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A cross-sectional survey on cigarette smoking in the Chinese high-income areas

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Title page

Complete manuscript title: A cross-sectional survey on cigarette smoking in the Chinese high-income areas

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A cross-sectional survey on cigarette smoking in the Chinese high-income areas

Abstract

Objective To evaluate the smoking status and its influencing factors in high-income areas of China.

Methods GNI data is used to determine China's high-income economic regions, and the results of the survey in *Global Adult Tobacco Survey Gats-China 2018* are used for statistical analysis.

Results A total of 4064 people were included in our study, including 881 smokers (21.68%), 2884 smokers (70.96%), 299(7.36%) smokers who used to smoke but now don't smoke. Using the standardized rate method, the standardized smoking rate in high-income areas and non-high-income areas in China was calculated to be 23.56% and 27.77% respectively. Male, high school education or below, knowledge of e-cigarette information, permission to smoke at home, and people with poor smoking health literacy are the main influencing factors of smokers in high-income areas of China.

Conclusion The smoking rate of people in China's high-income areas is lower than the overall smoking rate in China, which is related to the education, rich medical resources, and strict management system in China's high-income areas in such areas, we should strengthen the awareness and publicity of smoking harmful to health, encourage the prohibition of smoking at home, increase investment in higher education, and improve residents' smoking health literacy level. Thereby achieving the purpose of reducing the smoking rate of people and better controlling the prevalence of smoking.

Keywords Smoking; China; Shanghai; Beijing; Investigate

Article Summary

Strengths

1. This is the first study to assess the prevalence of smoking in high-income areas in China;

2.Our study measured the smoking knowledge scores of people in high-income areas in China. This is the first time to describe the distribution of smoking knowledge among people in high-income areas in China;

3.The results of our study can help developing countries to better control smoking and formulate policies.

Limitation

China has a very large population, the sample size included in our study is limited, and the results of the study may be biased.

Introduction

Smoking is the main inducement of chronic non-communicable diseases in the world, and it is also an important risk factor for cardiovascular diseases (CVD) and lung diseases[1]. In 2019, smoking, as the second largest health risk factor in the world, caused 8.71 million deaths, accounting for 15.4% of the annual deaths[2]. As a major tobacco producer and consumer in the world, China is at the center of this health crisis[3]. The results of the 2018 China Adult Tobacco Survey released by the Chinese Center for Disease Control and Prevention show that the smoking rate of people aged 15 and over in China is 26.6%, including 50.5% for men and 2.1% for women Although the overall rate is lower than the previous survey (28.1% in 2010), there are still a large number of smokers[4].

Previous studies have shown that the exposure and use of tobacco products are related to the regional income level[5]. Compared with developed countries, the smoking rate of people in developing countries is often higher, and the national economic development is one of the main influencing factors of smoking prevalence[6]. Several studies on smoking prevalence have found that low-income people have a stronger response to tobacco prices than high-income people[7-9]. Other studies found no evidence of the difference[10, 11]. In the past three decades, China's economy has developed rapidly, and the national income of some regions has reached the standard of international developed regions and has entered the ranks of high-income areas. The

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control of tobacco epidemic is a long-term process, which is highly related to the residents' education and culture, health literacy, behavior cognition, family income and mental health[12-14]. In recent decades, some cities in China have rapidly completed industrialization and modernization, and become areas with higher economic level. However, there is a certain lag in the changes of smoking intensity pattern, social and economic group composition, tobacco epidemic trend and other fields, which are different from those in developed countries[15]. In carrying out tobacco epidemic control, it must be slightly different from developed countries, but there is no research on it. Therefore, it is necessary to analyze the characteristics of smoking behavior in high-income areas of China, to provide suggestions for developing countries to improve the control of tobacco epidemic at the same time of rapid economic growth.

Methods

Research object

According to the per ca-pita GDP of China's provinces in 2018 published in the *2019 China Statistical Yearbook,* and according to the economic division standard of high-income countries by the World Bank (GNI > 12056$, the average exchange rate in 2018 is 1$≈6.6118 RMB). Since there is no specific GNI value in each region of China, only the regional GDP value, the formula is used for conversion

Regional GNI = Regional GDP/(National GDP/NationalG NI)

According to the formula, China's provinces who's regional GNI economic conditions meet the high-income regional standard are: Beijing (23125$), Tianjin (18188$), Shanghai (20338$), Jiangsu Province (17353$), Zhejiang Province (14863$), Fujian Province (13741$), Guangdong Province (13020$).

Data sources

The research data comes from *global adult tobacco survey gats-China 2018*, *gats China 2018* is a multi-stage stratified cluster sample sampling survey conducted by the Chinese center for disease control and prevention in 2018, and 19,376 people were

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selected for interview survey. According to our research needs, we selected seven provinces in this survey and included 4851 samples. After checking the data and eliminating some invalid data, 4064 people were included in the study.

Analytical index

Demographic data

All subjects were provided with gender, age, province, residence attribute (urban and rural), education level (no formal education, below primary school, below junior high school, junior high school, high school, university, postgraduate and above), annual family income, occupation (agriculture, forestry, animal husbandry, government civil servants, business administration, factory workers, teachers, health workers, and students). Demographic information of 12 items, such as health, military, unemployed, retired, etc.), number of family members, number of family members over 15 years old, workplace (indoor and outdoor), family smoking regulations (allowed, not allowed but with exceptions, never allowed, no regulations), and information about electronic cigarettes.

Patient and Public Involvement

No patient involved

Knowledge and attitudes of smoking

All subjects were asked to answer this part, 12 items were used to evaluate smoking knowledge, including statements on smoking and the relationship between smoking and the consequences of specific diseases, with 1 point for correct answer and 0 point for wrong or uncertain answer. The attitude towards smoking was evaluated through five items, including:

(1) whether to pay attention to the health warning on the cigarette case? ("yes", "no" or "uncertain");

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(2) Do you agree to print health warning pictures in cigarette packs? ("Yes", "No" or "Uncertainty");

(3) Whether to agree to increase tobacco tax and retail price of cigarettes? ("Yes", "No" or "Uncertain");

(4) If the tobacco tax is increased, whether part of the funds should be used for tobacco control? ("Yes", "No" or "Uncertain");

(5) If the tobacco tax is increased, do you think that part of the funds should be used for health insurance? ("yes", "no" or "uncertain")

statistical method

SPSS 21.0 software was used for statistical analysis, descriptive statistical method was used to describe demographic data and the proportion of different answers in different groups of questionnaires, Chi-square test was used to analyze the uni-variate of smokers and quitters, the test standard is α=0.05, and multiple Logistic regression model was established to evaluate the influence of different variables on smoking and quitting status (including is α=0.05, excluding is α=0.10), the bilateral test p<0.05 was considered to be statistically significant.

Results

Demographic data

There are 881 smokers (21.68%), 2884 never smokers (70.96%), and 299 smokers (7.36%) (Table 1).

Prevalence of smoking

According to the sampling results of China's population aged 15 and over in 2018 surveyed by *China Statistical Yearbook in 2019*, the population aged over 15 in China's high-income areas is calculated. According to the results of smoking sampling survey, the total smoking rate in the survey area is 30.75%, of which 44.52% is male and 1.62% is female (Table 2). According to the total population of China in 2018 and the officially

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announced smoking rate of the population in 2018, using the standardized rate method, it is calculated that the standardized smoking rate in China's high-income areas is 23.56%, while that in non-high-income areas is 27.77%.

