

Chinese smokers' cigarette purchase behaviours, cigarette prices and consumption: findings from the ITC China Survey

Jidong Huang,¹ Rong Zheng,² Frank J Chaloupka,¹ Geoffrey T Fong,^{3,4} Qiang Li,³ Yuan Jiang⁵

¹Institute for Health Research and Policy, University of Illinois at Chicago, Chicago, Illinois, USA

²School of International Trade and Economics, University of International Business and Economics, Beijing, China

³Department of Psychology, University of Waterloo, Waterloo, Ontario, Canada

⁴Ontario Institute for Cancer Research, Toronto, Ontario, Canada

⁵Chinese Center for Disease Control and Prevention, Beijing, China

Correspondence to

Dr Jidong Huang, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago, 1747 West Roosevelt Road, Chicago, Illinois 60608, USA; jhuang12@uic.edu

Received 8 March 2013

Revised 11 July 2013

Accepted 21 August 2013

Published Online First

18 September 2013

ABSTRACT

Background While cigarette purchasing behaviour has been shown to be linked with certain tobacco use outcomes such as quit intentions and quit attempts, there have been very few studies examining cigarette purchasing behaviours and their impact on cigarette price and consumption in China, the world's largest cigarette consumer.

Objective The aim of the present study was to examine the extent and determinants of cost/price-related purchase behaviours, and estimate the impact of these behaviours on cigarette prices paid by Chinese smokers. It also assesses the socioeconomic differences in compensatory purchase behaviours, and examines how they influence the relationship between purchase behaviours, cigarette prices and cigarette consumption.

Methods Multivariate analyses using the general estimating equations method were conducted using data from the International Tobacco Control China Survey (the ITC China Survey), a longitudinal survey of adult smokers in seven cities in China: Beijing, Changsha, Guangzhou, Kunming, Shanghai, Shenyang and Yinchuan. In each city, about 800 smokers were surveyed in each wave. The first three waves—wave 1 (conducted between March to December 2006), wave 2 (November 2007 to March 2008) and wave 3 (May to October 2009 and February to March 2010)—of the ITC China Survey data were used in this analysis. Various aspects of smokers' self-reported price/cost-related cigarette purchasing behaviours were analysed.

Results Nearly three-quarters (72%) of smokers surveyed indicated that a major reason they chose their most-used cigarette brand was its low cost/price. Almost half (50.6%) of smokers reported buying in cartons in their most recent cigarette purchase. Smokers with lower income and/or low levels of education were more likely to choose a brand because of its low cost/price. However, those with higher income and/or high levels of education were more likely to buy cartons. Gender and age were also related to type of purchase behaviours. Those behaviours led to reductions in purchase prices. The price savings ranged from ¥0.54 to ¥1.01 per pack of cigarettes, depending on the behaviour examined, representing a price reduction of 8% to 15%.

Conclusions A significant portion of Chinese urban adult smokers engaged in cost/price-reducing purchase behaviours. Such behaviours reduce cigarette purchase prices and are associated with increased cigarette consumption. Smokers of different socioeconomic status engaged in different purchase behaviours to mitigate the impact of higher cigarette prices. Reducing tobacco use through raising tobacco taxes/prices in China needs to take into account these cost/price-reducing behaviours.

BACKGROUND

Tobacco imposes tremendous health and economic costs on China.^{1–5} Significantly increasing tobacco product excise taxes and prices has been shown to be an effective policy to reduce tobacco use and tobacco-caused health and economic burdens.^{6–7} In addition, studies have also found that smokers of lower socioeconomic status (SES) tend to be more responsive to tax and price changes.⁷ This differential responsiveness to price change based on SES serves as an important avenue to reduce tobacco use, particularly among those with low SES. The intended impact of higher prices/taxes on cessation and reduction in cigarette consumption could be mitigated, however, if smokers engage in compensatory behaviours that offset or reduce the impact of higher taxes and prices. For example, when cigarette taxes/prices become higher, smokers may switch to a cheaper brand or other less expensive tobacco products, obtain cigarettes from cheaper sources, or purchase of cartons.^{8–11} Indeed, previous studies have found evidence that the link between high taxes/price and quit intentions and quit attempts was attenuated by smokers' price-reducing purchase behaviours.^{12–15} Consequently, it is important to understand smokers' behavioural responses in order to accurately assess the impact of higher taxes/prices. Because of the potential importance of the possible modifying role of SES on the relationship between purchase behaviour and tobacco use outcomes, it is also important to examine the socioeconomic differences in compensatory purchase behaviours, and their role in modifying the impact of increasing cigarette prices on tobacco use outcomes. This information may be especially useful in directing future tobacco control policies in China.

Previous studies examining cigarette price elasticity in China have provided some evidence that Chinese smokers' cigarette consumption was sensitive to price changes, at least among some subgroups,^{16–17} indicating that higher tobacco taxes/prices could be an effective policy tool to reduce tobacco use and tobacco-induced deaths and diseases in China. Unfortunately, to date, there have been very few studies that looked at smokers' purchasing behaviour in China, and its impact on cigarette prices and consumption. In addition, little is known about the potential role of SES in modifying the impact of higher tobacco prices/taxes among Chinese smokers. This paper fills these research gaps. It examines the extent and determinants of several price-reducing purchase behaviours; estimates the impact of these behaviours on cigarette

To cite: Huang J, Zheng R, Chaloupka FJ, et al. *Tob Control* 2014;**23**:i67–i72.

prices; and investigates the association between these behaviours and cigarette consumption among Chinese adult urban smokers. Additionally, this paper assesses the socioeconomic differences in these compensatory purchase behaviours and examines how they influence the relationship between purchase behaviours and cigarette prices.

METHODS

Data

The analyses in this paper rely on the International Tobacco Control Policy Evaluation Project—China Surveys (the ITC China Survey). The ITC China Project, established in 2006, is a longitudinal cohort survey conducted in seven cities in China (Beijing, Changsha, Guangzhou, Kunming, Shanghai, Shenyang and Yinchuan). These seven cities differ in their population sizes, areas and levels of economic development. They are located in different geographic regions in China, and are good representatives of China's urban areas. Approximately 800 adult smokers are recruited by probability sampling methods in each city in each wave. Respondents lost to follow-up are replaced with comparable respondents so as to maintain city level representative samples. The retention rate of the ITC China survey was high, more than 80%.¹⁸ More detailed information on the ITC China survey sampling methodology can be found in Wu *et al* (2010).¹⁸

This study used the first three waves of the ITC China Surveys, conducted in 2006, 2007/2008, and 2009/2010, respectively. The sample consisted of approximately 2400 smokers from each city (800 smokers in each wave) with the exception of Kunming, which was added to ITC China Survey in the third wave, with only 800 smokers. Because of the missing values (including non-responses and refusals) in the key outcome variables, the final analytical sample consisted of approximately 13 000 smokers.

Measures

The key variables we examined in this study were: (1) whether respondents identified cost as a major reason for choosing their most-used cigarette brand; (2) whether the most recent cigarette purchase for self was in cartons or in packs; and (3) the price of a pack of cigarette paid by smokers in their most recent purchase. In addition, we also examined the association between purchase behaviours and smoking intensity, approximated by the average number of cigarettes smoked per day.

The ITC China Survey asked smokers the cigarette brand they smoked most often in the past 30 days, and asked about the reasons for using this brand. One of the response categories is 'affordable cost/price'. We constructed a dichotomous variable based on the response to this question. If a smoker indicated that he/she considered low cost/price as a factor in choose the brand, this variable was coded as 1; otherwise, it was coded as 0. This variable captures whether Chinese smokers were cost/price conscious when making a brand choice.

The ITC China Survey also asked smokers about their most recent cigarette purchase experience; in particular, how much they paid and whether they purchased in cartons or in packs. We created a dichotomous variable to capture purchases in cartons, with a value of 1 indicating a purchase was made in cartons, and a value of 0 otherwise. The cigarette price variable used in this study was the self-reported price for a pack of cigarettes, which was constructed based on the total price paid and the total number of packs bought in the most recent cigarette purchase. In our analyses, we dropped 79 observations that reported extremely high (greater than ¥100 per pack) and low (less than ¥0.2 per pack) unit prices. The cigarette price variable

was inflation adjusted. Cigarette consumption is defined as the average number of cigarettes smoked by an individual per day, which was derived from the questions that asked about the number of cigarettes smoked per day for daily smokers, and the number of cigarettes smoked per week for non-daily smokers. Based on this cigarette per day (CPD) variable, three dichotomous variables were created to capture the smoking intensity: light smokers (≤ 10 CPD), moderate smokers (11–19 CPD), and heavy smokers (≥ 20 CPD).

