

## Original Investigation

# Socioeconomic disparities in quit intentions, quit attempts, and smoking abstinence among smokers in four western countries: Findings from the International Tobacco Control Four Country Survey

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## Abstract

**Introduction:** Lower socioeconomic status (SES) groups have higher rates of tobacco use, are less likely to successfully quit, and may also be less likely to intend or attempt to quit. However, results are inconsistent for some outcomes, and little is known about how socioeconomic disparities vary across countries and over time.

**Methods:** This study examined the associations between SES and quitting-related behaviors among representative samples of smokers in Canada, the United States, the United Kingdom, and Australia, using data from the first five waves (2002–2006/2007) of the International Tobacco Control Four Country Survey (35,532 observations from 16,458 respondents). Generalized estimating equations modeling was used to examine whether education and income were related to intentions to quit, incidence of quit attempts, and smoking abstinence. Potential differences in the associations over time and across countries were also considered.

**Results:** Smokers with higher education were more likely to intend to quit, to make a quit attempt, and to be abstinent for at least 1 and 6 months; smokers with higher income were more likely to intend to quit and to be abstinent for at least 1 month. Some between-country differences were observed: U.K. and U.S. smokers were less likely to intend to quit than Australians and Canadians; and, although U.K. respondents were least likely to attempt to quit, those that did were more likely to be abstinent.

**Discussion:** The results suggest that socioeconomic disparities exist at multiple stages in the path to smoking cessation. Potential effects on socioeconomic disparities should be considered when implementing cessation interventions.

## Introduction

Tobacco use is the leading preventable cause of death in developed countries (World Health Organization, 2002) such as Canada, the United States, the United Kingdom, and Australia, as well as a leading contributor to the socioeconomic disparities in health observed in these countries (Jha et al., 2006; Siahpush, English, & Powles, 2006). This unequal burden of tobacco use and related illness is due to a disproportionate share of smokers in lower socioeconomic status (SES) groups: a clear gradient has been observed in smoking prevalence by income, education level, occupational class, and various other measures of disadvantage, and those with lower SES have about twice the odds of smoking compared to those of higher SES (Bobak, Jha, Nguyen, & Jarvis, 2000; Jarvis & Wardle, 2006; Schaap & Kunst, 2009). Although smoking prevalence has steadily declined in most developed countries, evidence suggests that socioeconomic inequalities in smoking have persisted over time, and even increased (Bobak et al., 2000; Giskes et al., 2005; Harper & Lynch, 2007; Jarvis & Wardle, 2006; Najman, Toloo, & Siskind, 2006; National Center for Health Statistics, 1998; Smith, Frank, & Mustard, 2009).

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## Socioeconomic disparities in smoking cessation

A major contributor to existing disparities in tobacco use is socioeconomic variation in smoking cessation (Kotz & West, 2009; Schaap & Kunst, 2009). Studies examining SES and smoking cessation in Western countries generally indicate that lower SES smokers are less likely to be successful quitters, although findings are varied with respect to specific SES measures and the magnitude of these relationships. In the United States, numerous studies have documented a relationship between increased quitting success and higher education level (de Walque, 2004; Gilman, Abrams, & Buka, 2003; Gilman et al., 2008), and noted greater proportions of former smokers among those with higher educational attainment (Barbeau, Krieger, & Soobader, 2004; Centers for Disease Control and Prevention, 2002; Fagan, Shavers, Lawrence, Gibson, & Ponder, 2007). A similar relationship has been observed with income, with lower quit rates among those below the poverty line (Agrawal, Sartor, Pergadia, Huizink, & Lynskey, 2008; Barbeau et al., 2004; Centers for Disease Control and Prevention, 2002; Flint & Novotny, 1997) and lower likelihood of being a former smoker among those with low income (Fagan, Shavers, et al., 2007). Further, some U.S. studies have found mixed results for odds of successfully quitting, with income but not education as a significant predictor (Fagan, Shavers, et al., 2007; Hymowitz et al., 1997) or, in contrast, education but not income as a significant predictor (Lillard, Plassmann, Kenkel, & Mathios, 2007). European studies have also found up to double the odds or rates of quitting smoking between the highest and lowest SES groups, including occupational class in the United Kingdom (Kotz & West, 2009) and Sweden (Lindstrom, Hanson, Ostergren, & Berglund, 2000); social class in Denmark (Albertsen, Hannerz, Borg, & Burr, 2003; Osler & Prescott, 1998); and education in Finland (Broms, Silventoinen, Lahelma, Koskenvuo, & Kaprio, 2004), Spain (Fernandez, Garcia, et al., 2001), Denmark (Osler, Prescott, Godtfredsen, Hein, & Schnohr, 1999), and the United Kingdom (Graham & Der, 1999), and in an analysis of 18 European countries (Schaap et al., 2008). Higher education was also linked to increased odds of cessation in an Australian analysis, although this relationship became nonsignificant when other individual and environmental factors were controlled (Siahpush, Borland, & Scollo, 2003).

The literature also suggests that socioeconomic disparities may be increasing; analyses of smoking cessation patterns over time have documented a trend toward increasing cessation in higher SES groups, widening inequalities in smoking in Western countries. Historical data from the United States indicate that while quit rates have increased over time, they have been lowest among the less-educated (Gilpin & Pierce, 2002) and among blue-collar workers (Covey, Zang, & Wynder, 1992), leading to increased educational and occupational class differences in current smoking. U.K. studies of social class differences have observed cessation rates in the highest social classes that were at least twice those observed in the lowest groups (Jarvis & Wardle, 2006; Jefferis, Power, Graham, & Manor, 2004). European studies on smoking cessation show a similar pattern of increasing inequalities over time: a 12-country study noted a stronger relationship between education and prevalence for current smoking than ever smoking, suggesting higher educated groups have had higher rates of quitting (Cavelaars et al., 2000), and analyses in Spain and Italy have also identified increasing educational inequalities due to higher quit rates/ratios among the higher educated (Federico,

Costa, & Kunst, 2007; Fernandez, Schiaffino, Garcia, & Borrás, 2001; Schiaffino et al., 2007). Several studies in the United States and Europe have also identified increasing socioeconomic differentials in smoking and cessation among younger age cohorts, suggesting that tobacco-related health disparities will be larger in the future (de Walque, 2004; Federico et al., 2007; Gilpin & Pierce, 2002; Schaap et al., 2008).

While it is important to document these socioeconomic disparities in cessation, quit success represents the end point of a smoking cessation process. Looking further upstream in the pathway to quitting, at measures such as quit intentions and quit attempts, may be useful for identifying where and how such disparities could be reduced through effective intervention. However, few studies have explored the associations of SES with quit intentions and quit attempts, and findings in this area have been mixed.

Regarding quit intentions, studies in the United States (Fagan, Augustson, et al., 2007), the Netherlands (Dotinga, Schrijvers, Voorham, & Mackenbach, 2005), and the United States, the United Kingdom, Canada and Australia combined (Siahpush, McNeill, Borland, & Fong, 2006) have found that smokers with higher income and/or education were more likely to intend to quit. On the other hand, another Dutch study (Droomers, Schrijvers, & Mackenbach, 2004) and a recent Canadian analysis (Reid, Hammond, & Driezen, 2010) both failed to find a significant association between education and intentions to quit in the next month or 6 months, respectively.

Existing evidence on quit attempts has also been varied. Some studies in the United States have observed differences in quit attempts by socioeconomic measures, with lower likelihood of quit attempts in the past year among smokers with lower education (Gilman et al., 2008; Hatziandreu et al., 1990; Levy, Romano, & Mumford, 2005; Lillard et al., 2007; Shiffman, Brockwell, Pillitteri, & Gitchell, 2008) and income levels (Levy et al., 2005); conversely, others have found no association with income (Barbeau et al., 2004; Lillard et al.) or education (Barbeau et al.). Recent studies in Canada (Reid et al., 2010) and the United Kingdom (Kotz & West, 2009), as well as an analysis including the United States, United Kingdom, Canada and Australia (Hyland et al., 2006), have also failed to find an association between education (in Canada and in the four countries), income (in the four countries) or social class (in the United Kingdom), and likelihood of having made a quit attempt. Overall, these findings indicate that lower SES smokers are either equally or less likely to make quit attempts than their higher SES peers.

Overall, the existing literature has identified considerable, and potentially growing, socioeconomic disparities in smoking, whereby higher SES smokers are more likely to successfully quit. The few studies on the relation between SES and the steps toward quitting—quit intentions and quit attempts—are less clear, but suggest that the same disparities may exist. However, it is unclear how these differences may have changed in more recent years as the tobacco control landscape has evolved, and how they may vary in between countries with different policy environments.

## Objectives

Using data from the International Tobacco Control (ITC) Four Country Survey (Fong et al., 2006), this study examined

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socioeconomic patterns in smoking cessation and in stages on the path to quitting among smokers in Canada, the United States, the United Kingdom, and Australia over a 4-year period. Specifically, we examined the extent to which income and education were related to (a) intentions to quit smoking; (b) incidence of quit attempts, overall and among those who intended to quit; and (c) abstinence from smoking among those who attempted to quit. We also considered differences over time in the associations between SES variables and cessation measures, and whether the relation between SES and cessation measures varied between the four countries.

