The impact of current smoking, regular drinking, and physical inactivity on health care-seeking behavior in China

Changle Li and Jing Sun*

Abstract

Background: People with lifestyle behaviors, such as current smoking, regular drinking, and physical inactivity, may experience a lack of or delayed health care, leading to severe sickness and higher health care expenditures in the future. Hence, the current study aims to ascertain the effects of current smoking, regular drinking, and physical inactivity on health care-seeking behavior among adults who report physical discomfort in China.

Methods: The data used in this study were obtained from the China Family Panel Studies (CFPS). The final sample consisted of 44,362 individuals who participated in all five waves of data collection. Logistic regression models were used for the analysis.

Results: The results of fixed effects logistic regression showed that among those who reported physical discomfort, adults who currently smoked cigarettes were 0.65 times less likely to seek health care than those who formerly smoked. Compared to nondrinkers, adults who regularly drank alcohol had a decreased likelihood of seeking health care. Adults who never engaged in physical exercise had 24% lower odds of seeking health care than those who engaged in physical exercise.

Conclusions: Current smoking, regular drinking, and physical inactivity decreased the probability of seeking health care among adults who reported physical discomfort. Therefore, screening and brief advice programs should be delivered by primary-level care and should pay more attention to individuals who engage in lifestyle behaviors such as current smoking, regular drinking, and physical inactivity, thus avoiding missed opportunities to treat chronic conditions and detect new diseases early.

Keywords: Lifestyle, Smoking, Regular drinking, Physical inactivity, Health care-seeking behavior

Background

In 2015, a Chinese national nutrition and chronic disease report indicated that the prevalences of current smoking, harmful drinking, and physical inactivity among adults were 28.1, 9.3, and 71.3%, respectively [1]; these preventable risk factors have contributed to the increased rise in chronic diseases. Chronic diseases now account for approximately 80% of total deaths and 70% of total disability-adjusted life years lost in China [2].

Lifestyles have proven to be independent or synergistic causes of diseases, such as hypertension, dyslipidemia, diabetes, and obesity [3]. Most people make lifestyle changes due to the health concerns and illnesses they experience. For example, in 2018, 38.7% of Chinese smokers stopped smoking because they were worried about their future health status, and 26.6% stopped smoking because they experienced severe sickness [4]. In addition, former smoking has been associated with higher health
Data source and study sample

The data used in this study were obtained from the China Family Panel Studies (CFPS), conducted by the Institute of Social Science Survey of Peking University. The CFPS is a nationally representative, biennial survey designed to collect Chinese community-, family-, and individual-level longitudinal data; the data cover twenty-five provinces and their administrative equivalents, representing approximately 95% of the total population in mainland China. The CFPS uses multistage probability proportional-to-size sampling. More details of the data collection process were given in Xie and Lu [14]. The CFPS questionnaires include questions on demographic background, family structure/transfer, health status and physical functioning, health care utilization, insurance status, work, income, expenditure, asset ownership, community-level information, etc. [15].

The CFPS primarily conducts face-to-face interviews. Telephone or online interviews are used as a substitute only when the CFPS fails to complete face-to-face interviews. In the first wave in 2010, 14,960 households, including 33,600 adults (above 16 years old) and 8990 children, were successfully interviewed; in four waves of full sample follow-up surveys in 2012, 2014, 2016, and 2018, 13,315 households (35,720 adults and 8624 children), 13,946 households (37,147 adults and 8617 children), 14,019 households (36,892 adults and 8427 children), and 14,218 households (37,354 adults and 8735 children) were successfully interviewed, respectively. More details about the CFPS are available from Xie and Hu [16].

From the full sample, only the adults (16 years old or older) who reported feeling any physical discomfort in the past 2 weeks prior to the survey interview were selected. The final sample consisted of 44,362 individuals who participated in all five waves of data collection.

Measures

**Dependent variable**

Health care-seeking behavior was set as a binary variable, indicating the decision to consult a doctor (or not) among the adults who reported feeling any physical discomfort in the past 2 weeks. The question in the CFPS that represent this variable is: ‘Have you seen a doctor within the past two weeks?’ Response options are: Yes or no.