In addition to those key variables, depending on the analysis, we also included a number of key demographic and socioeconomic individual/household-level characteristics such as family income, age, gender, level of education, marital status, and various other SES characteristics that are captured in the ITC China Surveys, as well as interview waves/years, city, and cigarette brands when appropriate. Specifically, age was grouped into 18–24 years, 25–39 years, 40–54 years, and 55 years or older. Marital status was classified as: married; divorced, separated or widowed; and single. Education level was classified into three categories: less than high school, high school, and post-secondary education. Monthly household income was classified into three categories based on the cut-offs for urban areas from the 2010 China Statistics Yearbook: low-income level ($< ¥1000$), medium-income level (¥1000–2999) and high-income level ($\geq ¥3000$). Employment status was grouped into employed, unemployed, and retired.

Analysis and statistical methodology

To understand the extent of price/cost related purchase behaviours among Chinese smokers, we examined the sample means of the key purchase behaviour variables discussed above. Our calibration of the sample means uses standard complex survey poststratification techniques for variance estimation, which took into account the complex survey/sampling strategies of the ITC China Surveys. In addition, those statistics were properly weighted using the sampling weights, described fully in the weighting methodology available at <http://www.itcproject.org>.

To examine who engaged in price/cost-related purchase behaviours, we estimated the following models:

$$PB_{ijt} = \beta_0 + \beta_1 X_{ijt} + \beta_2 CPD_{ijt} + Wave_{ij} + City_{it} + e_{ijt} \quad (1)$$

Where PB_{ijt} represents one of the two purchase behaviour variables discussed above, by the i_{th} individual in the j_{th} city in interview wave/year t . X_{ijt} is a vector of individual-level and familial-level demographic and socioeconomic characteristics such as age, gender, marital status, education level, and inflation-adjusted family income. CPD is a variable capturing smoking intensity, represented by the number of cigarettes smoked per day. $City_{it}$ is the city indicator for the i_{th} individual in interview wave/year t . $Wave_{ij}$ is the interview wave/year indicator for the i_{th} individual in the j_{th} city, and e_{ijt} is the idiosyncratic error term.

To examine the association between purchase behaviours and cigarette price, we estimated the following model:

$$P_{ijt} = \beta_0 + \beta_1 PB_{ijt} + Wave_{ij} + City_{it} + Brand_{ijt} + e_{ijt} \quad (2)$$

Where P_{ijt} represents the log form of the inflation-adjusted price for a pack of cigarettes reported by the i_{th} individual in the j_{th} city in interview wave/year t in his/her most recent purchase for himself/herself. PB_{ijt} represents one of the two purchase behaviour variables. $Brand_{ijt}$ is a vector of dummy variables indicating

the cigarette brand the i_{th} individual bought in his/her most recent purchase in the j_{th} city and in interview wave/year t .

Because the ITC China Survey data are longitudinal in nature, errors are correlated within observations across waves for the same individual. As a result, equation (1) and (2) were estimated using the general estimating equations (GEE) method (STATA V.12 `xtgee` command), which took into account the correlation in error terms among the same respondent across different interview waves (mean SEs were clustered by individual). Because of the nature of the purchase behaviour variables, which are all dichotomous variables, equation (1) was estimated using GEE model with a logit link, with no preimposed assumption on the structure of the covariance matrix of the error terms.

RESULTS

Table 1 contains the summary statistics for the key SES variables used in this study. Our smoker sample was evenly distributed across interview waves and cities, with the exception of the city of Kunming, which was added in the third wave. The urban smokers in our sample were predominantly male (95%), with an average age of 50; 89% of them were married at the time of the survey. In all, 43% of the smokers in the sample reported having an average family income per month between ¥1000–2999, with 15% of smokers having a family income that fell below ¥1000 per month and about 36% with an income of more than ¥3000 per month. The income information was missing for the remaining 6%. A total of 12% of smokers reported having less than a high school education, 66% of smokers reported having a high school degree, and about 22% of smokers reported having some schooling beyond high school, which included 2-year college courses.

Close to three-quarters (73%) of smokers reported that cost/price was a reason for choosing their most-used cigarette brand, indicating a high level of cost/price consciousness among Chinese urban smokers. Approximately half of the smokers bought cigarettes in cartons in their most recent purchase. The inflation-adjusted average price for the pack of cigarettes that smokers bought in their most recent purchase was 6.75 RMB in 2009 ¥ value, and the average number of cigarettes consumed per day was 17 among the smokers in these 7 Chinese cities. Approximately 15% of smokers reported smoking more than 20 cigarettes per day; close to half reported smoking between 10 and 20 cigarettes per day, the remaining 37% smoked less than 10 cigarettes per day.

SES profile for those who engaging in price/cost-related purchase behaviour

Table 2 presents the results for equation (1), examining the SES factors associated with the price/cost-related purchase behaviours. Compared to those with the highest income, smokers with income between ¥1000–2999 (OR 1.16 (95% CI 1.02 to 1.31)) and those with less than ¥1000 per month (OR 1.32 (95% CI 1.02 to 1.59)) were more likely to report that cost/price was a reason for choosing their most-used cigarette brand. Similarly, compared to those with at least some secondary education, those with a high school degree were more cost/price conscious (OR 1.25 (95% CI 1.09 to 1.43)) when choosing a cigarette brand. Compared to the employed, retired smokers were more likely to choose a brand for its low cost/price (OR 1.19 (95% CI 1.02 to 1.38)). Not surprisingly, compared to light smokers, those who smoke more than 10 cigarettes per day were more likely (OR 1.14 (95% CI 1.02 to 1.28)) to report that cost/price was a reason for choosing their most-used cigarette brand, the heaviest smokers—those who smoke more than

Table 1 Summary statistics

	N	%
Purchase behaviours		
The most-used cigarette brand chosen because of its low cost/price: 1: yes; 0: no	14 161	72.6
Most recent cigarette purchase for self was in carton: 1: yes; 0: no	13 861	50.6
Gender		
Male	13 457	95.0
Female	704	5.0
Age (years)		
18–24	184	1.3
25–39	2465	17.4
40–54	6826	48.2
55+	4686	33.1
Marital status		
Married	12 633	89.2
Divorced, separated, widowed	894	6.3
Single	634	4.5
Average total household income per month (¥)		
<1000	2117	14.9
1000–2999	6078	42.9
≥3000	5064	35.8
Missing	902	6.4
Education		
Less than high school	1692	11.9
High school	9293	65.6
College and above	3176	22.4
Employment status		
Employed	8595	60.9
Unemployed	1869	13.3
Retired	3641	25.8
Cigarettes per day (CPD)		
≤10 CPD	5209	36.8
11–19 CPD	6848	48.4
≥20 CPD	2104	14.9
City		
Beijing	2213	15.6
Shenyang	2256	15.9
Shanghai	2255	15.9
Changsha	2185	15.4
Guangzhou	2260	16.0
Yinchuan	2203	15.6
Kunming	789	5.6

20 cigarettes per day—did not differ significantly from the lightest smokers. Female smokers (OR 0.73 (95% CI 0.53 to 0.99)) and those aged 25–39 (OR 0.78 (95% CI 0.64 to 0.96)) were less likely to report considering low cost/price as a reason for choosing a brand.