## Methods

### Sample

This study analyzed data from the first five waves of the ITC Four Country Survey (2002–2006/2007), a longitudinal cohort survey conducted via telephone interviews with nationally representative samples of over 2,000 adult smokers in each of the four countries (Canada, the United States, the United Kingdom, and Australia). Eligible respondents were identified and recruited via random-digit dialed telephone surveys, using probability sampling methods. To be eligible, participants had to be 18 years or older, have smoked at least 100 cigarettes in their lifetimes, and have smoked at least once in the 30 days prior to recruitment. Cooperation rates (proportion of those screened and eligible who agreed to participate) were high (78.7%–83.2%) in Wave 1, although overall response rates were much lower (from 25.6% in the United States

to 49.5% in Canada) but comparable with other telephone surveys in the same countries when calculated using the same measures (see Hammond, Fong, Thompson & Driezen, 2004). Respondents were re-contacted in subsequent waves, with between-wave retention rates of 61%–75%. To replenish respondents lost to follow-up, additional individuals were sampled at each wave using the same design and protocol as in Wave 1. Respondents who quit smoking were retained in the sample for future waves. Figure 1 shows sample size, retention, and replenishment over survey waves.

The sampling design was intended to provide a random, unbiased, and representative sample of adult smokers within each country, and sampling weights were used to account for any uneven representation (Thompson et al., 2006). Comparisons with national benchmark surveys indicated that the demographic profile of each sample resembled the overall distribution of socio-demographic characteristics within each country (Hammond, Fong, Thompson & Driezen, 2004).

The sample for the current study was limited to respondents who were daily smokers at the time of recruitment; nondaily smokers constituted less than 10% of the overall sample, and present some difficulty in applying conventional definitions of cessation. This analysis included data from Waves 1 through 5 and included all observations for eligible respondents, regardless of their time of entry or exit.

Additional details regarding the methods are provided in Thompson and colleagues (2006) and in the ITC Four Country Survey Technical Reports (accessible at <http://www.itcproject.org>).

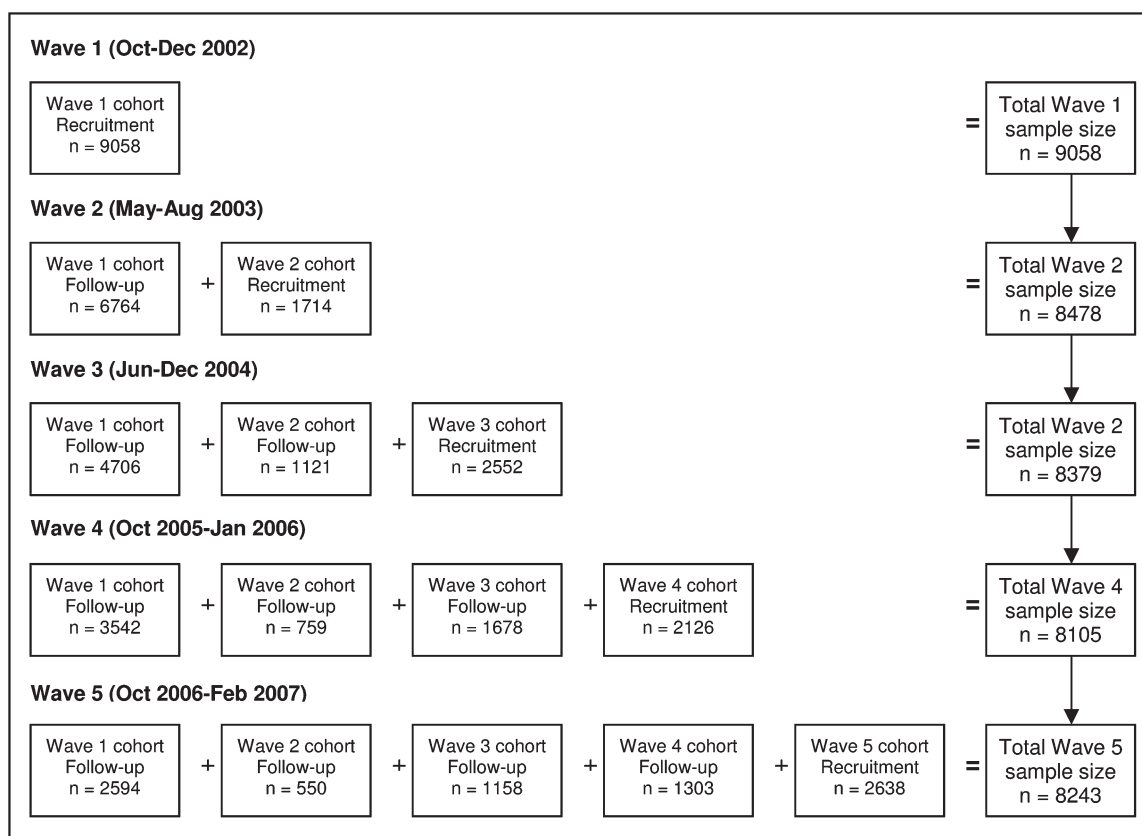


Figure 1. Sample size, participant retention, and timing of each ITC Four Country Survey wave.

## Study protocols

Interviews were conducted over the telephone by trained interviewers at professional research firms and according to standard protocols. Respondents initially completed a 10-min recruitment survey and were re-contacted for the 35-min main survey about 1 week later. Further details of survey protocols and methods are provided elsewhere (Thompson et al., 2006).

The ITC Four Country Survey protocols were cleared for ethics by institutional review boards or research ethics boards in each country: University of Waterloo (Canada), Roswell Park Cancer Institute (United States), University of Illinois-Chicago (United States), University of Strathclyde (United Kingdom), and The Cancer Council Victoria (Australia). The current analysis also received ethics clearance from the University of Waterloo's Office of Research Ethics.

## Measures

### Outcome variables

Quit intentions were derived from the survey item, "Are you planning to quit smoking . . . within the next month, within the next 6 months, sometime in the future beyond 6 months, or are you not planning to quit?" A dichotomous variable for any intentions (first three response categories) compared with no intentions (last category) was created. In addition, a 6-month intentions variable was created to compare those who intended to quit within the next 6 months (first two categories) with those who did not intend to quit within the next 6 months (last two categories). Incidence of quit attempts since the last survey was measured at each wave (starting in Wave 2) based on response (yes/no) to "Have you made any attempts to stop smoking since we last talked with you, that is since [last survey date]?"

Smoking status was self-reported and derived from up to seven survey items regarding current smoking behavior and frequency, and included six categories: 1) daily smoker, 2) weekly smoker, 3) monthly smoker, 4) quit within the last month, 5) quit within the last 6 months, and 6) quit more than 6 months ago. Three abstinence measures were created, for 1, 6, and 12 months. The 1-month abstinence measure included smoking status categories 5 and 6 (vs. 1–4) and similarly, the 6-month abstinence measure included smoking status category 6 (vs. 1–5). The 12-month abstinence measure was determined using additional survey items. Those who were quit (smoking status 4–6) at the previous wave were asked if they had stayed quit in the following two items: "The last time we spoke to you in [last survey date], you were not smoking. Are you back smoking or are you still stopped?" and for those who answered that they were still quit, "So you have been quit the entire time since [quit date] -- is that correct?" Respondents who were quitters both at the time of the survey and at the previous wave and answered positively to these abstinence items were classified as 12-month quitters.

### Independent variables

The independent variables of primary interest were education and income. Education level was coded into three categories: low (high school or less), moderate (technical/trade/college completion or some university), and high (university degree or higher). Income level was coded as low ( $\leq$ \$30,000/£15,000), moderate (\$30,000–59,000/£15,000–30,000), high (\$60,000+/ $>$ £30,000), and refused/not stated. Income and education collected at the time of each observation were used in the analysis, with one

exception: Wave 2 values for income and education were imputed from Wave 1 values due to missing data. In this way, any changes to SES variables that occurred over the course of the study were captured.

All analyses included the following demographic covariates: country (Australia, Canada, United Kingdom, United States), age (continuous), sex (male, female), ethnicity (minority, nonminority), and marital status (married/common-law, separated/divorced/widowed, single). Survey wave (1–5) was included as a measure of calendar time. To control for the potential effects of repeated testing, time in sample (number of waves that the respondent had been in the sample) was also included.

A measure of dependence, the heaviness of smoking index (HSI), was also included to account for the potential effects of dependence on the relationship between the outcomes and SES. The HSI was calculated as the sum of the scores from two categorical variables, time to first cigarette and cigarettes per day (CPD; Hyland et al., 2006): time to first cigarette was assigned a value of 0 for  $>60$  min, 1 for 31–60 min, 2 for 6–30 min, or 3 for 5 or fewer min; CPD was assigned a value of 0 for 0–10 CPD, 1 for 11–20 CPD, 2 for 21–30 CPD, or 3 for  $>30$  CPD. Possible HSI values ranged from 0 to 6. Depending on the outcome being analyzed, the HSI variable reflected either current HSI (for quit intentions), HSI at the previous wave (for quit attempts), or HSI at entry into the study (for abstinence).

## Analysis

The analyses used generalized estimating equations (GEE) modeling (Liang & Zeger, 1986; Hardin & Hilbe, 2003), which accounts for repeated measurements on the same subjects and allows analysis of overall group trends without relying on individuals to be present at all timepoints. Separate GEE models were created for each of the outcome variables. Each model included country, age, sex, ethnicity, income, education, marital status, HSI, survey wave, and time in sample. Income and education were added to the models concurrently, as independent variables, to measure the effect of each in the other's presence; an interaction term for education by income was also created to test their combined influence. As a second step, in addition to these covariates (the base model), all two-way interactions between the SES variables and covariates, plus the interaction of country and wave, were screened for significance at  $p < .05$  with the base model and added sequentially to the models using forward selection until no other interactions were significant.

