The journey to quitting smoking

Margot Shields

Abstract

Objectives

This article outlines smoking trends over the past 10 years among the population aged 18 or older. Factors associated with smoking cessation and relapse are examined, as well as factors associated with having no intention of quitting in the next 6 months.

Data sources

Data are from the household cross-sectional and longitudinal components of Statistics Canada's National Population Health Survey (1994/95 to 2002/03) (NPHS) and from the 2000/01 and 2003 Canadian Community Health Survey (CCHS).

Analytical techniques

Trends in smoking rates were calculated using cross-sectional data from the NPHS and the CCHS. Factors associated with cessation and relapsing were examined using pooling of repeated observations over two-year periods and logistic regression based on NPHS longitudinal data from 1994/95 to 2002/03. Factors associated with having no plans to quit were examined with logistic regression, based on 2003 CCHS cross-sectional data.

Main results

In 2003, 19% of the Canadian population aged 18 or older smoked cigarettes daily, down 7 percentage points from a decade earlier. Smoking cessation, relapsing and having no plans to quit were all associated with addiction levels, notably, cigarettes smoked per day. Smoke-free homes and workplace smoking bans were associated with reduced cigarette consumption.

Key words

smoking prevalence, tobacco use, psychological stress, longitudinal studies, stages of change

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Despite substantial declines over the past decade, close to one in four Canadians aged 18 or older smoked in 2003. Given that smoking remains the major preventable cause of death in Canada,[1] this rate is unacceptably high. In 1998, the deaths of approximately 48,000 Canadians were attributable to smoking, up almost 25% since 1989.[1] Recent estimates suggest that 50% of smokers will die as a result of smoking-related illness.[2] As well, second-hand smoke is harmful to non-smokers; in 1998, an estimated 1,000 deaths in Canada resulted from exposure to environmental tobacco smoke.[1]

Smoking causes lung and other cancers, coronary heart disease, stroke, and chronic lung disease; quitting reduces the risks of developing these diseases.[3-5] In fact, quitting brings health benefits at any age.[2] The risk of mortality for former smokers who have been abstinent for 10 to 15 years approaches that of people who have never smoked.[4]

Although quitting is one of the most important steps that smokers can take to improve their health, it is certainly not easy. Smoking is highly addictive, so the effort required to stop is daunting. Quitting typically involves five distinct stages: precontemplation, contemplation, preparation,

action and maintenance (see *Stages of change*).[6] The factors associated with being at the various stages are not necessarily the same,[3,6-8] so understanding what is important at each stage is key to developing public health programs aimed at reducing the smoking rate.

With information from the National Population Health Survey (NPHS) and the Canadian Community Health Survey (CCHS) (see *Data sources*), this article updates Canadian smoking trends for the population aged 18 or older (see *Analytical techniques*, *Definitions* and *Limitations*). The association between smoke-free environments and cigarette consumption is explored with data from the 2003 CCHS. Based on longitudinal data from five cycles of the NPHS (1994/95 to 2002/03), smoking

Data sources

The smoking data for 1994/95 to 2003 are from the National Population Health Survey (NPHS) and the Canadian Community Health Survey (CCHS). The rates for the mid-1960s are from the Survey of Smoking Habits 1966 and are based on the household population aged 17 or older.

National Population Health Survey

Since 1994/95, Statistics Canada's biennial National Population Health Survey has collected information about the health of the Canadian population. The survey covers household and institutional residents in all provinces and territories, except people on Indian reserves, on Canadian Forces bases, and in some remote areas.

For each of the first three NPHS cycles (1994/95, 1996/97 and 1998/99), two cross-sectional files were produced: General and Health. The General file contains socio-demographic and some health information for each member of participating households (collected using the General questionnaire). The Health file contains additional, in-depth health information (collected using the Health questionnaire) about one randomly selected household member, as well as the information from the General file about that individual. Starting in 2000/01 (cycle 4), the NPHS became strictly longitudinal, and the General and Health questionnaires were combined.

For the first three cycles, two cross-sectional response rates were calculated: household and person. The household response rate is the percentage of households where at least the General questionnaire was completed for the randomly selected respondent. The person response rate is the percentage of responding households for which the Health questionnaire was completed for the randomly selected respondent. In 1994/95, the household response rate was 88.7%, and the person response rate was 96.1%. The corresponding rates were 82.6% and 95.6% in 1996/97, and 87.6% and 98.5% in 1998/99.

The time series smoking data for 1994/95, 1996/97 and 1998/99 were calculated using the NPHS cross-sectional Health files. The rates are based on the household population aged 18 or older living in the 10 provinces.