With respect to buying in cartons at the most recent purchase, female smokers (OR 1.63 (95% CI 1.28 to 2.09)), those retired (OR 1.49 (95% CI 1.28 to 1.73)), as well as medium smokers (OR 1.65 (95% CI 1.48 to 1.84)) and heavy smokers (OR 2.32 (95% CI 1.99 to 2.71)), were more likely to purchase in cartons. Compared to those aged 55 and above, younger smokers were less likely to buy in cartons, with young adults, those aged 18–24, being the least likely to buy in cartons. Compared to high-income smokers, smokers with medium-income and low-income levels were both less likely to buy in cartons, presumably due to cash constraints. Those who

Table 2 Socioeconomic status (SES) factors associated with purchase behaviours (ORs from general estimating equation (GEE) models)

Variables	The most-used cigarette brand chosen because of its low cost		Most recent cigarette purchase for self was in carton	
	OR	95% CI	OR	95% CI
Gender				
Male	Reference		Reference	
Female	0.725*	0.530 to 0.992	1.631***	1.276 to 2.085
Age (years)				
55+	Reference		Reference	
40–54	0.921	0.794 to 1.069	0.672***	0.579 to 0.780
25–39	0.784*	0.643 to 0.956	0.383***	0.313 to 0.469
18–24	0.959	0.637 to 1.444	0.247***	0.151 to 0.403
Marital status				
Married	Reference		Reference	
Divorced or widowed	0.899	0.706 to 1.145	0.923	0.749 to 1.139
Single	1.015	0.787 to 1.309	0.602**	0.443 to 0.819
Average total household income per month (¥)				
≥3000	Reference		Reference	
1000–2999	1.158*	1.021 to 1.314	0.764***	0.680 to 0.858
<1000	1.466***	1.224 to 1.756	0.607***	0.513 to 0.719
Missing	0.925	0.751 to 1.139	0.730**	0.589 to 0.905
Education				
College and above	Reference		Reference	
High school	1.247**	1.091 to 1.426	0.736***	0.641 to 0.846
No formal education or prime school	1.074	0.865 to 1.335	0.717**	0.582 to 0.882
Employment status				
Employed	Reference		Reference	
Unemployed	0.935	0.795 to 1.101	0.959	0.822 to 1.120
Retired	1.186*	1.019 to 1.381	1.490***	1.284 to 1.730
Cigarettes per day (CPD)				
CPD low	Reference		Reference	
CPD middle	1.139*	1.018 to 1.275	1.649***	1.476 to 1.841
CPD high	1.155	0.981 to 1.360	2.322***	1.987 to 2.714
Survey wave				
Wave 1	Reference		Reference	
Wave 2	1.191**	1.060 to 1.338	1.110*	1.004 to 1.227
Wave 3	2.109***	1.863 to 2.388	1.033	0.928 to 1.151
City				
Beijing	Reference		Reference	
Shenyang	1.919***	1.547 to 2.381	0.195***	0.157 to 0.243
Shanghai	0.849	0.696 to 1.034	0.329***	0.265 to 0.408
Changsha	2.339***	1.858 to 2.944	0.200***	0.160 to 0.251
Guangzhou	0.651***	0.531 to 0.799	0.338***	0.270 to 0.424
Yinchuan	0.496***	0.405 to 0.606	0.106***	0.085 to 0.133
Kunming	1.435*	1.018 to 2.024	0.347***	0.261 to 0.460
Constant	1.588***	1.255 to 2.010	3.477***	2.797 to 4.323
Observations	14 161		14 046	
Number of IDs	7283		7257	

*p<0.05, **p<0.01, ***p<0.001.

were single were also less likely to purchase in cartons than their married counterparts.

The impact of purchase behaviour on cigarette prices

Table 3 presents the estimated effects of price/cost-related purchase behaviours on cigarette prices based on equation (2) using the GEE method. The results in table 3 show that the two purchase behaviours are associated with reduced cigarette prices when examined alone and in combination. There are at least two reasons that might explain why smokers engaged in those two behaviours pay less for a pack of cigarettes than their

counterparts who did not. First, smokers who engage in those two behaviours may be more likely to buy different/cheaper brands of cigarettes (different mix of brands). Second, even when buying the same brand, smokers who engage in those two behaviours may be more likely to price shop across different locations/stores/vendors and/or purchase cheaper sub-brands within the same brand, as well as engaging in other price-reducing strategies (price shopping). To better understand the impact of these different mechanisms on prices, we estimated equation (2) using two different specifications: with and without controlling for cigarette brands. The top section of table 3 excludes brand-specific

Table 3 The impact of purchase behaviours on cigarette price (general estimating equation (GEE) models)

Variables	Coefficient	SE	Coefficient	SE	Coefficient	SE
Do not control for cigarette brands:						
The most-used cigarette brand chosen because of its low cost: 1: yes; 0: no	-0.181***	0.0145			-0.180***	0.0144
Most recent cigarette purchase for self was in carton: 1: yes; 0: no			-0.103***	0.0133	-0.101***	0.0132
Observations	13 771		13 947		13 768	
Number of IDs	7218		7250		7217	
Average real price per pack	¥6.75		¥6.75		¥6.75	
Estimated percentage reduction in real price per pack	-17%		-10%		-17%	
Estimated amount reduction in real price per pack	¥1.15		¥0.68		¥1.15	
					¥0.67	
Do control for cigarette brands:						
The most-used cigarette brand chosen because of its low cost: 1: yes; 0: no	-0.166***	0.0144			-0.165***	0.0143
Most recent cigarette purchase for self was in carton: 1: yes; 0: no			-0.0891***	0.0132	-0.0869***	0.0131
Observations	13 235		13 404		13 232	
Number of IDs	7139		7176		7138	
Average real price per pack	¥6.75		¥6.75		¥6.75	
Estimated percentage reduction in real price per pack	-15%		-8%		-15%	
Estimated amount reduction in real price per pack	¥1.01		¥0.54		¥1.02	
					¥0.54	

SEs have been adjusted to take into account the correlations in the error terms among the same respondent. Interview waves/years, and cities were included in all regressions.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

indicators and shows the overall price reductions due to both mechanisms (different mix of brands and price shopping). The bottom section includes brand-specific indicators and shows the price reductions as a result of price shopping (including purchase cheaper sub-brands within the same brand).

Choosing a brand based on cost/price consideration was associated with a decrease in cigarette prices. The estimated magnitude of its coefficient translates to a reduction of 17% in price or ¥1.15 for a pack of cigarettes when brand-specific indicators were not included. When brand-specific indicators were controlled for, the price reduction was 15% or ¥1.03 for a pack of cigarettes, with the average price for a pack of cigarettes being ¥6.75. In addition, purchasing in cartons was also found to be associated with a decrease in purchase price by approximately 10%, or a reduction of ¥0.68 per pack of cigarettes, when brand-specific indicators were not included; and a reduction of 8%, or ¥0.54 per pack of cigarettes, when cigarette brands were controlled for. Sensitivity analyses (last two columns in table 3) also reveal the estimated price reductions did not change when both behaviours were controlled for. These results suggested substantial impact on cigarettes prices of engaging in price/cost-related purchase behaviours. In addition, price shopping across different locations/stores/vendors and/or buying cheaper sub-brands accounted for a significant portion (80% to 88%) of the estimated price differentials between smokers who engage in those two behaviours and smoker who did not. The rest of the price differentials between those two groups were due to their use of different cigarette brands.

It is noteworthy that the estimates in table 3 do not represent the causal impact of those behaviours on purchase prices, rather they reflect the observed price differentials associated with those behaviours. To the extent that purchase prices may be correlated with the average retail prices, and higher average overall retail cigarette prices may lead to more cost-reducing behaviours, the estimated price differentials are likely to be endogenous and represent a conservative lower-bound estimate of the true impact of those behaviours on prices.

DISCUSSION

Our analysis of the ITC China Survey data revealed that a significant portion of Chinese urban smokers engaged in price/cost-related purchase behaviours. In particular, nearly three-quarters (72%) of smokers surveyed indicated that an important reason they chose their most-used cigarette brand was its low cost/price. Additionally, buying in cartons was also popular among Chinese smokers, with almost half of smokers reporting buying in cartons at their most recent cigarette purchase.

The analyses also revealed SES differences in engaging in price/cost-related purchase behaviours. Our analyses show that those with low family income and/or low levels of education tend to be more likely to choose a brand based on its low cost/price, indicating that low-income/education smokers are fairly sensitive to cigarette price/cost. However, those with a higher income and/or high level of education are more likely to buy in cartons, presumably to take advantage of the lower per-unit price and also to minimise time costs or opportunity costs of having to make frequent purchases. Our finding that low-income smokers were less likely to buy in cartons when they purchase cigarettes does not necessarily reflect a lack of price sensitivity among those individuals; rather, we believe it reflects the liquidity constraints among low-income smokers in China, even though the unit price is lower when purchasing cartons. In addition to SES differences, we also found significant gender differences in price/cost-related purchase behaviours. Female smokers were less likely to report that low cost/price was a reason for choosing their most-used cigarette brand, suggesting that brand choices among women are influenced more by factors other than low cost/price. However, female smokers were more likely to purchase cartons than their male counterparts. Younger adults were less likely to report that low cost/price was a reason for choosing their most-used cigarette brand; they were also less likely to purchase cartons.