Models for quit intentions included all current smokers (former smokers were not asked the question) at all five waves. Models for quit attempts since the last survey were conducted using data for Waves 2 through 5 for respondents who were smokers at the previous wave, first with the entire sample, and also only for those who intended to quit at the previous wave, in order to answer the question of whether there were SES differences in progressing from intending to quit to making an actual quit attempt. Models for smoking abstinence included respondents from Waves 2 through 5 for the 1- and 6-month measures, and respondents from Waves 3 through 5 for the 12-month measure; only those who had attempted to quit since entry into the study were included, to see whether abstinence rates differed by SES given a quit attempt.



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The samples were weighted cross-sectionally on country, age, sex, and ethnicity (only in the United States) using standardized weights to ensure representative samples from each country. Each respondent's weight at time of entry into the study was applied to their observation(s) in each subsequent wave.

All analyses were conducted in SAS version 9.1 (SAS Institute Inc., Cary, NC).

## Results

### Sample

The full ITC sample for Waves 1 through 5 consisted of 18,090 unique respondents, providing 42,263 observations. Of these 18,090 respondents, 1,630 were excluded due to not being daily smokers at recruitment (1,315 nondaily smokers; 315 quitters), and 2 were excluded due to missing smoking status at wave of recruitment. The sample available for analysis thus consisted of 16,458 unique respondents, providing 35,532 observations. Respondents/observations with missing values on any of the variables included in particular analyses were excluded on a casewise basis. Table 1 shows the unweighted sample characteristics for unique respondents, by wave of recruitment.

### Outcomes

Table 2 shows the weighted proportions of smokers in each education group, income group, and country, (a) who planned to

quit (at all, and in the next 6 months), (b) who attempted to quit since last surveyed, both among all eligible respondents and among only those who intended to quit, and (c) were quit for at least 1, 6, and 12 months at the time they were surveyed, both for the total sample and only for those who had attempted to quit since entry into the study.

### Quit intentions

Overall, the majority of smokers in the sample (71.5%) were planning on quitting sometime, although only one third of the sample (33.3%) planned on quitting within the next 6 months (Table 2). In the GEE model for planning to quit at all (Table 3), smokers with moderate and high education had 32% and 36% greater odds, respectively, of intending to quit than those with low education. Quit intentions also increased with income. Similar effects of SES variables were observed in the model for planning to quit within the next 6 months (Table 3): moderately educated smokers had 21% greater odds of intending to quit than smokers with low education, and highly educated smokers had 38% and 14% greater odds of intending to quit than smokers with low or moderate education, respectively. High-income smokers were also more likely than those with low or moderate income to intend to quit in the next 6 months. Those who did not provide income information were less likely to intend to quit in both models. Intentions to quit also varied by country for both outcomes: Canadian smokers were more likely to intend to quit than smokers in all other countries, whereas U.S. smokers were less likely than Australians and Canadians, and U.K. smokers were less likely than all others.

**Table 1. Sample characteristics of unique respondents (*n* = 16,458), by wave of recruitment**

|  | Wave 1<br>( <i>n</i> = 8,167) | Wave 2<br>( <i>n</i> = 1,548) | Wave 3<br>( <i>n</i> = 2,335) | Wave 4<br>( <i>n</i> = 1,968) | Wave 5<br>( <i>n</i> = 2,440) | Total<br>( <i>n</i> = 16,458) |
|--|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Country                                |                               |                               |                               |                               |                               |                               |
| Canada                                 | 24.4 (1,996)                  | 30.4 (470)                    | 21.2 (496)                    | 24.4 (480)                    | 22.7 (553)                    | 24.3 (3,995)                  |
| United States                          | 23.5 (1,916)                  | 40.3 (624)                    | 35.0 (816)                    | 34.9 (686)                    | 28.6 (697)                    | 28.8 (4,739)                  |
| United Kingdom                         | 27.0 (2,201)                  | 14.5 (224)                    | 23.5 (548)                    | 24.1 (474)                    | 23.2 (566)                    | 24.4 (4,013)                  |
| Australia                              | 25.2 (2,054)                  | 14.9 (230)                    | 20.3 (475)                    | 16.7 (328)                    | 25.6 (624)                    | 22.6 (3,711)                  |
| Age, mean ( <i>SD</i> )                | 41.8 (14.4)                   | 42.8 (14.3)                   | 43.0 (14.1)                   | 43.5 (14.7)                   | 44.8 (14.2)                   | 42.7 (14.4)                   |
| Sex                                    |                               |                               |                               |                               |                               |                               |
| Male                                   | 45.4 (3,710)                  | 47.5 (735)                    | 45.1 (1,054)                  | 42.2 (831)                    | 43.9 (1,072)                  | 45.0 (7,402)                  |
| Female                                 | 54.6 (4,457)                  | 52.5 (813)                    | 54.9 (1,281)                  | 57.8 (1,137)                  | 56.1 (1,368)                  | 55.0 (9,056)                  |
| Ethnicity                              |                               |                               |                               |                               |                               |                               |
| Nonminority                            | 87.3 (7,115)                  | 85.3 (1,314)                  | 89.0 (2,070)                  | 88.1 (1,734)                  | 87.5 (2,134)                  | 87.5 (14,367)                 |
| Minority                               | 12.8 (1,040)                  | 14.7 (227)                    | 11.0 (257)                    | 11.9 (234)                    | 12.5 (304)                    | 12.6 (2,062)                  |
| Marital status                         |                               |                               |                               |                               |                               |                               |
| Married/common-law                     | 50.0 (4,076)                  | 50.3 (777)                    | 50.7 (1,183)                  | 48.4 (952)                    | 47.5 (1,158)                  | 49.6 (8,146)                  |
| Divorced/separated/widowed             | 22.9 (1,864)                  | 24.0 (371)                    | 23.5 (549)                    | 25.9 (510)                    | 28.1 (684)                    | 24.2 (3,978)                  |
| Single                                 | 27.1 (2,207)                  | 25.7 (397)                    | 25.8 (602)                    | 25.6 (504)                    | 24.4 (595)                    | 26.2 (4,305)                  |
| Education level                        |                               |                               |                               |                               |                               |                               |
| Low (high school or less)              | 57.3 (4,664)                  | 46.2 (715)                    | 56.0 (1,303)                  | 55.7 (1,092)                  | 57.3 (1,395)                  | 55.9 (9,169)                  |
| Moderate (college/some university)     | 31.0 (2,518)                  | 42.6 (658)                    | 28.6 (665)                    | 28.7 (562)                    | 28.0 (682)                    | 31.0 (5,085)                  |
| High (university or higher)            | 11.7 (952)                    | 11.1 (172)                    | 15.5 (360)                    | 15.6 (306)                    | 14.7 (357)                    | 13.1 (2,147)                  |
| Income level                           |                               |                               |                               |                               |                               |                               |
| Low (under \$30K/£15K)                 | 31.3 (2,545)                  | 32.8 (505)                    | 31.5 (735)                    | 34.0 (669)                    | 32.7 (797)                    | 32.0 (5,251)                  |
| Moderate (\$30-60K/£15-30K)            | 34.5 (2,802)                  | 33.8 (519)                    | 34.8 (811)                    | 31.7 (623)                    | 31.4 (765)                    | 33.7 (5,520)                  |
| High (over \$60K/£30K)                 | 26.4 (2,147)                  | 26.1 (402)                    | 27.8 (648)                    | 27.4 (539)                    | 27.5 (671)                    | 26.9 (4,407)                  |
| Not stated                             | 7.7 (628)                     | 7.3 (112)                     | 6.0 (139)                     | 7.0 (137)                     | 8.5 (207)                     | 7.5 (1,223)                   |
| Cigarettes per day, mean ( <i>SD</i> ) | 18.6 (10.8)                   | 18.8 (11.1)                   | 18.5 (11.2)                   | 18.3 (11.0)                   | 19.1 (11.1)                   | 18.6 (10.9)                   |

Note. Data are presented as unweighted percentages (unweighted *n*) unless otherwise specified.