Current smokers

Current tobacco activities of smokers are as follows (Table 3). According to the survey, current smokers often smoke the first cigarette 6 to 30 minutes after waking up in the morning, and like to buy packaged cigarettes, the cost of buying cigarettes every time is mostly below that of 100RMB, they often buy cigarettes in supermarkets, and basically do not use smokeless tobacco.

Smoking cessation situation

Among the current smokers, 364 people (41.32%) have tried to quit smoking, and more than half of the smokers (63.22%) are unwilling to quit smoking (Table 4). Among the people who tried to quit smoking, the main reason for quitting smoking is health (got ill or worried about self-health), and most of the people who answered the last smoking cessation situation insisted on quitting smoking for several months recent, medical investigation showed that 54.57% of people were asked about their medical treatment by doctors, and 73.60% of patients who asked about smoking were advised to quit smoking, about the warnings on cigarette packs, only a small number of people (24.08%) think it is useful, while most people think it is useless or pay no attention to it.

Knowledge and attitudes of smoking

1-12 options are knowledge questions of smoking (Table 5). There are 7 questions with the correct answer rate exceeding 50%, and the question numbers are 1, 4, 6, 8, 9, 11 and 12 respectively, many people do not know the harm of smoking or secondhand smoke to stroke, heart disease, erectile dysfunction, heart disease in adults.

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Smoking knowledge scores

The knowledge questions of smoking as knowledge judgment questions, evaluate the smoking knowledge of the survey population. The scores of "1-4" represented "smoking knowledge is poor", "5-8" demonstrated "fair", "9-12" demonstrated "good" (Table 6). The scores of 918 people (22.59%) were evaluated as poor, and 1445 people (36.48%) smoking knowledge scores were evaluated as good, and the overall distribution of smoking knowledge scores was 7.33±3.14. After examination, there are significant differences in smoking scores among smokers, never smokers and those who have given up smoking (P<0.001).

Factors Associated with Smoking

There are 12 input variables: the factors with p<0.05 in Table 1 and smoking knowledge scores are selected as input variables, and the current smoking status is taken as output variable, and a binary Logistic model is established (Table 7). Gender, education level, e-cigarette knowledge, smoking rules at home and smoking knowledge are the influencing factors of smoking rate in high-income areas of China.

Conclusion

The smoking rate in China is still higher than the world average. Our research results show that the smoking rate of residents over 15 years old in high-income areas in China is 23.56%, which is lower than the smoking rate of 26.6% of the general population in China surveyed in the same year[4]It shows that the overall tobacco epidemic situation in China's high-income areas is slightly better than China's overall level, and the progress of tobacco control in China's high-income areas is better than that in other areas of China. This shows that the government of high-income areas in China has implemented a series of tobacco control policies, such as taking hospitals, transportation, shopping malls and other public places as key monitoring areas, forcing smoke-free measures, and posting "no smoking" warnings some achievements have been made [16-18]. But, this data in China is still higher than

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the 19.2% shown in the World Health Organization's *2019 Global Tobacco Epidemic Report*[17], the number of deaths caused by smoking in the world accounted for 11% (about 6.4 million) in 2015, while China accounted for about 28% of the global smoking-related deaths[16], there is still a big gap between this and the realization of the tobacco control goal of the "Healthy China 2030" Planning Outline, especially in some low-and middle-income areas, there are still phenomena such as lax enforcement of tobacco control[20, 21], it should also be noted that China's "tobacco control" road is still very long.

Gender, education level and tobacco health literacy are the main influencing factors of smoking among residents in high-income areas of China. The multivariate Logistic regression analysis of smoking in high-income areas of China shows that gender, education level, e-cigarette knowledge, family smoking regulations and tobacco health literacy are the main influencing factors of smoking among residents over 15 years old in high-income areas of China. Male is the risk factor of smoking, which is consistent with other related research results in China[22-24], the smoking rate of male is 45.84%, that of female is 1.00%, and the smoking probability of male is 129.92 times that of female (OR=129.92), which indicates that the smoking rate of women in high-income areas in China is not high, suggesting that the key population of tobacco control is still male residents. Undergraduate/college education or above is the protective factor of smoking, the possible reason is that residents with higher education know more about health knowledge, more inclined to adopt a healthy lifestyle [25]. The survey results are consistent-cigarette awareness is a risk factor for smoking, some studies have shown that residents who have heard of e-cigarette information are more likely to try smoking out of curiosity. Domestic smoking regulations that are not allowed, not allowed, but with exceptions and no restrictions are the protective factors of smoking now, it may be because there is no explicit regulation allowing smoking at home, and family members will consider the feelings of other members, thus reducing the possibility of smoking. The higher the score of smoking health knowledge, the smaller the possibility of smoking, probably because people with certain smoking

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health literacy can recognize the harm of smoking to health, to have certain self-restraint ability to refuse smoking.

The rich resources of education and medical care in China's high-income areas make the influencing factors of smoking different from the overall situation in China. We choose the areas with the highest economic income in China, these areas have the following advantages: First, they are rich in educational resources, among the 144 key universities in China, 77 universities are located in these seven areas, and people living in these areas can receive better education, the overall education is higher, and the higher the education is, the better they can realize the harm of tobacco to human body; Second, it is rich in medical resources, according to the list of hospitals in *Fudan University in China in 2019*, 66 hospitals in the top 100 hospitals on the list are from these 7 regions, and 36 hospitals in the top 50 are in these 7 cities, there are more scientific research projects on smoking diseases led by medical institutions, and more health education such as smoking hazard propaganda is carried out among the population, public hospitals face all groups when carrying out health education, without distinguishing factors such as age, occupation and economic income; Third, it has a more complete institutional supervision mechanism, these areas are the main pilot areas for China's new systems and new regulations[17,18], the residents' behavior and constraints are more strict, and the effect of implementing the smoking ban policy will be better, these resource advantages make the main influencing factors of smoking in high-income areas of China different from the overall influencing factors of smoking in China.

Totally, in China's high-income economic regions, male, those with high school education or below, who know electronic cigarette information, are allowed to smoke at home, and those with a poor health literacy are the people with high smoking rate, and need professional smoking cessation services to help them quit smoking, therefore, these people should be listed as the key service targets for providing professional smoking cessation services in China's high-income regions. In addition, it is suggested that government departments in low-and middle-income areas can refer to the practices

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in high-income areas, such as setting up special smoking areas in some hospitals with better conditions. At the same time, in order to achieve better tobacco control effect to catch up with and surpass the global average level, the implementation of national smoke-free legislation should be promoted as soon as possible to protect people from the harm of second-hand smoke. Secondly, it can further increase the tobacco tax, make the tobacco price higher, reduce the availability, and make it more unbearable from an economic point of view, thus reducing the number of smokers. Third, we should strengthen the awareness propaganda of smoking harmful to health, encourage the prohibition of smoking at home, increase investment in higher education, improve the residents' smoking health literacy level, and achieve the goal of reducing people's smoking rate. Better control the prevalence of smoking and provide corresponding help to quit smoking. Fourthly, to reduce the allure of tobacco and prevent teenagers from smoking the first cigarette, to control the number of new smokers.