The analyses in this paper also provide evidence on the impact of price/cost-related purchase behaviours on cigarette prices. Our results show that those who chose cigarette brands

based on low cost/price, and those who bought in cartons, paid significantly lower prices than those who did not, even for the same cigarette brand. The price savings ranged from ¥0.54 to ¥1.03 per pack of cigarettes, depending on the behaviour examined, representing an 8% to 15% price reduction. Previous studies have found evidence of a link between purchase behaviour and certain tobacco use outcomes, such as quit intentions and quit attempts. Our results provide additional evidence by demonstrating the link between purchase behaviour and reduced cigarette prices. This has implications for those who engage in these behaviours, particularly among low-income individuals and female smokers.

Our study is subject to a number of limitations. In particular, because our smoker sample covers only 7 cities in China, and is older than the general adult smoker population in China, the representativeness and generalisation of our findings is limited. Despite these limitations, our analyses show that Chinese adult urban smokers are sensitive to the price/cost of cigarettes. They engage in price/cost-related purchase behaviours to minimise the impact of cigarette price on consumption. More important, smokers of different SES status engage in different purchase behaviours to mitigate the impact of higher cigarette prices. Low-income smokers are more likely to consider cost/price when choosing a cigarette brand. High-income smokers and smokers with high levels of education tend to buy in cartons. This has implications for studies that examine the price elasticity of cigarette demand in China. The existence and the extent of these complex behavioural responses among Chinese smokers may explain the low price elasticities found in some recent studies.^{17 19}

The finding from our study that smokers of different SES engage in different purchase behaviours to mitigate the impact of higher cigarette prices has important implications for tobacco control policy in China. Because low-income smokers are more likely to consider cost/price when choosing a cigarette brand, from a tobacco control policy perspective an excise tax structure that has a heavy specific tax component would be more likely to reduce tobacco use among low-income smokers because an increase in a specific tax would raise the price of cheaper brands relative to premium brands to a greater extent than would an ad valorem tax. In addition, minimum price laws that prevent cigarette retail prices from falling below a floor regardless of brand could be an effective policy tool to reduce cigarette consumption among low-income smokers, if the minimum price was set well above the current prices charged for the least expensive brands on the market. Additionally, policies that restrict price discounts through buying cartons could be an effective way to reduce cigarette consumption among high-income smokers in China.

What this paper adds

- ▶ This is one of the first studies to examine cigarette purchase behaviours and their relationship to cigarette price and consumption among adult urban Chinese smokers.
- ▶ A significant portion of Chinese urban smokers engage in price/cost-reducing purchase behaviours. Those behaviours reduce cigarette prices paid and are associated with increased consumption. Smokers of different socioeconomic status (SES) engaged in different purchase behaviours to mitigate the impact of higher cigarette prices.

Acknowledgements The authors would like to thank Richard S Gallagher for his editorial help.

Contributors JH, FJC, RZ and GTF designed the study; GTF, QJ, and YJ collected data; JH conducted data analysis; JH, RZ, and FJC contributed to data interpretation; JH wrote the first draft; JH, RZ, FJC and GTF revised the draft; The final version of this paper has been reviewed and approved by all coauthors.

Funding GTF was supported by a Senior Investigator Award from the Ontario Institute for Cancer Research and by a Prevention Scientist Award from the Canadian Cancer Society Research Institute. The ITC China Project was supported by grants from the US National Cancer Institute (R01-CA125116 and P01 CA138389), the Roswell Park Transdisciplinary Tobacco Use Research Center (P50 CA111236), the Canadian Institutes of Health Research (57897, 79551, and 115016), and the Chinese Center for Disease Control and Prevention. Additional support for this project was provided by a grant from the Canadian International Development Research Centre (grant no. 106839-001), titled 'Impact of Tobacco Tax and Price Policies on Tobacco Use in China'. None of the funding agencies played any role in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. The opinions expressed here are those of the authors, and do not necessarily reflect those of the sponsors.

Competing interests None.

Patient consent Obtained.

Ethics approval The ITC China Surveys were cleared for ethics by Research Ethics Boards or International Review Boards at the University of Waterloo (Canada), Roswell Park Cancer Institute (US), and the Chinese Center of Disease Control and Prevention.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Peto R, Britain ICRF (Great, Organization WH). *Mortality from smoking in developed countries, 1950–2000: indirect estimates from national vital statistics*. Oxford University Press, 1995.
- 2 Peto R, Lopez AD. Future worldwide health effects of current smoking patterns. In: Everett Loop C, Pearson CE, Rory Schwarz M, eds. *Critical Issues in Global Health*. San Francisco: Jossey-Bass, 2001;154–61.
- 3 Sung H, Wang L, Jin S, et al. Economic burden of smoking in China, 2000. *Tob Control* 2006;15(Suppl 1):i5–i11.
- 4 Yang L, Sung H-Y, Mao Z, et al. Economic costs attributable to smoking in China: update and an 8-year comparison, 2000–2008. *Tob Control* 2011;20:266–72.
- 5 Jin SG, Lu BY, Yan DY, et al. An evaluation on smoking-induced health costs in China (1988–1989). *Biomed Environ Sci BES* 1995;8:342–9.
- 6 Jha P, Chaloupka F. *Tobacco Control in Developing Countries*. 1st ed. Oxford University Press, USA, 2000.
- 7 International Agency for Research on Cancer. IARC Handbooks of Cancer Prevention, Tobacco Control, Vol. 14. Effectiveness of Tax and Price Policies for Tobacco Control. Lyon, France, 2011.
- 8 Hyland A, Bauer JE, Li Q, et al. Higher cigarette prices influence cigarette purchase patterns. *Tob Control* 2005;14:86–92.
- 9 White VM, Gilpin EA, White MM, et al. How Do Smokers Control their Cigarette Expenditures? *Nicotine Tob Res* 2005;7:625–35.
- 10 Cummings KM, Hyland A, Lewit E, et al. Use of discount cigarettes by smokers in 20 communities in the United States, 1988–1993. *Tob Control* 1997;6(Suppl 2):S25–30.
- 11 Hyland A, Higbee C, Bauer JE, et al. Cigarette purchasing behaviors when prices are high. *J Public Health Manag Pract* 2004;10:497–500.
- 12 Hyland A, Laux FL, Higbee C, et al. Cigarette purchase patterns in four countries and the relationship with cessation: findings from the International Tobacco Control (ITC) Four Country Survey. *Tob Control* 2006;15(Suppl 3):iii59–64.
- 13 Li Q, Hyland A, Fong GT, et al. Use of less expensive cigarettes in six cities in China: findings from the International Tobacco Control (ITC) China Survey. *Tob Control* 2010;19(Suppl 2):i63–8.
- 14 Licht AS, Hyland AJ, O'Connor RJ, et al. How do price minimizing behaviors impact smoking cessation? Findings from the International Tobacco Control (ITC) four country survey. *Int J Environ Res Public Health* 2011;8:1671–91.
- 15 Licht AS, Hyland AJ, O'Connor RJ, et al. Socio-economic variation in price minimizing behaviors: findings from the International Tobacco Control (ITC) four country survey. *Int J Environ Res Public Health* 2011;8:234–52.
- 16 Hu T, Mao Z, Shi J, et al. The role of taxation in tobacco control and its potential economic impact in China. *Tob Control* 2010;19:58–64.
- 17 Hu T-W. *Tobacco Control Policy Analysis in China: Economics and Health*. World Scientific, 2008.
- 18 Wu C, Thompson ME, Fong GT, et al. Methods of the International Tobacco Control (ITC) China Survey. *Tob Control* 2010;19(Suppl 2):i1–5.
- 19 Lance PM, Akin JS, Dow WH, et al. Is cigarette smoking in poorer nations highly sensitive to price? Evidence from Russia and China. *J Health Econ* 2004;23:173–89.

