study (30.47%) was higher than that in the whole China (28.63%) in 2010.<sup>6</sup> With respect to the amount of cigarettes consumed per day among current smokers, this study (14.12 cigarettes) was similar to the 2008 survey (14.7 cigarettes). The age at smoking initiation was also similar between the two surveys. Therefore, available tobacco control measures in this period, including educational programs, rules and their degree of implementation, did not reduce the tobacco consumption in Beijing effectively.<sup>26</sup>

Besides the sustained high prevalence of tobacco smoking, the quit proportion (8.91%) was not optimistic yet, which was lower than that in the 2008 survey (15.4%). In addition, most former smokers were old and quit owing to diseases. Among the former smokers, only 27.38% gave up smoking in recent two years which demonstrated the high demand for effective tobacco cessation supporting measures. On the other hand, the prevalence of attempting to quit was considerable, which is in line with the previous study,<sup>27</sup> but the lack and unavailability of smoking cessation support efforts impeded the success of quitting smoking.<sup>26,27</sup>

Same as active tobacco smoking, numerous studies have illuminated the healthy and economic hazards of exposure to SHS.<sup>28–30</sup> Beijing Municipal Government has implemented rules of smoking prohibition at

certain places to protect nonsmokers from SHS. Nevertheless, the prevalence of nonsmokers and former smokers being victims of SHS was even slightly higher than that of the 2008 survey (45.96% vs. 43.40%).<sup>10</sup> Male passive smokers mainly reported exposure to SHS at workplace, which was not included in previous tobacco control rules.<sup>25</sup> In addition, the poor implementation of the tobacco control rules and lack of awareness of SHS harm might have driven the high prevalence of passive smoking.<sup>26,27</sup> Fortunately, the strictest tobacco control law has been issued by Beijing Municipal Government on November 28th, 2014 and came into effect on June 1st, 2015, which bans tobacco smoking in all indoor public and working places in Beijing.<sup>13</sup> The law will protect more nonsmokers from exposing to SHS at public places. Females, major victims of SHS, were mainly exposed to SHS at home. A previous study found that household being completely free of tobacco was rare, and offering cigarette was common at household in China.<sup>31</sup> Therefore, effective dissemination of knowledge about SHS harm is still needed.

Some limitations of this study have to be considered when interpreting the results. First, although a standardized questionnaire was administered by well-trained research staff, the information about tobacco smoking could be biased due to the variation in understanding of survey questions among study participants. Second, awareness and knowledge of respondents may cause errors between perceived and actual exposure to SHS. Third, the data on age of smoking initiation and quitting smoking relied on self-report information, and therefore, recall bias was inevitable. Fourth, the ranges of participants' age in the five studies for comparison are not absolutely same, so it would impair the precision of comparison. However, the influence is limited due to the proportions of youngest and oldest participants are very low and age-based standardization. Despite these limitations, our study provided the scientific data on tobacco smoking based on the remarkable strengths of this study, including a large and representative sample selected by a well sampling design, a high response rate, and vigorous quality assurance throughout the study.

## Conclusions

In conclusion, the current study finds that although the tobacco smoking prevalence has decreased since 1996 in Beijing, the prevalence is still extremely high among males. In addition, the age of smoking initiation

is becoming younger, and the quit proportion stays low. Furthermore, nonsmokers, especially females, do still suffer from SHS critically. Besides the newest and strictest tobacco control law, effective smoking cessation support to help current smokers quit, and more health education programs about tobacco harm are also urgently needed. From the lessons of failure in tobacco control by previous rules, we realize that complete implementation and enforcement of tobacco control rules is the key point of achieving tobacco control.

### Conflicts of interest

We declared that we don't have any conflicts of interest.

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