Abbreviation

GDP: Gross Domestic Product

GNI: Gross National Income

Contributions

Concept and design: Yuan Lei and Sun Jinhai designed the study. Liu Pei and Liu Lijuan controlled the quality of data and performed the statistical analysis. Yuan Lei, Zhao Zhe, Wei Zhenbang and Liu Lijuan managed and checked all the data. Sun Jinhai, Zhao Zhe and Yuan Lei contributed to the manuscript preparation, editing and review. All authors read, checked, and approved the final manuscript.

Competing interests: None declare

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Table 1 Basic information

Characteristics		Current Smoker	Never Smoker	Former Smoker	χ^2	P
Province	Beijing	33	144	14	48.55	<0.001
	Tianjin	20	50	8		
	Shanghai	109	336	44		
	Jiangsu	260	582	80		
	Zhejiang	130	582	80		
	Fujian	22	42	2		
	Guangdong	307	1003	68		
Gender	Male	859	736	279	1696.55	<0.001
	Female	22	2148	20		
Age	15~	6	63	2	181.74	<0.001
	20~	95	359	6		
	30~	95	506	15		
	40~	156	498	28		
	50~	198	504	50		
	60~	331	954	198		
Urban-Rural Indicator	Urban	636	2195	203	13.28	0.001
	Rural	245	689	96		
Education level	No Formal Schooling	28	321	17	168.44	<0.001
	Less Than Primary School Completed	99	259	42		
	Primary School Completed	116	304	40		
	Less than Secondary School Completed	45	98	22		
	Secondary School Completed	286	640	70		
	High School Completed	178	484	59		
	College/University Completed	125	719	48		
	Post Graduate Degree Completed	4	59	1		
Profession	Agriculture, Forestry, Animal Husbandry	147	378	46	159.12	<0.001
	Government Employee	33	118	5		
	Factory, Business, Service Industry Employee	296	857	65		
	Teacher	5	62	1		
	Healthcare Provider	3	56	2		
	Student	1	64	1		
	Soldier	1	2	1		

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	No job	39	278	23		
	Retired	168	649	119		
	Other	188	420	36		
Number of persons live in this household	1	164	463	56	33.42	<0.001
	2	290	927	128		
	3	178	662	46		
	4	93	395	27		
	5	87	254	25		
	6～	69	183	17		
Number of family members over 15-years old	1	172	562	59	13.02	0.223
	2	381	1253	149		
	3	165	607	44		
	4	120	355	38		
	5	33	82	7		
	6～	10	25	2		
Household income (RMB)	<10000	75	232	36	39.75	<0.001
	10000-29999	150	400	30		
	30000-49999	185	535	57		
	50000-99999	253	739	89		
	100000-199999	125	536	52		
	200000-299999	29	147	13		
	≥300000	13	63	4		
	Don't Know/Refused	51	232	18		
Work place	Indoors	516	1424	104	53.89	<0.001
	Outdoors	365	1460	195		
Smoking rules at home	Allowed	425	635	81	274.08	<0.001
	Not allowed, but exceptions	153	628	77		
	Never allowed	173	1226	95		
	No rules	130	395	46		
Approaches to hear about e-cigarettes	Yes	463	1162	142	43.41	<0.001
	No	418	1722	157		

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Table 2 Survey area smoking rates

Province	Population (Ten thousand)			Smoking rates (%)
	Female	Male	Total	Female
Beijing	952	978	1930	40.51
Tianjin	751	649	1400	48.65
Shanghai	1118	1068	2186	46.35
Jiangsu	3497	3446	6943	50.40
Zhejiang	2549	2402	4950	37.72
Fujian	1688	1593	3281	52.63
Guangdong	5069	4357	9426	40.93
Total	15625	14491	30116	44.52

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Table 3 Recent tobacco activities of current smokers

Questions	Valid Case (%)
How soon after you wake up in the morning do you usually have you first smoke?	747
Within 5 minutes	152(20.35)
6 to 30 minutes	242(32.40)
31 to 60 minutes	124(16.60)
More than 60minutes	225(30.12)
Refused	4(0.54)
The last time you bought cigarettes for yourself, did you buy loose cigarettes, packs, cartons, or something else?	839
Cigarettes	8(0.95)
Packs	458(54.59)
Cartons	353(42.07)
Never bought cigarettes/Refused	20(2.38)
How much money did you pay for the last time you purchased cigarettes? (RMB)	809
<20	274(33.87)
20-49	170(21.01)
50-99	87(10.75)
100-199	128(15.82)
200-499	120(14.83)
>500	30(3.71)
The last time you purchased cigarettes for yourself, where did you buy them?	816
Kiosks/Gas Station/Convenience Store	186(22.79)
Tobacco store/Liquor store	171(20.96)
Store/Supermarket	430(52.70)
Other	29(3.55)
Do you currently use smokeless tobacco daily, less than daily, or not at all?	881
Daily	17(1.93)
Less than daily	6(0.68)
Not at all	858(97.39)

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Table 4 Cessation Attempts and History

Question	Valid Case (%)
Have you ever tried to stop smoking?	881
Yes	364(41.32)
No	517(58.68)
Which of the following best describes your thinking about quitting smoking?	881
Quit within the next month	29(3.29)
Thinking within the next 12 months	62(7.04)
Quit someday, but not in 12 months	143(16.23)
Not interested in quitting	557(63.22)
Don't Know/Refuse/Missing	90(10.22)
What was the most important reason for you to try to stop smoking last time?	364
Got illness	109
Worried about self-health	106
Heavy economic burden	25
Family's disapproval	61
Other	63
Thinking about the last time you tried to quit, how long did you stop smoking?	123
Months	70
Weeks	26
Days	24
Less than one day 24 hours	3
During any visit to a doctor or health care provider in the past 12 months, were you asked if you smoke tobacco?	361
Yes	197
No	164
During any visit to a doctor or health care provider in the past 12 months, were you advised to quit smoking tobacco?	197
Yes	145
No	52
Have the warnings on cigarette packs made you think about quitting?	818
Yes	197
No	597
No attention	24

18

Table 5 Knowledge and attitudes of smoking

Code	Statement about smoking	Yes	No	Uncertain
1	Smoking can cause serious illness	3405	189	470
2	Smoking can cause stroke (blood clots in the brain that many causes paralysis)	1632	615	1817
3	Smoking can cause heart disease	1964	528	1572
4	Smoking can cause lung cancer	3232	142	689
5	Smoking can cause erectile dysfunction	1065	425	2573
6	Second-hand smoke can cause serious illness among non-smokers	2751	384	929
7	Second-hand smoke can cause heart disease in adults	1538	698	1828
8	Second-hand smoke can cause lung illness in children	2647	271	1146
9	Second-hand smoke can cause lung cancer in adults	2569	302	1193
10	Do you think low tar cigarettes are less harmful than regular cigarettes?	1112	819	1975
11	Do you think smoking should be allowed in hospital	31	3927	106
12	Do you think smoking should be allowed in public transportation vehicles	19	3929	116
13	Did you notice any health warnings on cigarette packages?	2275	921	868
14	Do you support printing health warning picture on cigarette packages?	2257	869	438
15	Do you support to increase the taxation of cigarettes increase retail price of cigarettes?	1750	1233	1081
16	If there was an increase in the tax on cigarettes, do you think part of the money should be spent on tobacco control?	2854	426	784
17	If the was an increase in the tax on cigarettes, do you think part of the money should be spent on paying some of the costs of health insurance	3296	245	523