**Independent variables**

The respondents completed a face-to-face interview about lifestyle factors, including current smoking, regular drinking, and physical inactivity. In the CFPS, each respondent was asked, ‘Have you smoked in the past month?’ A respondent reporting ‘Yes’ was categorized as current smoking. Respondents who reported ‘No’ were then asked, ‘Have you ever smoked? Yes or No.’ If the respondent reported ‘Yes’, the respondent was categorized as former smoking. If the respondent reported ‘No’ to both questions, the respondent was categorized as never smoking. Regular drinking was defined as a binary variable. The CFPS question supporting this variable was ‘Have you often drunk alcohol (at least three times a week) in the past month?’ Respondents reporting ‘Yes’ were coded as 1, and those reporting ‘No’ were coded as 0. In the CFPS, the respondents were asked how often they participated in physical exercise in the past week. The respondents were categorized as physical inactivity if they answered “Never”.

The other independent variables were selected based on previous studies and included the respondent's age, gender, marital status, urban residency, household income, medical insurance status, educational attainment, employment status, self-reported health status, chronic conditions, and severity of physical discomfort (SPD). A single question was used to measured SPD, which was classified into three categories by asking the respondents how serious they thought their physical discomfort was: mild, moderate, or serious. Definitions of all relevant variables are provided in Table 1.

**Statistical analysis**

Bivariate analyses were used to examine differences between adults who consulted a doctor (seeking health care) and those who did not consult a doctor when they felt physical discomfort in each wave. Pearson's
The chi-square test was used to analyze the categorical independent variables. The current study examined the relationship between the dependent variable and independent variables using pooled and panel data estimation. Pooled estimation can increase the sample size, but it is often biased or at least inefficient [17]. Therefore, a pooled regression model can be a starting point. After the use of the pooled regression
model, the data were treated as having a panel structure, and a choice between fixed and random effects models had to be made. The panel structure can increase the degrees of freedom and decrease the collinearity among independent variables. Based on Hausman's specification test, fixed effects estimation should be preferred over random effects estimation. However, when estimating the fixed effects model, many pieces of information are lost. Therefore, a random effects model was also presented in this study [17, 18].

Since the dependent variable was a binary response variable, logistic regression was used to examine the impact of current smoking, regular drinking, and physical inactivity on health care-seeking behavior in China. The final model was adjusted for all the confounding variables. The results are presented as odds ratios (ORs)