中国吸烟者卷烟购买行为、卷烟价格和消费：来自国际烟草控制政策评估项目 (ITC) 中国调查的发现

Jidong Huang,¹ Rong Zheng,² Frank J Chaloupka,¹ Geoffrey T Fong,^{3,4} Qiang Li,³ Yuan Jiang⁵

¹Institute for Health Research and Policy, University of Illinois at Chicago, Chicago, Illinois, USA

²中国, 北京市, 对外经济贸易大学, 国际贸易和经济学院

³Department of Psychology, University of Waterloo, Waterloo, Ontario, Canada

⁴Ontario Institute for Cancer Research, Toronto, Ontario, Canada

⁵中国, 北京市, 中国疾病预防控制中心

通讯作者:

Dr Jidong Huang

地址:

Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago, 1747 West Roosevelt Road, Chicago, Illinois 60608, USA
电子邮箱:
jhuang12@uic.edu

2013年3月8日收稿

2013年7月11日修订

2013年8月21日接受

2013年9月18日在线优先发表

摘要

背景 尽管已经证实卷烟购买行为与某些烟草使用的结果(如戒烟意向和戒烟尝试)有关联,但在世界上最大的卷烟消费市场—中国,却鲜有研究涉及卷烟购买行为及其对卷烟价格和消费的影响的研究。

目的 本研究旨在探寻与成本/价格相关的购行为的范围和决定因素,并估计这些行为对中国吸烟者所支付卷烟价格的影响。本文也评估了补偿购买行为社会经济方面的差异,并研究了社会经济地位差异如何影响购买行为、卷烟价格及卷烟消费相互之间的关系。

方法 本文采用广义估计方程方法对ITC项目中国调查的数据做了多元分析。ITC项目中国调查在北京、长沙、广州、昆明、上海、沈阳和银川这7个中国城市对成年吸烟者进行的一个纵向调查。在每个城市,每轮调查包含了约800名吸烟者。本文分析使用了ITC项目中国调查前三轮的调查数据。这三轮调查分别发生在2006年3月到2006年12月(第一轮),2007年11月到2008年3月(第二轮)和2009年5月到2009年10月以及2010年2月到2010年3月(第三轮)。本文从多方面分析了与吸烟者自报价格/成本相关的卷烟购买行为。

结果 几乎3/4(72%)的吸烟者表示他们选择常用卷烟品牌的一个主要原因是该品牌的低成本/价格。大约1/2(50.6%)的吸烟者表示在最近的卷烟购买中他们都是购买整条的卷烟。低收入和/或低受教育程度的吸烟者更可能会因为低成本/价格而选择某一品牌。然而,收入较高和/或较高受教育程度的吸烟者更偏好整条购买卷烟。某些购买行为也和性别、年龄有关,这些行为降低了购买价格。依据不同的购买行为,每包卷烟节约的购买价格从0.54元人民币到1.01元人民币不等,表现为价格降低了8%到15%。

结论 中国城市成年吸烟者中的很大一部分采取过降低成本/价格的购买行为。这样的购买行为降低了卷烟的价格,也促进了卷烟消费量的增加。不同社会经济地位的吸烟者会采取不同的购买行为来减缓较高的卷烟价格带来的影响。因此,在中国通过提高烟草的税收/价格来减少烟草使用必须要考虑这些与降低成本/价格相关的购买行为。

前言

烟草给中国带来了巨大的健康和经济损失^[1-5]。大幅提高烟草产品的消费税和价格已经被认为是降低烟草使用和缓解烟草使用带来的健康和经济损失的一项有效措施^[6,7]。此外,研究也表明社会经济地位(SES)较低的吸烟者很可能对税收和价格的变化更加敏感^[7]。这种由于社会经济地位的差异性而形成的对价格变动的不同响应,是减少烟草使用的一个重要途径。然而,如果吸烟者采用了补偿性行为以抵消或减少高税收/价格的影响,那么高税收/价格对戒烟和减少卷烟消费的预期影响可能被削弱。例如,当卷烟的税收/价格变的更高,吸烟者可能转向更便宜的品牌或其他花费较少的烟草产品,或从更廉价的途径获取卷烟,或整条地购买卷烟^[8-11]。事实上,先前的研究已经发现高税收/价格和戒烟意愿以及戒烟尝试之间的联系会因吸烟者为了降低价格而进行的购买行为而有所削弱^[12-15]。因此,为了准确评估高税收/价格的影响,理解吸烟者的响应行为显得很重要。由于社会经济地位(SES)对购买行为和烟草使用结果之间的关系有着潜在的重要影响,研究社会经济地位在补偿购买行为中的差异以及其在改变卷烟价格提高对烟草使用结果的影响中所扮演的角色也很重要。这些信息可能对指导中国制定未来的烟草控制政策有很大帮助。

过去对中国卷烟价格弹性所进行的研究已经提供了一些证据。这些证据显示,至少在部分人群中,中国吸烟者的卷烟消费对价格的改变是敏感的^[16,17]。这表明,在中国,更高的烟草税收/价格可以是一个有效的政策工具以减少烟草使用以及烟草所致的死亡和疾病。然而,在中国,迄今为止只有很少的研究关注了吸烟者的购买行为,以及该购买行为对烟草价格和消费的影响。此外,我们对社会经济地位(SES)在烟草价格/税收提高给中国吸烟者带来的影响中的潜在作用也知之甚少。本文填补了这些研究的空白领域,研究了若干与降低价格相关的购买行为的作用范围和决定因素,估计了这些行为对卷烟价格的影响,调查了这些行为和中国城市成年吸烟者的卷烟消费之间的联系。此外,本文评估了这些补偿购买行为的社会经济差异,并研究了这些差异怎样影响购买行为和卷烟价格之间的关系。

引用建议: Huang J, Zheng R, Chaloupka FJ, et al. *Tob Control* 2014;23:i67-i72.

方法

数据

本文的分析以ITC项目中国调查为基础。ITC项目中国调查始于2006年，是一个在中国七个城市（北京、长沙、广州、昆明、上海、沈阳和银川）进行的纵向队列研究。这七个城市在人口规模、地域和经济发展水平方面各不相同。这些城市位于中国不同的地理区域，能很好地代表中国城市地区。通过使用概率抽样的方法，每轮调查在各城市招募大约800名成年吸烟者。失访者会被与其具有可比性的补充受访者所替代，以维持城市水平的代表性样本。ITC项目中国调查的样本保留率较高，超过80%^[18]。关于ITC项目中国调查抽样方法更详细的信息可以参考Wu等的研究（2010）^[18]。

本研究使用了ITC项目中国调查的前三轮数据。这三轮调查分别于2006年、2007/2008年和2009/2010年进行。样本由来自上述每个城市（昆明除外）大约2400名（每轮调查800名吸烟者）吸烟者组成。而昆明是在第三轮调查时才加入ITC项目中国调查的，所以昆明仅调查了800名吸烟者。由于一些关键性的结果变量中存在缺失值（包括失访和拒访），我们采用的分析样本共包括约13000名吸烟者。

变量

本研究中我们研究的关键性变量是：（1）受访者是否将成本作为选择他们常用卷烟品牌的一个主要原因；（2）最近是按条还是按包购买卷烟；（3）最近的购买行为中吸烟者支付的每包卷烟的价格。此外，我们也研究了购买行为和吸烟强度之间的联系。吸烟强度用日均卷烟消费量来估计。

ITC项目中国调查中，吸烟者被询问在过去30天中他们最常使用的卷烟品牌，以及使用该品牌的原因。回答选项之一是“可承受的成本/价格”。我们根据对这个问题的回答构建了一个二分类变量。如果一个吸烟者表示他/她在选择卷烟品牌时将低廉的成本/价格作为一个考虑因素，该变量为1，否则为0。这一变量能反映中国吸烟者在选择卷烟品牌时是否具有成本/价格意识。

ITC项目中国调查还会询问吸烟者最近的卷烟购买经历，特别是他们花费了多少钱以及他们是按条还是按包购买卷烟。我们构建了一个二分类变量来反映按条购买的采购行为。赋值为1时表明按条购买，否则赋值为0。本研究使用的卷烟价格变量来自于受访者对每包卷烟自报的价格。该价格是根据最近的卷烟购买行为中支付的总价格和购买的卷烟数量而构建的。在我们的分析中，我们剔除了79条过高的（每包超过100元）或过低的（每包低于0.2元）单位价格的观测记录。我们依据通货膨胀调整了卷烟价格变量。卷烟消费量被定义为受访者日均吸烟量。这些数据来源于询问日常吸烟者每日吸烟的数量和非日常吸烟者每周吸烟的数量。基于日均吸烟量（CPD）这一变量，我们创建了三个二分类变量来反映吸烟的强度：轻度吸烟者（≤10 CPD），中度吸烟者（11–19 CPD）和重度吸烟者（≥20 CPD）。