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Table 6 Distribution of smoking knowledge scores

Scores	Current Smoker	Never Smoker	Former Smoker	Total	χ^2	P
1-4	271	585	62	918	49.68	<0.001
5-8	319	1065	117	1501		
9-12	291	1234	120	1645		

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Table 7 Factors Associated with Smoking

Independent variables	P	OR	CI
Gender			
Female		1.00	
Male	<0.001	129.92	59.69-282.75
Education			
No Formal Schooling		1.00	
Less Than Primary School Completed	0.556	0.68	0.19-2.45
Primary School Completed	0.231	0.47	0.13-1.63
Less than Secondary School Completed	0.257	0.46	0.12-1.76
Secondary School Completed	0.105	0.37	0.11-1.23
High School Completed	0.059	0.30	0.09-1.05
College/University Completed	0.002	0.14	0.04-0.51
Post Graduate Degree Completed	0.001	0.06	0.01-0.33
Know e-cigarettes			
NO		1.00	
YES	<0.001	2.01	1.48-2.73
Smoking rules at home			
Allowed		1.00	
Not allowed, but exceptions	<0.001	0.48	0.33-0.69
Never allowed	<0.001	0.24	0.17-0.35
No rules	0.002	0.52	0.34-0.78
Knowledge of smoking			
1-4		1.00	
5-8	0.001	0.49	0.33-0.73
9-12	0.003	0.53	0.35-0.81

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Table 1 Basic information

Characteristics		Current Smoker	Never Smoker	Former Smoker	χ^2	P
Province	Beijing	33	144	14	48.55	<0.001
	Tianjin	20	50	8		
	Shanghai	109	336	44		
	Jiangsu	260	582	80		
	Zhejiang	130	582	80		
	Fujian	22	42	2		
	Guangdong	307	1003	68		
Gender	Male	859	736	279	1696.55	<0.001
	Female	22	2148	20		
Age	15~	6	63	2	181.74	<0.001
	20~	95	359	6		
	30~	95	506	15		
	40~	156	498	28		
	50~	198	504	50		
	60~	331	954	198		
Urban-Rural Indicator	Urban	636	2195	203	13.28	0.001
	Rural	245	689	96		
Education level	No Formal Schooling	28	321	17	168.44	<0.001
	Less Than Primary School Completed	99	259	42		
	Primary School Completed	116	304	40		
	Less than Secondary School Completed	45	98	22		
	Secondary School Completed	286	640	70		
	High School Completed	178	484	59		
	College/University Completed	125	719	48		
	Post Graduate Degree Completed	4	59	1		
Profession	Agriculture, Forestry, Animal Husbandry	147	378	46	159.12	<0.001
	Government Employee	33	118	5		
	Factory, Business, Service Industry Employee	296	857	65		
	Teacher	5	62	1		
	Healthcare Provider	3	56	2		
	Student	1	64	1		
	Soldier	1	2	1		

	No job	39	278	23		
	Retired	168	649	119		
	Other	188	420	36		
Number of persons live in this household	1	164	463	56	33.42	<0.001
	2	290	927	128		
	3	178	662	46		
	4	93	395	27		
	5	87	254	25		
	6~	69	183	17		
Number of family members over 15-years old	1	172	562	59	13.02	0.223
	2	381	1253	149		
	3	165	607	44		
	4	120	355	38		
	5	33	82	7		
	6~	10	25	2		
Household income (RMB)	<10000	75	232	36	39.75	<0.001
	10000-29999	150	400	30		
	30000-49999	185	535	57		
	50000-99999	253	739	89		
	100000-199999	125	536	52		
	200000-299999	29	147	13		
	≥300000	13	63	4		
	Don't Know/Refused	51	232	18		
Work place	Indoors	516	1424	104	53.89	<0.001
	Outdoors	365	1460	195		
Smoking rules at home	Allowed	425	635	81	274.08	<0.001
	Not allowed, but exceptions	153	628	77		
	Never allowed	173	1226	95		
	No rules	130	395	46		
Approaches to hear about e-cigarettes	Yes	463	1162	142	43.41	<0.001
	No	418	1722	157		

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Table 2 Survey area smoking rates

Province	Population (Ten thousand)			Smoking rates (%)		
	Female	Male	Total	Female	Male	Total
Beijing	952	978	1930	40.51	0.89	17.28
Tianjin	751	649	1400	48.65	4.88	25.64
Shanghai	1118	1068	2186	46.35	0.39	22.29
Jiangsu	3497	3446	6943	50.40	1.40	24.30
Zhejiang	2549	2402	4950	37.72	0.22	16.41
Fujian	1688	1593	3281	52.63	7.14	33.33
Guangdong	5069	4357	9426	40.93	0.51	47.60
Total	15625	14491	30116	44.52	1.62	30.75

Table 3 Recent tobacco activities of current smokers

Questions	Valid Case (%)
How soon after you wake up in the morning do you usually have you first smoke?	747
Within 5 minutes	152(20.35)
6 to 30 minutes	242(32.40)
31 to 60 minutes	124(16.60)
More than 60minutes	225(30.12)
Refused	4(0.54)
The last time you bought cigarettes for yourself, did you buy loose cigarettes, packs, cartons, or something else?	839
Cigarettes	8(0.95)
Packs	458(54.59)
Cartons	353(42.07)
Never bought cigarettes/Refused	20(2.38)
How much money did you pay for the last time you purchased cigarettes? (RMB)	809
<20	274(33.87)
20-49	170(21.01)
50-99	87(10.75)
100-199	128(15.82)
200-499	120(14.83)
>500	30(3.71)
The last time you purchased cigarettes for yourself, where did you buy them?	816
Kiosks/Gas Station/Convenience Store	186(22.79)
Tobacco store/Liquor store	171(20.96)
Store/Supermarket	430(52.70)
Other	29(3.55)
Do you currently use smokeless tobacco daily, less than daily, or not at all?	881
Daily	17(1.93)
Less than daily	6(0.68)
Not at all	858(97.39)

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Table 4 Cessation Attempts and History

Question	Valid Case (%)
Have you ever tried to stop smoking?	881
Yes	364(41.32)
No	517(58.68)
Which of the following best describes your thinking about quitting smoking?	881
Quit within the next month	29(3.29)
Thinking within the next 12 months	62(7.04)
Quit someday, but not in 12 months	143(16.23)
Not interested in quitting	557(63.22)
Don't Know/Refuse/Missing	90(10.22)
What was the most important reason for you to try to stop smoking last time?	364
Got illness	109
Worried about self-health	106
Heavy economic burden	25
Family's disapproval	61
Other	63
Thinking about the last time you tried to quit, how long did you stop smoking?	123
Months	70
Weeks	26
Days	24
Less than one day 24 hours	3
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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2,3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	Not applicable
Study size	10	Explain how the study size was arrived at	4,5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	Not applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Table1,6,7
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	6,7
Outcome data	15*	Report numbers of outcome events or summary measures	6,7
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 1
		(*b*) Report category boundaries when continuous variables were categorized	5
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Table 6
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Table 2
Discussion			
Key results	18	Summarise key results with reference to study objectives	6-10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8,9,10
Generalisability	21	Discuss the generalisability (external validity) of the study results	9,10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

A cross-sectional survey on cigarette smoking in Chinese high-income areas

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Keywords:	PUBLIC HEALTH, PREVENTIVE MEDICINE, Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Title page

Complete manuscript title: A cross-sectional survey on cigarette smoking in Chinese high-income areas

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1

Abstract

   Objective: To evaluate smoking status and its influencing factors in high-income areas of China.