A longitudinal file is also produced for each NPHS cycle. In 1994/95, a subset of the randomly selected respondents (17,626) was chosen to be in the longitudinal panel and was followed over time. In subsequent cycles, the response rates for this panel were: 92.8% for cycle 2 (1996/97), 88.2% for cycle 3 (1998/99), 84.8% for cycle 4 (2000/01), and 80.6% for cycle 5 (2002/03). The analyses of factors associated with smoking cessation and relapsing are based on the cycle 5 (2002/03) longitudinal "square" file, which contains records for all originally selected panel members about whom cycle 1 information was available, whether or not information about them was obtained in later cycles. More detailed descriptions of NPHS design, sample and interview procedures can be found in published reports.[9,10]

Canadian Community Health Survey

The time series smoking rates for 2001/02 and 2003 are based on data for the population aged 18 or older from cycles 1.1 and 2.1 of the Canadian Community Health Survey. Associations between smoke-free homes and workplaces and smoking intensity are based on 2003 data. The analysis of factors associated with being a persistent smoker (having no intention of quitting in the near future) used 2003 data for the provinces of Newfoundland, Québec and Saskatchewan.

The CCHS collects cross-sectional information about the health of Canadians every two years. The survey covers the household population aged 12 or older in the provinces and territories, except residents of Indian reserves, Canadian Forces bases, and some remote areas. The first cycle (1.1) began in September 2000 and continued over 14 months. The response rate was 84.7%, yielding a sample of 131,535 respondents. Cycle 2.1 began in January 2003 and ended in December that year. The response rate was 80.6%; the sample, 135,573. A description of the CCHS methodology is available in a published report.[11]

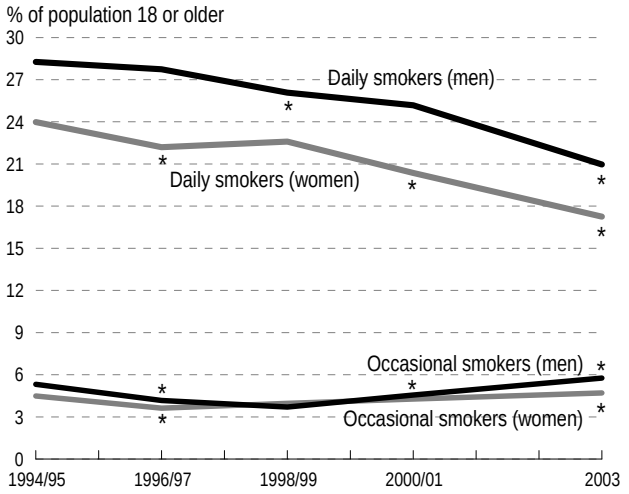
cessation and relapse rates are estimated, and factors associated with smoking cessation and relapse are examined. Cross-sectional data from the 2003 CCHS are used to identify the characteristics of smokers who have no plans to quit in the near future. Because some research suggests that factors associated with behaviour change among male and female smokers are different,[12-15] separate analyses are conducted for each sex.

Smoking less common

In the mid-1960s, close to half of Canadian adults smoked cigarettes; by 2003, the rate had fallen to 24% (data not shown). The decline in smoking over the last 40 years was much more pronounced among men than women. In the mid-1960s, men's rate had exceeded women's by 22 percentage points (59% versus 37%); by 2003, the gap had been reduced to 5 percentage points (27% versus 22%).

Most people who smoke do so daily. But trends in daily and occasional smoking differ. Since 1994/95, daily smoking rates have dropped, whereas occasional smoking rates remained relatively stable (Chart 1).

Chart 1
Percentage of current smokers, by sex and type of smoker, household population aged 18 or older, Canada excluding territories, 1994/95 to 2003



Data sources: 1994/95, 1996/97 and 1998/99 National Population Health Survey, cross-sectional sample, Health file; 2000/01 and 2003 Canadian Community Health Survey
Notes: The daily smoking rate for men is significantly higher than the rate for women in all periods. The occasional smoking rate for men is significantly higher than the rate for women in 2003.
** Significantly different from estimate for preceding period ($p < 0.05$)*

Quit rates rising

In this analysis, the quit rate is the percentage of people who had been smokers in one NPHS cycle, but when they were re-interviewed two years later, reported that they did not smoke.

During the last decade, the percentage of daily smokers who quit over a two-year period has risen (Table 1). Between 1994/95 and 1996/97, 9% of men who had been daily smokers quit; between 2000/01 and 2002/03, the figure was 18%. Among women, the percentage of daily smokers who quit over the same two-year intervals rose from 11% to 16%.

