

A novel approach to estimating the prevalence of untaxed cigarettes in the USA: findings from the 2009 and 2010 international tobacco control surveys

Brian V Fix,¹ Andrew Hyland,¹ Richard J O'Connor,¹ K Michael Cummings,² Geoffrey T Fong,^{3,4} Frank J Chaloupka,⁵ Andrea S Licht^{1,6}

¹Department of Health Behavior, Roswell Park Cancer Institute, Buffalo, New York, USA

²Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, Charleston, South Carolina, USA

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

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

⁵Department of Economics, Institute for Health Research and Policy, University of Illinois at Chicago, Chicago, Illinois, USA

⁶Department of Social and Preventive Medicine, State University of New York at Buffalo, Buffalo, New York, USA

Correspondence to

Brian V Fix, Department of Health Behavior, Roswell Park Cancer Institute, Elm and Carlton Street, Buffalo, NY 14263, USA; brian.fix@roswellpark.org

Received 28 February 2013

Revised 21 June 2013

Accepted 30 July 2013

Published Online First

22 August 2013

ABSTRACT

Background Increases in tobacco taxes are effective in reducing tobacco consumption, but because of the addictive nature of cigarettes, smokers often seek out less expensive sources of cigarettes. The objective of this study is to estimate the prevalence of cigarette packs that are untaxed by the state in which the participant resides in a sample of US smokers at two time points.

Methods Data for this study were taken from the 2009 and 2010 waves of the International Tobacco Control United States Survey. Members of this nationally representative cohort of smokers were invited to send us an unopened pack of their usual brand of cigarettes.

Results In 2009, 318 packs were received from 401 eligible participants (79%). In 2010, 366 packs were received from 491 eligible participants (75%). In total, 20% of the packs in 2009 and 21% in 2010 were classified as untaxed by the participant's state of residence. The prevalence of untaxed cigarettes was higher in states with higher-excise taxes. Smokers who do not have a plan to quit were significantly more likely to have sent back a pack that was classified as untaxed by the participant's state of residence.

Conclusions One in five packs were untaxed with rates higher in states with higher-excise taxes. It is unclear whether these estimates differ from the actual prevalence of cigarettes that are untaxed by a smoker's state of residence. Harmonisation of excise tax rates across all 50 US states might be one method of reducing or eliminating the incentive to avoid or evade these taxes.

INTRODUCTION

In a recent review of research on the public health benefits of tobacco taxation, Chaloupka *et al*¹ found that increases in taxes on tobacco products are effective in reducing tobacco consumption, especially among the young and the poor. When taxes increase and prices reflect that increase, there are two major behavioural effects. First, smoking prevalence decreases, both because there is an increase in quitting among smokers and because there are fewer non-smokers (almost entirely among youth and young adults) who become smokers. Second, there is a decrease in consumption among those who remain smokers.^{2–9} Further, the effect of high tobacco taxes on public health is amplified when a portion of the tax revenue is used to fund additional tobacco control and public health programmes.^{10–12}

However, not all of the effects of a tax/price increase on behaviour result in positive health

benefits. Some smokers may respond by switching to a less expensive brand or changing the source of cigarettes so as to lower out-of-pocket expenses. That is, smokers may seek to reduce the impact of the tax increase by seeking cheaper sources of cigarettes through a variety of legal and illicit channels.^{5 13–15} Recent studies suggest that the availability of lower-cost cigarettes may blunt the public health impact of high prices and/or taxes on smoking prevalence. Licht and colleagues found that smokers who engaged in price or tax avoidance behaviours were less likely to report cessation, and that over the long term, the use of low and untaxed cigarette sources was associated with low rates of cessation.^{16 17}

Measuring the prevalence of various price-minimising strategies can be difficult. While brand switching can be assessed using survey items, more furtive behaviours like purchasing untaxed cigarettes can be harder to measure.

Previous studies have collected discarded cigarette packs in order to estimate the prevalence of untaxed or 'contraband' tobacco products. A recent study examining littered packs in the South Bronx area of New York City found that 42% of packs examined did not have any tax stamp and 15.8% had tax stamps from a state other than New York affixed to the packs.¹⁸ Another study that relied upon a collection of discarded cigarette packs to estimate the prevalence of foreign tobacco in New Zealand found that 3.2% of packs examined were from outside of the country, which translates to approximately \$36 million in lost tax revenue for the New Zealand government.¹⁹ However, the relatively narrow geographic areas where the cigarette packs are collected limit the generalisability of such studies. Additionally, estimates based on littered packs can be problematic given that in the USA tax stamps are affixed to the outer cellophane, which can be lost or discarded rather than the actual package. Further, estimates based on discarded packs could be a reflection of commuting and tourism patterns rather than tax avoidance or evasion. Examining unopened packs would avoid this problem, but since these are typically not discarded, they would need to be provided by smokers for examination, the feasibility of which is unknown.

This article reports on a supplementary study conducted during the 2009 and 2010 waves of the International Tobacco Control United States (ITC US) survey. The nationally representative sample of adult smokers in the ITC US cohort were invited

To cite: Fix BV, Hyland A, O'Connor RJ, *et al.* *Tob Control* 2014;**23**:i61–i66.

to send us an unopened pack of their usual brand of cigarettes, purchased from the outlet where they normally purchase their cigarettes.

The main objective of this study was to estimate the prevalence of cigarette packs that are untaxed by the participant's state of residence in a sample of US smokers at two time points. An additional objective was to examine the characteristics of participants who sent cigarette packs that were untaxed by the participant's state of residence.

METHODS

The data sources for this study are the 2009 and 2010 ITC US surveys. The ITC US survey began in 2002 and has been conducted approximately annually, in conjunction with ITC surveys in Canada, UK and Australia. It includes questions to assess smoking behaviour, attempts at cessation and attitudes and beliefs about tobacco products, as well as questions pertaining to each of the demand reduction policies of the WHO Framework Convention on Tobacco Control and a set of important psychosocial mediators and moderators of tobacco use and of cessation. The ITC US survey use random digit dialling to recruit a sample of randomly selected adult (≥ 18 years) smokers. Cohort members who are lost to follow-up are replaced with newly recruited participants from the same sampling frame to preserve the overall sample size from wave to wave. A primary objective of each ITC survey is to evaluate the psychosocial and behavioural effects of national-level and sub-national tobacco control policies.²⁰

This article reports data from US participants in two versions of the ITC survey. The 2009 survey was conducted between November 2009 and January 2010 of the existing cohort at the previous wave of the ITC US survey (Wave 7, which had been conducted between October 2008 and July 2009). The 2010 survey was conducted between July 2010 and January 2011. Further details of the sampling design used in the ITC survey can be found at <http://www.itcproject.org/>.

The total eligible sample size for the 2009 survey was 912 participants who at the preceding wave of the ITC US survey (Wave 7) reported being a daily smoker of 10 or more cigarettes per day, reported that they regularly smoked a particular variety of factory-made cigarettes and provided the type of location where they usually purchase their cigarettes. For the 2010 survey, the total eligible sample size was 1144 smokers. Daily smokers who reported in the telephone survey that they smoked five or more cigarettes per day and reported that they smoked factory-made or mostly factory-made cigarettes were eligible for the pack collection component of the study.

The eligibility criteria differed between the two data collections because the first wave of data collection was done as a feasibility study. These criteria were used because we hypothesised that daily smokers of at least 10 cigarettes per day would be more likely to have a pack of cigarettes readily available to send back to us. Given the positive response to the first wave of data collection, we opened the second wave to a wider array of current smokers, using >5 cigarettes per day as the eligibility criteria.

Those who agreed to send in a pack of their usual brand of cigarettes were mailed a data collection kit, which included an information sheet, cover letter, instructions asking them for an unopened pack of their usual brand of cigarettes, a short questionnaire, a plastic zip-top bag for their cigarette pack and a postage-paid return envelope. Participants received US\$25 in order to compensate them for their time and effort.

When cigarette packs were received, they were subject to a thorough visual inspection. Characteristics of each pack including brand, descriptive term, length, pack colour and type of tax stamp were recorded. All of the data collection methods were reviewed and approved by the Roswell Park Cancer Institute Institutional Review Board and the University of Waterloo Human Research Ethics Committee.