### Table 2: Description of the selected variables in the five waves (percentage)

| Variable                      | 2010 N=8358 | 2012 N=9061 | 2014 N=8774 | 2016 N=9021 | 2018 N=9148 |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|
| Health care-seeking behavior  | 68.8        | 65.4        | 72.3        | 74.9        | 76.1        |
| Current smoking               | 28.8        | 27.4        | 26.2        | 24.9        | 25.7        |
| Former smoking                | 7.3         | 5.0         | 5.2         | 5.2         | 8.2         |
| Never smoking                 | 63.9        | 67.5        | 68.6        | 69.8        | 66.2        |
| Regular drinking              | 12.9        | 13.2        | 13.1        | 11.7        | 12.5        |
| Physical inactivity           | 72.0        | 56.9        | 63.2        | 58.8        | 52.8        |
| Age group                     |             |             |             |             |             |
| 16–24                         | 6.8         | 7.4         | 6.4         | 7.3         | 6.4         |
| 25–64                         | 76.0        | 74.5        | 73.7        | 70.9        | 69.9        |
| ≥65                           | 17.2        | 18.2        | 20.0        | 21.8        | 23.7        |
| Male                          | 42.7        | 43.4        | 42.3        | 42.0        | 42.8        |
| Educational attainment        |             |             |             |             |             |
| Illiteracy                    | 36.1        | 35.4        | 35.4        | 34.5        | 30.4        |
| Elementary school             | 21.5        | 21.6        | 22.2        | 21.5        | 21.6        |
| Middle school                 | 25.0        | 23.8        | 24.4        | 24.4        | 26.1        |
| High school                   | 11.8        | 12.4        | 11.7        | 11.7        | 12.5        |
| Above three-year college      | 5.7         | 6.8         | 6.3         | 8.0         | 9.5         |
| Married                       | 82.5        | 82.5        | 82.3        | 80.4        | 79.9        |
| Urban residency               | 44.8        | 45.4        | 47.1        | 47.5        | 47.7        |
| Medical insurance             |             |             |             |             |             |
| GMI                           | 4.7         | 3.7         | 2.9         | 1.9         | 2.4         |
| UEMI                          | 9.5         | 12.2        | 12.6        | 12.4        | 13.1        |
| URMII                         | 7.0         | 7.6         | 8.2         | 8.0         | 7.9         |
| NRRCMI                        | 58.1        | 64.6        | 67.5        | 68.2        | 67.7        |
| Other Insurance               | 0.5         | 0.3         | 0.6         | 0.4         | 0.3         |
| No Insurance                  | 20.2        | 11.7        | 8.2         | 9.1         | 8.6         |
| Household income               | 3.3 (5.3)   | 4.2 (5.0)   | 4.6 (6.1)   | 5.4 (12.5)  | 5.6 (8.5)   |
| Economically active           | 45.4        | 67.5        | 71.5        | 75.3        | 73.2        |
| Health status                 |             |             |             |             |             |
| Poor                          | 38.9        | 41.0        | 36.1        | 36.2        | 36.4        |
| Fair                          | 42.0        | 23.0        | 19.5        | 22.6        | 16.7        |
| Good                          | 19.1        | 36.0        | 44.4        | 41.3        | 46.9        |
| Chronic conditions            | 29.0        | 22.1        | 34.6        | 34.0        | 32.7        |
| Severity of physical discomfort|             |             |             |             |             |
| Mild                          | 22.2        | 24.1        | 20.8        | 20.9        | 17.3        |
| Moderate                      | 40.1        | 39.7        | 47.2        | 42.3        | 44.4        |
| Serious                       | 37.7        | 36.2        | 32.0        | 36.8        | 38.4        |

RMB: 1000 Chinese Renminbi is approximately 150 US$  
*Values are expressed as the mean (standard deviation)
along with 95% confidence intervals (CIs). All statistical analyses were carried out using the statistical software package STATA 15.

Results
A descriptive summary of all variables over time is shown in Table 2. Among those who reported physical discomfort, the proportion of people seeking health care increased from 68.8% in 2010 to 76.1% in 2018. Approximately 26.0% of adults currently smoked tobacco products from 2010 to 2018. Approximately 12.0% of adults regularly drank alcohol from 2010 to 2018. The prevalence of physical inactivity was 72.0% in 2010. This proportion decreased to 52.8% in 2018.

Table 3 compares adults who sought health care and those who did not seek health care when they felt physical discomfort based on a variety of lifestyle factors. Among those who reported physical discomfort, adults who currently smoked were less likely to seek health care, and a similar trend was observed for adults who regularly drank alcohol. In addition, the chi-square test found that current smoking and regular drinking were significantly associated with health care-seeking behavior in some or all five waves.

Table 4 presents the results of the regression analysis for the pooled logistic, random effects logistic, and fixed effects logistic models. The likelihood ratio test and Hausman’s specification test showed highly significant test statistics ($\text{LR} = 569.63$ and $\chi^2(24) = 162.32$). These results further demonstrated that the fixed effects logistic model should be preferred over the random effects logistic model. The results of the logistic regression analysis are shown in Table 4 as ORs. An OR greater than one indicated a positive effect on the likelihood of seeking health care, while an OR less than one indicated a negative effect.

Column (iii) of Table 4 presents factors affecting health care-seeking behavior using the fixed effects logistic model. Among those who reported physical discomfort, adults who currently smoked cigarettes were 0.65 times less likely to seek health care than those who formerly smoked (OR = 0.65, 95% CI: 0.50, 0.84). Compared to nondrinkers, adults who regularly drank alcohol had a decreased likelihood of seeking health care (OR = 0.77, 95% CI: 0.65, 0.91). Adults who never engaged in physical exercise had 24% lower odds of seeking healthcare than those who engaged in physical exercise (OR = 0.76, 95% CI: 0.69, 0.83).