   Design: Cross-sectional.

   Setting: High-income areas in China.

   Participants: 4064 persons 15 years of age or older, from the survey results of in *Global Adult Tobacco Survey-China 2018.*

   Methods Gross national income data were used to determine China's high-income economic regions, and the results of the survey in *Global Adult Tobacco Survey -China 2018* were used for statistical analysis.

   Results A total of 4064 people were included in our study, including 881 current smokers, 2884 who had never smoked, and 299 who had quit smoking. Using the standardized rate method, the standardized smoking rates in high-income and non-high-income areas in China were calculated to be 23.56% and 27.77%, respectively. Men, high school education or below, knowledge of e-cigarette information, permission to smoke at home, and people with poor smoking health literacy are the main influencing factors of smokers in high-income areas of China.

   Conclusion: The smoking rate of people in China's high-income areas is lower than the overall smoking rate in China, and we should increase the public awareness that smoking is harmful to health, encourage the prohibition of smoking at home, increase investment in higher education, and improve residents' smoking health literacy level., The purpose of this study was to encourage reduction in the rate of smoking and better control the prevalence of smoking.

   Keywords Smoking; China; Investigate; High income area; Smoking knowledge

Article Summary

Strengths and limitations of this study

1. This study is the first nationwide study to analyze the prevalence of smoking in all high-income areas in China;

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2. The research data comes from the public data surveyed by the National Center for Disease Control and Prevention, which is highly representative;

3. Due to the limited sample size, there may be some deviations between the research results and the actual results;

4. Smoking prevalence is based on self-reporting by the participants and may be affected by recall bias.

Introduction

Smoking is the main cause of chronic non-communicable diseases worldwide, and it is also an important risk factor for cardiovascular diseases and lung diseases.[1] In 2019, as the second largest health risk factor in the world, smoking caused 8.71 million deaths, accounting for 15.4% of the annual deaths.[2] As a major tobacco producer and consumer in the world, China is at the center of this health crisis.[3] The results of the 2018 Chinese Adult Tobacco Survey released by the Chinese Center for Disease Control and Prevention (CCDC) show that the smoking rate of people aged 15 and over in China is 26.6%, including 50.5% for men and 2.1% for women.[4] Although the overall rate is lower than in the previous survey (28.1% in 2010), the number of people who smoke is still high compared with the global smoking rate of 19.2%.[4-5]

Previous studies have shown that exposure and use of tobacco products are related to regional income levels.[6] Compared with developed countries, the smoking rate of people in developing countries is often higher, and national economic development is one of the main factors influencing smoking prevalence.[7] Several studies on smoking prevalence have found that people with low-income have a stronger response to tobacco prices than people with high-income.[8-10] Other studies found no evidence of this difference.[11-12] In the past three decades, China's economy has developed rapidly, and the national income of some regions has reached the standard of developed regions worldwide and has entered the ranks of high-income areas. Control of the tobacco epidemic is a long-term process, which is strongly related to the residents' education, culture, health literacy, behavior, cognition, family income, and mental health.[13-14]

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In recent decades, some cities in China have seen rapid growth in industrialization and modernization and have become areas of higher economic levels. However, there is a lag in changes related to smoking intensity pattern, social and economic group composition, the tobacco epidemic trend, and other factors that are different from those in developed countries.[15] The process of controlling the tobacco epidemic needs to be different from that used in developed countries; however, there are no studies on this yet. Therefore, it is necessary to analyze the characteristics of smoking behavior in high-income areas of China to provide suggestions for developing countries to improve the control of the tobacco epidemic while undergoing rapid economic growth.

Methods

Definition and selection of high-income regions in China

According to the per capita gross domestic product (GDP) of China's provinces in 2018 published in the *2019 China Statistical Yearbook,* and according to the economic division standard of high-income countries by the World Bank (gross national income [GNI] > 12055$, on average 1$ equaled 6.6118 RMB in 2018).[16] Since only the GDP, and not the GNI value is mentioned for each region of China, the regional GDP value is used to calculate the regional GNI value. The formula used for conversion is:

$$\text{Regional GNI} = \text{Regional GDP}/(\frac{\text{National GDP}}{\text{National GNI}})$$

According to the formula, the provinces with regional GNI that meet high-income regional standards are: Beijing (23,125$), Tianjin (18,188$), Shanghai (20,338$), Jiangsu (17,353$), Zhejiang (14,863$), Fujian (13,741$), and Guangdong (13,020$).

Data sources

The research data comes from the Global Adult Tobacco Survey (GATS)-China 2018, which was a multi-stage stratified cluster sample sampling survey conducted by the CCDC in 2018, and 19,376 people were selected for interview survey［17］. The detailed design report is available

here:(https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/Publications.aspx

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Accessed 5 Jan 2022). The inclusion criteria included, living in China's high-income provinces and age above 15. The data of 4851 respondents belonged to high-income areas. The exclusion criteria included, no response to any item in the survey and/or no response to smoking knowledge and/or no response to smoking attitude. A total of 4064 respondents were selected for this study.

Smoking classification

This study divided participants into three categories: 881 current smokers (smokers at the time of the survey), 2884 people whose had smoked (never-smokers), and 299 people who had quit smoking (quit-smokers).

Analytical index

Demographic data

All participants provided the following demographic data: sex, age, province, residence attributes (urban and rural), education level (no formal education, below primary school, below junior high school, junior high school, high school, university, postgraduate, and above), annual family income, occupation (agriculture, forestry, animal husbandry, government civil servants, business administration, factory workers, teachers, health workers, students, solider, no job, retired, and other employment statuses), number of family members, number of family members 15 years and older, workplace (indoor and outdoor), family smoking regulations (allowed, generally not allowed but with exceptions, never allowed, no regulations), and knowledge about electronic cigarettes.

Smoking cessation

The smoking cessation of current 881 smokers was investigated through seven questions, including:

(1) Have you ever tried to stop smoking? ("Yes" or "No").

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(2) Which of the following best describes your thinking about quitting smoking? ("Quit within the next month", "Thinking within the next 12 months", "Quit someday, but not in 12 months", "Not interested in quitting", "Don't Know", or "Refuse/Missing").

(3) What was the most important reason for you to try to stop smoking last time? ("Got illness", "Worried about self-health", "Heavy economic burden", "Family's disapproval" or "Other").

(4) Thinking about the last time you tried to quit, how long did you stop smoking? ("Months", " Weeks", " Days" or "Less than one day 24 hours").

(5) During any visit to a doctor or health care provider in the past 12 months, were you asked if you smoke tobacco? ("Yes" or "No").