The behaviours measured in this study are broadly categorised as tax avoidance or tax evasion. Tax avoidance is operationally defined as any form of direct purchase that seeks to reduce the overall cost of cigarettes through legal means such as purchasing from an Indian Reservation, cross-border outlet, duty-free shop or via the internet. Tax evasion is defined as any form of purchase that seeks to avoid paying taxes on a pack of cigarettes by purchasing through illicit means such as street vendors or legitimate outlets that sell packs of cigarettes with the inappropriate or no tax stamp.

Quantifying such behaviour can present challenges, as smokers may be reluctant to report engaging in these behaviours and/or may not be aware that their behaviours constitute tax avoidance or tax evasion at all. The approach to measuring such behaviours reported in this manuscript yields an estimate based on a combination of tax avoidance and tax-evasive behaviours. Because we did not ask participants to send a receipt or otherwise verify the state in which they purchased the cigarettes sent for evaluation, it was not possible to measure the two behaviours separately. Despite this limitation, this approach allows for an objective assessment of cigarette tax status.

Observational data from a visual inspection of the state tax stamp on the cigarette packs were used to determine whether a pack was classified as untaxed or taxed by the participant's state of residence. Taxed packs were defined as packs that carried a tax stamp matching the participant's state of residence. If there was no stamp or the stamp did not match the participant's state of residence, the pack was classified as untaxed. Three states (NC, ND and SC) do not use tax stamps. So, packs received from participants in these states ($n=18$ packs from participants in the 2009 study; $n=18$ packs from participants in the 2010 study) were excluded from the analyses (total sample size of 300 packs in 2009 and 348 in 2010). We had no basis for classifying these as untaxed or taxed at the state level based on our operational definition.

Bivariate χ^2 test statistics were used to examine the relationship between residence in a high excise tax state compared with a low excise tax state (defined as state excise taxes above or below the federal tax rate of \$1.01 per pack), various demographic measures (age, gender, race, income, education and heaviness of smoking index) and purchasing cigarettes that were classified as untaxed by the participant's state of residence. Gamma tests were used to assess the strength of association between packs that were not taxed by the participant's state of residence and the ordinal variables. In addition, self-reported brand and pack Universal Product Code (UPC) obtained during the telephone interview was compared with the brand family and UPC printed on the pack sent for analysis. The UPC is a specific bar code used for tracking merchandise sold to consumers. Each variety of cigarettes is assigned a unique UPC. All analyses were conducted using SPSS 16.0 (Chicago, Illinois, USA).

RESULTS

In 2009, of the 678 smokers who completed the telephone interview, 401 were invited to send in cigarette packs and 318 cigarette packs were received ($318/401=79\%$). In 2010, 1146

smokers completed the telephone survey, 491 were invited to send in cigarette packs and 366 cigarette packs were received ($366/491=75\%$). Combined, we received 686 packs of cigarettes from participants at both collection periods, and of these, 166 (24.0%) came from the same individuals in both the 2009 and 2010 survey waves. Because of the different eligibility criteria between the two surveys, we elected to analyse the data from each survey as two independent cross sections, and in addition performed a cohort analysis among the 166 smokers who participated in both waves.

In 2009, cigarette packs representing 64 different brand varieties were received. A cross tabulation of a usual cigarette brand as self-reported by smokers during the telephone interview and a cigarette brand sent by participants in the cigarette pack collection revealed 97.2% agreement between the participant's self-reported brand as indicated in the telephone survey and the pack received. In 2010, cigarette packs representing 70 different brand varieties were sent by study participants for analysis. Of the 366 packs received, 92.6% matched the brand family self-reported by participants during the telephone interview.

In an additional analysis, the self-reported UPC from the participant's usual brand was compared to assess any differences between the UPC reported during the telephone interview and the UPC recorded from the pack that was sent for analysis. In 2009, 286 participants reported a UPC during the telephone interview. Of these, 59.1% matched the UPC on the pack sent for analysis. In 2010, 67.3% of 303 UPCs reported during the telephone interview matched the UPC on the pack sent for analysis. A more in-depth analysis comparing the UPC as reported during the telephone interview and the UPC as recorded directly from the pack sent by participants indicates that the majority of the mismatched UPCs were a result of the participant's failure to report a prefix or suffix digit. Among the participants who provided a UPC during the 2009 telephone interview, 86.0% either matched directly or were missing a prefix or suffix digit. In 2010, among the participants who provided a UPC during their telephone interview, 82.3% either matched directly or were missing a prefix or suffix digit.

2009 study results

Looking at the 300 packs from states use tax stamps, approximately 6% lacked a tax stamp. Approximately 20% ($n=59$) of packs did not bear a tax stamp that matched the participant's state of residence. Of these, 24 packs were from a state bordering the participant's state of residence, 19 carried no stamp, 11 carried a tribal stamp and 5 carried some other type of stamp or mark.

Characteristics of participants who sent packs that were untaxed by the participant's state of residence were compared with those who sent packs that carried a tax stamp for the state in which they reside. Relatively few demographic differences were observed. Though not statistically significant, when compared to non-whites, white participants were more likely to have sent a cigarette pack classified as untaxed by the participant's state of residence (5.3% vs 20.8%; $p=0.100$). Participants with a higher level of education (30.6%) were more likely than those with a moderate level (19.3%) and a low level of education (14.7%) to have sent a pack classified as untaxed by the participant's state of residence ($\gamma=-0.028$; $p=0.035$). No statistically significant differences were observed with respect to age, gender or income. Participants who indicated that they had made a special effort to buy cheaper cigarettes in the 12 months prior to being interviewed were significantly more likely to have sent a pack classified as untaxed by the

participant's state of residence than those participants who indicated that they had not made a special effort to buy cheaper cigarettes (31.9% vs 17.4%; $\gamma=0.195$; $p=0.021$). In addition, those with no plans to quit were more likely (29.7% vs 15.0%; $\gamma=0.296$; $p=0.003$) to have sent a pack classified as untaxed by the participant's state of residence than those participants who indicated a plan to quit.

2010 study results

Examining the 348 packs from states using tax stamps, approximately 8% did not bear a tax stamp. Approximately 21% ($n=73$) of packs did not bear a tax stamp that matched the participant's state of residence and were classified as untaxed by the participant's state of residence. Of these, 25 packs were from a state bordering the participant's state of residence, 27 carried no stamp, 15 carried a tribal stamp and 6 carried some other type of stamp or mark.

Characteristics of participants who sent packs that were untaxed by the participant's state of residence were compared with those who sent packs that carried a tax stamp for the state in which they reside. Relatively few demographic differences were observed. When compared with younger participants (ages 18–39), older participants (ages 40 and older) were significantly more likely to have sent a cigarette pack classified as untaxed by the participant's state of residence (8.7% vs 23.0%; $\gamma=0.516$; $p=0.016$). No statistically significant differences were observed with respect to gender, race, education or income. Participants who indicated that they had made a special effort to buy cheaper cigarettes in the 12 months prior to being interviewed were significantly more likely to have sent a pack classified as untaxed by the participant's state of residence than those participants who indicated that they had not made a special effort to buy cheaper cigarettes (36.8% vs 17.3%; $\gamma=-0.471$; $p=0.001$). In addition, those with no plans to quit were more likely (26.2% vs 17.3%; $\gamma=0.259$ $p=0.043$) to have sent a pack classified as untaxed by the participant's state of residence than those participants who indicated a plan to quit.

State tax rate versus state tax stamp presence

We next examined whether participants residing in higher-tax states were more likely to return packs untaxed by the participant's state of residence. To facilitate analysis, we dichotomised states as to whether the state tax was greater than the federal excise tax (\$1.01/pack) or less. In 2009, 28.4% of packs from higher-tax states were untaxed by the participant's state of residence, compared with 12.0% of lower-tax states ($p<0.001$). In 2010, the corresponding numbers were 31.8% in higher-tax states versus 9.9% in lower-tax states ($p<0.001$).