除了这些关键变量，依据分析，我们也搜集了一些关键的人口学和社会经济的个人/家庭层面的特征，例如家庭收入、年龄、性别、教育水平、婚姻状况和其他收集在ITC项目中国调查中的社会经济地位方面的特征，以及调查轮次/年份、城市及卷烟品牌。具体来说，我们将不同年龄分为四组：18–24岁，25–39岁，40–54岁以及55岁及以上。婚姻状况分为：结婚，离婚，分居或丧偶，单身。教育水平分为三类：高中以下水平，高中水平，高等教育水平。基于2010年中国统计年鉴对城市地区的划分，家庭月收入分为：低

收入（<1000元），中等收入（1000–2999元）和高收入（≥3000元）。职业状态被分为就业、失业和退休。

统计分析方法

为了推断与成本/价格相关的购买行为在中国吸烟者中的作用范围，我们计算了上文讨论的关键性的购买行为变量的样本均数。我们采用方差估计的标准复杂调查事后分层技术来校准样本均数。该技术考虑了ITC项目中国调查的复杂调查/抽样策略。此外，我们根据抽样权重对那些统计数据做了适当的加权处理，关于加权方法的详细描述可以参考<http://www.itcproject.org>。

为研究参与成本/价格相关的购买行为的人群具有哪些特征，我们估算出了以下模型：

$$PB_{ijt} = \beta_0 + \beta_1 X_{ijt} + \beta_2 CPD_{ijt} + Wave_{ijt} + City_{ijt} + e_{ijt} \quad (1)$$

这里 PB_{ijt} 代表上文讨论的两个购买行为变量之一。其中 i, j, t 分别表示第 i 个个体，第 j 个城市，第 t 轮调查。 X_{ijt} 是一个反映个体水平和家庭水平的人口及社会经济特征（例如，年龄、性别、婚姻状况、教育水平以及调整通货膨胀后的家庭收入）的向量。 CPD 是一个反映吸烟强度的变量，用日均吸烟量来代表。 $City_{ijt}$ 是第 t 轮调查中，第 i 个个体所在城市的指标。 $Wave_{ijt}$ 是第 j 个城市第 i 个个体的调查轮次指标。 e_{ijt} 是异质误差项。

为调查购买行为和卷烟价格之间的联系，我们构建了以下模型：

$$P_{ijt} = \beta_0 + \beta_1 PB_{ijt} + Wave_{ijt} + City_{ijt} + Brand_{ijt} + e_{ijt} \quad (2)$$

这里 P_{ijt} 表示调整通货膨胀后一包卷烟的价格的对数形式，其中卷烟价格是由第 t 轮调查中第 j 个城市的第 i 个个体报告的他/她最近一次购买卷烟时的卷烟价格。 PB_{ijt} 代表两个购买行为之一的变量。 $Brand_{ijt}$ 是一个由0-1变量组成的向量，表示第 t 轮调查中第 j 个城市的第 i 个个体在他/她最近一次卷烟购买中购买的卷烟品牌。

因为ITC项目中国调查数据本身是纵向的，因此同一个个体在不同调查中的观测误差是相互关联的。所以，方程（1）和（2）使用广义估计方程（GEE）的方法（STATA V.12 `xtgee` command）估算。该方法考虑了同一个受访者在不同调查轮次（均方误差聚集在同一个体的观测值中）之间的误差项的相互关联。因为购买行为变量的性质——都是二分类变量——方程（1）使用GEE模型的logit连接来估计，对于误差项的协方差矩阵结构没有预先加上的结构假设。

结果

表1包含了本研究中使用的关键SES变量的汇总数据。我们的吸烟者样本均匀地分布于各轮调查和各个城市中（第三轮调查才加入的昆明除外）。在我们的样本中，城市吸烟者主要是男性（95%），平均年龄为50岁；其中89%的人在受调查时已经结婚。43%的吸烟者报告平均每月的家庭收入在1000元到2999元，15%的吸烟者每月家庭收入低于1000元，大约36%的吸烟者每月家庭收入高于3000元，剩下6%的家庭收入信息缺失。12%的吸烟者报告其教育水平低于高中，66%的吸烟者报告有高中教育水平，大约22%的吸烟者报告受过高于高中水平的教育，包括2年制大专课程。

将近3/4 (73%)的吸烟者报告成本/价格是他们选择常用卷烟品牌的原因之一。这表明在中国城市吸烟者中存在高水平的成本/价格意识。大约一半的吸烟者在他们最近一次购买卷烟中按条购买。调整通货膨胀后,吸烟者在他们最近的购买活动中购买的每包烟的平均价格是6.75元人民币(以2009年人民币的价值为准),而且在这7个中国城市中吸烟者平均每日消费的卷烟数量是17支。大约15%的吸烟者报告每天吸烟超过20支;将近一半的吸烟者报告每天吸烟介于10到20支之间,剩下的37%每天吸烟少于10支。

有成本/价格相关购买行为的人群的社会经济地位 (SES) 概况

表2显示了方程(1)的结果,研究了和成本/价格相关购买行为为有关联的SES因素。和最高收入组相比,每月收入介于1000-2999元的吸烟者(OR 1.16 (95% CI 1.02 - 1.31))和低于1000元的吸烟者(OR 1.32 (95% CI 1.10-1.59))更可能报告成本/价格是他们选择常用卷烟品牌的原因之一。同样地,相比那些受过高等教育的人群,那些只有高中教育水平的人在选择品牌时有更多的成本/价格意识(OR 1.25 (95% CI 1.09 - 1.43))。相比已就业的吸烟者,退休的吸烟者更可能因为低成本/价格选择一个品牌(OR 1.19 (95% CI 1.02 - 1.38))。和预料的一样,那些吸烟每天超过10支的吸烟者比轻度吸烟者更可能(OR 1.14 (95% CI 1.02 - 1.28))报告成本/价格是他们选择常用卷烟品牌的原因之一,而重度吸烟者(每天吸烟超过20支)和轻度吸烟者没有显著差异。女性吸烟者(OR 0.73 (95% CI 0.53 - 0.99))和年龄25到39岁的吸烟者(OR 0.78 (95% CI 0.64 - 0.96))较少地将低成本/价格当作品牌选择的原因之一。

关于是否在最近的购买行为中整条购买卷烟,女性吸烟者(OR 1.63 (95% CI 1.28 -2.09))、已退休吸烟者(OR 1.49 (95% CI 1.28 -1.73))、以及中度吸烟者(OR 1.65 (95% CI 1.48 -1.84))和重度吸烟者(OR 2.32 (95% CI 1.99-2.71))更可能整条购买卷烟。和55岁及以上的吸烟者相比,年轻吸烟者不太可能整条购买卷烟;年轻人中,年龄18到24岁的吸烟者最不可能整条购买卷烟。和高收入吸烟者相比,可能由于现金有限,中等收入和低收入水平的吸烟者都较少可能整条购买卷烟。单身的吸烟者比相应的已婚的吸烟者也更少可能整条购买卷烟。

购买行为对卷烟价格的影响

表3展示了基于方程(2)使用GEE估计的价格/成本相关的购买行为对卷烟价格的影响。表3中的结果显示,无论是单独分析还是结合在一起分析,这两种购买行为都和较低的卷烟价格是有关联的。至少有两个原因可以解释为什么有这两种行为的吸烟者支付的每包卷烟的价格比对应的其他没有这两种行为的吸烟者少。首先,存在这两种行为的吸烟者更可能购买不同的/更便宜的卷烟品牌(或者品牌组合)。第二,即使购买的是同一品牌,存在这两种行为的吸烟者更可能不同的地点/商店/供应商选择价格低的购买途径,或者购买同一品牌下的更便宜的品种,以及其他降低价格的策略(比价购物)。为了更好的理解这些不同的机制对价格的影响,我们使用两个不同的设定来构建方程(2):控制和不控制卷烟品牌这一变量。表3的前半部分没有考虑特定品牌指标,并且显示,上文提到的两种价格/成本相关的购买行为(品牌组合和比价购物)导致总体卷烟价格降低。表3的后半部分考虑了品牌指标,并显示了由于比价购物(包括购