(6) During any visit to a doctor or health care provider in the past 12 months, were you advised to quit smoking tobacco? ("Yes" or "No").

(7) Have the warnings on cigarette packs made you think about quitting? ("Yes", "No" or "No attention paid").

Knowledge of smoking

All participants were provided 12 item this questionnaire: to evaluate smoking knowledge, including statements on smoking and the relationship between smoking and the consequences such as specific diseases. The specific questions have been shown in supplementary (Supplementary materials, Table1). Each question was scored 1 point for correct answers and 0 points for incorrect answers. The score was calculated according to the Reference 18.[18]

Questions for knowledge judgment evaluated the knowledge of smoking in the survey population. The scores of 1–4 indicated "poor smoking knowledge", 5–8 indicated "fair", and 9–12 demonstrated "good".

Attitude towards smoking

The attitude towards smoking was evaluated through five questions, including:

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(1) Do you pay attention to health warnings on the cigarette case? ("Yes", "No" or "Uncertain").

(2) Do you agree with having health warning pictures printed on cigarette packs? ("Yes", "No" or "Uncertain").

(3) Do you agree with increasing the tobacco tax and retail price of cigarettes? ("Yes", "No" or "Uncertain").

(4) If the tobacco tax increases, should part of the funds be used for tobacco control? ("Yes", "No" or "Uncertain").

(5) If the tobacco tax is increased, do you think that part of the funds should be used for health insurance? ("Yes", "No" or "Uncertain").

Statistical method

The SPSS Statistics version 21.0 (Armonk, NY, IBM Corp.) software was used for statistical analysis. Descriptive statistical method was used to describe demographic data and the proportion of answers that varied in the questionnaires, amongst different groups; We used the standardized rate method to calculate smoking prevalence in high-income areas based on population adjustments; Chi-square test was used to analyze the uni-variate analyses of smokers and quit-smokers, the test standard was $\alpha=0.05$.

We selected current smokers and never-smokers as evaluation variables using stepwise regression analysis established to evaluate the influence of different variables on smoking and quitting status (including $\alpha=0.05$, excluding $\alpha=0.10$), the bilateral test ($p<0.05$) was considered statistically significant.

Patient and Public Involvement

No participants were involved in deciding the research question, study design, outcome measures, or interpretation of results. This study uses data provided through a survey by the participants, and were securely accessed and stored. There are no plans to disseminate the results of the research to the study participants. No permission was required for accessing and using this data.

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Results

Demographic data

The demographic data of the survey respondents are shown in Table 1. The results of the study were based on 881 smokers, 2884 never-smokers, and 299 quit-smokers.

The population aged 15 years and over in China's high-income areas was calculated according to the sampling results of China's population in 2018 surveyed by *the China Statistical Yearbook in 2019*. According to the results of the smoking sampling survey, the total smoking rate in the survey area was 30.75%, of which 44.52% were men and 1.62% were women (Supplementary materials, Table2). Using the standardized rate method and based on the total population of China and officially announced smoking rate in 2018, the standardized smoking rate in high-income areas was 23.56%, while that in non-high-income areas was 27.77%.

Current smokers

The current tobacco usage activities of smokers are shown in Table 2. According to the survey, current smokers often smoked their first cigarette 6 to 30 minutes after waking up in the morning and like to buy packaged cigarettes The cost of buying cigarettes every time was mostly below 100RMB, they often bought cigarettes in supermarkets, and did not use smokeless tobacco.

Smoking cessation

Among the current smokers, 364 people (41.32%) had tried to quit smoking, and more than half of the smokers (63.22%) were unwilling to quit smoking (Table 3). Among the people who tried to quit smoking, the main reason for quitting was health (either they got ill or worried about their health). Most of the people who answered the last smoking cessation situation persisted on quitting smoking for several months. The data was got by the Question D02A in the GATS. The investigation which was carried out by the Questions B16 and B17 in the GATS showed that 54.57% of people were asked about their treatment by doctors and 73.60% of patients who had asked about

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smoking had been advised to quit (D02A, B16 and B17 in Supplementary materials, Table3). Only a small number of people (24.08%) thought that the warnings on the cigarette packs were useful, while most thought they were useless or paid no attention to them.

Knowledge of and attitude on smoking

Questions 1 to 12 are based on knowledge of smoking (Table 4). There are 7 questions with the correct answer rate exceeding 50%. Many people do not have the knowledge of the harm caused by smoking or by secondhand smoke in relation to stroke, heart disease, erectile dysfunction, and heart disease in adults.

Smoking knowledge scores

The scores based on knowledge of smoking for 918 people (22.59%) were evaluated as poor and for 1445 people (36.48%) as good (Table 5). After analysis, there were significant differences in smoking scores among current-smokers, never-smokers, and quit-smokers (*P*<0.001).

Factors Associated with Smoking

There are 12 input variables: the factors with *P*<0.05, as shown in Table 1 and smoking knowledge scores were selected as input variables, the current smoking status was taken as the output variable and a binary logistic model was established (Table 6). The results of stepwise regression analysis show that 5 variables are the influencing factors of smoking in high-income areas: sex, education level, e-cigarette knowledge, smoking rules at home, and smoking knowledge.

Discussion

This study is the first to examine the prevalence of smoking among people in high-income areas in China. It evaluates smoking knowledge and attitudes towards smoking, and analyzes the main influencing factors of smoking among people in

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high-income areas. The regional formulation of tobacco control policies provides good theoretical support.

However, the smoking rate in China is still higher than the global average. Our results of our analysis show that the smoking rate of residents 15 years and older in high-income areas in China is 23.56%, which is lower than the smoking rate of 26.6% of the general population in China surveyed in the same year.[4] Studies have shown that the government in high-income areas of China, has implemented a series of tobacco control policies, such as taking hospitals, transportation, shopping malls and other public places as key monitoring areas, forcing smoke-free measures, and posting "no smoking" warning signs, all of which have led to some success.[19-23]

The current characteristics of smokers in high-income areas in China are that they buy cigarettes for no more than 100 RMB each time, they like to buy packaged cigarettes, and they often smoke within 6-30 minutes after waking up in the morning; more than 40% of smokers have tried to quit smoking, and the main reason for quitting is worry about their health. Therefore, there are strong recommendations for smokers. First, through family education, our research shows that family regulations can reduce the likelihood of smoking; the second is to print health warning slogans on cigarette packs. Our research finds that people who quit smoking pay more attention to their own health, but the warnings on cigarette packs are often ignored. Therefore, we recommend that smokers pay attention to the harmful effects of tobacco use. Third, is that doctors can strengthen the smoking related education in patients. We found that only 54.57% of Chinese patients were asked about smoking history when they treatment by doctors, 73.60% of patients were advised to quit smoking, and some patients failed to get a doctor's advice to quit smoking.

Sex, education level, and tobacco health literacy are the main factors influencing smoking among residents in high-income areas of China. The multivariate logistic regression analysis of smoking in high-income areas of China showed that sex, education level, e-cigarette knowledge, family smoking regulations, and tobacco health literacy are the main influencing factors of smoking among residents over 15 years old

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in high-income areas of China. Being a man is a risk factor for smoking, which is consistent with other related research results in China.[24-26] The smoking rate of men is 45.84%, that of women is 1.00%, and the smoking probability of men is 129.92 times that of women (OR=129.92), which indicates that the smoking rate of women in high-income areas in China is not high, suggesting that the key population of tobacco control is still men.