Irrespective of the estimation method, adults who currently smoked cigarettes, regularly drank alcohol, and never engaged in physical exercise were less likely to seek health care when they felt physical discomfort (see Columns (i)- (iii) of Table 4).

Discussion
The current study examined the association between lifestyle factors and health care-seeking behavior among a Chinese adult general population using a five-wave longitudinal dataset. This study found that the proportion of individuals seeking health care increased from 68.8% in 2010 to 76.1% in 2018. This result is not unexpected. Since the launch of the new health reform of 2009, the Chinese government has made considerable investments

| Year | N     | Seeking health care | Current smoking (%) | Yes | No | P value | Regular drinking (%) | Yes | No | P value | Physical inactivity (%) | Yes | No | P value |
|------|-------|---------------------|---------------------|-----|----|---------|----------------------|-----|----|---------|------------------------|-----|----|---------|
| 2010 | 8358  | Yes                 | 67.7                | 32.3|    | 0.185   | Yes                  | 62.3| 37.7| <0.001  | Yes                    | 68.7| 31.3| 0.795   |
|      |       | No                  | 69.2                | 30.8|    |         | No                   | 69.7| 30.3| <0.001  | No                     | 69.0| 31.0| 0.778   |
| 2012 | 9061  | Yes                 | 61.3                | 38.7|    |        | Yes                  | 57.0| 43.1| 0.001   | Yes                    | 65.5| 34.5| 0.204   |
|      |       | No                  | 67.0                | 33.0|    |        | No                   | 66.7| 33.3| <0.001  | No                     | 65.3| 34.8| 0.045   |
| 2014 | 8774  | Yes                 | 69.6                | 30.4|    | <0.001  | Yes                  | 64.9| 35.1| <0.001  | Yes                    | 71.8| 28.2| <0.001  |
|      |       | No                  | 73.3                | 26.7|    |         | No                   | 73.4| 26.6| <0.001  | No                     | 73.1| 26.9| <0.001  |
| 2016 | 9021  | Yes                 | 72.7                | 27.3|    |         | Yes                  | 69.7| 30.3| 0.005   | Yes                    | 74.2| 25.8|         |
|      |       | No                  | 75.7                | 24.3|    |         | No                   | 75.6| 24.4| <0.001  | No                     | 74.2| 25.8|         |
| 2018 | 9148  | Yes                 | 73.1                | 26.9|    | <0.001  | Yes                  | 69.8| 30.2| <0.001  | Yes                    | 74.2| 25.8|         |
|      |       | No                  | 77.1                | 22.9|    |         | No                   | 77.0| 23.1|         | No                     | 78.1| 21.9|         |
in strengthening the accessibility and availability of health care facilities. As a result, almost every community (village) has at least one primary care facility. Moreover, China successfully achieved near-universal health insurance coverage, with 95% of the population covered in 2011, and proposed a zero-profit drug policy, compelling