Table 2. Outcome measures, by education, income, and country

| Sample                             | Outcome                  |                                   |  |  |  |   |  |   |  |  |  |  |
|------------------------------------|--------------------------|-----------------------------------|--|--|--|---|--|---|--|--|--|--|
|                                    | Planning to quit at all  | Planning to quit in next 6 months |  | Attempted to quit since last survey date   |  | Quit for at least 1 month                   |  | Quit for at least 6 months                  |  | Quit for at least 12 months                |  |  |
|                                    | All smokers (n = 34,972) | All smokers (n = 34,972)          | All eligible <sup>a</sup> (n = 20,651) | Intended to quit <sup>b</sup> (n = 14,524) | All eligible <sup>a</sup> (n = 22,074) | Attempted to quit <sup>c</sup> (n = 10,894) | All eligible <sup>a</sup> (n = 22,074) | Attempted to quit <sup>c</sup> (n = 10,894) | All eligible <sup>a</sup> (n = 12,186) | Attempted to quit <sup>c</sup> (n = 7,269) |  |  |
| Overall                            | 71.5                     | 33.3                              | 37.4                                   | 45.1                                       | 11.7                                   | 23.9  | 7.5                                    | 15.3  | 7.2                                    | 12.1                                       |  |  |
| Education level                    |                          |                                   |  |  |  |   |  |   |  |  |  |  |
| Low (high school or less)          | 67.6                     | 30.1                              | 35.9                                   | 44.1                                       | 11.1                                   | 23.3  | 7.0                                    | 14.7  | 7.1                                    | 12.2                                       |  |  |
| Moderate (college/some university) | 76.2                     | 36.2                              | 38.4                                   | 45.0                                       | 11.5                                   | 22.9  | 7.5                                    | 14.8  | 6.7                                    | 11.0                                       |  |  |
| High (university or higher)        | 76.7                     | 40.1                              | 41.5                                   | 49.4                                       | 14.8                                   | 28.3  | 9.8                                    | 18.6  | 8.7                                    | 14.1                                       |  |  |
| Income level                       |                          |                                   |  |  |  |   |  |   |  |  |  |  |
| Low (under \$30K/£15K)             | 66.4                     | 30.6                              | 36.9                                   | 46.7                                       | 9.8                                    | 20.5  | 6.4                                    | 13.3  | 6.2                                    | 10.6                                       |  |  |
| Moderate (\$30-60K/£15-30K)        | 73.2                     | 33.4                              | 37.4                                   | 44.7                                       | 11.3                                   | 22.6  | 7.2                                    | 14.5  | 7.1                                    | 11.8                                       |  |  |
| High (over \$60K/£30K)             | 76.6                     | 37.3                              | 38.7                                   | 44.9                                       | 13.8                                   | 27.4  | 8.8                                    | 17.4  | 7.8                                    | 12.9                                       |  |  |
| Not stated                         | 63.0                     | 27.1                              | 33.9                                   | 42.1                                       | 12.5                                   | 28.4  | 8.2                                    | 18.8  | 9.0                                    | 15.9                                       |  |  |
| Country                            |                          |                                   |  |  |  |   |  |   |  |  |  |  |
| Canada                             | 78.2                     | 40.0                              | 38.7                                   | 45.5                                       | 11.8                                   | 23.3  | 7.4                                    | 14.6  | 6.8                                    | 11.2                                       |  |  |
| United States                      | 71.1                     | 31.3                              | 40.1                                   | 46.1                                       | 11.8                                   | 22.0  | 7.6                                    | 14.2  | 7.8                                    | 12.4                                       |  |  |
| United Kingdom                     | 62.8                     | 28.2                              | 34.6                                   | 44.8                                       | 12.8                                   | 28.0  | 8.2                                    | 17.9  | 7.4                                    | 13.1                                       |  |  |
| Australia                          | 73.7                     | 33.5                              | 35.9                                   | 43.8                                       | 10.0                                   | 22.1  | 6.7                                    | 14.7  | 6.5                                    | 11.6                                       |  |  |

Notes. Data are presented as weighted percentages.

<sup>a</sup>Among all eligible respondents (observations).

<sup>b</sup>Among only those who intended to quit at the previous wave.

<sup>c</sup>Among only those who had attempted to quit since the previous wave.

**Table 3. Odds ratios (95% CIs) for weighted GEE main effects models for quit intentions and attempts**

| Variable                            | Outcome  |  |  |   |
|-------------------------------------|--|--|--|---|
|                                     | Planning to quit at all<br>(no. obs = 34,712,<br>no. respondents=16,458) | Planning to quit in<br>next 6 months<br>(no. obs =34,712, no.<br>respondents = 16,458) | Attempted to quit since last survey date   |   |
|                                     |  |  | Among all eligible<br>respondents<br>(no. obs =20,486, no.<br>respondents = 9,889) | Among those who intended<br>to quit at the previous wave<br>(no. obs =14,429, no.<br>respondents = 7,892) |
| Education level                     | <b><i>p</i> &lt; .0001</b>   | <b><i>p</i> &lt; .0001</b>   | <b><i>p</i> = .01</b>  | <b><i>p</i> = .02</b>   |
| Low (high school or less)           | 1.0  | 1.0  | 1.0  | 1.0   |
| Moderate (college/some university)  | <b>1.32**</b> (1.21–1.43)  | <b>1.21**</b> (1.13–1.30)  | 1.06 (0.97–1.15)   | 1.03 (0.94–1.14)  |
| High (university or higher)         | <b>1.36**</b> (1.21–1.52)  | <b>1.38**</b> (1.26–1.53)  | <b>1.19**</b> (1.06–1.34)  | <b>1.20**</b> (1.06–1.37)   |
| High vs. moderate education         | 1.03 (0.91–1.16)   | <b>1.14**</b> (1.03–1.26)  | 1.13 (1.00–1.28)   | <b>1.16*</b> (1.02–1.33)  |
| Income level                        | <b><i>p</i> &lt; .0001</b>   | <b><i>p</i> &lt; .0001</b>   | <i>p</i> = .40   | <i>p</i> = .53  |
| Low (under \$30K/£15K)              | 1.0  | 1.0  | 1.0  | 1.0   |
| Moderate (\$30–60K/£15–30K)         | <b>1.18**</b> (1.08–1.28)  | 1.05 (0.97–1.13)   | 0.98 (0.90–1.08)   | 0.97 (0.87–1.08)  |
| High (over \$60K/£30K)              | <b>1.26**</b> (1.14–1.40)  | <b>1.17**</b> (1.07–1.27)  | 0.99 (0.89–1.10)   | 0.96 (0.85–1.08)  |
| Not stated                          | <b>0.82**</b> (0.72–0.93)  | <b>0.81**</b> (0.71–0.93)  | 0.87 (0.75–1.02)   | 0.87 (0.72–1.05)  |
| High vs. moderate income            | 1.07 (0.98–1.18)   | <b>1.11**</b> (1.03–1.20)  | 1.01 (0.92–1.11)   | 0.98 (0.89–1.09)  |
| Country                             | <b><i>p</i> &lt; .0001</b>   | <b><i>p</i> &lt; .0001</b>   | <b><i>p</i> = .0004</b>  | <i>p</i> = .21  |
| Australia                           | 1.0  | 1.0  | 1.0  | 1.0   |
| Canada                              | <b>1.27**</b> (1.14–1.41)  | <b>1.28**</b> (1.17–1.40)  | 1.08 (0.97–1.20)   | 1.05 (0.94–1.18)  |
| United Kingdom                      | <b>0.61**</b> (0.55–0.68)  | <b>0.77**</b> (0.71–0.85)  | <b>0.88*</b> (0.79–0.97)   | 0.97 (0.86–1.10)  |
| United States                       | <b>0.85**</b> (0.77–0.95)  | <b>0.85**</b> (0.78–0.94)  | 0.90 (0.80–1.01)   | 0.93 (0.81–1.05)  |
| Canada vs. United Kingdom           | <b>2.07**</b> (1.87–2.29)  | <b>1.66**</b> (1.52–1.81)  | <b>1.23**</b> (1.10–1.37)  | 1.08 (0.96–1.22)  |
| Canada vs. United States            | <b>1.48**</b> (1.34–1.64)  | <b>1.50**</b> (1.37–1.63)  | <b>1.19**</b> (1.07–1.33)  | <b>1.14*</b> (1.01–1.28)  |
| United Kingdom vs.<br>United States | <b>0.72**</b> (0.65–0.79)  | <b>0.90*</b> (0.83–0.99)   | 0.97 (0.87–1.09)   | 1.05 (0.93–1.20)  |

Notes. Data are presented as odds ratios (95% CI). Each model also included the following covariates: age (*p* < .01 for both planning to quit models and quit attempts among eligible respondents: lower odds with increasing age), sex (*p* < .01 for planning to quit at all: lower odds for males), ethnicity (*ns*), marital status (*p* = .01 for planning to quit at all: lower odds for single vs. married; *p* < .01 for quit attempts among those who intended to quit: higher odds for separated/divorced/widowed vs. married), HSI<sup>a</sup> (*p* < .01 for all models: lower odds with greater HSI scores), survey wave<sup>b</sup> (*p* < .01 for planning to quit in the next 6 months and both quit attempts models: higher odds in more recent waves), and time in sample (*p* < .01 for planning to quit at all and in next 6 months, lower odds with more waves in sample). CI = confidence interval; GEE = generalized estimating equations; HSI = heaviness of smoking index.

\*Significantly different at *p* < .05, in weighted GEE models (with binomial variation and logit link) conducted separately for each outcome.

\*\*Significantly different at *p* < .01, in weighted GEE models (with binomial variation and logit link) conducted separately for each outcome.

<sup>a</sup>HSI at current wave for quit intentions, HSI at previous wave for quit attempts.

<sup>b</sup>Wave 1 and first wave in sample were excluded from quit attempts analyses due to the question about quit attempts only being asked of cohort respondents.