表1 分类汇总统计数据

	人数	%
购买行为		
因为低成本/价格而选择最常使用的卷烟品牌: 1 -是; 0 -否	14161	72.6
最近给自己买烟是整条购买: 1 - 是; 0 -否	13861	50.6
性别		
男性	13457	95.0
女性	704	5.0
年龄		
18 - 24	184	1.3
25 - 39	2465	17.4
40 - 54	6826	48.2
55+	4686	33.1
婚姻状况		
结婚	12633	89.2
离婚、分居、丧偶	894	6.3
单身	634	4.5
平均每月家庭总收入(¥)		
<1000	2117	14.9
1000 - 2999	6078	42.9
>= 3000	5064	35.8
缺失	902	6.4
教育		
低于高中	1692	11.9
高中	9293	65.6
大学及以上	3176	22.4
就业状况		
就业	8595	60.9
失业	1869	13.3
退休	3641	25.8
日均吸烟量		
<=10 CPD	5209	36.8
11-19 CPD	6848	48.4
>= 20 CPD	2104	14.9
城市		
北京	2213	15.6
沈阳	2256	15.9
上海	2255	15.9
长沙	2185	15.4
广州	2260	16.0
银川	2203	15.6
昆明	789	5.6

买同一品牌下较为廉价的品种)造成的价格降低。

基于成本/价格来选择品牌的购买行为和卷烟价格的降低是相关的。当不控制特定品牌指标时,模型估计的系数大小可以理解为价格降低17%或每包卷烟降低1.15元。当控制特定品牌指标时,估计系数表示价格减少15%或每包卷烟减少1.03元,平均每包卷烟的价格是6.75元。此外,我们发现整条购买卷烟的购买行为也和购买价格的降低有关。当不考虑品牌指标时,整条购买导致价格降低大约10%或每包卷

表2 和购买行为相关的社会经济地位 (SES) 因素 (OR值来自广义估计方程 (GEE) 模型)

变量	因为低成本而选择最常使用的卷烟品牌		最近给自己整条购买卷烟	
	OR	95% CI	OR	95% CI
性别				
男性	参照		参照	
女性	0.725*	(0.530 - 0.992)	1.631***	(1.276 - 2.085)
年龄				
55+	参照		参照	
40 - 54	0.921	(0.794 - 1.069)	0.672***	(0.579 - 0.780)
25 - 39	0.784*	(0.643 - 0.956)	0.383***	(0.313 - 0.469)
18 - 24	0.959	(0.637 - 1.444)	0.247***	(0.151 - 0.403)
婚姻状况				
结婚	参照		参照	
离婚或丧偶	0.899	(0.706 - 1.145)	0.923	(0.749 - 1.139)
单身	1.015	(0.787 - 1.309)	0.602**	(0.443 - 0.819)
平均每月家庭总收入 (元)				
≥ 3000	参照		参照	
1000 - 2999	1.158*	(1.021 - 1.314)	0.764***	(0.680 - 0.858)
< 1000	1.466***	(1.224 - 1.756)	0.607***	(0.513 - 0.719)
缺失	0.925	(0.751 - 1.139)	0.730**	(0.589 - 0.905)
教育				
大学及以上	参照		参照	
高中	1.247**	(1.091 - 1.426)	0.736***	(0.641 - 0.846)
没受过正式教育或中小学	1.074	(0.865 - 1.335)	0.717**	(0.582 - 0.882)
就业状态				
就业	参照		参照	
失业	0.935	(0.795 - 1.101)	0.959	(0.822 - 1.120)
退休	1.186*	(1.019 - 1.381)	1.490***	(1.284 - 1.730)
每日吸烟量 (CPD)				
CPD低	参照		参照	
CPD中	1.139*	(1.018 - 1.275)	1.649***	(1.476 - 1.841)
CPD高	1.155	(0.981 - 1.360)	2.322***	(1.987 - 2.714)
调查序列				
第一轮	参照		参照	
第二轮	1.191**	(1.060 - 1.338)	1.110*	(1.004 - 1.227)
第三轮	2.109***	(1.863 - 2.388)	1.033	(0.928 - 1.151)
城市				
北京	参照		参照	
沈阳	1.919***	(1.547 - 2.381)	0.195***	(0.157 - 0.243)
上海	0.849	(0.696 - 1.034)	0.329***	(0.265 - 0.408)
长沙	2.339***	(1.858 - 2.944)	0.200***	(0.160 - 0.251)
广州	0.651***	(0.531 - 0.799)	0.338***	(0.270 - 0.424)
银川	0.496***	(0.405 - 0.606)	0.106***	(0.0852 - 0.133)
昆明	1.435*	(1.018 - 2.024)	0.347***	(0.261 - 0.460)
截距项	1.588***	(1.255 - 2.010)	3.477***	(2.797 - 4.323)
观测值数量	14,161		14,046	
ID数量	7,283		7,257	

*p<0.05, **p<0.01, ***p<0.001.

表3 购买行为对卷烟价格的影响 (GEE模型)

变量	系数	标准误	系数	标准误	系数	标准误
不控制卷烟品牌:						
因为低成本而选择最常使用的卷烟品牌: 1 - 是; 0 - 否	-0.181***	(0.0145)			-0.180***	(0.0144)
最近给自己整条购买卷烟: 1 - 是; 0 - 否			-0.103***	(0.0133)	-0.101***	(0.0132)
观测值数量	13,771		13,947		13,768	
ID数量	7,218		7,250		7,217	
每包卷烟的平均实际价格	¥6.75		¥6.75		¥6.75	
估计每包卷烟实际价格减少的百分比	-17%		-10%		-17%	
					-10%	
估计每包卷烟实际价格减少的值	¥1.15		¥0.68		¥1.15	
					¥0.67	
控制卷烟品牌:						
因为低成本而选择最常使用的卷烟品牌: 1 - 是; 0 - 否	-0.166***	(0.0144)			-0.165***	(0.0143)
最近给自己整条购买卷烟: 1 - 是; 0 - 否			-0.0891***	(0.0132)	-0.0869***	(0.0131)
观测值数量	13,235		13,404		13,232	
ID数量	7,139		7,176		7,138	
每包卷烟的平均实际价格	¥6.75		¥6.75		¥6.75	
估计每包卷烟实际价格减少的百分比	-15%		-8%		-15%	
					-8%	
估计每包卷烟实际价格减少的值	¥1.01		¥0.54		¥1.02	
					¥0.54	

误差项已被调整以考虑同一受访者之间误差项的相关性。调查轮次/年份和城市都被纳入到所有的回归中。

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ 。

烟降价0.68元。当考虑了卷烟品牌时, 价格减少为8%或每包卷烟减少0.54元。敏感性分析(表3最后两列)也显示当控制了这两种行为时, 估计的价格降低没有变化。这些结果暗示价格/成本相关的购买行为对卷烟价格的影响很大。此外, 在不同的地点/商店/供应商比价购物和/或购买更便宜的品种能解释很大一部分(80%-88%)存在于有上述两种行为的吸烟者和没有这些行为的吸烟者之间的估计价格的差异。这两个人群之间存在的价格差异的其他部分是由于他们使用不同的卷烟品牌。

值得注意的是, 表3中的估计值不能代表上述行为对购买价格的因果性影响, 它们只是反映了观察到的价格变化和那些行为之间的关联。在某种程度上, 购买价格可能和平均零售价格是相关的, 而更高的卷烟平均零售价格可能导致更多的降低成本的行为, 估计价格的差异可能是内生性的, 并且代表购买行为对价格真实影响的下限的保守估计。

讨论

我们对ITC项目中国调查数据的统计分析表明, 很大一部分中国城市吸烟者存在着价格/成本相关的购买行为。特别是近3/4(72%)的被调查的吸烟者表示他们选择常用卷烟品牌的一个重要原因就是该品牌的低成本/价格。此外, 在中国吸烟者中也流行整条购买卷烟, 几乎有一半的吸烟者报告说在他们最近的卷烟购买行为中是整条购买的。

分析还揭示了在参与价格/成本相关的购买行为中社会经济地位上的差异。我们的分析显示, 低家庭收入和/或低受教育水平的人群更倾向于出于卷烟的低成本/价格的

考虑来选择卷烟品牌。这表明低收入/受教育水平的吸烟者对于卷烟的价格/成本是相当敏感的。然而, 更高收入和/或高受教育水平的人群更可能会整条购买卷烟, 这大概是为了降低单位价格并减少频繁购买导致的时间成本或机会成本。我们关于低收入吸烟者不太可能整条购买卷烟的发现并不意味着这一人群缺乏价格敏感性。尽管整条购买卷烟可以使卷烟的单位价格更低, 我们认为上述现象反映了中国低收入吸烟者中的流动性约束。除了社会经济地位上的差异, 我们发现在价格/成本相关的购买行为中也存在显著的性别差异。女性吸烟者较少可能报告低成本/价格是她们选择常用卷烟品牌的原因之一。这暗示在品牌选择方面, 女性更多地被除低成本/价格外的其他因素所影响。然而, 女性吸烟者比相应的男性吸烟者更可能整条购买卷烟。年轻人较少可能报告低成本/价格是选择常用卷烟品牌的原因之一; 他们也不太可能整条购买卷烟。