2009 and 2010 purchase locations

Nearly all of the participants (97.8% in 2009 and 97.5% in 2010) indicated that the pack sent for consideration was purchased from the outlet where they usually purchase their cigarettes. Figure 1 presents the distribution of cigarette packs classified as untaxed by the participant's state of residence by the type of outlet. The sources of the cigarette packs classified as untaxed by the participant's state of residence remained relatively consistent across both data collections.

Of the 166 participants who sent packs during both the 2009 and 2010 collections, 16.1% sent packs classified as untaxed by the participant's state of residence both times and 7.7% were classified as untaxed by the participant's state of residence during one collection but not the other. The majority (76.1%) of packs sent by participants in both collections were classified

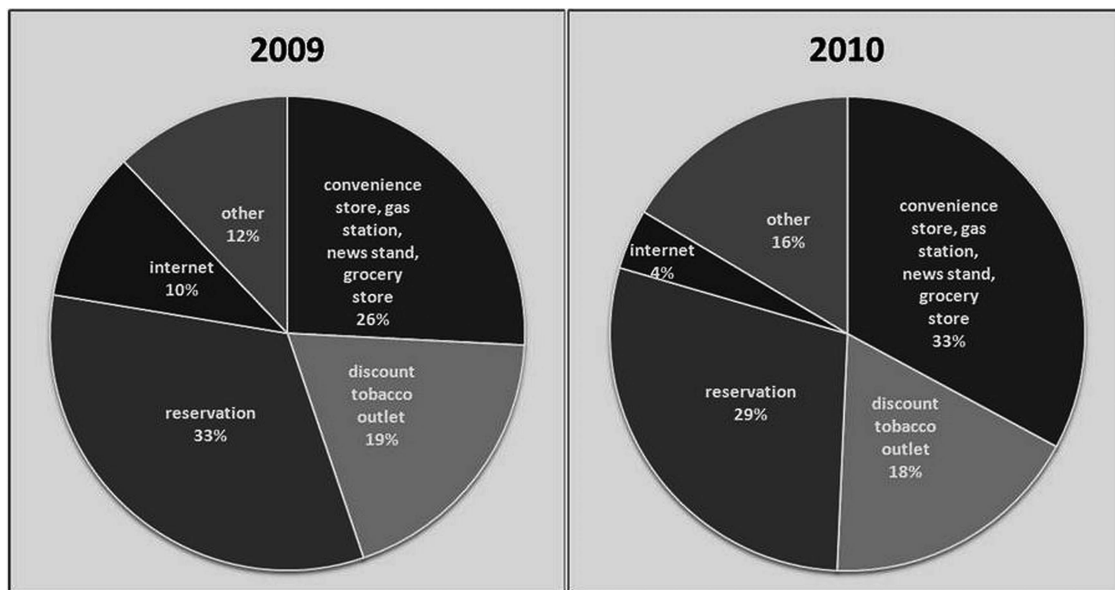


Figure 1 Distribution of packs classified as untaxed by the participant's state of residence by outlet type.

as taxed at the state level both times. Most (85.4%) reported purchasing their cigarettes from the same type of outlet at both waves. Of those who reported purchasing their cigarettes from a convenience store, gas station, news stand or grocery store, 91.5% did so at both waves. Similar percentages were observed among those who reported purchasing their cigarettes on an Indian Reservation (84.6%) and those who reported purchasing their cigarettes at a discount tobacco outlet (83.3%).

DISCUSSION

In 2009 and 2010, approximately one in five cigarette packs sent by smokers in this study were classified as untaxed by the participant's state of residence as measured by the presence or absence of a tax stamp from the state in which they reside.

Few consistent patterns were observed with respect to the distribution of non-matching states of residence and tax stamps. Of note, however, is the number of cigarette packs sent by New York State residents that carried no tax stamp or the stamp of a state other than New York ($n=14$ of 17 packs in 2009; $n=11$ of 14 packs in 2010). In New York State, tax-free cigarettes can be purchased on Indian Reservations. A 2004 study found that 32% of smokers in New York State purchased cigarettes from an Indian Reservation at least once, while 25% of smokers frequently purchased cigarettes at an Indian Reservation.²¹ More broadly, those in higher-excite tax states (defined as a state tax higher than the federal rate of \$1.01/pack) were significantly more likely to return packs not taxed in the participant's state of residence. This validates the general observation that higher tax rates create incentives to seek out lower prices. An important caveat is that this analysis does not factor in county-level and city-level taxes. For example, states like Illinois have state taxes below the federal rate, but a resident of Chicago would additionally be liable for Cook County and City of Chicago taxes, which would bring the total tax due higher than the federal rate.

Of the stamps classified as untaxed by the participant's state of residence, approximately one-third (32.2% in 2009 and 36.9% in 2010) did not have any tax stamp affixed to the outside of the pack. This suggests the need for all states to use tax stamps to indicate that state tax has been paid on each pack

of cigarettes sold within each state. This would allow for a more complete estimate of the prevalence of tax avoidance and/or evasion. However, the presence of tax stamps on all packs cannot reduce rates of tax evasion and avoidance as long as there continues to be disparities in tax rates between states. For example, New York State currently levies the highest excise tax rate on cigarettes at \$4.35 per pack, while Virginia's cigarette excise tax, at \$0.30 per pack, is the lowest.²² Perhaps requiring all tax collections and tax stamps to be applied at the point of manufacture (ie, federal, state and local) would eliminate opportunities for tax evasion. Adopting policies geared towards limiting price differentials across jurisdictions might be another method of disincentivising smokers to avoid or evade taxes in their state of residence.

Few demographic differences were observed between participants who sent a pack that was classified as state tax paid and those who sent a pack that was untaxed by the participant's state of residence. Those with a higher education level were more likely to have sent a pack bearing a tax stamp that did not match their state of residence relative to those with lower levels of education in 2009. Those aged 40 and older were more likely to have sent a pack bearing the stamp of a state other than their state of residence relative to those aged 18–39 years in 2010. At both waves, smokers who reported that they made a special effort to purchase less expensive cigarettes and those who do not have a plan to quit smoking were significantly more likely to have sent a pack that was classified as untaxed by the participant's state of residence. This suggests that some smokers (with means to do so) could be seeking out lower-cost products in response to higher prices rather than quitting smoking.

The analysis examining the relationship between a self-reported brand and UPC information and the brand family and UPC printed on the pack sent for analysis was done in order to address concerns over whether a participant might report smoking a more expensive brand and send us a less expensive brand, but yielded some interesting results.

The high rate of agreement between the usual brand reported at the time of the telephone interview and the brand family of the pack sent for analysis suggests that the majority of participants did indeed send the variety that they usually smoke.

However, the low rate of agreement between the self-reported UPC and the UPC printed on the pack might suggest otherwise. The reasons for this discrepancy are unclear. It is possible that some participants were inaccurate in their self-report of the UPC or smokers in this study might have switched to a different variety within the same brand family during the time between the telephone interview and when they sent the pack for analysis. A third possibility is that the participant deliberately deceived us by sending a pack different from their self-reported variety and/or purchased from a different location.

A strength of this study is that the prevalence estimates are based on cigarette packs sent from a sample of US smokers participating in a nationally representative survey at two different time points. The prevalence estimates appear steady across two surveys. The majority of the participants who initially agreed to take part in the pack collections sent a pack for analysis. These high rates of participation and replication of findings suggest that this type of data collection is feasible and relatively cost-effective given the \$25 compensation for time and effort.

Conceptually, obtaining this estimate directly from unopened cigarette packs sent by smokers should be a more accurate method than other previously attempted approaches using tax stamps on discarded packs to measure tax avoidance and/or tax evasion. However, the study has several significant limitations that could be refined for use in future data collections of this type. First, the sample size was small and there were differences in the distribution of cigarette packs collected in each state. We received no packs from smokers in Alaska, Delaware, Hawaii, Idaho, Maine, Rhode Island, South Dakota and Vermont in 2009 and no packs from Hawaii, Rhode Island and Vermont in 2010. Because of this, the ability to generalise these results as representative of the population of smokers at large is limited.

Additional limitations related to the sampling strategy employed here may also lead to inaccurate prevalence estimates. It could also be argued that the study eligibility criteria could create a significant bias, as individuals who are smoking 10 or more cigarettes per day may have a greater incentive to seek out less costly cigarettes. Previous studies have shown that individuals who have higher daily cigarette consumption are more likely to engage in tax avoidance behaviours.^{7 8 16} However, both the populations under consideration and the estimates of tax avoidance and/or evasion were similar at two time points using more restrictive and less restrictive eligibility criteria. Further, smokers who are knowingly avoiding taxes by purchasing cigarettes from unlicensed tobacco outlets might be less likely to answer a survey or send a cigarette pack for inspection. The prevalence of packs that did not show evidence of tax avoidance or evasion was higher among those who sent a pack during both data collections when compared with the overall sample averages in both 2009 and 2010, lending some support to this hypothesis. Future data collections of this type might consider refining the study methods to be more inclusive of individuals who smoke fewer than 10 cigarettes per day and those who consciously evade cigarette taxes to better reflect the overall population of smokers.

Previously published literature has suggested links between a combination of high tobacco prices and the convenient availability of lower-cost alternatives.^{8 16} Another study published in 2010 used data from a random sample of littered cigarette packs in the city of Chicago to estimate tax avoidance. Nearly three quarters of the packs collected did not contain a local tax stamp. Further, as the distance between the collection site and the border of the state of Indiana increased, the probability of the pack bearing a local tax stamp also increased.²³ In this

study, we were unable to measure the distance between a participant's residence and the tobacco outlet from which the cigarette pack sent for inspection was purchased. Because of this, we were unable to measure proximity and access to lower-priced sources as factors. Future research might consider methods of obtaining information related to the purchase location in order to better evaluate the association between tax avoidance and/or evasion and the ease of obtaining cigarettes at a lower cost.

The prevalence estimates of tax avoidance and/or tax evasion at the state level were taken from packs of cigarettes sent by a sample of US smokers, participating in a nationally representative survey. What is unclear is whether these estimates are lower than the actual prevalence of sales of cigarettes that are untaxed by a smoker's state of residence. The use of state tax stamps by all 50 US states could be a step towards a more accurate prevalence estimate. In terms of policy, harmonising tax rates across all US states could be a step towards reducing or eliminating incentives to seek out lower-cost cigarettes. Future research should consider a focus on how the proximity to lower-tax or lower-cost sources of cigarettes influences tax avoidance and/or evasion.

What this paper adds

- ▶ The paper provides a prevalence estimate of tax avoidance and/or tax evasion obtained from packs of cigarettes sent by a sample of US smokers participating in a nationally representative survey.
- ▶ Using a pack collection method we found that one in five packs were untaxed with rates higher in states with higher-excise taxes. What is unclear is whether these estimates differ from the actual prevalence of sales of cigarettes that are untaxed by the participant's state of residence. In terms of policy, harmonisation of excise tax rates across all 50 US states might be one method of reducing or eliminating the incentive to avoid or evade these taxes.

Contributors RJO, GTF, KMC, AH: conception and survey design. BVF: data analysis. BVF, RJO, FJC, GTF, KMC, AH, ASL: drafting the manuscript and revising it critically for important intellectual content. All authors read and approved the final manuscript.

Funding This research was funded by grants from the National Cancer Institute of the United States (R01 CA 100362, P50 CA111236 (Roswell Park Transdisciplinary Tobacco Use Research Center), P01 CA138389, and R25 CA113951), Canadian Institutes of Health Research (79551 and 115016). Geoffrey T Fong was supported by a Senior Investigator Award from the Ontario Institute for Cancer Research (OICR) and a Prevention Scientist Award from the Canadian Cancer Society Research Institute.

Competing interests KMC has served in the past and continues to serve as a paid expert witness for plaintiffs in litigation against the tobacco industry.

Patient consent Obtained.

Ethics approval All of the data collection methods were reviewed and approved by the Roswell Park Cancer Institute Institutional Review Board and the University of Waterloo Human Research Ethics Committee.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement In order for research teams outside the ITC Project to gain access to any of the data, the successful completion and approval of an ITC Data Usage Application is required. Both ITC principal investigators and research teams outside the ITC Project who have received approval to use the data are required to sign an ITC Data Usage Agreement. More information is available at <http://www.itcproject.org>.

REFERENCES

- 1 Chaloupka FJ, Yurekli A, Fong GT. Tobacco taxes as a tobacco control strategy. *Tob Control* 2012;21:172–80.
- 2 Jha P, Chaloupka FJ. *Curbing the epidemic: governments and the economics of tobacco*. Washington, DC: The World Bank, 1999.
- 3 Levy DT, Cummings KM, Hyland A. Increasing taxes as a strategy to reduce cigarette use and deaths: results of a simulation model. *Prev Med* 2000;31:279–86.
- 4 Chaloupka FJ, Warner KE. The Economics of Smoking. In: Culyer CJ, Newhouse JP, eds. *Handbook of Health Economics 1st ed*. Elsevier: Amsterdam, The Netherlands: 2000:1539–1627.
- 5 Frieden TR, Mostashari F, Kerker BD, et al. Adult tobacco use levels after intensive tobacco control measures: New York City, 2002–2003. *Am J Public Health* 2005;95:1016–23.
- 6 Chaloupka FJ, Cummings KM, Morley CP, et al. Tax, price and cigarette smoking: evidence from the tobacco documents and implications for tobacco company marketing strategies. *Tob Control* 2002;11:i62–72.
- 7 Hyland A, Bauer JE, Li Q, et al. Higher cigarette prices influence cigarette purchase patterns. *Tob Control* 2005;14:86–92.
- 8 Hyland A, Laux FL, Higbee C, et al. Cigarette purchasing patterns in four countries and the relationship with cessation: findings from the International Tobacco Control (ITC) Four Country Survey. *Tob Control* 2006;15:iii59–64.
- 9 McGoldrick DE, Boonn AV. Public policy to maximize tobacco cessation. *Am J Prev Med* 2010;38:S327–32.
- 10 Farrelly MC, Pechacek TF, Chaloupka FJ. The impact of tobacco control program expenditures on aggregate cigarette sales: 1981–2000. *J Health Econ* 2003;22:843–59.
- 11 Farrelly MC, Pechacek TF, Thomas KY, et al. The impact of tobacco control programs on adult smoking. *Am J Public Health* 2008;98:304–9.
- 12 Tauras JA, Chaloupka FJ, Farrelly MC, et al. State tobacco control spending and youth smoking. *Am J Public Health* 2005;95:338–44.
- 13 Hyland A, Bauer JB, Li Q, et al. Higher cigarette prices influence cigarette purchase patterns. *Tob Control* 2005;14:86–92.
- 14 White VM, Gilpin EA, White MM, et al. How do smokers control their cigarette expenditures? *Nico Tob Res* 2005;7:625–35.
- 15 Scollo M, Younie S, Wakefield M, et al. Impact of tobacco tax reforms on tobacco prices and tobacco use in Australia. *Tob Control* 2003;12:ii59–66.
- 16 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.
- 17 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.
- 18 Kurti MK, von Lampe K, Thompkins DE. The illegal cigarette market in a socioeconomically deprived inner-city area: the case of the South Bronx. *Tob Control* 2013;22:138–40.
- 19 Wilson N, Thomson G, Edwards R, et al. Estimating missed government tax revenue from foreign tobacco: survey of discarded cigarette packs. *Tob Control* 2009;18:416–18.
- 20 Thompson ME, Fong GT, Hammond D, et al. Methods of the International Tobacco Control (ITC) four country survey. *Tob Control* 2006;15(Suppl 3):iii12–18.
- 21 Davis K, Farrelly M, Li Q, et al. *Cigarette purchasing patterns among New York State smokers: implications for health, price, and revenue*. Albany, NY: New York State Department of Health, 2004.
- 22 Campaign for Tobacco-Free Kids. State cigarette excise taxes and rankings. 2013. <http://www.tobaccofreekids.org/research/factsheets/pdf/0097.pdf> [accessed 6 Jun 2013].
- 23 Merriman D. The micro-geography of tax avoidance: evidence from littered cigarette packs in Chicago. *Am Econ J Econ Policy* 2010;2:61–84.

估计美国未上税卷烟流行率的新方法： 2009年和2010年国际烟草控制政策评估 项目的发现

Brian V Fix,¹ Andrew Hyland,¹ Richard J O'Connor,¹ K Michael Cummings,² Geoffrey T Fong,^{3,4} Frank J Chaloupka,⁵ Andrea S Licht^{1,6}

¹ Department of Health Behavior, Roswell Park Cancer Institute, Buffalo, New York, USA

² Department of Psychiatry and Behavioral Sciences, Medical University of South Carolina, Charleston, South Carolina, USA

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

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

⁵ Department of Economics, Institute for Health Research and Policy, University of Illinois at Chicago, Chicago, Illinois, USA

⁶ Department of Social and Preventive Medicine, State University of New York at Buffalo, Buffalo, New York, USA

通讯作者：

Brian V Fix

地址：

Department of Health Behavior, Roswell Park Cancer Institute, Elm and Carlton Street, Buffalo, NY 14263, USA

电子邮箱：

brian.fix@roswellpark.org

2013年2月28日收稿

2013年6月21日修订

2013年7月30日接受

2013年8月22日在线优先

发表

摘要

背景 提高烟草税有助于减少烟草消费，但是因为卷烟的成瘾性，吸烟者经常寻找较廉价的卷烟来源。本研究的目的是估计在两个时间点上，一个美国吸烟者样本中的受访者在居住州使用未上税卷烟的流行率。

方法 本研究数据来自2009年和2010年国际烟草控制政策评估项目（ITC项目）美国调查。这一调查中的具有全国代表性的吸烟者队列成员被邀请寄给我们一盒他们常用的未开封卷烟。

结果 2009年，我们从401位合格的受访者那里收到了318盒卷烟（79%）。2010年，我们从491位合格的受访者那里收到了366盒卷烟（75%）。总的来说，2009年收到的卷烟中的20%和2010年收到的21%在受访者的居住州被归为未上税卷烟。消费税越高的州，其未上税卷烟的流行率越高。无戒烟计划者更倾向于寄一盒在其居住州被归为未上税卷烟的卷烟。

结论 调查中约1/5的卷烟为未上税卷烟，且消费税越高的州该比率越高。尚不清楚这些估计与吸烟者居住州的未上税卷烟的实际流行率是否存在较大差异。在美国所有50个州统一烟草消费税率，可能会成为一个削弱或消除避税逃税动机的办法。

前言

在最近一篇有关烟草税的公共卫生效益的研究综述中，Chaloupka等人^[1]发现提高烟草制品的税能有效减少烟草消费，尤其是年轻人和贫穷群体的烟草消费。当烟草税提高并且价格随之增加时，会出现两种主要的行为效果。第一，吸烟率下降，这是因为戒烟者的增加以及非吸烟者（几乎全部分布于青少年和青壮年）更少地转变为吸烟者。第二，坚持吸烟的人群的卷烟消费量下降^[2-9]。另外，当一部分税收被用于支持更多的烟草控制和公共卫生项目时，高烟草税的公共卫生效益进一步增强^[10-12]。

但是，并非所有提高税率/价格的举措对吸烟行为的影响都会产生正面的健康效益。一些吸烟者可能会通过转而购买较为廉价的卷烟

品牌或者改变卷烟获取途径来降低支出。这也就是说，吸烟者可能为了降低税收增加带来的影响，会通过各种合法或者非法的途径寻找价格更低廉的卷烟来源^[6,13-15]。最近的研究显示，低价卷烟的可及性可能会削弱高价格和/或高税收对降低吸烟率的作用，从而减弱其对公众健康的有利影响。Licht及其同事发现，存在避免价格或税收影响行为的吸烟者更可能不报告戒烟；而且从长期来看，从低价和未上税卷烟的来源购买卷烟的行为与低戒烟率是相关联的^[16,17]。

衡量各种价格最小化策略的流行率可能比较困难。品牌转换这一种策略可以利用调查获得的数据进行评估，然而评估例如购买未上税卷烟这样的更隐秘的行为则更难。

之前的研究收集了丢弃的卷烟烟盒以估计未上税或走私的烟草产品的流行率。最近的一项研究调查了纽约市南布朗克斯区（South Bronx）散落的卷烟烟盒，发现42%被调查的烟盒没有任何印花税票，15.8%的烟盒贴有其他州的印花税票^[18]。另外一项在新西兰进行的、依靠收集废弃烟盒以估计外国烟草流行率的研究发现，3.2%被调查的烟盒来自国外，这意味着新西兰政府有接近3600万美元的税收损失^[19]。但是，此类研究中收集卷烟烟盒的地理区域相对狭窄，限制了其普遍性。另外，鉴于美国的印花税票贴在外面的玻璃纸上，这层玻璃纸相对于真正的烟盒来说容易被丢失或丢弃，所以根据散落的烟盒估计流行率可能存在着问题。另外，基于丢弃的烟盒的估计可能是通勤和旅游模式的一种反映，而非避税或逃税。检查未开封烟盒可以避免这些问题，但是鉴于通常它们不是被丢弃的，而是需要由吸烟者提供以供检查，其可行性未知。

本文报告了一个在2009年和2010年ITC项目美国调查期间进行的补充研究。具有全国代表性的ITC项目美国调查队列中的成人吸烟者被邀请寄给我们一盒他们常用品牌的未开封卷烟，且该卷烟购自他们经常购买卷烟的经销点。

本研究的主要目的是估计美国吸烟者样本居住州在两个时间点上未上税卷烟的流行率。另一个目的是调查那些寄回在居住州未上税卷烟的受访者的特征。

引用建议：Fix BV, Hyland A, O'Connor RJ, et al. *Tob Control* 2014;23:i61-i66.

方法

本研究的数据来自2009年和2010年的ITC项目美国调查。ITC项目美国调查开始于2002年，几乎每年都会进行，并与ITC项目在加拿大、英国和澳大利亚的调查协同进行。其内容包括评估吸烟行为、戒烟尝试、对烟草的态度和信念，以及与世界卫生组织《烟草控制框架公约》里要求采取政策减少烟草的条款相关的问题和关于烟草使用与戒烟方面的社会心理学介质。ITC项目美国调查通过随机拨号的方法来招募一个随机选择的成年（≥18岁）吸烟者样本。失访者会被来自相同样本框架的新招募的调查对象取代，以维持每一轮调查的总体样本量一致。ITC调查的主要目标是评价在国家和地区层面的烟草控制政策带来的心理和行为影响^[20]。

本文报告了两轮ITC项目美国调查的数据。2009年的调查在2009年11月到2010年1月进行，调查对象为ITC项目美国调查前一轮（第7轮，在2008年10月到2009年7月进行）的既有队列。2010年的调查在2010年7月到2011年1月之间进行。有关ITC调查样本设计的进一步细节可参见<http://www.itcproject.org/>。

2009年调查的总体合格样本为912名吸烟者。他们参与了第7轮ITC项目美国调查，并且报告日均吸烟量等于或大于10支，且通常吸某种特定的机制卷烟并同时提供了其经常购买卷烟的地点类型。2010年调查的总体合格样本为1144名吸烟者。2010年的调查中，选取的提供卷烟的合格样本是那些在电话调查里报告日均吸烟量等于或大于5支，并且吸的卷烟为机制卷烟或者大部分为机制卷烟的每日吸烟者。

两次数据收集的合格标准有差异，这是因为第一轮数据收集是作为可行性研究进行的。采纳这些标准是因为日均吸烟量至少为10支的吸烟者更有可能有现成的一盒卷烟寄给我们。考虑到第一轮数据收集的积极反应，第二轮研究我们面向更广泛社群的吸烟者，将每日吸烟量等于或大于5支作为合格标准。

我们邮寄给同意寄来一盒其常用品牌卷烟的受访者一份数据收集包，包括信息表、说明信、向他们索要一包未拆封的其常用品牌卷烟的介绍、一份小问卷、一个用于放置卷烟烟盒的塑料密封袋和一个邮资已付的回邮信封。受访者获得25美元以补偿其付出的时间和精力。

收到的卷烟烟盒需经过仔细的检查。每个烟盒的特点，包括品牌、描述性词语、长度、颜色以及印花税票的类型，都被记录下来。所有数据收集方法都通过了Roswell Park Cancer Institute机构审查委员会和University of Waterloo人类研究伦理委员会的审查和批准。

本研究测量的行为笼统地分为避税或者逃税。避税被定义为任何形式的通过合法途径降低卷烟总成本的直接购买行为，比如从印第安人保留地、跨境经销点、免税店或者通过网络购买卷烟。逃税被定义为任何形式的通过非法途径避免为卷烟纳税的购买行为，比如在卖无印花税票或者印花税票不正确的卷烟的摊贩或者合法经销点购买。

量化这些行为是一个挑战，因为吸烟者也许不太情愿报告自己从事了这些行为和/或可能根本没有意识到他们的行为等同于避税或逃税。本文测量此类行为的方法产生了一个基于避税和逃税的联合估计。因为我们没有要求受访者寄来其购买卷烟的收据或者其他能识别购买卷烟的州的材料，分别测量这两种行为是不可能的。尽管有此限制，这个方法容许了对卷烟税收状况的客观评价。

通过观察卷烟烟盒上的州印花税票得到的观察性数据，可以判定每盒卷烟在受访者居住州属于未上税类还是已上税类。已上税类的卷烟被定义为包装盒上带有与受访者所居住州匹配的印花税票。如果没有印花税票或者税票与受访者所居住州不匹配，则该烟盒被定义为未上税类。三个州（北卡罗莱纳州、北达科塔州和南卡罗莱纳州）不使用印花税票。所以，从这三个州的受访者（2009年有18盒卷烟；2010年有18盒卷烟）那里收到的烟盒被排除在外（总样本量2009年为300个，2010年为348个）。根据我们的操作性定义，对于以上三个州的卷烟，我们没有在州的层面将它们分类为已上税类或未上税类的基准。

我们用二元 χ^2 检验来研究在高消费税州和低消费税州（定义为消费税每包高于或低于联邦税率1.01美元的州）居住的受访者，各种人口学指标（年龄、性别、种族、收入、受教育水平和烟瘾指数）与购买在受访者所居住州被归于未上税卷烟的行为之间的关系。Gamma检验用于评估未在调查对象所居住州上税的烟盒与有序变量之间的关联强度。除此之外，我们还比较了电话调查获得的自报品牌和其通用货品代码（UPC）与寄来的卷烟的品牌系列和包装上的UPC。UPC是用来追踪卖给消费者的商品的特殊条形码。每种不同的卷烟都有一个唯一的UPC。所有的分析都借助SPSS 16.0（Chicago, Illinois, USA）进行。

结果

2009年，在完成电话调查的678名吸烟者中，401名被邀请寄来卷烟烟盒，共收到了318盒卷烟（318/401=79%）。2010年，1146名吸烟者完成了电话调查，491名被邀请寄来卷烟烟盒，共收到了366盒卷烟（366/491=75%）。我们从两轮调查的受访者那里收到了总计686盒卷烟，其中166个（24.0%）来自参与了2009年和2010年两轮调查的相同受访者。因为两次调查的合格标准不同，我们决定将每次调查的数据作为独立的横断面来分析，另外对参与了两轮调查的166名吸烟者中进行队列分析。

2009年，收到的卷烟代表了64个不同的品牌类别。根据吸烟者在电话调查中自报的常用卷烟品牌和卷烟收集中吸烟者寄来的卷烟品牌得出的交叉分组列表显示，受访者在电话调查中的自报品牌和收集到的卷烟的一致率达到了97.2%。2010年，收到的卷烟代表了70个不同的品牌类别。在这366盒卷烟中，92.6%与受访者在电话调查中的自报品牌一致。

在补充分析中，我们比较了受访者常用品牌的自报UPC以评估电话调查中报告的UPC与寄来供分析的卷烟的UPC之间是否存在差异。2009年，286名受访者通过电话调查报告了UPC。其中，59.1%与寄来供分析的卷烟上的UPC匹配。2010年，通过电话调查报告的303份UPC中有67.3%与寄来供分析的卷烟上的UPC匹配。为了进一步分析，我们比较了通过电话调查报告的UPC与调查对象寄来供分析的卷烟上直接记录的UPC，发现大多数不匹配的UPC是由于受访者未能正确地报告前缀或后缀的一位数字。在2009年电话调查中提供UPC的受访者中，86.0%的人直接匹配或者丢失了前缀或后缀的一位数字。在2010年电话调查中，82.3%的提供UPC的人直接匹配或者丢失了前缀或后缀的一位数字。

2009年研究结果

通过观察300盒来自使用印花税票的州的卷烟，我们发现将近6%的卷烟缺少印花税票。接近20% (n=50) 的卷烟未带有与受访者所居住州匹配的印花税票。其中，24盒卷烟来自受访者所居住州的邻州，19盒未贴有税票，11盒贴有部落税票，5盒贴有其它种类的税票或标记。

我们比较了寄来在其所居住州未上税卷烟的受访者与寄来在其所居住州已上税的卷烟的受访者的特点，发现他们之间人口学上的差异较小。与非白种人相比，白种人更有可能寄来被其所居住州归类为未上税的卷烟，这一差别在统计上不显著 (5.3%和20.8%；P=0.100)。受教育水平高的受访者 (30.6%) 与中等水平 (19.3%) 和低水平 (14.7%) 的受访者相比，更有可能寄来被其所居住州归类为未上税的卷烟 ($\gamma=-0.028$ ； $p=0.035$)。在年龄、性别或者收入方面，我们没有发现显著的统计上的差异。曾经表示在购买更便宜的卷烟做过特殊努力的受访者，与那些表示没有为购买更便宜的卷烟做过特殊努力的受访者相比，更有可能寄来在所居住州被归类为未上税的卷烟 (31.9%和17.4%； $\gamma=0.195$ ； $p=0.021$)。另外，没有戒烟计划的吸烟者与有戒烟计划的吸烟者相比，更有可能寄来被其所居住州归类为未上税的卷烟 (29.7%和15.0%； $\gamma=0.296$ ； $p=0.003$)。

2010年研究结果

我们检查了从使用印花税票的州寄来的348盒卷烟，发现接近8%未携带印花税票。接近21% (n=73) 的卷烟烟盒未携带与受访者所居住州相匹配的印花税票，在受访者所居住州被归类为未上税。其中，25盒卷烟来自受访者所居住州的邻州，27盒未贴有税票，15盒贴有部落税票，6盒贴有其他类型的税票或标记。

比较寄来在其所居住州未上税卷烟的受访者与寄来携带所居住州印花税票的卷烟的受访者的特点，他们之间的人口学上的差异较小。与较年轻的受访者 (18-39岁) 相比，较年长的受访者 (40岁或者更大) 更有可能寄来被其所居住州归类为未上税的烟盒 (8.7%和23.0%；P=0.016)。在性

别、种族、受教育程度和收入方面没有发现显著的统计学差异。曾经表示在调查前12个月为购买更便宜的卷烟做过特殊努力的受访者，与那些表示没有为购买更便宜的卷烟做过特殊努力的调查对象相比，更有可能寄来被调查对象所居住州归类为未上税的卷烟 (36.8%和17.3%； $\gamma=-0.471$ ； $p=0.001$)。另外，没有戒烟计划的吸烟者与有戒烟计划的吸烟者相比，更有可能寄来被调查对象所居住州归类为未上税的卷烟 (26.2%和17.3%； $\gamma=0.259$ ； $p=0.043$)。

州税率与是否携带州印花税票

我们接下来检验在较高税率州定居的受访者是否更有可能寄来在其所居住州被归为未上税卷烟的烟盒。为了便于分析，我们将各州按州税率是否高于联邦消费税率 (1.01美元/盒) 分为两类。在2009年，来自高税率州的卷烟28.4%是未在其所居住州上税的，这一比例在低税率州仅为12.0% ($p<0.001$)。在2010年，高税率州相对应的比例为31.8%，而低税率州为9.9% ($p<0.001$)。

2009年和2010年购买地点

几乎所有的受访者 (2009年为97.8%，2010年为97.5%) 表示寄来供研究的卷烟是从他们经常购买卷烟的经销点买的。图1展示了被受访者所居住州归于未上税卷烟的经销点类型的分布。被调查对象所居住州归于未上税的卷烟的来源在整个数据收集过程中相对一致。

在连续参与了2009年和2010年两次卷烟收集的166名受访者中，16.1%的人两次都寄来在其所居住州被归于未上税的卷烟，7.7%的人只在一次收集集中寄来在其所居住州被归于未上税的卷烟。大部分受访者 (76.1%) 在两次收集过程中寄来的卷烟在州水平上是归于已上税的。大多数 (85.4%) 受访者报告在两轮调查中，他们从相同类型的经销点购买卷烟。在报告过从便利店、加油站、报刊亭或杂货店购买卷烟的受访者中，91.5%的人在两轮调查中都是这样做的。在那些报告从印第安人保留地 (84.6%) 和低价烟草经销点 (83.3%) 购买卷烟的受访者中我们观察到类似的比例。

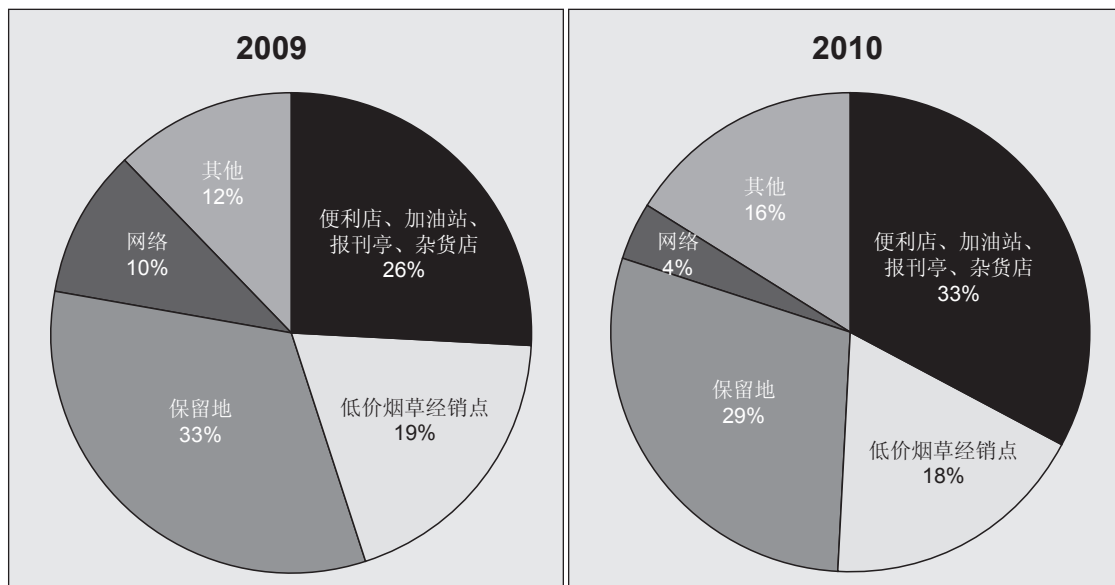


图1 在受访者所居住州被归于未上税卷烟的经销点类型的分布

讨论

2009年和2010年,通过观察受访者所居住州的印花税票的有或无,本研究发烟者寄来的卷烟中接近五分之一被其所居住州归为未上税类。

我们几乎没有发现在受访者所居住州和寄回卷烟上的与州不匹配的印花税票之间存在统一的模式。但是,纽约州的居民所寄的卷烟烟盒上无印花税票或者非纽约州的税票的数目(2009年17盒中有14盒;2010年14盒中有11盒)值得我们注意。在纽约州,免税卷烟可以从印第安保留地购买。2004年的一项研究发现,纽约州32%的吸烟者至少从印第安保留地购买过一次卷烟,而25%的吸烟者频繁地在印第安保留地购买卷烟^[21]。更广泛地讲,较高消费税率(定义为州税比联邦税1.01美元/盒高)的州的受访者更有可能寄回在其所居住州未上税的卷烟。这验证了一个一般的观察发现,即更高的税率会刺激吸烟者去寻找更低价格的卷烟。需要郑重声明的是,本分析没有考虑县级和市级税的因素。比如,在类似伊利诺伊斯的州,州税率低于联邦税率,但是芝加哥的居民还需要额外向库克郡和芝加哥市纳税,这将导致总税率比联邦税率更高。

在受访者所居住州被归于未上税的卷烟中,接近三分之一(2009年为32.2%,2010年为36.9%)的烟盒外面没有贴任何印花税票。该现象提示所有州亟需使用印花税票,以暗示本州内所售的卷烟已上税。这种做法可以使我们更加完整地估计避税和/或逃税率。但是,只要各州之间税率不一致的情况持续存在,即使每盒卷烟上都有印花税票也不能降低避税率和逃税率。比如,当前纽约州对卷烟征收的消费税率最高,为每盒4.35美元,而维吉尼亚州的卷烟消费税率最低,为每盒0.30美元^[22]。也许,在卷烟生产时按照制造地(即联邦、州和地区)上税并贴上印花税票,可以消除逃税的机会。采取措施减少各行政区之间的价格差异,可能是抑制吸烟者在其居住州避税或逃税的另一个方法。

通过观察,寄来被其居住州归于已上税的卷烟的受访者和那些寄来未上税的卷烟的受访者之间,几乎没有人口学差异。2009年的调查中,受教育水平较高的受访者相对于受教育水平较低的受访者更有可能寄来贴有与其所居住州不匹配的印花税票的卷烟。2010年的调查中,40岁及以上的受访者比18-39岁的受访者更有可能寄来贴有与其所居住州不匹配的印花税票的卷烟。在两轮调查中,为购买更便宜的卷烟做过特殊努力的吸烟者和没有戒烟计划的吸烟者更有可能寄来在其所居住州被归于未上税的卷烟。这暗示一些吸烟者(如果有可能的话)会寻求更低成本的产品来应对较高的价格,而非戒烟。

本分析检验了受访者自报的和印在寄来的卷烟上的品牌与UPC信息的关系,因为我们担心受访者可能报告吸比较贵的品牌却寄来比较便宜的品牌,而这一分析产生了一些有趣的结果。

电话调查时的自报品牌与寄来供分析用的烟盒上的品牌系列间的高度一致率,说明大部分受访者的确寄来了他们常吸的卷烟种类。但是,自报UPC和烟盒上印刷的UPC的低一致率却暗示了与之相反的情况。这一差异的原因并不清楚。可能是一些受访者自报的UPC不准确,或者本研究中的吸烟者在电话调查和邮寄卷烟之间的这段时间里换用了同一卷烟品牌系列下的其它种类。第三种可能是受访者有意欺

骗我们,寄来与他们自报种类不同并/或从不同的地点购买的卷烟。

本研究一大优势是,通过研究在两个不同时间点参与全国代表性调查的美国吸烟者样本寄来的卷烟,估计了吸烟流行率。流行率的估计在两次调查中表现稳定。大部分最初同意参与烟盒收集的受访者寄来了供分析用的卷烟。高参与率和结果的可重复性暗示这种类型的数据收集是可行的并且符合成本效益(对受访者付出的时间和努力,我们给予其25美元的补偿)。

理论上说,相比于其它之前尝试运用丢弃的烟盒上的印花税票来测量避税和/或逃税的方法,直接由吸烟者寄来未开封卷烟并将其用于估计应该是一种更准确的方法。但是,本研究有几个明显的不足,可以加以优化并用于未来这种类型的数据收集。第一,样本量小,且在每个州收集的卷烟的分布有差异。2009年我们没有收到阿拉斯加州、特拉华州、夏威夷州、爱达荷州、缅因州、罗德岛州、南达科他州和佛蒙特州的吸烟者寄来的卷烟,2010年则缺少夏威夷州、罗德岛州和佛蒙特州的卷烟。正因如此,本文研究结果难以代表吸烟者人群的普遍情况。

另外的局限是我们使用的抽样策略可能导致不准确的流行率估计。另外,本研究选取研究对象的标准也存在争议,因为每天吸10支或者更多卷烟的受访者可能有更大的动力去寻求低价的卷烟,这可能导致明显的偏误。之前的研究已经表明每日卷烟消费量更多的个体更有可能有逃税行为^[7,8,16]。但是,使用较严格的或者较不严格的合格标准,在两个时间点,不管是研究的人群还是逃税和/或漏税的估计都是类似的。并且,从无执照的烟草经销点购买卷烟以故意逃税的吸烟者,更不倾向于参与调查或者寄来卷烟以供检查。与2009年和2010年的全样本均数相比,未显示逃税或漏税证据的烟盒在两次数据集中都寄回烟盒的调查对象中的流行率更高,增加了对该假设的支持。未来这种类型的数据收集可能要考虑优化研究方法,使其包括更多每日吸烟少于10支的个体和故意逃避卷烟税的个体,以使数据收集能更好地代表全部吸烟人群。

之前发表的论文提出了高烟草价格和低成本替代品的方便可及性之间的联系^[8,16]。2010年发表的另一研究使用了芝加哥市散落的卷烟烟盒的一个随机样本的数据。在这一研究中,大约三分之一收集的烟盒没有当地印花税票。进一步研究发现,随着收集点和印地安那州边界的距离的增加,烟盒附带本地印花税票的比率也在增加^[23]。在本研究中,我们无法测量受访者居住地和购买寄来供检查的卷烟烟盒的烟草经销点的距离。因此,我们无法测量接近程度,也无法将较低价格来源作为一个影响因素来评估。未来的研究也许可以考虑获得购买地相关的信息,以更好的估计逃税和/或漏税与低价卷烟的可及性之间的关系。

根据参与了全国代表性调查的美国吸烟者样本寄来的卷烟烟盒,本研究估计了州级的逃税漏税率。尚不清楚这些估计是否比吸烟者居住州销售的未上税卷烟的实际流行率低。所有50个州均使用州印花税票可能有助于更确切的流行率估计。政策方面,统一美国所有州的税率可能有助于减少或消除寻求更低成本卷烟的动力。未来的研究应该考虑较低税额或较低成本的卷烟来源是如何影响逃税和/或漏税的。

本文贡献

- ▶ 本文提供了卷烟避税和/或逃税率的估计，即通过研究参与了全国代表性调查的美国吸烟者样本寄来的未开封卷烟获得相关结论。
- ▶ 利用烟盒收集的方法，我们发现五分之一的卷烟未上税，且消费税越高的州该比率越高。尚不清楚这些估计与吸烟者所居住州的未上税卷烟的实际流行率是否有区别。在政策方面，在美国所有的50个州统一消费税税率，可能会成为一个削弱或消除避税逃税动机的办法。

贡献

RJO、GTF、KMC、AH：概念和调查设计。BVF：数据分析。BVF、RJO、FJC、GTF、KMC、AH、ASL：起草手稿并对重要的知识内容进行批判性修改。所有作者阅读并同意了最终稿。

经费

the National Cancer Institute of the United States (R01 CA 100362, P50 CA111236 (Roswell Park Transdisciplinary Tobacco Use Research Center), P01 CA138389, and R25 CA113951)和 Canadian Institutes of Health Research (7955 and 115016)的基金资助。Geoffrey T Fong获得了the Ontario Institute for Cancer Research (OICR)的Senior Investigator Award和the Canadian Cancer Society Research Institute的Prevention Scientist Award的支持。

利益冲突 KMC过去曾供职于且继续作为付费专家证人供职于控告烟草行业的诉讼的原告。

知情同意 已获得。

伦理审核 所有的数据收集方法都通过了 Roswell Park Cancer Institute机构审查委员会和 University of Waterloo 人类研究伦理委员会的审查和批准。

出处和同行审查 未开展；外部同行已评审。

数据共享声明 ITC项目外的研究团队为获得本研究的任何数据，需要成功地完成和获批ITC数据使用申请书。获得使用数据批准的ITC主要调查员及ITC项目外研究团队，需要签署ITC数据使用协议。需要了解更多信息请登陆<http://www.itcproject.org>。

参考文献

- 1 Chaloupka FJ, Yurekli A, Fong GT. Tobacco taxes as a tobacco control strategy. *Tob Control* 2012;21:172–80.
- 2 Jha P, Chaloupka FJ. *Curbing the epidemic: governments and the economics of tobacco*. Washington, DC: The World Bank, 1999.
- 3 Levy DT, Cummings KM, Hyland A. Increasing taxes as a strategy to reduce cigarette use and deaths: results of a simulation model. *Prev Med* 2000;31:279–86.
- 4 Chaloupka FJ, Warner KE. The Economics of Smoking. In: Culyer CJ, Newhouse JP, eds. *Handbook of Health Economics 1st ed*. Elsevier: Amsterdam, The Netherlands: 2000:1539–1627.
- 5 Frieden TR, Mostashari F, Kerker BD, et al. Adult tobacco use levels after intensive tobacco control measures: New York City, 2002–2003. *Am J Public Health* 2005;95:1016–23.
- 6 Chaloupka FJ, Cummings KM, Morley CP, et al. Tax, price and cigarette smoking: evidence from the tobacco documents and implications for tobacco company marketing strategies. *Tob Control* 2002;11:i62–72.
- 7 Hyland A, Bauer JE, Li Q, et al. Higher cigarette prices influence cigarette purchase patterns. *Tob Control* 2005;14:86–92.
- 8 Hyland A, Laux FL, Higbee C, et al. Cigarette purchasing patterns in four countries and the relationship with cessation: findings from the International Tobacco Control (ITC) Four Country Survey. *Tob Control* 2006;15:iii59–64.
- 9 McGoldrick DE, Boonn AV. Public policy to maximize tobacco cessation. *Am J Prev Med* 2010;38:S327–32.
- 10 Farrelly MC, Pechacek TF, Chaloupka FJ. The impact of tobacco control program expenditures on aggregate cigarette sales: 1981–2000. *J Health Econ* 2003;22:843–59.
- 11 Farrelly MC, Pechacek TF, Thomas KY, et al. The impact of tobacco control programs on adult smoking. *Am J Public Health* 2008;98:304–9.
- 12 Tauras JA, Chaloupka FJ, Farrelly MC, et al. State tobacco control spending and youth smoking. *Am J Public Health* 2005;95:338–44.
- 13 Hyland A, Bauer JE, Li Q, et al. Higher cigarette prices influence cigarette purchase patterns. *Tob Control* 2005;14:86–92.
- 14 White VM, Gilpin EA, White MM, et al. How do smokers control their cigarette expenditures? *Nico Tob Res* 2005;7:625–35.
- 15 Scollo M, Younie S, Wakefield M, et al. Impact of tobacco tax reforms on tobacco prices and tobacco use in Australia. *Tob Control* 2003;12:ii59–66.
- 16 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.
- 17 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.
- 18 Kurti MK, von Lampe K, Thompkins DE. The illegal cigarette market in a socioeconomically deprived inner-city area: the case of the South Bronx. *Tob Control* 2013;22:138–40.
- 19 Wilson N, Thomson G, Edwards R, et al. Estimating missed government tax revenue from foreign tobacco: survey of discarded cigarette packs. *Tob Control* 2009;18:416–18.
- 20 Thompson ME, Fong GT, Hammond D, et al. Methods of the International Tobacco Control (ITC) four country survey. *Tob Control* 2006;15(Suppl 3):iii12–18.
- 21 Davis K, Farrelly M, Li Q, et al. *Cigarette purchasing patterns among New York State smokers: implications for health, price, and revenue*. Albany, NY: New York State Department of Health, 2004.
- 22 Campaign for Tobacco-Free Kids. State cigarette excise taxes and rankings. 2013. <http://www.tobaccofreekids.org/research/factsheets/pdf/0097.pdf> [accessed 6 Jun 2013].
- 23 Merriman D. The micro-geography of tax avoidance: evidence from littered cigarette packs in Chicago. *Am Econ J Econ Policy* 2010;2:61–84.