**Table 4** Logistic regression analysis of health care-seeking behavior

| Smoking status                  | Pooled logistic (Odds Ratios (95% CI)) | Random effects logistic (Odds Ratios (95% CI)) | Fixed effects logistic (Odds Ratios (95% CI)) |
|---------------------------------|----------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Current smoking                 | 0.84*** (0.75, 0.93)                   | 0.79*** (0.69, 0.89)                          | 0.65*** (0.50, 0.84)                          |
| Never smoking                   | 0.90* (0.80, 1.00)                     | 0.86** (0.75, 0.98)                           | 0.79* (0.60, 1.04)                            |
| Former smoking (ref.)           |                                        |                                               |                                               |
| Regular drinking                | 0.76*** (0.71, 0.82)                   | 0.72*** (0.67, 0.79)                          | 0.77*** (0.65, 0.91)                          |
| Physical inactivity             | 0.76*** (0.72, 0.79)                   | 0.73*** (0.69, 0.77)                          | 0.76*** (0.69, 0.83)                          |
| Age group                       |                                        |                                               |                                               |
| 16–24 (ref.)                    |                                        |                                               |                                               |
| 25–64                           | 1.18*** (1.07, 1.31)                   | 1.23*** (1.09, 1.39)                          | 0.97 (0.69, 1.37)                             |
| > =65                           | 1.57*** (1.40, 1.75)                   | 1.74*** (1.52, 2.00)                          | 1.74*** (1.17, 2.59)                          |
| Male                            | 0.98 (0.92, 1.05)                      | 0.97 (0.90, 1.06)                             | 0.99 (0.92, 3.26)                             |
| Educational attainment          |                                        |                                               |                                               |
| Illiteracy (ref.)               |                                        |                                               |                                               |
| Elementary school               | 0.99 (0.93, 1.07)                      | 1.01 (0.93, 1.10)                             | 1.15 (0.86, 1.55)                             |
| Middle school                   | 0.98 (0.91, 1.06)                      | 0.99 (0.91, 1.08)                             | 1.23 (0.83, 1.81)                             |
| High school                     | 0.79*** (0.73, 0.86)                   | 0.76*** (0.68, 0.84)                          | 1.18 (0.71, 1.96)                             |
| Above three-year college        | 0.59*** (0.53, 0.66)                   | 0.53*** (0.47, 0.61)                          | 1.21 (0.67, 2.20)                             |
| Married                         | 1.24*** (1.16, 1.33)                   | 1.30*** (1.19, 1.41)                          | 0.91 (0.72, 1.16)                             |
| Urban residency                 | 0.83*** (0.79, 0.88)                   | 0.80*** (0.75, 0.86)                          | 1.25*** (1.00, 1.56)                          |
| Medical insurance               |                                        |                                               |                                               |
| GMI                             | 1.24*** (1.08, 1.43)                   | 1.25*** (1.05, 1.48)                          | 1.01 (0.74, 1.39)                             |
| UEMI                            | 1.14*** (1.04, 1.26)                   | 1.14*** (1.01, 1.27)                          | 1.08 (0.87, 1.35)                             |
| URMi                            | 1.14*** (1.03, 1.27)                   | 1.17*** (1.03, 1.32)                          | 1.19 (0.97, 1.46)                             |
| NRCMI                           | 1.51*** (1.40, 1.62)                   | 1.57*** (1.44, 1.71)                          | 1.09 (0.93, 1.28)                             |
| Other Insurance                 | 0.92 (0.67, 1.27)                      | 0.87 (0.60, 1.27)                             | 0.89 (0.51, 1.54)                             |
| No Insurance (ref.)             |                                        |                                               |                                               |
| Household income                | 1.01*** (1.00, 1.01)                   | 1.01*** (1.00, 1.01)                          | 1.01*** (1.00, 1.02)                          |
| Economically active             | 1.01 (0.96, 1.07)                      | 1.03 (0.97, 1.10)                             | 1.04 (0.92, 1.17)                             |
| Health status                   |                                        |                                               |                                               |
| Poor                            | 1.38*** (1.29, 1.47)                   | 1.46*** (1.36, 1.58)                          | 1.42*** (1.26, 1.59)                          |
| Fair (ref.)                     |                                        |                                               |                                               |
| Good                            | 0.94*** (0.89, 0.99)                   | 0.94*** (0.88, 1.00)                          | 1.04 (0.93, 1.16)                             |
| Chronic conditions              | 2.42*** (2.29, 2.57)                   | 2.69*** (2.51, 2.88)                          | 2.04*** (1.85, 2.25)                          |
| Severity of physical discomfort |                                        |                                               |                                               |
| Mild                            | 0.58*** (0.55, 0.61)                   | 0.52*** (0.48, 0.55)                          | 0.52*** (0.47, 0.58)                          |
| Moderate (ref.)                 |                                        |                                               |                                               |
| Serious                         | 1.87*** (1.76, 1.98)                   | 2.09*** (1.95, 2.24)                          | 1.94*** (1.75, 2.15)                          |
| Constant                        | 1.44*** (1.21, 1.72)                   | 1.62*** (1.32, 1.99)                          |                                               |

Likelihood ratio test in random effects logistic model: LR = 569.63, p < 0.001
Hausman’s specification test is significant at the 1% level: $\chi^2(24) = 162.32, p < 0.001$
Asterisks *** indicate statistical significance at the 1% level, ** at the 5% level, and * at the 10% level
public hospitals nationwide to sell drugs at cost without mark-up fees to make health care facilities more attractive to patients [19–21].

