

Trends in cigarette pricing and purchasing patterns in a sample of US smokers: findings from the ITC US Surveys (2002–2011)

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ABSTRACT

Objective This paper examines trends in cigarette prices and corresponding purchasing patterns over a 9-year period and explores characteristics associated with the quantity and location of cigarettes purchased by adult smokers in the USA.

Methods The data for this paper come from a nationally representative longitudinal survey of 6669 adult smokers (18 years and older) who were recruited and surveyed between 2002 and 2011. Telephone interviews were conducted annually, and smokers were asked a series of questions about the location, quantity (ie, single vs multiple packs or cartons) and price paid for their most recent cigarette purchase. Generalised estimating equations were used to assess trends and model characteristics associated with cigarette purchasing behaviours.

Results Between 2002 and 2011, the reported purchase of cigarette cartons and the use of coupons declined while multipack purchases increased. Compared with those purchasing by single packs, those who purchased by multipacks and cartons saved an average of \$0.53 and \$1.63, respectively. Purchases in grocery and discount stores declined, while purchases in tobacco only outlets increased slightly. Female, older, white smokers were more likely to purchase cigarettes by the carton or in multipacks and in locations commonly associated with tax avoidance (ie, duty free shops, Indian reservations).

Conclusions As cigarette prices have risen, smokers have begun purchasing via multipacks instead of cartons. As carton sales have declined, purchases from grocery and discount stores have also declined, while an increasing number of smokers report low tax sources as their usual purchase location for cigarettes.

INTRODUCTION

Many key tobacco control policies are implemented in order to (1) reduce cigarette consumption among current smokers and (2) discourage tobacco consumption among non-smokers, especially youth.^{1,2} The most effective way to achieve these goals is to increase the price of cigarettes.³ The higher the price of purchasing a pack of cigarettes, the less likely it is that people will buy and consume cigarettes.⁴

However, there are many factors that can disrupt the simple relationship between the price of cigarettes and consumption. For example, consumers can offset higher prices by purchasing cigarettes in bulk such as in cartons or in multipacks rather than as single packs. In addition, smokers can switch to

lower priced cigarette brands, switch to brands offering price discounts and shop for cigarettes in locations where cigarettes are less expensive.^{5,6} Finally, smokers can respond to higher cigarette prices by reducing their daily intake of cigarettes or stop their cigarette consumption all together. While not all smokers will necessarily engage in price-minimising behaviours, the steady rise in cigarette prices coupled with increasing rates of unemployment, stagnant and/or declining wages, and higher household expenses for items like gasoline and food have combined over the past several years to make cigarettes less affordable. A recent article from the International Tobacco Control (ITC) United States Survey reported an increase in the use of discount cigarettes by US smokers after the 2009 increase of \$0.61 in the federal excise tax (FET) on cigarettes.⁷

Previous studies from the ITC Project have examined price-minimising behaviours in relationship to smoking cessation and smoker socioeconomic status using data from the USA, the UK, Canada and Australia.^{6,8} The present study examines trends in purchasing patterns in a group of US adult smokers surveyed annually between 2002 and 2011. During this time period, cigarette prices increased as a result of state and federal tax increases. In addition, cigarette manufacturers began to compete more directly on purchase price rather than image-based advertising due to restrictions in advertising.⁹

This paper extends the previous work by (1) examining trends in cigarette prices and typical quantity of cigarettes purchased (ie, single vs multiple packs or cartons), use of coupons and locations where cigarettes are typically purchased; (2) assessing characteristics related to bulk purchasing, coupon use and tax avoidance; and (3) observing how these activities coincide with changes in pricing and tax rates. Taken together, this information is used to evaluate the trends in, and the profile of smokers who use tactics to lower their cigarette costs in response to increased state and federal cigarette excise taxes over a 9-year period.

METHODS

Study design and sample

This paper uses data from a nationally representative longitudinal survey of 6669 adult current smokers who were recruited and surveyed between 2002 and 2011 for the ITC US Survey. Standardised telephone interviews were conducted annually. At initial enrolment, survey participants



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included adult smokers (18 years of age and older) who reported that they had smoked at least 100 cigarettes in their lifetime and had smoked at least 1 cigarette in the past 30 days. Probability sampling methods were used to recruit the sample using random-digit dialling. If multiple adult smokers were present in the home, the next-birthday method was used to select the respondent. Survey participants who were lost to follow-up in subsequent survey waves were replenished using the same procedures as the original recruitment. This process was used to maintain a sample size of 1500–2000 participants per wave. The average attrition rate was 35% for each survey wave. Further details of the survey methodology have been documented elsewhere.¹⁰