本文中的统计分析也提供了关于价格/成本相关的购买行为对卷烟价格影响的证据。我们的结果显示即便是同样的卷烟品牌, 那些基于低成本/价格选择卷烟品牌的人群和整条购买卷烟的人群支付的价格明显低于没有上述行为的人群。依据研究的具体行为, 每包卷烟节省的价钱从0.54元到1.03元不等, 相当于价格降低8%到15%。过去的研究已经发现证据证明了购买行为和某些烟草使用结果(例如戒烟意愿和戒烟尝试)之间的关联。我们的研究提供了更多的证据, 证明购买行为和卷烟价格降低之间的联系。这使我们能够更充分的了解有这些购买行为的人群, 尤其是低收入人群和女性吸烟者。

我们的研究也存在一些局限性。具体来说，我们的吸烟者样本仅仅覆盖了中国的7个城市，而且研究的吸烟者年龄比中国一般成年吸烟人群大，这限制了研究结果的代表性和推广性。尽管存在这些局限，我们的研究显示，中国城市成年吸烟者对卷烟的价格/成本较为敏感。他们通过价格/成本相关的购买行为来最小化卷烟价格对卷烟消费造成的影响。更重要的是，处于不同社会经济地位的吸烟者会通过不同的购买行为来缓解更高的卷烟价格带来的影响。在选择一个卷烟品牌时，低收入的吸烟者更倾向于考虑成本/价格。高收入吸烟者和高教育水平的吸烟者倾向于整条购买卷烟。这些结论对研究中国卷烟需求的价格弹性有一定意义。中国吸烟者中这些复杂的行为反应的存在及其范围可能可以解释在最近一些研究中发现的低价格弹性^[17,19]。

本研究发现，不同社会经济地位的吸烟者会通过不同的购买行为去减缓更高的卷烟价格带来的影响，这对于中国制定烟草控制政策具有重要意义。因为低收入吸烟者在选择卷烟品牌时更可能考虑成本/价格，从烟草控制政策的视角来看，相比从价税，从量税的增加可能会更大幅度地提高高价品牌（相对高端品牌而言）的价格，因此从量税占大份额的消费税结构更可能减少低收入吸烟者中的烟草使用。此外，如果将卷烟的最低价格设定为高于目前市场最便宜的卷烟品牌价格，那么针对所有品牌的最低价格法，能防止卷烟零售价格跌落至某一限度以下，这可能是减少低收入吸烟者的卷烟消费的一个有效的政策工具。此外，限制整条购买卷烟而获得价格折扣的政策可能也是一个有效的降低中国高收入吸烟者的卷烟消费的方法。

本文贡献

- ▶ 这是首批关于中国城市成年吸烟者卷烟购买行为以及这些行为和卷烟价格与消费之间关系的研究之一。
- ▶ 中国城市成年吸烟者中的很大一部分采取了降低成本/价格的购买行为。这样的购买行为降低了卷烟的价格，也促进了卷烟消费量的增加。不同社会经济地位的吸烟者会采取不同的购买行为来减缓较高的卷烟价格带来的影响。

致谢

感谢Richard S Gallagher的编辑协助。

贡献

JH、FJC、RZ和GTF设计了该研究；GTF、QJ和YJ收集了数据；JH进行数据分析；JH、RZ和FJC对数据进行了解释；JH写了第一稿；JH、RZ、FJC和GTF修改了初稿；本文的最终版本由所有作者共同检查和认可。

经费

GTF获得 the Ontario Institute for Cancer Research 的 Senior Investigator Award和 the Canadian Cancer Society Research Institute 的 Prevention Scientist Award的支持。ITC项目中国调查受助于 US National Cancer Institute (R01-CA125116 和 P01 CA138389)、the Roswell Park Transdisciplinary Tobacco Use Research Center (P50 CA111236)、the Canadian Institutes of Health Research (57897、79551和115016)和中国疾病预防控制中心。对本项目额外的资助来自于 the Canadian International Development Research Centre (资助号106839-001)、名称

“Impact of Tobacco Tax and Price Policies on Tobacco Use in China”。资助机构没有参与本研究设计、数据收集、分析和解释、报告撰写以及论文的发表。本文中的观点仅代表作者本人的观点而不反映赞助方的观点。

利益冲突 无。

知情同意 已获得。

伦理审核 ITC中国调查通过 University of Waterloo研究伦理委员会（加拿大），Roswell Park Cancer Institute国际审查委员会（美国），以及中国疾病预防控制中心的伦理审查。

出处和同行审查 未开展；外部同行已评审。

参考文献

- 1 Peto R, Britain ICRF (Great, Organization WH). *Mortality from smoking in developed countries, 1950–2000: indirect estimates from national vital statistics*. Oxford University Press, 1995.
- 2 Peto R, Lopez AD. Future worldwide health effects of current smoking patterns. In: Everett Loop C, Pearson CE, Rory Schwarz M, eds. *Critical Issues in Global Health*. San Francisco: Jossey-Bass, 2001;154–61.
- 3 Sung H, Wang L, Jin S, et al. Economic burden of smoking in China, 2000. *Tob Control* 2006;15(Suppl 1):i5–i11.
- 4 Yang L, Sung H-Y, Mao Z, et al. Economic costs attributable to smoking in China: update and an 8-year comparison, 2000–2008. *Tob Control* 2011;20:266–72.
- 5 Jin SG, Lu BY, Yan DY, et al. An evaluation on smoking-induced health costs in China (1988–1989). *Biomed Environ Sci BES* 1995;8:342–9.
- 6 Jha P, Chaloupka F. *Tobacco Control in Developing Countries*. 1st ed. Oxford University Press, USA, 2000.
- 7 International Agency for Research on Cancer. IARC Handbooks of Cancer Prevention, Tobacco Control, Vol. 14. Effectiveness of Tax and Price Policies for Tobacco Control. Lyon, France; 2011.
- 8 Hyland A, Bauer JE, Li Q, et al. Higher cigarette prices influence cigarette purchase patterns. *Tob Control* 2005;14:86–92.
- 9 White VM, Gilpin EA, White MM, et al. How Do Smokers Control their Cigarette Expenditures? *Nicotine Tob Res* 2005;7:625–35.
- 10 Cummings KM, Hyland A, Lewit E, et al. Use of discount cigarettes by smokers in 20 communities in the United States, 1988–1993. *Tob Control* 1997;6(Suppl 2):S25–30.
- 11 Hyland A, Higbee C, Bauer JE, et al. Cigarette purchasing behaviors when prices are high. *J Public Health Manag Pract* 2004;10:497–500.
- 12 Hyland A, Laux FL, Higbee C, et al. Cigarette purchase patterns in four countries and the relationship with cessation: findings from the International Tobacco Control (ITC) Four Country Survey. *Tob Control* 2006;15(Suppl 3):iii59–64.
- 13 Li Q, Hyland A, Fong GT, et al. Use of less expensive cigarettes in six cities in China: findings from the International Tobacco Control (ITC) China Survey. *Tob Control* 2010;19(Suppl 2):i63–8.
- 14 Licht AS, Hyland AJ, O'Connor RJ, et al. How do price minimizing behaviors impact smoking cessation? Findings from the International Tobacco Control (ITC) four country survey. *Int J Environ Res Public Health* 2011;8:1671–91.
- 15 Licht AS, Hyland AJ, O'Connor RJ, et al. Socio-economic variation in price minimizing behaviors: findings from the International Tobacco Control (ITC) four country survey. *Int J Environ Res Public Health* 2011;8:234–52.
- 16 Hu T, Mao Z, Shi J, et al. The role of taxation in tobacco control and its potential economic impact in China. *Tob Control* 2010;19:58–64.
- 17 Hu T-W. Tobacco Control Policy Analysis in China: Economics and Health. World Scientific, 2008.
- 18 Wu C, Thompson ME, Fong GT, et al. Methods of the International Tobacco Control (ITC) China Survey. *Tob Control* 2010;19(Suppl 2):i1–5.
- 19 Lance PM, Akin JS, Dow WH, et al. Is cigarette smoking in poorer nations highly sensitive to price? Evidence from Russia and China. *J Health Econ* 2004;23:173–89.