Undergraduate/college education or above is a protective factor for smoking; a possible reason for this is that residents with higher education have more knowledge about health and are inclined to adopt to a healthy lifestyle.[27] The survey results show that consistent cigarette publicity is a risk factor for smoking, and some studies have shown that residents who have heard of e-cigarettes are more likely to try smoking out of curiosity. Regulations disallowing smoking, but with exceptions or no restrictions at home, are currently the protective factors of smoking, which may be because there are no explicit regulations about smoking at home, and family members will consider the feelings of other members, thus reducing the possibility of smoking. The higher the score of smoking health knowledge, lower the possibility of smoking, probably because people with certain smoking health literacy can recognize the harm caused, try to have some self-restraint to refuse smoking.

Given the need, this study provides strong policy recommendations. In China's high-income economic regions, men with high school education or below, who know about electronic cigarettes, are allowed to smoke at home People with poor health literacy are those with a high smoking rate, and need professional smoking cessation advice to help them quit smoking and should be listed as key targets to provide professional smoking cessation help in China's high-income regions.

In addition, it is suggested that government departments in low-and middle-income areas refer to the practices in high-income areas, such as setting up special smoking areas in some hospitals resulting in better conditions. At the same time, in order to achieve better tobacco control be comparable with the global average level, the implementation of national smoke-free legislation should be promoted as soon as

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possible to protect people from the harm of second-hand smoke. Second, increasing the tobacco tax, making tobacco more expensive, reducing its availability, and make it less economically viable could reduce the number of smokers. Third, we should increase the awareness of the harm smoking causes to health, encourage the prohibition of smoking at home, increase investment in higher education, improve the residents' smoking health literacy level, and achieve the goal of reducing people's smoking rate. Better control of the prevalence of smoking and providing corresponding help to quit smoking is required. Fourth, reduce the allure of tobacco use and prevent teenagers from smoking their first cigarette, to control the number of new smokers.

Limitations

This study some limitations. First, China has a large population, the sample size of our study was relatively small and did not cover the entire population. Second, there are many influencing factors of smoking, and we only measured some of them. Despite the limitations of the study, our research results are helpful for the classification and formulation of China's tobacco control policies. In the follow-up, we will continue to increase the number of relevant studies to improve our existing shortcomings.

Conclusion

This study reveals the prevalence and main factors of smoking in high-income areas in China. The prevalence of smoking in high-income areas in China is lower than that in China as a whole, sex, education level, and tobacco health literacy are the main factors influencing smoking among residents in high-income areas of China. Our research results can provide a good reference for China to formulate tobacco control policies in high-income areas.

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Author Contributions

Concept and design: Yuan Lei and Sun Jinhai designed the study. Liu Pei and Liu Lijuan controlled the quality of the data and performed statistical analysis. Yuan Lei, Zhao Zhe, Wei Zhen bang, and Liu Lijuan managed and checked all the data. Sun Jinhai, Zhao Zhe, and Yuan Lei contributed to manuscript preparation, editing, and review. All authors read, checked, and approved the final manuscript.

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Data availability statement: All the data we used have been publicly released on the GATS website: http://ghdx.healthdata.org/record/china-global-adult-tobacco-survey-2018 (accessed on January 5, 2022).

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Table 1 Basic information

Characteristics		Current Smoker	Never Smoker	Former Smoker	χ^2	P
Province	Beijing	33	144	14	48.55	<0.001
	Tianjin	20	50	8		
	Shanghai	109	336	44		
	Jiangsu	260	582	80		
	Zhejiang	130	582	80		
	Fujian	22	42	2		
	Guangdong	307	1003	68		
Gender	Male	859	736	279	1696.55	<0.001
	Female	22	2148	20		
Age	15~	6	63	2	181.74	<0.001
	20~	95	359	6		
	30~	95	506	15		
	40~	156	498	28		
	50~	198	504	50		
	60~	331	954	198		
Urban-Rural Indicator	Urban	636	2195	203	13.28	0.001
	Rural	245	689	96		
Education level	No Formal Schooling	28	321	17	168.44	<0.001
	Less Than Primary School Completed	99	259	42		
	Primary School Completed	116	304	40		
	Less than Secondary School Completed	45	98	22		
	Secondary School Completed	286	640	70		
	High School Completed	178	484	59		
	College/University Completed	125	719	48		
	Post Graduate Degree Completed	4	59	1		
Profession	Agriculture, Forestry, Animal Husbandry	147	378	46	159.12	<0.001
	Government Employee	33	118	5		
	Factory, Business, Service Industry Employee	296	857	65		
	Teacher	5	62	1		
	Healthcare Provider	3	56	2		
	Student	1	64	1		

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		1	2	1		
	Soldier	1	2	1		
	No job	39	278	23		
	Retired	168	649	119		
	Other	188	420	36		
Number of persons live in this household	1	164	463	56	33.42	<0.001
	2	290	927	128		
	3	178	662	46		
	4	93	395	27		
	5	87	254	25		
	6~	69	183	17		
Number of family members over 15-years old	1	172	562	59	13.02	0.223
	2	381	1253	149		
	3	165	607	44		
	4	120	355	38		
	5	33	82	7		
	6~	10	25	2		
Household income (RMB)	<10000	75	232	36	39.75	<0.001
	10000-29999	150	400	30		
	30000-49999	185	535	57		
	50000-99999	253	739	89		
	100000-199999	125	536	52		
	200000-299999	29	147	13		
	≥300000	13	63	4		
	Don't Know/Refused	51	232	18		
Work place	Indoors	516	1424	104	53.89	<0.001
	Outdoors	365	1460	195		
Smoking rules at home	Allowed	425	635	81	274.08	<0.001
	Not allowed, but exceptions	153	628	77		
	Never allowed	173	1226	95		
	No rules	130	395	46		
Approaches to hear about e-cigarettes	Yes	463	1162	142	43.41	<0.001
	No	418	1722	157		

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Table 2 Recent tobacco activities of current smokers

Questions	Valid Case (%)
How soon after you wake up in the morning do you usually have you first smoke?	747
Within 5 minutes	152(20.35)
6 to 30 minutes	242(32.40)
31 to 60 minutes	124(16.60)
More than 60minutes	225(30.12)
Refused to reply	4(0.54)
The last time you bought cigarettes for yourself, did you buy loose cigarettes, packs, cartons, or something else?	839
Cigarettes	8(0.95)
Packs	458(54.59)
Cartons	353(42.07)
Never bought cigarettes/Refused	20(2.38)
How much money did you pay for the last time you purchased cigarettes? (RMB)	809
<20	274(33.87)
20-49	170(21.01)
50-99	87(10.75)
100-199	128(15.82)
200-499	120(14.83)
>500	30(3.71)
The last time you purchased cigarettes for yourself, where did you buy them?	816
Kiosks/Gas Station/Convenience Store	186(22.79)
Tobacco store/Liquor store	171(20.96)
Store/Supermarket	430(52.70)
Other	29(3.55)

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Do you currently use smokeless tobacco daily, less than daily, or not at all?	881
Daily	17(1.93)
Less than daily	6(0.68)
Not at all	858(97.39)