Stages of change

Research suggests that smokers go through five distinct stages in their attempts to quit.[3,6,16,17] It is not uncommon to cycle through these stages several times before successful abstinence.

- At the *precontemplation stage*, smokers have no plans to quit in the foreseeable future. In this article, smokers in the precontemplation stage are referred to as "persistent" smokers.
- At the *contemplation stage*, smokers recognize the problem and are seriously thinking about addressing it, typically in the next six months, although they will not necessarily quit within that period.
- The *preparation stage* involves a firm commitment to quit. Smokers at this stage have usually taken some initial steps to alter their behaviour, and they have immediate plans to quit.[6]
- At the *action stage*, a change has been made—the smoker has quit. In this analysis, the action stage was defined by a transition from daily smoking to not smoking between two consecutive National Population Health Survey (NPHS) cycles (see *Analytical techniques*).
- *Maintenance* is the stage at which an ex-smoker works to prolong abstinence and become a successful quitter. Although relapse is most likely to occur within a year of quitting, it sometimes happens after several years of continuous maintenance. In this analysis, pairs of consecutive cycles of the NPHS longitudinal file were used to identify former daily smokers who, at the follow-up interview two years later, reported that they smoked daily.

Table 1
Percentage of daily and occasional smokers who quit in a two-year period, by sex, household population aged 18 or older, Canada excluding territories, 1994/95 to 2002/03

	Total smokers			Daily smokers			Occasional smokers		
	Both sexes	Men	Women	Both sexes	Men	Women	Both sexes	Men	Women
		%			%			%	
Overall two-year quit rate	17.0	17.2	16.7	12.7	13.1	12.2	40.6	40.1	41.1
1994/95 to 1996/97	14.2	12.7	15.8	9.6	8.7	10.7	38.7	34.5	43.1
1996/97 to 1998/99	15.9	16.6*	15.0	11.8*	12.7*	10.8	41.1	40.6	41.7
1998/99 to 2000/01	17.5*	18.4*	16.6	13.9*	15.0*	12.8	39.9	42.1	38.1
2000/01 to 2002/03	21.5*	22.7*	20.3*	16.8*	17.9*	15.6*	43.1	45.1	41.1

Data source: 1994/95 to 2002/03 National Population Health Survey, longitudinal sample, Health file (square)
** Significantly different from 1994/95 to 1996/97 ($p < 0.05$)*

At around 40%, two-year quit rates were far higher among occasional smokers. However, most occasional smokers have a lower level of addiction than do daily smokers, so the high quit rates are not surprising. Because occasional smokers are a unique and relatively small group, in this article, the analysis of factors associated with smoking cessation is limited to daily smokers.

Not all daily smokers are equally likely to quit. In fact, about a third of them have no plans to do so in the immediate future (see *Persistent smokers*). Some characteristics and situations seem to facilitate quitting, while others may be impediments. Moreover, factors that may be important, such as smoking behaviour, health, lifestyle, psycho-social variables and socio-demographic characteristics, do not exist in isolation. When eight years of longitudinal data from the NPHS were examined and potential interrelationships were taken into account, only some of these variables emerged as being significantly associated with quitting smoking.

Addiction levels

The addictiveness of nicotine has been cited as the main impediment to smoking cessation.[18] One of the most consistent research findings is that the number of cigarettes smoked per day is negatively associated with quitting.[8,12,14,15,19-23] And based on NPHS data, light smokers (less than 10 cigarettes a day) had substantially higher odds of quitting than did heavy smokers (25 or more) (Tables 2 and 3).

The timing of the first cigarette of the day is another measure of addiction.[24] Men and women who reported smoking their first cigarette within 30 minutes of waking were less likely to quit than were those who waited for more than an hour. As well, men and women who had started smoking when they were younger than 18 were less likely to quit than were those who had begun at older ages.

Smoke-free environments

A growing number of constraints have been placed on smoking in both public and private locations. In 2003, substantial percentages of men and women who were daily smokers lived in homes where smoking was completely restricted and worked in environments where smoking was banned (Table 4).

However, according to the analyses of NPHS data, workplace restrictions were not related to smoking cessation. And although smokers who lived in smoke-free homes were more likely to quit, this association was not significant when the effects of the other factors—notably, smoking intensity—were taken into account. Smokers who lived in such homes tended to be light smokers, who were the most likely to quit.

Nonetheless, restrictions on smoking in private households and public places are related to decreased tobacco consumption.[25-27] Male daily smokers living in smoke-free homes averaged 14 cigarettes a day, compared with 19 a day for those who lived in households where smoking was

Table 2
Odds ratios relating selected characteristics of male daily smokers to quitting in a two-year period, household population aged 18 or older, Canada excluding territories, 1994/95 to 2002/03

	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio‡	95% confidence interval
Men				
Cigarettes per day				
1 to 9 (light)	2.9*	2.0, 4.1	2.5*	1.7, 3.7
10 to 24 (moderate)	1.2	0.9, 1.6	1.1	0.9, 1.5
25 or more (heavy)†	1.0	...	1.0	...
First cigarette of day§				
Within 30 minutes of waking	0.5*	0.4, 0.7	0.6*	0.4, 0.8
31 to 60 minutes after waking	0.8	0.5, 1.1	0.8	0.5, 1.1
More than an hour after waking†	1.0	...	1.0	...
Age of smoking initiation				
Younger than 18†	1.0	...	1.0	...
18 or older	1.6*	1.3, 2.0	1.4*	1.1, 1.7
Smoke-free home				
Yes	1.4*	1.0, 1.9	1.1	0.8, 1.6
No†	1.0	...	1.0	...
Smoking banned at work§ (workers aged 18 to 54)				
Yes	1.1	0.8, 1.6	0.9	0.7, 1.4
No†	1.0	...	1.0	...
Chronic conditions				
Vascular				
At least one new condition	2.7*	1.9, 3.9	2.9*	2.0, 4.2
At least one existing condition	0.8	0.6, 1.2	0.8	0.6, 1.2
None†	1.0	...	1.0	...
Respiratory				
At least one new condition	0.8	0.5, 1.5	0.8	0.5, 1.5
At least one existing condition	0.7	0.5, 1.1	0.8	0.5, 1.2
None†	1.0	...	1.0	...
Body mass index (BMI)				
Not overweight (< 25)†	1.0	...	1.0	...
Overweight/Obese (≥ 25)	1.2	0.9, 1.5	1.1	0.9, 1.4
Heavy drinking				
Yes	0.7*	0.5, 0.9	0.8	0.6, 1.0
No†	1.0	...	1.0	...
Psychological distress				
Low†	1.0	...	1.0	...
Moderate	0.7*	0.6, 0.9	0.7*	0.6, 0.9
High	0.6*	0.4, 0.8	0.7*	0.5, 1.0
Low emotional support††				
Yes	0.6*	0.4, 0.8	0.6*	0.4, 0.9
No†	1.0	...	1.0	...
Chronic stress‡‡				
0 to 1 stressor (low)†	1.0	...	1.0	...
2 to 5 stressors (moderate)	1.1	0.7, 1.6	1.2	0.8, 1.9
6 or more stressors (high)	0.9	0.5, 1.5	1.0	0.6, 1.7
Age group				
18 to 29	0.9	0.7, 1.2	1.0	0.8, 1.4
30 to 64†	1.0	...	1.0	...
65 or older	1.3	0.9, 1.9	1.3	0.9, 1.9
Education				
Less than secondary graduation	1.1	0.8, 1.5	1.2	0.8, 1.6
Secondary graduation†	1.0	...	1.0	...
Some postsecondary	1.5*	1.0, 2.1	1.6*	1.1, 2.2
Postsecondary graduation	1.6*	1.1, 2.2	1.5*	1.1, 2.2
Household income				
Low/Lower-middle†	1.0	...	1.0	...
Middle/Upper-middle/High	1.9*	1.4, 2.5	1.7*	1.2, 2.3
Child(ren) aged 5 or younger in household				
Yes	1.5*	1.1, 1.9	1.4*	1.0, 1.8
No†	1.0	...	1.0	...

Data source: 1994/95 to 2002/03 National Population Health Survey, longitudinal sample, Health file (square)
† Reference category
‡ Adjusted for cigarettes per day, age of smoking initiation, smoke-free home status, chronic conditions (vascular and respiratory), BMI, heavy drinking, psychological distress, age, education, household income and children 5 or younger in household (see Analytical techniques*)*
§ Based on cohorts 2, 3 and 4 (see Analytical techniques*)*
†† Based on cohorts 1 and 2 (see Analytical techniques*)*
‡‡ Based on cohorts 1 and 4 (see Analytical techniques*)*
** p < 0.05*
··· Not applicable

permitted (Chart 2). The corresponding averages for women were 11 and 16. As well, men who smoked daily but were employed in environments where smoking was banned averaged 15 cigarettes a day, compared with 18 a day for those who could smoke at work; for women, the averages were 14 and 15 (Chart 3).

The combination of a smoke-free home and workplace smoking bans yields even larger differences in consumption (Chart 4). Male daily smokers facing such restrictions averaged 7 fewer cigarettes a day than did those who could smoke at work and at home. For women, the difference was 6 fewer cigarettes a day.

The relationship between smoking restrictions and cigarette consumption is relevant for two reasons. First, there is a dose-response between the number of cigarettes smoked per day and the risk

Table 3
Odds ratios relating selected characteristics of female daily smokers to quitting in a two-year period, household population aged 18 or older, Canada excluding territories, 1994/95 to 2002/03

	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio‡	95% confidence interval
Women				
Cigarettes per day				
1 to 9 (light)	2.0*	1.4, 2.9	1.7*	1.1, 2.5
10 to 24 (moderate)	1.1	0.8, 1.4	1.0	0.7, 1.4
25 or more (heavy)†	1.0	...	1.0	...
First cigarette of day§				
Within 30 minutes of waking	0.6*	0.5, 0.8	0.7*	0.5, 1.0
31 to 60 minutes after waking	0.9	0.7, 1.3	1.0	0.7, 1.4
More than an hour after waking†	1.0	...	1.0	...
Age of smoking initiation				
Younger than 18†	1.0	...	1.0	...
18 or older	1.3*	1.0, 1.6	1.3*	1.0, 1.6
Smoke-free home				
Yes	1.5*	1.1, 2.1	1.3	1.0, 1.9
No†	1.0	...	1.0	...
Smoking banned at work§ (workers aged 18 to 54)				
Yes	0.9	0.7, 1.3	0.8	0.6, 1.2
No†	1.0	...	1.0	...
Chronic conditions				
Vascular				
At least one new condition	2.1*	1.6, 2.8	2.4*	1.7, 3.3
At least one existing condition	1.0	0.7, 1.4	1.1	0.7, 1.5
None†	1.0	...	1.0	...
Respiratory				
At least one new condition	0.7	0.4, 1.1	0.7	0.4, 1.2
At least one existing condition	1.0	0.7, 1.3	1.0	0.7, 1.4
None†	1.0	...	1.0	...
Body mass index (BMI)				
Not overweight (< 25)†	1.0	...	1.0	...
Overweight/Obese (≥ 25)	1.0	0.8, 1.3	1.1	0.8, 1.3
Heavy drinking				
Yes	0.7*	0.5, 1.0	0.7*	0.5, 0.9
No†	1.0	...	1.0	...
Psychological distress				
Low†	1.0	...	1.0	...
Moderate	1.0	0.7, 1.2	0.9	0.7, 1.2
High	1.0	0.7, 1.3	0.9	0.7, 1.3
Low emotional support††				
Yes	0.8	0.5, 1.2	0.8	0.5, 1.3
No†	1.0	...	1.0	...
Chronic stress‡‡				
0 to 1 stressor (low)†	1.0	...	1.0	...
2 to 5 stressors (moderate)	0.7	0.5, 1.0	0.8	0.5, 1.2
6 or more stressors (high)	0.6*	0.4, 0.8	0.5*	0.3, 0.8
Age group				
18 to 29	1.4*	1.0, 1.7	1.5*	1.1, 2.0
30 to 64†	1.0	...	1.0	...
65 or older	1.4	1.0, 1.9	1.1	0.7, 1.5
Education				
Less than secondary graduation	1.2	0.9, 1.6	1.2	0.9, 1.7
Secondary graduation†	1.0	...	1.0	...
Some postsecondary	1.3	0.9, 1.7	1.2	0.9, 1.7
Postsecondary graduation	1.5*	1.1, 2.1	1.4*	1.1, 1.9
Household income				
Low/Lower-middle†	1.0	...	1.0	...
Middle/Upper-middle/High	1.4*	1.1, 1.8	1.4*	1.1, 1.8
Child(ren) aged 5 or younger in household				
Yes	0.9	0.7, 1.2	0.9	0.7, 1.2
No†	1.0	...	1.0	...

Data source: 1994/95 to 2002/03 National Population Health Survey, longitudinal sample, Health file (square)
† Reference category
‡ Adjusted for cigarettes per day, age of smoking initiation, smoke-free home status, chronic conditions (vascular and respiratory), BMI, heavy drinking, psychological distress, age, education, household income and children 5 or younger in household (see Analytical techniques*)*
§ Based on cohorts 2, 3 and 4 (see Analytical techniques*)*
†† Based on cohorts 1 and 2 (see Analytical techniques*)*
‡‡ Based on cohorts 1 and 4 (see Analytical techniques*)*
** p < 0.05*
... Not applicable

of disease and death—the more cigarettes smoked, the greater the chances of getting sick and dying.[5] Second, as the analysis of NPHS data shows, lower consumption is associated with an increased likelihood of quitting. