Tobacco expenditure, smoking-induced deprivation, and financial stress: Results from the International Tobacco Control (ITC) four country survey

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Abstract

Introduction and Aims—While higher tobacco prices lead to a reduction in smoking prevalence, there is a concern that paying more for cigarettes can lead to excess financial burden. Our primary aim was to examine the association of daily cigarette expenditure with smoking induced deprivation (SID) and financial stress (FS).

Design and Methods—We used data from wave 7 (2008–2009) of the International Tobacco Control (ITC) Four Country Survey which is a survey of smokers in Canada, the US, the UK, and Australia (n=5887). Logistic regressions were used to assess the association of daily cigarette expenditure with smoking-induced deprivation and financial stress.

Results—In multivariate analyses, a one standard deviation increase in daily cigarette expenditure was associated with an increase of 24% (p = 0.004) in the probability of experiencing SID. While we found no association between daily cigarette expenditure and FS, we found that SID is a strong predictor of FS (OR: 6.25; P < 0.001). This suggests that cigarette expenditure indirectly affects FS through SID. Results showed no evidence of an interaction between cigarette expenditure and income or education in their effect on SID or FS.

Conclusions—Our results imply that spending more on tobacco may result in SID but surprisingly has no direct effect on FS. While most smokers may be adjusting their incomes and consumption to minimize FS, some fail to do so occasionally as indexed by the SID measure. Future studies need to prospectively examine the effect of increased tobacco expenditure on financial burden of smokers.

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Keywords

Tobacco prices; tobacco taxation; smoking-induced deprivation; financial stress; tobacco prices; tobacco taxation; tobacco control policy

INTRODUCTION

Higher cigarette prices are associated with a decrease in the prevalence of smoking.[1–3] This decrease is estimated to be larger among lower socioeconomic smokers.[4–7] However, there is a concern that those lower socioeconomic smokers who, despite an increase in cigarette prices, continue to smoke may experience excess financial burden.[4, 8–10] This concern has never been empirically validated. A closely related issue and concern, which is addressed in the current study, is whether smokers who spend more money on cigarettes are more likely to experience financial burden.

Financial burden of smoking on individual smokers has been conceptualized as smoking-induced deprivation (SID) and financial stress (FS),[11–17] and a few studies have examined their determinants. Using a sample of 6,839 smokers from Canada, the US, the UK, and Australia, Siahpush et al. found that younger age, minority status, lower income, higher level of nicotine dependence, and having more friends who smoke were associated with the probability of experiencing SID (i.e. spending money on cigarettes instead of on household essentials).[15] In a different study, Siahpush et al. used data on 6,892 households in Australia and showed that experiencing FS (e.g. not being able to pay important bill on time due to lack of money) was associated with being a smoking-household, having low income, being a renter versus a home owner, and being a single parent.[18] The authors also found that smoking households with a higher percentage of expenditure on tobacco faced an increasing chance of experiencing financial stress. Similarly, in a study of low income British families, Marsh and McKay found that smoking, lack of educational qualifications, low income, manual work, claiming welfare benefits, and living in subsidized housing were associated with FS.[19] Finally, in a longitudinal study of 5,699 individuals in Australia, Siahpush et al. found that being a smoker, younger, female, not married, as well as having a lower level of education, income and occupation were associated with a higher probability of experiencing FS.[17]

We don't know of any studies on the association of cigarette expenditure on SID and FS among smokers. Our purpose was to examine the association of daily cigarette expenditure with SID and FS in an international sample of smokers from Canada, the US, the UK, and Australia. Our purpose was also to examine the interaction of socioeconomic status with daily cigarette expenditure in their effect on SID and FS.

METHODS

Data

Data came from wave 7 (2008–2009) of the International Tobacco Control (ITC) Four Country Survey (ITC-4 survey). A detailed description of the ITC conceptual framework and survey methodology can be found elsewhere.[20, 21] Briefly, ITC is a prospective

cohort study designed to evaluate the psychosocial and behavioral outcomes following from the implementation of the provisions of the WHO framework Convention on Tobacco (FCTC).[20] All aspects of the study protocol and survey measures are standardized across the four countries. Data collection is based on telephone interviews of a probability sample of smokers. Due to attrition, the sample is replenished at each survey wave to maintain adequate sample size. The wave 7 of the ITC-4 survey collected data from 1510 (1190 recontact and 320 new recruits), 1518 (1136 recontact and 382 new recruits), 1487 (1127 recontact and 360 new recruit), and 1372 (1252 recontact and 120 new recruit) current smokers from Canada, the US, the UK, and Australia, respectively. Current smokers are defined as those who have smoked 100 or more cigarettes in their lifetime and currently smoke at least monthly.

Measurement

SID and FS were the outcomes. SID was measured with the question "In the last six months, has there been a time when the money you spent on cigs resulted in not having enough money for household essentials such as food? [yes/no]".[15] FS was measured with the question "In the last month, because of shortage of money, were you unable to pay any important bills on time, such as electricity, telephone or rent bills?[yes/no]".[11, 13]

The covariate of interest was daily cigarette expenditure. Respondents were asked about how much they spent in their last purchase of cigarettes and whether they bought cartons, packs or singles. Information was also collected on the number of packs in each carton and number of cigarettes in each pack. This information along with the number of cigarettes each participant smoked per day was used to compute daily cigarette expenditure for those who smoked factory made cigarettes. For roll-your-own users, price paid for the last pouch or pouches of tobacco and the number of days it took to smoke each pouch, were used to compute daily cigarette expenditure. In each country, we converted the distribution of daily cigarette expenditure into z-scores.

Several other smoking-related covariates were included in the analysis. Respondents were classified as having purchased from low/untaxed sources if they made their last purchased of factory-made or roll-your-own cigarettes from military commissaries (US only), Indian Reservations (US and Canada only), duty free shops, outside the state or country, by telephone, internet, someone else, or a friend or relative.[22, 23] Minutes to first cigarette after waking was used as an indicator of nicotine dependence. We did not use number of cigarettes smoked per day as a predictor of SID or FS because this would have been tantamount to examining the association of price paid per cigarette instead of total tobacco expenditure with SID or FS; the focus of our research was on total tobacco expenditure. Recent quitting activity was measured by asking the respondents whether they made a quit attempt in the past year. Two psychosocial variables that were shown to be an important predictor of SID in previous research were included:[15] "Smoking calms you down when you are stressed or upset" and "smoking is an important part of my life". The response options were: strongly agree, agree, neither agree nor disagree, and strongly disagree. Respondents who strongly agreed or agreed were distinguished from others. Finally, we also

included information on "Of the five closest friends or acquaintances that you spend time with on a regular basis, how many of them are smokers?"

The following demographic covariates assessed at recruitment were included in the analysis: sex, age, minority status, and country. Income and education were included as indicators of socioeconomic status. Annual household income was categorized into "under $30,000" (low)", "$30,000–59,999" (medium), and "$60,000 and over" (high) for the US, Canadian, and Australian samples. For the UK sample, the following categories were used: "£15,000 or under"(low), £15,001–30,000"(medium) and "£30,001 and over"(high). Level of education consisted of three categories: high school diploma or lower (low); technical, trade school, community college, or some university (medium); university degree (high).

Statistical analysis

Weighted data were used in all analyses. Logistic regression modeling was employed in two stages to examine the association of daily cigarette expenditure with SID and FS. In the first stage, bivariate regressions were performed for all predictors. The covariates, except daily cigarette expenditure, with *p*-values less than 0.1 were then entered into the second stage of modeling to estimate multiple regression equations. Daily cigarette expenditure was included in the second stage regardless of its bivariate *p*-value. Cases with missing values for any of the study variables, except income, were excluded from the analysis. The effect of missing values for income, which comprises about 8% of the sample, was modeled in regression analyses. To examine the interaction of income or education with expenditure in their effect on SID or FS, we assessed the *p*-value for the effect of the product terms between income or education and expenditure on SID or FS.

The sample size in the multiple regression analyses for predicting SID and FS was 5,297 and 4,254, respectively. The FS had a smaller sample size because the replenishment part of the sample was not asked the FS question. Stata Special Edition Version 12 was used in all analyses.[24]

RESULTS

Overall, about 7% of the sample experienced SID and 10.9% experienced FS. There was a strong association between SID an FS. While among those who experienced SID 42.5% reported to have experienced FS, among those who did not experience SID only 8.7% reported to have experienced FS. The average amount paid for cigarettes each day was $C5 in Canada, $US3.2 in the US, £3 in the UK, and $A6.7 in Australia. Table 1 shows the percentage that experienced SID and FS by country by income. The US had the highest percentage of smokers who experienced SID and FS (7.4 and 14, respectively) and the UK had the lowest percentage (4.5 and 7.6, respectively). Low income groups experienced more SID and FS than other income groups in all countries.

Table 2 provides sample characteristic and bivariate associations of the covariates with SID and FS. While percent with SID increased with higher daily cigarette expenditure, there appeared to be no relationship between FS and expenditure. Those who purchased low/ untaxed cigarettes were less likely to experience SID and FS. Smokers who had their first

cigarettes earlier after waking were more likely to experience SID and FS, as were those who had made a quit attempt in the past year, had more friends who smoked, or believed that smoking calms them or is an important part of their lives. Being younger and of low income or education were associated with a higher chance of experiencing SID.

Being a female, younger, a minority, of low income or education were all associated with a higher chance of experiencing FS.

Table 3 provides crude as well as adjusted odds ratios for the association of daily cigarette expenditure and other covariates with SID. The adjusted model showed that a one standard deviation increase in daily cigarette expenditure was associated with an increase of 24% in the odds of SID. Shorter time to first cigarette after waking was associated with a higher probability of SID, as were the belief that smoking is calming or an important part of the respondent's life. Lower age was associated with higher probabilities of SID. Both lower income and education were associated with a higher probability of SID. Smokers in Australia had the highest probability of SID followed by those in the US, Canada, and the UK. There was little evidence for an association of purchase of low/untaxed cigarettes, quit attempt in the past year, number of friends who smoke, and minority status with SID. We added relevant product terms in the multivariate model and found no indication of an interaction between income (p=0.180), education (p=0.765), or country (p=0.889) with cigarette expenditure in their effects on SID. Finally, we note that when FS was included in the model for predicting SID, the odds of daily tobacco expenditure decreases to 1.16 (p=0.029). The association of FS and SID was strong with an odds ratio of 5.85 (p <0.001).

Table 4 provides crude as well as adjusted odds ratios for the association of daily cigarette expenditure and other covariates with FS. The adjusted model provided no evidence for a relationship between cigarette expenditure, purchase of low/untaxed cigarettes, quit attempt in the past year and education and FS. Shorter time to first cigarette was associated with a higher probability of experiencing FS, as well as the belief that smoking is calming, being female, lower age, being a minority, or lower income. Smokers in Australia had the highest probability of FS, followed by those in US, Canada, and the UK. We added relevant product terms in the multivariate model and found no indication of an interaction between income (p=0.357), education (p=0.164), or country (p=0.305) with cigarette expenditure in their effects on FS. Finally, we note that when SID was included in the model for predicting FS, the odds of daily tobacco expenditure did not change appreciably. The association of SID and FS was strong with an odds ratio of 6.25 (P<0.001).

Given that cigarette expenditure was associated with SID and not with FS, and that SID was strongly associated with FS, we investigated evidence for an indirect effect of cigarette expenditure on FS. Following the strategy recommended by Zhao et al.[25], we performed the bootstrap test with 5000 replications and found strong evidence (p = 0.003) for the existence of an indirect effect of cigarette expenditure on FS through SID. The indirect effect in this case is the product of the effect of cigarette expenditure on SID and the effect of SID on FS, controlling for covariates.

DISCUSSION

In this study we used cross-sectional data from smokers in Canada, the US, the UK, and Australia and found that those who spend more money on cigarettes are more likely to experience SID. We did not find any evidence for a direct relationship between cigarette expenditure and FS, which is surprising, given the strong association between the less common SID and FS. Our data showed no indication that the association of cigarette expenditure with FS or SID varies by levels of income or education, or by country.

While there are no previous studies on how daily cigarette expenditure affects SID or FS, our findings regarding the association of other smoking-related and sociodemographic variables were consistent with previous research. Our results that shorter time to first cigarette after waking and lower income were associated with a higher probability of SID were similar to findings reported by Siahpush et al.[15] Similarly, consistent with a different study by Siahpush et al., we found that being younger, female, and having lower income was associated with a higher probability of FS.[17]

A weakness of the study was that it used cross-sectional data which do not allow strong causal inference about the relationship between predictors and outcomes. Further, while our sample is broadly representative of the population of smokers, it does not include some highly disadvantaged smokers such as the homeless. Thus, we were not able to study the impact of increased tobacco expenditure which might disrupt any economic homeostasis among this group. The other notable weakness is that we relied on self-report. It is possible that asking about FS in a long survey about tobacco, led those who did not consciously associate their FS with smoking to deny any problem, or those feeling guilty about spending money on cigarettes when they could not afford it, to deny FS. However, this seems unlikely as they acknowledged SID more as expenditure increased, which in some respects appears even more unacceptable.

The fact that higher expenditure on cigarettes increases the chances of experiencing SID, which in turn can indirectly result in higher likelihood of FS, implies that the policy of increasing the price of tobacco might promote financial burden among smokers. However, given the cross-sectional nature of our data, we cannot firmly conclude that an increase in price will lead to excess financial burden. Future prospective studies are required to provide a better understanding of the effect of tobacco price policies on financial burden, especially among lower socioeconomic groups that are already experiencing financial difficulties and deprivation.

Acknowledgements

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Table 1

Smoking-induced deprivation (SID) and financial stress (FS) by country by income

		Canada	US	UK	Australia
% experiencing SID	Whole sample	6.8	7.4	4.5	6.9
	Low income	13.2	11.8	8.0	10.4
	Med income	6.3	3.5	2.1	7.3
	High income	4.0	5.7	2.6	4.0
% experiencing FS	Whole sample	10.3	14.0	7.6	11.5
	Low income	13.1	23.2	12.3	13.6
	Med income	12.0	9.4	2.9	12.7
	High income	8.7	7.4	7.9	10.2

Table 2

Sample characteristics and percent experiencing smoking-induced deprivation (SID) and financial stress (FS)

	% in sample	% SID (*p*-value)[a]	% FS (*p*-value)
Cigarette expenditure[b]		(<0.001)	(0.513)
1st tertile (low expenditure)	34.34	4.65	10.05
2nd tertile	33.07	8.13	11.68
3rd tertile (high expenditure)	32.59	8.65	10.97
Purchased low/untaxed		(0.087)	(0.020)
Yes	18.71	5.44	8.24
No	81.29	7.31	11.55
Minutes to first cigarette		(0.008)	(0.062)
0–5	26.48	10.69	14.04
6–20	26.05	7.55	12.33
21–60	37.23	4.77	8.08
61+	10.24	4.33	9.12
Quit attempt in past year		(0.037)	(0.065)
Yes	32.56	8.31	12.57
No	67.44	6.27	10.14
Smoking calms stress		(0.004)	(0.018)
Agree	83.32	7.59	11.52
Do not agree	16.68	3.78	7.78
Important part of my life		(0.022)	(0.102)
Agree	48.07	8.04	11.9
Do not agree	51.93	5.87	8.04
No. of friends who smoke[b]		(0.044)	(0.001)
0–2	47.55	6.54	8.86
3–5	52.45	7.33	12.8
Sex		(0.491)	(0.005)
Male	53.20	6.65	9.21
Female	46.80	7.29	12.73
Age		(<0.001)	(<0.001)
18–24	6.48	18.42	21.42
25–39	31.65	0.66	13.52
40–54	35.88	6.71	10.02
55+	25.99	0.49	0.69
Minority status		(0.085)	(<0.001)
White/English speaking	89.20	6.71	9.74
Non-White/English Speaking	10.80	9.03	19.59

	% in sample	% SID (*p*-value)[a]	% FS (*p*-value)
Income		(<0.001)	(<0.001)
Low	26.04	11.01	16.02
Medium	30.92	5.43	9.37
High	35.06	4.71	8.77
Missing	7.98	9.47	8.77
Education		(0.001)	(0.026)
Low	50.20	7.83	11.11
Medium	32.14	0.75	12.12
High	17.66	3.45	7.86
Country		(0.042)	(0.012)
Canada	25.65	6.72	10.36
USA	25.79	8.41	13.98
UK	25.26	5.04	7.59
Australia	23.31	7.65	11.49

[a]P-values represent the amount of support that the data provides for an association between SID or FS and a covariate. In the computation of p-values "number of minutes to first cigarette" and "number of friends who smoke" are used as continuous variables.

[b]These are used as continuous variables in regression analyses.

Table 3

Crude and adjusted odds ratios (OR) and 95% confidence intervals (CI) for the association of daily tobacco expenditure and other covariates with experiencing smoking-induced deprivation (SID)

	Crude OR	*p*-value	Adjusted OR	*p*-value
Cigarette expenditure	1.26(1.13–1.40)	<0.001	1.24(1.07–1.45)	0.004
Purchased low/untaxed		0.087		0.598
Yes	0.73(0.51–1.05)		0.90(0.61–1.33)	
No	1.00		1.00	
Minutes to first cigarette	0.99(0.99–1.00)	0.008	0.99 0.99–1.00)	0.010
Quit attempt in past year		0.037		0.277
Yes	1.36(1.01–1.80)		1.19(0.87–1.61)	
No	1.00		1.00	
Smoking calms stress		0.004		0.026
Agree	2.09(1.26–3.46)		1.99(1.09–3.63)	
Do not agree	1.00		1.00	
Important part of my life		0.022		0.025
Agree	1.40(1.05–1.88)		1.00	
Do not agree	1.00		1.46(1.05–2.03)	
No. of friends who smoke	1.08(1.00–1.16)	0.044	0.98(0.90–1.07)	0.714
Sex		0.491		
Male	1.00			
Female	1.10(0.83–1.46)			
Age		<0.001		<0.001
18–24	1.00		1.00	
25–39	0.31(0.18–0.55)		0.27(0.15–0.49)	
40–54	0.32(0.19-–0.54)		0.23(0.13–0.42)	
55+	0.22(0.13–0.39)		0.12(0.07–0.23)	
Minority status		0.085		0.178
White/English speaking	1.00		1.00	
Non-White/English Speaking	1.38(0.95–1.99)		1.34(0.88–2.04)	
Income		<0.001		<0.001
Low	1.00		1.00	
Medium	0.46(0.23–0.66)		0.43(0.29–0.62)	
High	0.40(0.27–0.58)		0.36(0.24–0.54)	
Missing	0.84(0.47–0.54)		0.82(0.50–1.36)	
Education		<0.001		0.020
Low	1.00		1.00	
Medium	0.95(0.69–1.32)		1.11(0.78–1.59)	
High	0.42(0.29–0.62)		0.59(0.38–0.91)	
Country		0.042		0.007

	Crude OR	*p*-value	Adjusted OR	*p*-value
Canada	1.00		1.00	
USA	1.27(0.86–1.90)		1.15(0.73–1.81)	
UK	0.74(0.49–1.10)		0.65(0.42–1.01)	
Australia	1.15(0.78–1.70)		1.29(0.85–1.95)	

[a]Adjusted for all the covariates that had a p-value smaller than 0.05 in their crude association with SID.

Table 4

Crude and adjusted*a* odds ratios (OR) and 95% confidence intervals (CI) for the association of tobacco expenditure and other covariates with experiencing financial stress (FS)

	Crude OR	p-value	Adjusted OR	p-value
Cigarette expenditure	1.04(0.92–1.18)	0.513	1.07(0.93–1.23)	0.361
Purchased low/untaxed		0.020		0.435
Yes	0.69(0.50–0.94)		0.87(0.61–1.24)	
No	1.00		1.00	
Minutes to first cigarette	1.00(1.00–1.00)	0.062	1.00(0.99–1.00)	0.041
Quit attempt in past year		0.065		0.541
Yes	1.27(0.98–1.65)		1.09(0.83–1.44)	
No	1.00		1.00	
Smoking calms stress		0.018		0.059
Agree	1.54(1.08–2.21)		1.44(0.99–2.11)	
Do not agree	1.00		1.00	
Important part of my life		0.102		
Agree	1.24(0.96–1.59)			
Do not agree	1.00			
No. of friends who smoke	1.11(1.04–1.18)	0.001	1.07(0.99–1.15)	0.070
Sex		0.005		0.003
Male	1.00		1.00	
Female	1.44(1.11–1.86)		1.51(1.15–1.98)	
Age		<0.001		<0.001
18–24	1.00		1.00	
25–39	0.31(0.18–0.55)		0.55(0.28–1.06)	
40–54	0.32(0.19–0.54)		0.38(0.20–0.72)	
55+	0.22(0.13–0.39)		0.23(0.12–0.43)	
Minority status		<0.001		<0.001
White/English speaking	1.00		1.00	
Non-White/English Speaking	2.26(1.63–3.12)		2.14(1.52–3.01)	
Income		<0.001		<0.001
Low	1.00		1.00	
Medium	0.54(0.40–0.73)		0.55(0.39–0.76)	
High	0.50(0.36–0.70)		0.55(0.39–0.76)	
Missing	0.52(0.29–0.94)		0.43(0.23–0.82)	
Education		0.026		0.170
Low	1.00		1.00	
Medium	1.10(0.82–1.47)		1.19(0.86–1.63)	
High	0.68(0.39–0.95)		0.82(0.56–1.20)	
Country		0.012		0.046

	Crude OR	p-value	Adjusted OR	p-value
Canada	1.00		1.00	
USA	1.40(0.98–2.01)		1.04(0.71–1.54)	
UK	0.71(0.46–1.09)		0.61(0.38–0.96)	
Australia	1.12(0.80–1.57)		1.08(0.75–1.55)	

[a]Adjusted for all the covariates that had a p-value smaller than 0.05 in their crude association with FS.