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Table 3 Cessation Attempts and History

Question	Valid Case (%)
Have you ever tried to stop smoking?	881
Yes	364(41.32)
No	517(58.68)
Which of the following best describes your thinking about quitting smoking?	881
Quit within the next month	29(3.29)
Thinking within the next 12 months	62(7.04)
Quit someday, but not in 12 months	143(16.23)
Not interested in quitting	557(63.22)
Don't Know/Refuse/Missing	90(10.22)
What was the most important reason for you to try to stop smoking last time?	364
Got illness	109(29.95)
Worried about self-health	106(29.12)
Heavy economic burden	25(6.87)
Family's disapproval	61(16.76)
Other	63(17.31)
Thinking about the last time you tried to quit, how long did you stop smoking?	123
Months	70(56.91)
Weeks	26(21.14)
Days	24(19.51)
Less than one day 24 hours	3(2.44)
During any visit to a doctor or health care provider in the past 12 months, were you asked if you smoke tobacco?	361
Yes	197(54.57)
No	164(45.43)

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During any visit to a doctor or health care provider in the past 12 months, were you advised to quit smoking tobacco?	197
Yes	145(73.60)
No	52(26.40)
Have the warnings on cigarette packs made you think about quitting?	818
Yes	197(24.08)
No	597(72.98)
No attention paid	24(2.93)

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Table 4 Knowledge and attitude on smoking

Code	Statement about smoking	Yes	No	Uncertain
1	Smoking can cause serious illness	3405(83.78)	189(4.65)	470(11.56)
2	Smoking can cause stroke (blood clots in the brain that many causes paralysis)	1632(40.16)	615(15.13)	1817(44.71)
3	Smoking can cause heart disease	1964(48.33)	528(12.99)	1572(38.68)
4	Smoking can cause lung cancer	3232(79.53)	142(3.49)	670(16.49)
5	Smoking can cause erectile dysfunction	1065(26.21)	425(10.46)	2574(63.34)
6	Second-hand smoke can cause serious illness among non-smokers	2751(67.69)	384(9.45)	929(22.86)
7	Second-hand smoke can cause heart disease in adults	1538(37.84)	698(17.18)	1828(44.98)
8	Second-hand smoke can cause lung illness in children	2647(65.13)	271(6.67)	1146(28.20)
9	Second-hand smoke can cause lung cancer in adults	2569(63.21)	302(7.43)	1193(29.36)
10	Do you think low tar cigarettes are less harmful than regular cigarettes?	1270(31.25)	819(20.15)	1975(48.60)
11	Do you think smoking should be allowed in hospital	31(0.76)	3927(96.63)	106(2.61)
12	Do you think smoking should be allowed in public transportation vehicles	19(0.47)	3929(96.68)	116(2.85)
13	Did you notice any health warnings on cigarette packages?	2275(55.98)	921(22.66)	868(21.36)
14	Do you support printing health warning picture on cigarette packages?	2757(67.84)	869(21.38)	438(10.78)
15	Do you support the increase of taxation on cigarettes to increase their retail price?	1750(43.06)	1233(30.34)	1081(26.60)

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16	If there was an increase in the tax on cigarettes, do you think part of the money should be spent on tobacco control?	2854(70.23)	426(10.48)	784(19.29)
17	If the was an increase in the tax on cigarettes, do you think part of the money should be spent on paying some of the costs of health insurance?	3296(81.10)	245(6.03)	523(12.87)

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Table 5 Distribution of smoking knowledge scores

Scores	Current Smoker	Never Smoker	Former Smoker	Total	χ^2	P
1-4	271	585	62	918	49.68	<0.001
5-8	319	1065	117	1501		
9-12	291	1234	120	1645		

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Table 6 Factors Associated with Smoking

Independent variables	P	OR	CI
Sex			
Women		1.00	
Men	<0.001	129.92	59.69-282.75
Education			
No Formal Schooling		1.00	
Less Than Primary School Completed	0.556	0.68	0.19-2.45
Primary School Completed	0.231	0.47	0.13-1.63
Less than Secondary School Completed	0.257	0.46	0.12-1.76
Secondary School Completed	0.105	0.37	0.11-1.23
High School Completed	0.059	0.30	0.09-1.05
College/University Completed	0.002	0.14	0.04-0.51
Post Graduate Degree Completed	0.001	0.06	0.01-0.33
Know e-cigarettes			
No		1.00	
Yes	<0.001	2.01	1.48-2.73
Smoking rules at home			
Allowed		1.00	
Not allowed, but exceptions	<0.001	0.48	0.33-0.69
Never allowed	<0.001	0.24	0.17-0.35
No rules	0.002	0.52	0.34-0.78
Knowledge of smoking			
1-4		1.00	
5-8	0.001	0.49	0.33-0.73
9-12	0.003	0.53	0.35-0.81

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Table 1 Question of smoking

Code	Statement about smoking
1	Smoking can cause serious illness
2	Smoking can cause stroke (blood clots in the brain that many causes paralysis)
3	Smoking can cause heart disease
4	Smoking can cause lung cancer
5	Smoking can cause erectile dysfunction
6	Second-hand smoke can cause serious illness among non-smokers
7	Second-hand smoke can cause heart disease in adults
8	Second-hand smoke can cause lung illness in children
9	Second-hand smoke can cause lung cancer in adults
10	Do you think low tar cigarettes are less harmful than regular cigarettes?
11	Do you think smoking should be allowed in hospital
12	Do you think smoking should be allowed in public transportation vehicles

Table2 Survey area smoking rates

Province	Population (Ten thousand)			Smoking rates (%)		
	Female	Male	Total	Female	Male	Total
Beijing	952	978	1930	40.51	0.89	17.28
Tianjin	751	649	1400	48.65	4.88	25.64
Shanghai	1118	1068	2186	46.35	0.39	22.29
Jiangsu	3497	3446	6943	50.40	1.40	24.30
Zhejiang	2549	2402	4950	37.72	0.22	16.41
Fujian	1688	1593	3281	52.63	7.14	33.33
Guangdong	5069	4357	9426	40.93	0.51	47.60
Total	15625	14491	30116	44.52	1.62	30.75

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Table 3 Question of smoking cessation

Code	Statement about smoking cessation
B16	During any visit to a doctor or health care provider in the past 12 months, were you asked if you smoke tobacco?
B17	During any visit to a doctor or health care provider in the past 12 months, were you advised to quit smoking tobacco?
D02A	Thinking about the last time you tried to quit, how long did you stop smoking?

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3，4
Objectives	3	State specific objectives, including any prespecified hypotheses	3,4
Methods			
Study design	4	Present key elements of study design early in the paper	4-7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4-7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4-7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5-7*
Bias	9	Describe any efforts to address potential sources of bias	Not applicable
Study size	10	Explain how the study size was arrived at	4,5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5,7
		(*b*) Describe any methods used to examine subgroups and interactions	5-7
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	Not applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Table1,5,6
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	8,9
Outcome data	15*	Report numbers of outcome events or summary measures	8,9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 1
		(*b*) Report category boundaries when continuous variables were categorized	5
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Table 6
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	9-15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9-12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12
Generalisability	21	Discuss the generalisability (external validity) of the study results	10-12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.