Measures

Quantity of cigarettes purchased

Participants who reported smoking factory-made cigarettes were asked whether they bought cigarettes by carton, pack or by individual cigarettes out of a pack on their last purchase occasion. A standard carton of cigarettes contains 10 individual packs of 20 cigarettes each. For the purposes of this study, multipack purchases were defined as purchases of >1 and <10 individual packs of cigarettes. Bulk purchases were indicated by purchases of more than a single package of cigarettes (ie, either multiple packs or cartons). Previous studies have described multipack sales in terms of manufacturers' 'buy one get one free' promotions;¹¹ however, multipacks do not need to be part of a special price promotion offer.

Purchasing locations

Participants were asked where they bought their cigarettes on their last purchase occasion. Purchase locations were selected from a predefined list that included the following categories: (1) convenience store/gas station; (2) grocery, discount or drug store; (3) tobacco outlets, smoke shops; (4) Indian reservation; (5) liquor store; (6) outside of the state; (7) duty-free; (8) outside of the country; (9) from a toll-free number; (10) from the internet and (11) other. Text responses entered under 'other' were either added to the appropriate existing category (where appropriate) or left as 'other'. Among purchase locations, a purchase made at an Indian reservation, outside of one's home state, duty-free, from a toll-free number, outside of the country or from the internet was designated as a location with the potential for tax avoidance (low tax location).

Use of coupon/special price discounts

Participants were also asked whether they used any coupons or received special discounts on their last purchase of cigarettes. Those responding 'yes' were considered positive for coupon/discount use.

Purchase price

Participants were asked to report the amount they paid for the cigarettes they purchased last. Self-reported purchase prices were standardised to the cost paid for a single pack of 20 cigarettes and adjusted to reflect the price paid in 2011 US\$.¹²

Data and statistical analysis

Descriptive statistics were used to characterise trends in per pack cigarette prices and purchasing habits between 2002 and 2011. Generalised estimating equations (GEE) were used to (1) test for trends in bulk purchasing, coupon/special discount usage and purchase locations; (2) estimate adjusted wave specific prevalence rates for each of the outcomes and (3) model the

characteristics of participants associated with bulk purchasing and tax avoidance.¹³ Because all of the outcomes of interest were dichotomous, a repeated measures binomial distribution with the logit link was used for the regression models. An unstructured correlation structure was used to account for correlation among repeated measures on subjects. In cases where the model did not converge or the software indicated that a simpler correlation structure was more appropriate, an exchangeable correlation structure was used. We tested for linear trends in outcomes from 2002 to 2011. We also tested for differences in outcomes between the survey waves conducted prior to (wave 7, 2008–2009) and after (wave 8, 2010–2011) the \$0.61 increase in the FET on 1 April 2009. Variables examined as predictors of bulk purchasing and tax avoidance included the participant's gender, age, race, household income (ie, defined as low: ≤\$29 999; medium: \$30 000–\$59 999; or high: ≥\$60 000), education (ie, defined as low: ≤ high school; moderate: some college/tech/trade school, no degree; high: university degree or higher), level of nicotine dependence (ie, measured by heaviness of smoking index [scored 0–6] and categorised as low: ≤4 or high: >4), intention to quit smoking, geographic region of the USA (ie, northeast, south, midwest or west) and brand value type (ie, premium vs discount). Brand value type was determined using representations from the manufacturers and has been described elsewhere.⁷ Results were weighted to reflect the population composition of US adult smokers, and all analyses were performed using SAS V9.3.¹⁴

RESULTS

Sample characteristics

Table 1 shows the demographic characteristics of the study sample. In general, the sample is representative of the adult smoking population in the USA, with a slight overrepresentation of women and smokers between 40 and 54 years of age. While 44.5% of participants completed only a single survey, 55.5% completed two or more surveys.

Price paid per pack and purchase quantity

Figure 1 illustrates the prevalence of carton, multipack and single-pack purchases along with the average price paid for cigarettes from each survey wave from 2002 to 2011. The sharpest increase in the price paid for a package of cigarettes was observed between 2009 and 2011, corresponding to the \$0.61 increase in the FET on cigarettes. Over the entire study period, most smokers purchased by either single or multipack rather than by the carton, although the prevalence of carton purchases was the highest of the three categories. However, carton purchases began to decrease after 2007. Comparing the purchase price paid for cartons to single packs, the average savings per pack was \$1.63 for carton purchases, although there were fluctuations in savings over the survey period. On average, purchasing cigarettes by multipacks saved \$0.53 on average than purchasing a single pack. No statistically significant linear trends were detected in carton purchases (35.6% to 33.3%; $p=0.36$) or single-pack purchases (35.1% to 34.5%, $p=0.40$) while a slight increase was observed in multipack purchases (25.6% to 28.6%; $p<0.05$) from 2002 to 2011. Across the different survey waves, the prevalence of respondents switching from cartons to multipacks between successive waves ranged from 3.7 to 7.2%, while the prevalence of respondents switching from single packs to multipacks ranged from 4.3 to 6.5% from 2002 to 2011. No statistically significant linear trends over time were detected. The prevalence of switching from multipacks to single

Table 1 Baseline demographic characteristics of ITC US sample (N=6669)

Characteristic	N	Per cent
Sex		
Male	3032	(45.5)
Female	3637	(54.5)
Age		
18–24	749	(11.2)
25–39	1710	(25.6)
40–54	2436	(36.5)
55+	1774	(26.6)
Race		
Black	668	(10.1)
Other	813	(12.2)
White	5163	(77.7)
Education*		
Low	3037	(45.6)
Moderate	2547	(38.2)
High	1073	(16.1)
No answer	12	(0.2)
Income†		
Low	2454	(36.8)
Moderate	2182	(32.7)
High	1542	(23.1)
No answer	491	(7.4)
# of participants recruited at each survey wave		
Wave 1	2140	(32.1)
Wave 2	684	(10.3)
Wave 3	889	(13.3)
Wave 4	742	(11.1)
Wave 5	745	(11.1)
Wave 6	711	(10.7)
Wave 7	382	(5.7)
Wave 8	376	(5.6)
# Surveys completed by respondents		
1	2969	(44.5)
2	1519	(22.8)
3	876	(13.1)
4	498	(7.5)
5	319	(4.8)
6	212	(3.2)
7	124	(1.9)
8	152	(2.3)

*Education defined as low= \leq high school; moderate=some college/tech/trade school, no degree; high=university degree or greater.

†Income defined as low= \leq \$29 999; moderate=\$30 000–\$59 999; high \geq \$60 000. ITC, International Tobacco Control.

packs declined (5.1% to 1.9%, $p<0.001$). Switching from multi-packs to cartons also declined (3.6% to 1.3%, $p<0.01$).

Coupon use and special discount trends

As shown in figure 2, the reported use of coupon/special discount was relatively low from 2002 to 2011. The use of coupons and price discounts declined after 2005 when multi-pack purchasing began to increase, corresponding to the decline in manufacturer expenditures for coupons.⁹

Cigarette purchase location trends

Figure 3 depicts the locations of cigarette purchases over the eight survey waves. (Data values for figure 3 are available in

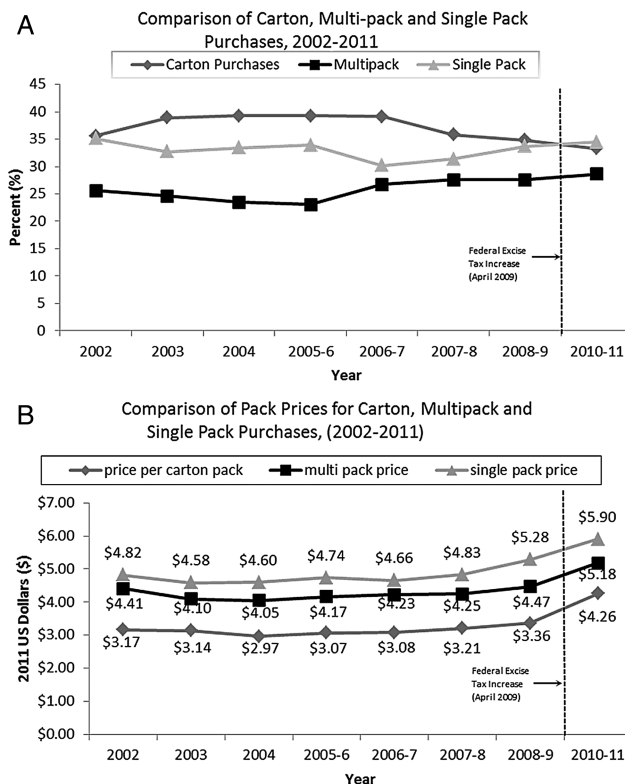


Figure 1 Trends in carton and pack purchases with average price paid per pack, 2002–2011. All percentages are adjusted for age, sex, time-in-sample, wave, and daily smoking only. Prices are additionally adjusted for income, education, region, brand type, and low tax purchase location.

online supplementary appendix 1.) Convenience stores and gas stations were the most frequently reported locations for cigarette purchases in all survey waves, followed by grocery and discount stores, and tobacco outlets (figure 3A). Purchases from convenience stores/gas stations were fairly stable over the survey period from 2002 to 2011 (56.6% to 59.7%; $p=0.08$). Decreases in purchases in grocery, discount and drug stores (19.6% to 12%; $p<0.01$) and ‘other’ locations (6.9% to 4.0%; $p<0.01$) were detected from 2002 to 2011. The use of tobacco outlets for purchases increased over this time period from 12.3% to 17.1% ($p<0.01$). Purchases from low tax locations

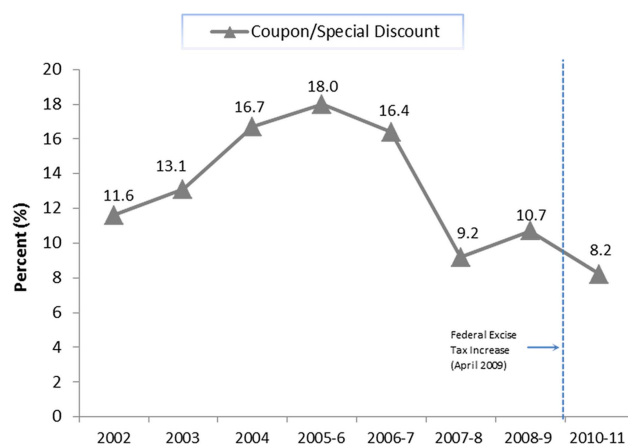


Figure 2 Coupon/special discount use, 2002–2011. All percentages are adjusted for age, sex, time-in-sample, wave, and daily smoking only.

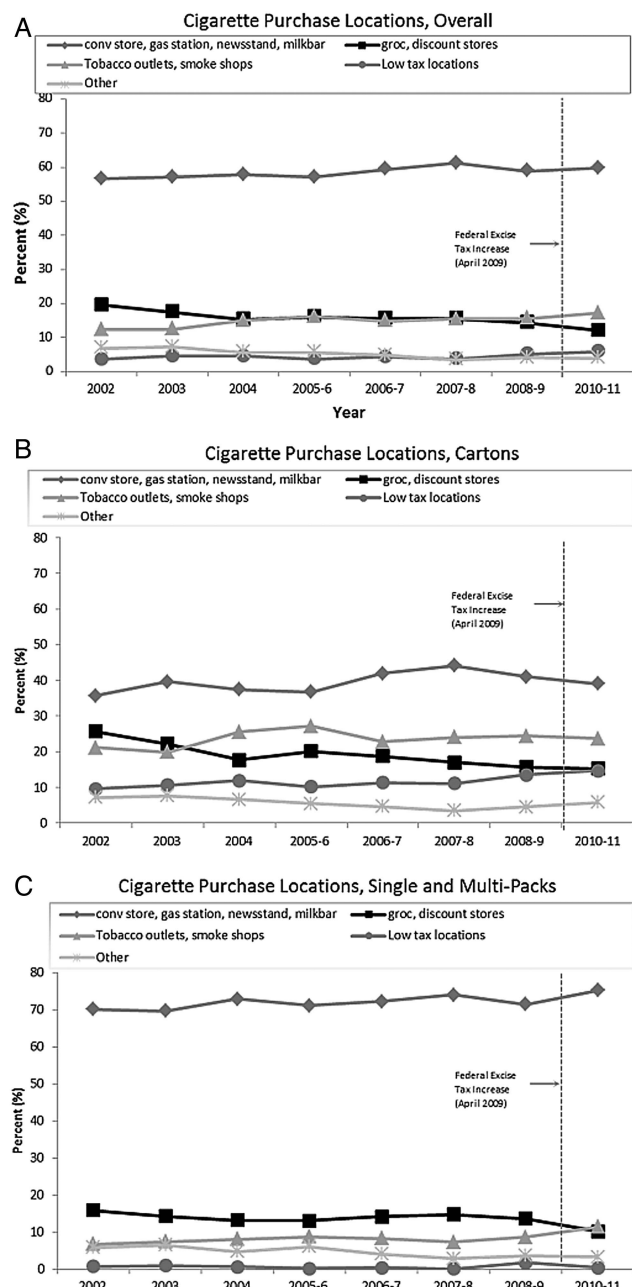


Figure 3 Locations of purchase overall and by bulk purchase type. All percentages are adjusted for age, sex, time-in-sample, wave, and daily smoking only. 'Other' locations include: bar/restaurant, casino; liquor store; military commissary; vending machine and all others.

rose from 3.6% in 2002 to 5.9% in 2011, although this result was not statistically significant ($p=0.15$). This trend was likely due in part to purchasing on Indian reservations, which rose from 2.2% to 3.6% from 2002 to 2011 ($p=0.04$).

Cartons were purchased most often from convenience stores and gas stations; grocery, discount and drug stores; and tobacco outlets (figure 3B). Purchases of cartons decreased in grocery and discount stores (25.7% to 15.3%; $p<0.01$) and also in 'other' locations (7.2% to 5.8%; $p=0.03$) from 2002 to 2011. Carton purchases from Indian reservations rose from 5.3% to 10.2% ($p<0.01$) over the survey period. The majority of single and multipack purchases were made at convenience stores and gas stations (figure 3C). The prevalence of single and multiple pack purchases decreased in 'other' locations from 5.9% to 3.3% ($p<0.01$) over the study period.

Use of bulk purchasing, coupons or tax avoidance has been highly consistent over the survey period (data not shown). Overall, 67–72% of smokers in each wave used either bulk purchasing, coupons or tax avoidance behaviours from 2002 to 2011.

Bulk purchasing and tax avoidance characteristics

Table 2 depicts factors associated with carton purchases, multipack purchases and tax avoidance. All outcomes were associated with female gender, older age (age ≥ 25 years), White race, greater nicotine addiction, use of discount cigarettes and intention to quit smoking. Additionally, carton purchasing was associated with high income and daily smoking. Carton purchasing was more likely in the southern region and less likely in the northeastern region when compared with the western region. Multipack purchases (compared with single-pack purchase) were additionally associated with moderate income (compared with high income), and living in the midwestern and southern regions of the USA and daily smoking. Tax avoidance was more likely in the northeastern region and less likely in the midwestern and southern regions when compared with the western region. Bulk purchasing and tax avoidance was less likely among smokers intending to quit. Controlling for age, sex, race, nicotine addiction, smoking status, intention to quit smoking, brand value, income, education, region, time-in-sample and wave we did not observe a statistically significant change in bulk purchasing and tax avoidance before and after the implementation of the FET in 2009.

DISCUSSION

The average price paid for a single package of cigarettes in the USA rose steadily from 2002 to 2011, with a large increase observed after the 2009 FET increase. On a per pack basis, the price was substantially lower for purchasing by the carton than by the pack. The price differential between carton and pack sales was fairly stable over the entire study period. Despite the relative per pack price advantage of purchasing cigarettes by the carton, smokers are increasingly choosing to purchase their cigarettes by the pack instead of by the carton. A number of factors may have contributed to this trend. Additional analyses of these data show that many smokers appear to be smoking fewer cigarettes per day, decreasing from 19 in 2002 to 17 in 2011. This is likely in response to higher cigarette prices, less disposable income and/or increasing restrictions on when and where they are permitted to smoke. Additionally, it is possible that some smokers may find the high entry cost of a carton of cigarettes too steep, whereas the perceived lower daily per pack price seems more affordable, especially if they are intending to reduce their smoking and/or stop smoking. Additional analyses of the data found that those who were intending to quit had a 20–54% reduced odds of bulk purchasing or purchasing from a low tax location.

Results from this study found that most smokers purchased either by single or multipack rather than by the carton, and this is consistent with other studies.^{5 15 16} The reported use of coupons and price discounts was not all that common among the smokers we surveyed and peaked at about 18% in 2005. Coupon use began to decline in the later years of the survey, coinciding with a decline in manufacturer expenditures for coupon promotions.⁹ Multipack purchasing increased noticeably after 2005. Smokers who previously reduced the price of their cigarette purchases through coupons and price discounts now had the option of reducing costs through purchasing multipacks. These trends may be reflective of changes in price promotions