When interactions were tested, in the model for any quit intentions, interactions between country and wave (*p* = .0007), age and education (*p* < .0001), and ethnicity and income were significant (*p* = .016). The effect of age was significant at all education levels but was stronger with increasing education. Intentions to quit increased with income only for respondents of minority ethnicity, although both minority and nonminority respondents who did not state income were less likely to intend to quit. In the model for intending to quit within the next 6 months, significant interactions were found between country and wave (*p* < .0001), country and income (*p* = .013), age and education (*p* = .015), and HSI and education (*p* = .024). In Canada, intentions to quit increased with income, although no differences were seen between those who did not provide information and those with low income. In the United Kingdom, high-income smokers were more likely to intend to quit in the next 6 months compared with low-income smokers, with no differences

between the other levels. In Australia and the United States, those who did not provide income information were less likely to intend to quit compared with those with low income, but no significant differences were found for other income levels. As with the model for any intentions, the effect of age was significant at all education levels but was stronger with increasing education. For all levels of HSI except 1 and 6, high-education smokers were more likely to intend to quit than low, and moderate education smokers were not significantly different.

### Quit attempts

More than one third of the full eligible sample (37.4%) had attempted to quit smoking since the last survey date (Table 2). Among respondents who had intended to quit at the previous wave, quit attempts were more common, at 45% (Table 2). GEE models were conducted first with the full eligible sample (daily smokers at recruitment and still smokers at the previous wave),

and also with only those who intended to quit at the previous wave. In the model with the full sample (Table 3), there was no difference in the odds of attempting to quit for moderate education compared with low, but those with high education had 20% greater odds of having made a quit attempt. There were no differences in quit attempts by income. When only those who intended to quit at the previous wave were included (Table 3), although some other covariates were different, the effects of education and income were the same. Considering country differences, in the full sample, U.K. respondents were less likely to have made a quit attempt than Australians or Canadians, and U.S. respondents were also less likely than Canadians to have attempted to quit. Among those who intended to quit, U.S. respondents were again less likely than Canadians to have attempted to quit.

In the interactions model with the full sample, significant interactions were found between country and wave ( $p < .0001$ ), age and income ( $p = .0008$ ), sex and income ( $p = .018$ ), country

and income ( $p = .033$ ), and wave and income ( $p = .028$ ). In the interactions model including only those who intended to quit at the previous wave, the interactions between country and wave ( $p < .0001$ ), age and income ( $p = .005$ ), and sex and income ( $p = .012$ ) were significant. The effect of age was only significant for high income. In addition, the effect of income depended on sex, with stronger effects seen for males.

**Smoking abstinence**

Table 4 shows the odds ratios for predictor variables in the models for smoking abstinence of at least 1, 6 and 12 months, among those who had attempted to quit since entry into the study.

**Quit for at least 1 month**

Overall, 12% of the eligible sample, and 24% of those who had made a quit attempt since entry into the study, had quit for at least 1 month (Table 2). In the model including those who had attempted to quit since entry into the study (Table 4), those

**Table 4. Odds ratios (95% CI) for weighted GEE main effects models for smoking abstinence**

| Variable                           | Outcome  |   |   |
|------------------------------------|--|---|---|
|                                    | Quit for at least 1 month <sup>a</sup><br>(no. obs = 10,820,<br>no. respondents = 5,289) | Quit for at least 6 months <sup>a</sup><br>(no. obs = 10,820,<br>no. respondents = 5,289) | Quit for at least 12 months <sup>a</sup><br>(no. obs = 7,217,<br>no. respondents = 3,823) |
| Education level                    | $p = .07$  | $p = .04$   | $p = .33$   |
| Low (high school or less)          | 1.0  | 1.0   | 1.0   |
| Moderate (college/some university) | 0.97 (0.84–1.11)   | 0.99 (0.83–1.18)  | 0.95 (0.75–1.19)  |
| High (university or higher)        | <b>1.20*</b> (1.00–1.44)   | <b>1.30*</b> (1.05–1.62)  | 1.18 (0.89–1.56)  |
| High vs. moderate education        | <b>1.25*</b> (1.03–1.51)   | <b>1.31*</b> (1.05–1.64)  | 1.25 (0.93–1.68)  |
| Income level                       | $p = .01$  | $p = .10$   | $p = .41$   |
| Low (under \$30K/£15K)             | 1.0  | 1.0   | 1.0   |
| Moderate (\$30–60K/£15–30K)        | 1.07 (0.92–1.25)   | 1.00 (0.83–1.21)  | 1.00 (0.78–1.29)  |
| High (over \$60K/£30K)             | <b>1.30**</b> (1.09–1.55)  | 1.19 (0.97–1.47)  | 1.15 (0.88–1.51)  |
| Not stated                         | <b>1.33*</b> (1.02–1.73)   | 1.32 (0.95–1.83)  | 1.30 (0.85–1.97)  |
| High vs. moderate income           | <b>1.22**</b> (1.05–1.41)  | 1.19 (1.00–1.42)  | 1.15 (0.92–1.43)  |
| Country                            | $p = .001$   | $p = .03$   | $p = .65$   |
| Australia                          | 1.0  | 1.0   | 1.0   |
| Canada                             | 0.93 (0.78–1.11)   | 1.05 (0.84–1.31)  | 1.12 (0.85–1.48)  |
| United Kingdom                     | <b>1.30**</b> (1.10–1.55)  | <b>1.34**</b> (1.09–1.66)   | 1.17 (0.90–1.53)  |
| United States                      | 1.04 (0.86–1.26)   | 1.22 (0.96–1.55)  | 1.17 (0.86–1.59)  |
| Canada vs. United Kingdom          | <b>0.72**</b> (0.60–0.86)  | <b>0.78*</b> (0.63–0.97)  | 0.96 (0.73–1.25)  |
| Canada vs. United States           | 0.89 (0.73–1.09)   | 0.86 (0.68–1.09)  | 0.96 (0.71–1.30)  |
| United Kingdom vs. United States   | <b>1.25*</b> (1.03–1.51)   | 1.10 (0.87–1.38)  | 1.00 (0.74–1.36)  |

Notes. Data are presented as odds ratios (95% CI). Each model also included the following covariates: age ( $p = .03$  for 1 month;  $p = .02$  for 6 and 12 months; higher odds with increasing age), sex (*ns*), ethnicity (*ns*), marital status ( $p = .02$  for 1 month, lower odds for single vs. married), HSI ( $p < .0001$  for all models, lower odds with greater HSI scores), survey wave<sup>b</sup> ( $p < .01$  for all models: higher odds in more recent waves), and time in sample<sup>c</sup> ( $p < .0001$  for all models, greater odds with more waves in sample). CI = confidence interval; GEE = generalized estimating equations; HSI = heaviness of smoking index.

\*Significantly different at  $p < .05$ , in weighted GEE models (with binomial variation and logit link) conducted separately for each outcome.

\*\*Significantly different at  $p < .01$ , in weighted GEE models (with binomial variation and logit link) conducted separately for each outcome.

<sup>a</sup>Among those who had attempted to quit since the previous wave.

<sup>b</sup>Wave 1 and first wave in sample were excluded from 12-month abstinence due to the quitting measures only being applicable to continuing cohort respondents.

<sup>c</sup>Due to the timeline for the outcome (i.e., respondents needed to be quit for two consecutive waves), only Waves 3 through 5 and time in sample of at least three waves were included.



with high education were more likely to have quit than those with low or moderate education, as were those with high income (and income not stated), compared with low or moderate income. U.K. respondents were more likely to be quit than smokers in Australia, Canada, and the United States, which were not significantly different from one another. When interactions were tested, a significant interaction was observed between age and education ( $p = .006$ ): age was not significantly associated with quitting among moderate- and high-education groups, but low-education respondents were more likely to quit with increasing age.

### Quit for at least 6 months

Overall, 7.5% of the eligible sample, and 15% of those who had attempted to quit since entry into the study, had quit for at least 6 months (Table 2). In the GEE model (Table 4), those with high education had about one third greater odds of having quit than those with low or moderate education, while no significant differences were observed by income. Differences by country were also observed: U.K. respondents were more likely to be quit than Australians and Canadians. The effects of wave and time in sample were particularly strong in this model. As in the model for 1-month abstinence, a significant interaction was observed between age and education ( $p = .001$ ).

### Quit for at least 12 months

Overall, 7.2% of the eligible sample, and 12% of those who had attempted to quit since entry into the study, had quit for at least 12 months (Table 2). In the GEE model (Table 4), neither the SES variables nor country had significant effects. As in the models for 1- and 6-month abstinence, a significant interaction was observed between age and education ( $p = .05$ ).

Due to the number of outcomes and models, only the main effects models are reported in the tables. Details of the models including all interactions are available elsewhere (Reid, 2008). In general, the addition of interactions to the main effects models did not substantially change the patterns of results for other variables.

## Discussion

This research capitalizes on a unique opportunity to study the relationship of SES and smoking cessation in four Western countries during a time of considerable policy change. It is also among the first to examine a spectrum of quitting outcomes, using longitudinal analysis. The findings indicate socioeconomic patterns in a number of cessation-related outcomes, including quit intentions, quit attempts, and varying lengths of smoking abstinence, as well as variations by country.

### Quit intentions

Although the majority of smokers in the four countries intended to quit at some point, there appears to be a substantial gap between intending to quit at all and committing to doing so in the near future. Smokers who say that they would like to quit sometime in the future may not be willing or ready to make a firm commitment to quitting, or they may be waiting for the right time or support.

Smokers with lower education or income were less likely to report intending to quit than those with higher education or

income. The effects of SES variables were similar, and even slightly stronger, for intending to quit at all compared to within the next 6 months. When interactions were considered, the effects of income were modified somewhat by ethnicity and country: intentions to quit at all increased with income only for minority ethnicity respondents, and intentions to quit within the next 6 months were greater for higher income respondents in Canada and the United Kingdom only.