On the other hand, the proportion of people seeking health care in China is much higher than the findings in European studies. Elnegaard et al. [22] found that the proportion of the adult Danish population contacting a general practitioner with at least one symptom was 37%. Elliott, McAteer, and Hannaford [23] reported that 20% of respondents with symptoms consulted with a primary care health professional in the UK. Health care-seeking behavior in different countries may have been affected by degrees of access to care and levels of out-of-pocket payments. Both Demark and the UK have easy and free access to health care facilities. The gap in the proportion of people seeking health care may be because of the formal referral system in China is now virtually absent. Patients have the freedom to choose any health care facilities they prefer to visit, regardless of their disease severity [24]. However, people with lifestyle behaviors including current smoking, regular drinking, and physical inactivity had a lower proportion of seeking health care in China.

A fixed effects logistic regression model was used to identify the lifestyle factors affecting health care-seeking behavior. The results indicate that among those who reported physical discomfort, adults who currently smoked cigarettes, regularly drank alcohol, and never engaged in physical exercise were less likely to seek health care. Similar results have been discovered in China, England, and Australia. For example, Zhou et al. [25] observed that physical inactivity decreased the probability of seeking health care in China. Smith et al. [12] found that smokers were less likely to seek help than nonsmokers in England. Feng et al. [13] revealed that people with multiple lifestyle factors, including smoking, alcohol consumption, diet and physical inactivity, were less likely to see general practitioners in Australia.

Four possible reasons may explain the inverse relationship between lifestyle factors and health care-seeking behavior. First, people with lifestyle behaviors including current smoking, regular drinking, and physical inactivity are more risk tolerant, and they may more willingly bear disease risk [26, 27]. A higher willingness to bear risk decreases the probability of seeking health care [28]. Second, lifestyle behaviors such as smoking, drinking, and physical inactivity, are linked with poor health conditions. People in poor health conditions are more likely to have negative experiences in the health care system and be less satisfied with it [29]. Lower patient satisfaction tends to decrease the probability of seeking health care [30]. Third, lifestyles result in chronic diseases, specifically heart disease, diabetes, and cancer [31]. People with lifestyle behaviors including current smoking, regular drinking, and physical inactivity may suffer from long-term chronic conditions and more than one chronic condition, which often leads to normalization of symptoms and thus inhibits health care seeking [32]. Last, lifestyle factors contribute to productive losses at work and reduced ability to work [33, 34]. People with lifestyle behaviors including current smoking, regular drinking, and physical inactivity may sacrifice some of their leisure time to perform unfinished work. Time constraints may delay some people from seeking health care [35].

Although the present study used a national survey to analyze the lifestyle factors affecting health care-seeking behavior among adults who reported physical discomfort, several limitations should be emphasized. First, the CFPS survey does not collect information on self-medication practice, so this study defined health care-seeking behavior as the seeking of professional help. Previous studies have shown that individuals who perceive themselves to have mild health problems are more likely to self-medicate in China [36, 37]. Second, data were obtained via a survey, and thus the limitations of all self-reported data such as recall bias and social desirability bias also apply here. Finally, although the present study adjusted for a large variety of control variables, it is possible that unknown or unmeasured confounders may explain the current findings.

Conclusions
This study estimated the effects of current smoking, regular drinking, and physical inactivity on health care-seeking behavior among adults who reported physical discomfort in China. The empirical findings suggested that current smoking, regular drinking, and physical inactivity decreased the probability of seeking health care among adults who reported physical discomfort. Therefore, primary-level care should deliver screening and brief advice programs and pay more attention to those with lifestyle behaviors such as current smoking, regular drinking, and physical inactivity, thus avoiding missed opportunities to treat chronic conditions and detect new diseases early.

Acknowledgments
The authors thank Zhengzhong Mao and Mariyam Suzana for the helpful comments.

Authors’ contributions
JS designed the study and made important contributions to the revision of the manuscript. CL led the data analysis and wrote the manuscript. All authors read and approved the final manuscript.

Funding
This research was funded by the Inner Mongolia Medical University Health Economics Professionals Team, Scientific Research Starting Foundation for Doctoral Scholars in Inner Mongolia Medical University (YKD2019BSJ008),
and Scientific Research Projects in Higher Education Institutions in Inner Mongolia (NSYSU2014S).

Availability of data and materials
The datasets generated and/or analyzed during the current study are available in the Peking University Open Research Data Platform repository, https://opendata.pku.edu.cn/dataset.xhtml?persistentId=doi:10.18170/DVN/45LCS0.

Declarations

Ethics approval and consent to participate
Permission and approval were obtained from the Peking University Biomedical Ethics Review Committee (IRB00001052–14010). All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication
No applicable.

Competing interests
The authors declare that they have no competing interests.

Received: 1 February 2021   Accepted: 30 December 2021
Published online: 10 January 2022

References

1. The Chinese National Health Commission. The Nutrition and Chronic Disease of the Chinese Population (2015). Available online: http://www.nhc.gov.cn/jk/s5879/201506/4505528e665f4360f8b868581ff158a2.shtml (Accessed on 15 Oct. 2020).

2. Wang L, Kong L, Wu F, Bai Y, Burton R. Preventing chronic diseases in China. Lancet. 2005;366(9499):1821–4.

3. Steyn K, Damasceno A. Lifestyle and related risk factors for chronic diseases. Dis Mortal Sub-Saharan Africa. 2006;2:247–65.

4. WHO. Global Adult Tobacco Survey (GATS). Fact sheet China 2018. Available online: https://www.who.int/docs/default-source/wpro-documents/countries/china/2018-gats-china-factsheet-cn-en.pdf?sfvrsn=3f4e2da9_2 (Accessed on 16 Oct. 2020).

5. Wagner EH, Curry SJ, Grothaus L, Saunders KW, McBride CM. The impact of smoking and quitting on health care expenditure. Arch Intern Med. 1995;155(16):1789–95.

6. Sturm R, An R, Maroba J, Patel D. The effects of obesity, smoking, and excessive alcohol intake on healthcare expenditure in a comprehensive medical scheme. S Afr Med J. 2013;103(11):840–4.

7. Wacker M, Holle R, Heinrich J, Ladwig KH, Peters A, Leidl R, et al. The association of smoking status with health utilisation, productivity loss and resulting costs: results from the population-based KORA F4 study. BMC Health Serv Res. 2013;13(1):278.

8. Kahende JW, Adhikari B, Maurice E, Rock V, Malarcher A. Disparities in health care utilization by smoking status—NHANES 1999-2004. Int J Environ Res Public Health. 2009;6(3):1095–106.

9. Kraft AD, Quimbo SA, Solon G, Shimkhada R, Florentino J, Peabody JW. The health and cost impact of care delay and the experimental impact of insurance on reducing delays. J Pediatr. 2009;155(2):281–5.

10. Chen J, Rizzo JA, Rodriguez HP. The health effects of cost-related treatment delays. Am J Med Qual. 2011;26(4):261–71.

11. Thomas AW, Valero-Elízondo J, Khera R, Warrach HJ, Krumholz HM, Nasir K, et al. Foregone and delayed medical care is associated with increased healthcare costs and utilization among heart failure patients in the United States. Circulation. 2019;140(Suppl 1):A13991.

12. Smith CF, Whitaker K, Winstanley K, Wardle J. Smokers are less likely than non-smokers to seek help for a lung cancer alarm/symptom. Thorax. 2016;71(7):659–61.

13. Feng X, Girgis F, McRae IS. People with multiple unhealthy lifestyles are less likely to consult primary healthcare. BMC Fam Pract. 2014;15(1):1–7.

14. Xie Y, Lu P. The sampling design of the China family panel studies (CFPS). Chin J Sociol. 2015;14(1):471–84.

Publisher’s Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.