Table 2 Characteristics associated with bulk purchasing and tax avoidance

Variables	Model 1 carton purchases versus non carton purchases (N=6206)		Model 2 multipack versus single pack purchases (N=4109)		Model 3 tax avoidance location versus other purchase location (N=6246)	
	OR	95% CI	OR	95% CI	OR	95% CI
Sex						
Females vs males	1.36	(1.21 to 1.53)	1.33	(1.17 to 1.52)	1.51	(1.18 to 1.92)
Age						
25–39 vs 18–24	2.13	(1.65 to 2.76)	1.70	(1.35 to 2.14)	1.45	(0.75 to 2.80)
40–54 vs 18–24	3.85	(3.00 to 4.95)	2.11	(1.68 to 2.63)	2.38	(1.27 to 4.45)
55–max vs 18–24	7.59	(5.86 to 9.84)	2.44	(1.89 to 3.15)	2.97	(1.55 to 5.66)
Race						
Other vs white	0.60	(0.49 to 0.73)	0.75	(0.61 to 0.93)	0.77	(0.53 to 1.11)
Black vs white	0.23	(0.17 to 0.30)	0.40	(0.32 to 0.51)	0.12	(0.04 to 0.32)
Income†						
Low vs high	0.66	(0.56 to 0.76)	1.13	(0.94 to 1.36)	1.13	(0.84 to 1.52)
Middle vs high	0.79	(0.69 to 0.91)	1.20	(1.01 to 1.43)	0.95	(0.71 to 1.28)
No answer vs high	0.94	(0.74 to 1.20)	1.06	(0.77 to 1.48)	0.73	(0.41 to 1.28)
Education‡						
Low vs high	0.99	(0.84 to 1.17)	0.87	(0.70 to 1.07)	0.94	(0.67 to 1.33)
Middle vs high	0.97	(0.85 to 1.11)	1.02	(0.88 to 1.19)	0.71	(0.54 to 0.93)
Nicotine dependence§						
≥4 vs <4	1.45	(1.32 to 1.60)	2.06	(1.74 to 2.44)	1.44	(1.19 to 1.75)
Smoking						
Daily vs non-daily	2.76	(2.16 to 3.52)	2.19	(1.71 to 2.81)	1.63	(0.85 to 3.14)
Brand value						
Premium vs discount	0.58	(0.51 to 0.65)	0.74	(0.63 to 0.86)	0.50	(0.39 to 0.63)
Region						
Midwest vs west	0.93	(0.77 to 1.11)	1.40	(1.15 to 1.71)	0.29	(0.20 to 0.42)
Northeast vs west	0.73	(0.60 to 0.88)	0.95	(0.77 to 1.18)	1.93	(1.46 to 2.55)
South vs west	1.25	(1.06 to 1.48)	1.41	(1.16 to 1.71)	0.18	(0.12 to 0.26)
Quit intentions						
Beyond 6 months vs not quitting	0.79	(0.71 to 0.87)	0.80	(0.68 to 0.94)	0.68	(0.55 to 0.84)
1–6 months vs not quitting	0.57	(0.50 to 0.64)	0.69	(0.58 to 0.82)	0.69	(0.54 to 0.90)
Within next month vs not quitting	0.46	(0.39 to 0.55)	0.51	(0.41 to 0.64)	0.61	(0.42 to 0.89)
Wave						
Wave 1 vs 8	1.02	(0.80 to 1.30)	0.92	(0.68 to 1.25)	0.61	(0.38 to 0.99)
Wave 2 vs 8	1.16	(0.92 to 1.47)	0.98	(0.73 to 1.32)	0.71	(0.45 to 1.11)
Wave 3 vs 8	1.19	(0.95 to 1.48)	0.90	(0.67 to 1.20)	0.72	(0.47 to 1.11)
Wave 4 vs 8	1.25	(1.01 to 1.54)	0.91	(0.68 to 1.21)	0.61	(0.40 to 0.92)
Wave 5 vs 8	1.18	(0.97 to 1.44)	1.17	(0.89 to 1.55)	0.71	(0.48 to 1.07)
Wave 6 vs 8	1.04	(0.87 to 1.25)	1.09	(0.82 to 1.45)	0.61	(0.41 to 0.89)
Wave 7 vs 8	0.99	(0.84 to 1.18)	1.02	(0.76 to 1.36)	0.91	(0.64 to 1.28)

Models also adjusted for time-in-sample. Statistically significant ORs are in bold.

*p<0.05.

†Income defined as low ≤\$29 999; medium=\$30 000–\$59 999, or high ≥\$60 000.

‡Education defined as low: ≤ high school; moderate: some college/tech/trade school, no degree; high: university degree or higher.

§Nicotine dependence measured by Heaviness of Smoking Index [scored 0–6] and categorised as either low: ≤4, or high: >4.

offered by cigarette manufacturers in response to the slowing US economy that negatively impacted the affordability of cigarettes.^{6 17} Multipacks represent an affordable option, with pricing between that of cartons and single packs. Noting price fluctuations and regional variation over the survey period, those purchasing by cartons spent an average of \$51.02 per purchase occasion compared with \$13.48 for multipacks and \$5.65 for single packs.

Advertising and price promotions, particularly those at the point of sale (POS) in convenience stores and gas stations (ie, multipack discounts, coupons, etc), constituted a significant proportion of cigarette manufacturer expenditures during the time period of this study and are often implemented to strategically

offset impending tax increases among current and potential smokers.^{4 18 19} Since pack purchases were overwhelmingly more likely to be made at these locations, advertising promotions at the POS for multipack purchases could help to explain why multipack purchases increased while carton purchases declined from 2006 to 2011.

Examination of characteristics of smokers using bulk purchasing and tax avoidance yielded similar results in that choice of discount brand was associated with bulk purchasing and tax avoidance. This may indicate that addicted smokers who exhibit these tactics are also likely to use discount cigarette brands at some point. Previous studies have shown that older, heavier smokers were more likely to switch to discount brands,⁷ while

this analysis has found that older smokers were more likely to use bulk purchasing and tax avoidance methods. Overall, white, female, older and more addicted smokers were more likely to purchase cigarettes in high quantities and try to avoid taxes. The fact that female smokers were more likely to purchase in high quantities and try to avoid taxes is consistent with the study by Licht *et al.*⁸ which uses ITC data from four countries. As well, studies using non-ITC data have found that female smokers were more likely to purchase in 'less expensive venues' or from Indian reservations, and also that female smokers were more likely to use promotional offers 'every time they see one'.^{20–22} An article by Pesko *et al.*¹⁶ reported that female smokers were more likely to purchase cartons, while a study by Mecredy *et al.*²³ found that a greater percentage of females purchased contraband tobacco regularly.

A distinguishing characteristic of carton purchasers was higher income since greater income is needed for this method of cost-cutting; this result is consistent with those from studies by Licht *et al.*⁸ Tax avoidance was more likely in areas where cigarette taxes (in addition to the cost of living) were highest (ie, west and northeast regions). Additionally, the higher total cost of cigarettes, in addition to the close proximity of Indian reservations, may also explain this occurrence. Previous research has indicated that price promotions are highest where tobacco control policies are strongest (ie, west and northeast).¹⁸ Work by Harding *et al.*²⁴ has also indicated that the impact of increased tax burden experienced by consumers differs by state tax rate, which, in turn, influences the extent to which consumers seek out strategies to minimise cigarette costs. Results from this study indicate that income is not associated with tax avoidance, while moderate income was associated with multipack purchases (compared with high income). Previous studies have found that price-sensitive smokers were more likely to take advantage of price promotions offered at the time of purchase.^{4–5} Licht *et al.*⁸ also reported that smokers from lower SES groups were less likely to travel to other, cheaper venues for purchases. This may be due in part to an inability to travel to other, cheaper venues for purchases. Although multipack purchasing was not associated with low income, multipack purchases may still represent a more affordable option to moderate-income smokers. Using our definition of low income, it may be that multipacks, like cartons, remain unaffordable to low-income smokers.

Results do not indicate that the federal tax increase resulted in a statistically significant *increase* in bulk purchasing, tax avoidance or coupon use between waves 7 and 8 (when the FET increase occurred); however, the price differential between those who did and those who did not use at least one of the strategies for price minimisation was greatest after wave 7. As well, some participants in wave 7 were surveyed after April 2009 (323/1763 or $\approx 18.3\%$), indicating that this measure of differences from wave 7 to 8 may be an underestimate of the differences. In order to more accurately isolate the effects of the FET, calendar year and month was controlled for and differences in outcomes before and after the FET increase were assessed, controlling for time-in-sample, sex, age, wave and daily smoking. We found that the FET tax increase was associated with decreased odds of purchasing by the carton (OR=0.80; $p<0.01$) and increased odds of purchasing at low tax locations (OR=1.43; $p=0.03$).

This should be interpreted carefully because other explanations could exist. First, consistent price promotions in the years leading up to the tax increase may have minimised the impact in such a way that a sudden, large increase in cost from the federal taxation was not experienced, thus *maintaining* prior purchase

habits, particularly among those purchasing by multipacks. Price reduction by bulk purchasing appears to be a consistent occurrence, irrespective of changes in tax policies for cigarettes. Second, the weakened economy during this time period could have influenced purchase behaviour.

Results from this study revealed that 4–7% of respondents switched from cartons to multipacks and also from single packs to multipacks between successive waves over the 2002 to 2011 period. This may indicate not only *reduced* smoking among previous carton purchasers, but also *increased* smoking among those who typically purchased by single packs, due to the increased volume of cigarettes on hand, effectively offsetting the benefits of cigarette price increases. This may indicate that multipack purchase discounts enable reductions in smoking frequency by heavy smokers to be offset by increases in smoking by moderate to light smokers.

While these data report valuable information regarding behaviours surrounding price increases, there are limitations. Our analysis is limited to the last purchase of cigarettes, rather than the usual purchase quantity, which could result in some misclassification. As well, multipack purchases do not necessarily indicate a multipack discount. In this definition, multipack purchases may or may not always represent 'buy one get one free' price promotions that are reported to the Federal Trade Commission. However, those who purchased in this manner did save more than those who purchased single packs, on average. Because the questionnaire item asks about coupons and special discounts simultaneously, we were unable to determine whether some smokers may have interpreted 'buy-one-get-one free' as a 'special discount.' As a result, we were unable to isolate multipack discounts from coupon use, and therefore could not adjust per pack average price without the possibility of excluding multipack discounts. Nonetheless, a sensitivity analysis revealed that exclusion of all coupon/discount purchases did not affect estimates of price or prevalence among carton, multipack and single-pack purchases. Next, we only observed small magnitudes of differences in our outcomes of interest. Despite this, small per cent differences may often equate to large numbers of affected lives at the population level. As well, we did not assess purchases of single/loose cigarettes because too few participants indicated purchasing in this quantity. Additionally, small sample sizes of individual tax avoidance methods (except for Indian reservations) prevented us from being able to assess characteristics related to specific tax avoidance methods. It is possible that characteristics may differ by specific tax avoidance methods as found by Licht *et al.*⁸

Cigarette consumption is reduced by 2.5–5% when prices increase 10%; however, consumers' uses of strategies to lessen the price they pay reduce this impact.^{3–25–26} We found that these price reduction strategies have remained high over the last 9 years in the USA, with differing strategies dominating at different times. Carton, multipack purchasing and coupons have long been an effective method for smokers to save money, with carton purchases more likely among those of higher SES. Multipack discounts and coupons serve as an effective method for all smokers (especially those of lower SES) to reduce their cigarette costs. Tax avoidance and coupon use were used less often for price reduction than bulk purchasing.

Results from this study support the notion that price promotions can induce cost savings, which can, in turn, decrease motivation for quitting smoking. The fact that over two-thirds of participants at each of the eight survey waves over 9 years reported using bulk purchasing, coupons, or tax avoidance demonstrates the very widespread availability of cost saving measures offered by the cigarette manufacturers. Multipack

purchasing, in particular, may especially lower motivation for quitting smoking. Tobacco manufacturers have used couponing and multipack discounts as a mechanism for offsetting the immediate impact of tax increases, resulting in a smaller reduction in cigarette consumption.⁴ Using these measures over time periods both prior to and after a tax increase circumvents the perception of a dramatic price increase that might prompt more smokers to think about quitting. Moreover, price promotions simply increase the affordability of smoking, thereby reducing smoking cessation. Standardising the quantity of cigarettes sold to packs and/or carton sizes only and establishing minimum pricing laws would help limit the manufacturers' ability to manipulate cigarette affordability, which would help strengthen the impact of price increases on smoking cessation.

What this paper adds

- This paper examines trends in cigarette prices and corresponding purchasing patterns from 2002 to 2011 and explores characteristics associated with the typical quantity of cigarettes purchased (ie, single vs multiple packs or cartons) and location where cigarettes are typically purchased by adult smokers in the USA.
- As cigarette prices have risen, consumers have found different ways to circumvent the increased costs of purchasing cigarettes. Over two-thirds of respondents reported using bulk purchasing, coupons and/or tax avoidance to lower the purchase costs of cigarettes. Despite the relative per pack price advantage of purchasing cigarettes by the carton instead of the pack, smokers increasingly chose to purchase their cigarettes by the pack instead of by the carton. A number of factors may have contributed to this trend including the fact that many smokers are smoking fewer cigarettes per day and/or increasing restrictions on when and where smokers are permitted to light up. It appears that multipacks are beginning to replace 10-pack carton sales as the primary means of bulk purchasing.

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