The current findings are consistent with studies documenting a relationship between intentions to quit and level of education (Dotinga et al., 2005) and income (Fagan, Augustson, et al., 2007). However, other studies have not found educational differences in intentions to quit (Droomers et al., 2004; Reid et al., 2010); this inconsistency may be due to differences in the samples, variable definitions, or study methods. Lower intentions to quit among lower socioeconomic groups may be due to lower levels of knowledge (Siahpush, McNeill, Hammond, et al., 2006) or less concern about the harms of smoking, different attitudes and social norms around smoking and cessation (Dotinga et al.; Manfredi, Cho, Crittenden, & Dolecek, 2007; Rise, Kovac, Kraft, & Moan, 2008; Sorensen, Emmons, Stoddard, Linnan, & Avrunin, 2002), greater stress (Manfredi et al., 2007; Stronks, van de Mheen, Looman, & Mackenbach, 1997) and dependence on smoking to cope, lower self-efficacy for quitting (Dotinga et al.; Droomers et al.; Siahpush, McNeill, Borland, et al., 2006), less social support (Sorensen et al., 2002), or some other factors.

Intentions to quit also differed by country: Canadian smokers were the most likely to intend to quit, followed by Australians, while smokers in the United States and particularly the United Kingdom were less likely to intend to quit. In addition, although “any” intentions were not related to time, intentions to quit within the next 6 months were greater in the two most recent waves; this finding indicates that smokers’ commitments to quit strengthened in the past few years, potentially due to increased tobacco control activity and changing social norms in the four countries.

### Quit attempts

A substantial proportion of smokers surveyed had made a quit attempt since the last survey, but some socioeconomic variation was observed. Highly educated smokers were more likely to have made an attempt than those with low education, although quit attempts did not differ by income level. Income, however, interacted with a number of variables in the models (age, sex, country, and wave in the full sample analysis, and age and sex in the analysis of those who intended to quit), making its association with quit attempts difficult to characterize beyond its average effect across groups.

The effects of SES variables were the same for both the full sample and only those who intended to quit, suggesting that fewer attempts to quit among lower SES groups is not simply due to lower intentions to quit, and that SES differences exist independently for both intentions and attempts. SES differences in quit attempts may be due to the same factors underlying differences in intentions to quit. Access to cessation assistance and perceptions of its effectiveness (Hammond et al., 2004; Roddy, Antoniak, Britton, Molyneux, & Lewis, 2006) may also vary by SES and contribute to whether a smoker moves from intending to quit to making a quit attempt. These results are consistent with U.S. studies that have reported decreased likelihood of

attempting to quit among lower education smokers, and inconsistent effects of income (Gilman et al., 2008; Hatziaandreu et al., 1990; Levy et al., 2005; Lillard et al., 2007; Shiffman et al., 2008). However, other studies in the United States, the United Kingdom, and Canada have found no SES differences in quit attempts (Barbeau et al., 2004; Kotz & West, 2009; Reid et al., 2010; West et al., 2001).

Differences in quit attempts between countries followed the same pattern as quit intentions, although with fewer significant findings: U.K. smokers were less likely to attempt to quit than Australians or Canadians in the full sample analysis, and U.S. respondents were also less likely to have attempted than Canadians in both samples. With respect to time, respondents were more likely to have made a quit attempt in more recent waves (compared with Wave 2); this is likely due to the shorter time period between Waves 1 and 2 compared with between the other waves.

## Smoking abstinence

Although direct comparisons with other studies are difficult due to varying study situations and definitions, abstinence rates in this study were relatively high (6-month rates of 8%, or 15% of those who attempted; and 12-month rates of 7%, or 12% of those who attempted) when compared with background unaided quit rates, which are estimated at 3% to 5% for 6–12 month abstinence after a given quit attempt (Hughes, Keely, & Naud, 2004).

Success in remaining abstinent from smoking varied by education and income for 1-month abstinence and by education for 6-month abstinence, although 12-month abstinence was not related to either socioeconomic measure. More specifically, respondents with high education and income were 20%–30% more likely to quit for at least 1 month than those with low or moderate education and income. In addition, respondents with high education were 30% more likely to quit for at least 6 months compared with those with low or moderate education. The results suggest that lower quitting success among lower SES groups is not simply due to fewer smokers attempting to quit.

Previous findings regarding SES and cessation are mixed, with more studies showing a relationship with education and/or income than not, but with considerable variation in the significance and magnitude of such associations. This creates some difficulty for comparing the current study with existing literature. However, the findings for 1- and 6-month abstinence are consistent with studies showing an association of higher income and/or education with greater cessation success in the countries studied (Agrawal et al., 2008; Barbeau et al., 2004; Fagan, Shavers, et al., 2007; Flint & Novotny, 1997; Gilman et al., 2003, 2008; Graham & Der, 1999; Hymowitz et al., 1997; Kotz & West, 2009; Lillard et al., 2007; West et al., 2001, Wetter et al., 2005).

Socioeconomic variation in 1- and 6-month abstinence may be affected by factors similar to those discussed for quit intentions and attempts: knowledge, attitudes and norms, stress, dependence, self-efficacy, and social support. In a study that also measured demographics, tobacco dependence, environmental and job-related characteristics, and transtheoretical model-based variables, there was an effect of education on smoking cessation regardless of the inclusion of any of these factors (Wetter et al., 2005), suggesting that relationship of education and cessation may operate through other variables. Cessation differences

may also be due to variation in social support (Droomers, Schrijvers, & Mackenbach, 2002), quit methods, use of cessation assistance, and access to such assistance (Bobak et al., 2000; Moolchan et al., 2007).

The finding that SES variables were important for the shorter time periods but not 12-month abstinence may be due to the smaller and more select population eligible to be quit for two consecutive survey waves. Lower SES respondents and those who had quit were both more likely to be lost to follow-up, so the relationships observed between SES measures and longer term quitting may have been distorted. However, greater attrition among low-SES respondents alone would not likely result in the pattern of results observed unless a disproportionate number of those lost were continuing smokers (e.g., unless more low-SES quitters stayed in the sample), if in fact there were underlying differences by SES in smoking abstinence. The remaining sample may also be subject to some other selection bias. Alternately, SES differences in abstinence may diminish over time after a quit attempt; however, given the amount of existing research indicating that smokers of lower SES are less likely to quit, this is unlikely.

One notable country difference was observed in shorter-term abstinence: among those who had attempted to quit, respondents in the United Kingdom were more likely to be quit for at least 1 month and at least 6 months than those in other countries. So, although United Kingdom smokers were less likely to attempt to quit, those that did attempt were more successful at remaining abstinent. The higher abstinence rates observed among U.K. smokers may be due to the comprehensive smoking cessation services offered by their national health authority (Judge, Bauld, Chesterman, & Ferguson, 2005).

Respondents' odds of quitting increased over the 4-year survey period, particularly with respect to 6-month abstinence rates. This may be due to the greater length of time between surveys after Wave 2 and/or an actual increase in quitting over time in the population of smokers, potentially due to tobacco control activity.

## Limitations

Although this study has a number of strengths, including its large, representative samples of smokers from multiple countries and the ability to examine multiple outcomes and covariates over time, this analysis is subject to some general limitations common to survey research, such as attrition and potential biases in the sample, and reliance on self-report. The self-reported nature of the data introduces the possibility of reporting inaccuracies in the outcomes; for example, errors in recalling quit date or past-year quit attempts, potential bias toward recalling only successful or recent quit attempts, and the potential of social desirability to cause over-reporting of intentions to quit. Although these issues could lead to overestimating the prevalence of the outcomes, there is no reason to believe they would vary by SES, so the relationships between the outcomes and SES would not be affected. In addition, previous research has indicated that self-report of smoking behavior is generally accurate when compared with biochemical validation, particularly for observational studies (Patrick et al., 1994).

Two SES measures, thought to measure unique aspects of SES, were tested in this study, strengthening its findings; however,

each has limitations. An absolute measure of household income was used as a general indicator of material circumstances, although the adequacy of this income level depends on other factors such as household composition and or local cost of living.

As with all longitudinal studies, sample attrition is a concern. Preliminary analyses of between-wave attrition (data not shown) indicated that there are some significant relationships between attrition rates and several variables of interest. Attrition varied over time and by country and was greater among respondents who were younger, male gender, of minority ethnicity, had quit smoking, smoked less frequently, and who did not intend to quit. Of particular interest to the current study, moderate- and high-income respondents were more likely to remain in the sample (compared with those who did not provide income information) as were those with moderate education (at Waves 1 and 2), or high education (at Wave 3) (compared with those with low education levels). The patterns of attrition observed in this study are similar to others that have found greater attrition among respondents who were men, younger, less educated, and had lower income (Bull, Pederson, Ashley, & Lefcoe, 1988; Psaty et al., 1994). In this study, differential attrition by SES or other demographic characteristics would only change the findings if some characteristic(s) associated with attrition was also related to SES and the outcomes, thus distorting their relationship (e.g., if the lower SES respondents that dropped out of the study were different from those who stayed in the study in a way that is related to the outcomes). Any biases that may have been introduced into the proposed analysis by attrition are not quantifiable; however, such biases may be reduced by including the covariates associated with attrition in the analyses, and thus partially controlling for their impact. In addition, attrition could have decreased power in this study by decreasing the size of the sample available for analysis, leading to more conservative conclusions and estimates of the effect of income and education on the outcomes.

## Conclusions

Socioeconomic differences favoring the more advantaged were found for a number of quitting-related outcomes: smokers with lower education were less likely to intend to quit, make a quit attempt, or be abstinent from smoking for at least 1 month or 6 months, and smokers with lower income were also less likely to intend to quit or be abstinent from smoking for at least 1 month. The findings indicate that SES differences in quit attempts extend beyond differences in intentions to quit, and differences in quit success extend beyond differences in quit attempts, suggesting that there are barriers related to SES at several stages along the spectrum of smoking cessation. Associations between SES variables and the outcomes varied, with education showing stronger relationships.

Country differences were observed for several outcomes. Canadian smokers were more likely to intend to quit than smokers in all other countries, whereas U.S. smokers were less likely than Australians and Canadians, and U.K. smokers were less likely than all others. Quit attempts followed the same pattern, although fewer comparisons reached significance. However, U.K. respondents who had attempted to quit were more likely to be abstinent from smoking for at least 1 or 6 months than smokers from other countries. These country differences

may be due to varying policy environments, or to differences in social, cultural, or individual-level factors.

## Implications

This research contributes to a better understanding of the relationship between SES and quitting smoking in four Western countries that include tobacco control leaders. Although the results show fairly modest differences by SES, when applied to whole populations, these differences translate to substantial numbers of smokers. Given that current smoking rates are higher in lower socioeconomic groups, cessation rates among lower SES smokers would need to be not only equal, but greater than those seen in higher SES groups in order to decrease existing disparities. Thus, socioeconomic disparities in tobacco use are unlikely to be diminished if current trends continue. As new policies and interventions are implemented, particular attention should be paid to their effects on smoking, cessation, and tobacco-related disparities. For instance, it remains unclear whether low-SES smokers would benefit from making existing cessation services more accessible, or if implementing targeted services and policy interventions is warranted.

This analysis focused mainly on sociodemographic variables in order to characterize the extent of SES disparities. However, the associations of these variables with the outcomes may be complex, and act through specific (and likely multiple) pathways to influence the outcomes. Research is needed to understand and identify these pathways and other variables (psychosocial, environmental, and otherwise) that may be related to both sociodemographics and the outcomes. Identification of these factors may provide insight into targets for intervention. Furthermore, research and subsequent interventions aimed at reducing smoking will be limited in their ability to do so unless they also alter the aspects of SES that are related to smoking and cessation; underlying issues that lead to inequity will need to be addressed in order to eliminate tobacco-related health disparities.

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## Declaration of Interests

*None declared.*

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## References

- Agrawal, A., Sartor, C., Pergadia, M. L., Huizink, A. C., & Lynskey, M. T. (2008). Correlates of smoking cessation in a nationally representative sample of US adults. *Addictive Behaviors*, *33*, 1223–1226.
- Albertsen, K., Hannerz, H., Borg, V., & Burr, H. (2003). The effect of work environment and heavy smoking on the social inequalities in smoking cessation. *Public Health*, *117*, 383–388.
- Barbeau, E. M., Krieger, N., & Soobader, M. (2004). Working class matters: Socioeconomic disadvantage, race/ethnicity, gender, and smoking in NHIS 2000. *American Journal of Public Health*, *94*, 269–278.
- Bobak, M., Jha, P., Nguyen, S., & Jarvis, M. (2000). Poverty and smoking. In P. Jha & F. J. Chaloupka (Eds.), *Tobacco control in developing countries* (pp. 41–61). New York: Oxford University Press.
- Broms, U., Silventoinen, K., Lahelma, E., Koskenvuo, M., & Kaprio, J. (2004). Smoking cessation by socioeconomic status and marital status: The contribution of smoking behaviour and family background. *Nicotine & Tobacco Research*, *6*, 447–455.
- Bull, S. B., Pederson, L. L., Ashley, M. J., & Lefcoe, N. M. (1988). Intensity of follow-up: Effects on estimates in a population telephone survey with an extension of Kish's (1965) approach. *American Journal of Epidemiology*, *127*, 552–561.
- Cavelaars, A. E. J. M., Kunst, A. E., Geurts, J. J. M., Crialesi, R., Grotvedt, L., Helmert, U., et al. (2000). Educational differences in smoking: International comparison. *British Medical Journal*, *320*, 1102–1107.
- Centers for Disease Control and Prevention. (2002). Cigarette smoking among adults—United States, 2000. *Morbidity and Mortality Weekly Report*, *51*, 642–645.
- Covey, L., Zang, E. A., & Wynder, E. L. (1992). Cigarette smoking and occupational status: 1977 to 1990. *American Journal of Public Health*, *82*, 1230–1234.
- de Walque, D. (2004). Education, information, and smoking decisions: Evidence from smoking histories, 1940–2000. *World Bank Policy Research Paper*, 3362. Retrieved 9 November 2007, from <http://econ/worldbank.org>
- Dotinga, A., Schrijvers, C. T. M., Voorham, A. J. J., & Mackenbach, J. P. (2005). Correlates of stages of change of smoking among inhabitants of deprived neighbourhoods. *European Journal of Public Health*, *15*, 152–159.
- Droomers, M., Schrijvers, C. T. M., & Mackenbach, J. P. (2002). Why do lower educated people continue smoking? Explanations from the longitudinal GLOBE study. *Health Psychology*, *21*, 263–272.
- Droomers, M., Schrijvers, C. T. M., & Mackenbach, J. P. (2004). Educational differences in the intention to stop smoking: Explanations based on the Theory of Planned Behaviour. *European Journal of Public Health*, *14*, 194–198.
- Fagan, P., Augustson, E., Backinger, C. L., O'Connell, M. E., Vollinger, R. E., Kaufman, A., et al. (2007). Quit attempts and intention to quit cigarette smoking among young adults in the United States. *American Journal of Public Health*, *97*, 1412–1420.
- Fagan, P., Shavers, V., Lawrence, D., Gibson, J. T., & Ponder, P. K. (2007). Cigarette smoking and quitting behaviours among unemployed adults in the United States. *Nicotine & Tobacco Research*, *9*, 241–248.
- Federico, B., Costa, G., & Kunst, A. E. (2007). Educational inequalities in initiation, cessation and prevalence of smoking among 3 Italian birth cohorts. *American Journal of Public Health*, *97*, 838–845.
- Fernandez, E., Garcia, M., Schiaffino, A., Borrás, J. M., Nebot, M., & Segura, A. (2001). Smoking initiation and cessation by gender and educational level in Catalonia, Spain. *Preventive Medicine*, *32*, 218–223.
- Fernandez, E., Schiaffino, A., Garcia, M., & Borrás, J. M. (2001). Widening social inequalities in smoking cessation in Spain, 1987–1997. *Journal of Epidemiology and Community Health*, *55*, 729–730.
- Flint, A. J., & Novotny, T. E. (1997). Poverty status and cigarette smoking prevalence and cessation in the United States, 1983–1993: The independent risk of being poor. *Tobacco Control*, *6*, 14–18.
- Fong, G. T., Cummings, K. M., Borland, R., Hastings, G., Hyland, A., Giovino, G. A., et al. (2006). The conceptual framework of the International Tobacco Control (ITC) Policy Evaluation Project. *Tobacco Control*, *15*(Suppl. 3), iii3–iii11.
- Gilman, S. E., Abrams, D. B., & Buka, S. L. (2003). Socioeconomic status over the life course and stages of cigarette use: Initiation, regular use, and cessation. *Journal of Epidemiology and Community Health*, *57*, 802–808.
- Gilman, S. E., Martin, R. T., Abrams, D. B., Kawachi, I., Kubzansky, L., Loucks, E. B., et al. (2008). Educational attainment and cigarette smoking: A causal association? *International Journal of Epidemiology*, *37*, 615–624.
- Gilpin, E. A., & Pierce, J. P. (2002). Demographic differences in patterns in the incidence of smoking cessation: United States 1950–1990. *Annals of Epidemiology*, *12*, 141–150.
- Giskes, K., Kunst, A. E., Benach, J., Borrell, C., Costa, G., Dahl, E., et al. (2005). Trends in smoking behaviour between 1985 and 2000 in nine European countries by education. *Journal of Epidemiology and Community Health*, *9*, 395–401.
- Graham, H., & Der, G. (1999). Patterns and predictors of smoking cessation among British women. *Health Promotion International*, *14*, 231–239.



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- Hammond, D., Fong, G. T., Thompson, M. E., & Driezen, P. (2004). International Tobacco Control Policy Evaluation Survey Wave 1 Technical Report. Retrieved 9 March 2007, from <http://www.itcproject.org>
- Hammond, D., McDonald, P. W., Fong, G. T., & Borland, R. (2004). Do smokers know how to quit? Knowledge and perceived effectiveness of cessation assistance as predictors of cessation behaviour. *Addiction*, *99*, 1042–1048.
- Hardin, J. W., & Hilbe, J. M. (2003). *Generalized estimating equations*. Boca Raton, FL: Chapman & Hall/CRC.
- Harper, S., & Lynch, J. (2007). Trends in socioeconomic inequalities in adult health behaviors among US states, 1990–2004. *Public Health Reports*, *122*, 177–189.
- Hatziafreu, E. J., Pierce, J. P., Lefkopoulou, M., Fiore, M. C., Mills, S. L., Novotny, T. E., et al. (1990). Quitting smoking in the United States in 1986. *Journal of the National Cancer Institute*, *82*, 1402–1406.
- Hughes, J. R., Keely, J., & Naud, S. (2004). Shape of the relapse curve and long-term abstinence among untreated smokers. *Addiction*, *99*, 29–38.
- Hyland, A., Borland, R., Li, Q., Yong, H. H., McNeill, A., Fong, G. T., et al. (2006). Individual-level predictors of cessation behaviours among participants in the International Tobacco Control (ITC) Four Country Survey. *Tobacco Control*, *15*(Suppl. III), iii83–iii94.
- Hymowitz, N., Cummings, K. M., Hyland, A., Lynn, W. R., Pechacek, T. F., & Hartwell, T. D. (1997). Predictors of smoking cessation in a cohort of adult smokers followed for five years. *Tobacco Control*, *6*(Suppl. 2), 57–62.
- Jarvis, M. J., & Wardle, J. (2006). Social patterning of individual health behaviours: The case of cigarette smoking. In M. Marmot & R. G. Wilkinson (Eds.), *Social determinants of health, Second Edition*. Oxford, England: Oxford University Press.
- Jefferis, B. J. M. H., Power, C., Graham, H., & Manor, O. (2004). Changing social gradients in cigarette smoking and cessation over two decades of adult follow-up in a British cohort. *Journal of Public Health*, *26*, 13–18.
- Jha, P., Peto, R., Zatonski, W., Boreham, J., Jarvis, M. J., & Lopez, A. D. (2006). Social inequalities in male mortality, and in male mortality from smoking: Indirect estimation from national death rates in England and Wales, Poland, and North America. *Lancet*, *368*(9533), 367–370.
- Judge, K., Bauld, L., Chesterman, J., & Ferguson, J. (2005). The English smoking treatment services: short-term outcomes. *Addiction*, *100*(Suppl. 2), 46–58.
- Kotz, D., & West, R. (2009). Explaining the social gradient in smoking cessation: It's not in the trying, but in the succeeding. *Tobacco Control*, *18*, 43–6.
- Levy, D. T., Romano, E., & Mumford, E. (2005). The relationship of smoking cessation to sociodemographic characteristics, smoking intensity, and tobacco control policies. *Nicotine & Tobacco Research*, *7*, 387–396.
- Liang, K. Y., & Zeger, S. L. (1986). Longitudinal data using generalized linear models. *Biometrika*, *73*, 13–22.
- Lillard, D. R., Plassmann, V., Kenkel, D., & Mathios, A. (2007). Who kicks the habit and how they do it: Socioeconomic differences across methods of quitting smoking in the USA. *Social Science & Medicine*, *64*, 2504–2519.
- Lindstrom, M., Hanson, B. S., Ostergren, P., & Berglund, G. (2000). Socioeconomic differences in smoking cessation: The role of social participation. *Scandinavian Journal of Public Health*, *28*, 200–208.
- Manfredi, C., Cho, Y. I., Crittenden, K. S., & Dolecek, T. A. (2007). A path model of smoking cessation in women smokers of low socio-economic status. *Health Education Research*, *22*, 747–756.
- Moolchan, E., Fagan, P., Fernander, A., Velicer, W. F., Hayward, M. D., King, G., et al. (2007). Addressing tobacco-related health disparities. *Addiction*, *102*(Suppl. 2), 30–42.
- Najman, J. M., Toloo, G., & Siskind, V. (2006). Socioeconomic disadvantage and changes in health risk behaviours in Australia: 1989–1990 to 2001. *Bulletin of the World Health Organization*, *84*, 976–984.
- National Center for Health Statistics. (1998). *Health, United States, 1998, with socioeconomic status and Health Chartbook*. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
- Osler, M., & Prescott, E. (1998). Psychosocial, behavioural, and health determinants of successful smoking cessation: A longitudinal study of Danish adults. *Tobacco Control*, *7*, 262–267.
- Osler, M., Prescott, E., Godtfredsen, N., Hein, H. O., & Schnohr, P. (1999). Gender and determinants of smoking cessation: A longitudinal study. *Preventive Medicine*, *29*, 57–62.
- Patrick, D. L., Cheadle, A., Thompson, D. C., Diehr, P., Koepsell, T., & Kinne, S. (1994). The validity of self-reported smoking: A review and meta-analysis. *American Journal of Public Health*, *84*, 1086–1093.
- Psaty, B. M., Cheadle, A., Koepsell, T. D., Diehr, P., Wickizer, T., Curry, S., et al. (1994). Race- and ethnicity-specific characteristics of participants lost to follow-up in a telephone cohort. *American Journal of Epidemiology*, *140*, 161–171.
- Reid, J. L. (2008). Are patterns of smoking cessation and related behaviours associated with socioeconomic status? An Analysis of Data from the International Tobacco Control Four Country Survey. (MSc thesis, University of Waterloo, 2008). URL: <http://hdl.handle.net/10012/4012>
- Reid, J. L., Hammond, D., & Driezen, P. (2010). Socio-economic status and smoking in Canada, 1999–2006: Has there been any progress on disparities in tobacco use? *Canadian Journal of Public Health*, *101*, 73–78.
- Rise, J., Kovac, V., Kraft, P., & Moan, I. S. (2008). Predicting the intention to quit smoking and quitting behaviour: Extending the theory of planned behaviour. *British Journal of Health Psychology*, *13*, 291–310.



- Roddy, E., Antoniak, M., Britton, J., Molyneux, A., & Lewis, S. (2006). Barriers and motivators to gaining access to smoking cessation services amongst deprived smokers—a qualitative study. *BMC Health Services Research*, 6, 147.
- Schaap, M. M., & Kunst, A. E. (2009). Monitoring of socioeconomic inequalities in smoking: Learning from the experiences of recent scientific studies. *Public Health*, 123, 103–109.
- Schaap, M. M., Kunst, A. E., Leinsalu, M., Regidor, E., Ekholm, O., Dzurova, D., et al. (2008). Effect of nationwide tobacco control policies on smoking cessation in high and low educated groups in 18 European countries. *Tobacco Control*, 17, 248–55.
- Schiaffino, A., Fernandez, E., Kunst, A., Borrell, C., Garcia, M., Borrás, J., et al. (2007). Time trends and educational differences in the incidence of quitting smoking in Spain (1965–2000). *Preventive Medicine*, 45, 226–232.
- Shiffman, S., Brockwell, S. E., Pillitteri, J. L., & Gitchell, J. G. (2008). Use of smoking cessation treatments in the United States. *American Journal of Preventive Medicine*, 34, 102–111.
- Siahpush, M., Borland, R., & Scollo, M. (2003). Factors associated with smoking cessation in a national sample of Australians. *Nicotine & Tobacco Research*, 5, 597–602.
- Siahpush, M., English, D., & Powles, J. (2006). The contribution of smoking to socioeconomic differentials in mortality: Results from the Melbourne Collaborative Cohort Study, Australia. *Journal of Epidemiology & Community Health*, 60, 1077–1079.
- Siahpush, M., McNeill, A., Borland, R., & Fong, G. T. (2006). Socioeconomic variations in nicotine dependence, self efficacy, and intention to quit across four countries: Findings from the International Tobacco Control (ITC) Four Country Survey. *Tobacco Control*, 15(Suppl. III), iii71–iii75.
- Siahpush, M., McNeill, A., Hammond, D., & Fong, G. T. (2006). Socioeconomic and country variations in knowledge of health risks of tobacco smoking and toxic constituents of smoke: Results from the 2002 International Tobacco Control (ITC) Four Country Survey. *Tobacco Control*, 15(Suppl. III), iii65–iii70.
- Smith, P., Frank, J., & Mustard, C. (2009). Trends in educational inequalities in smoking and physical activity in Canada: 1974–2005. *Journal of Epidemiology & Community Health*, 63, 317–323.
- Sorensen, G., Emmons, K., Stoddard, A. M., Linnan, L., & Avrunin, J. (2002). Do social influences contribute to occupational differences in quitting smoking and attitudes toward quitting? *American Journal of Health Promotion*, 16, 135–141.
- Stronks, K., van de Mheen, D., Looman, C. W. N., & Mackenbach, J. P. (1997). Cultural, material, and psychosocial correlates of the socioeconomic gradient in smoking behavior among adults. *Preventive Medicine*, 26, 754–766.
- Thompson, M. E., Fong, G. T., Hammond, D., Boudreau, C., Driezen, P., Hyland, A., et al. (2006). Methods of the International Tobacco Control (ITC) Four Country Survey. *Tobacco Control*, 15(Suppl. 3), iii12–iii18.
- West, R., McEwen, A., Bolling, K., & Owen, L. (2001). Smoking cessation and smoking patterns in the general population: A 1-year follow-up. *Addiction*, 96, 891–902.
- Wetter, D. W., Cofta-Gunn, L., Irvin, J. E., Fouladi, R. T., Wright, K., Daza, P., et al. (2005). What accounts for the association of education and smoking cessation? *Preventive Medicine*, 40, 452–460.
- World Health Organization. (2002). Chapter 4: Quantifying Selected Major Risks to Health. In *The World Health Report 2002: Reducing Risks, Promoting Healthy Life* (pp. 47–97), Geneva: Author.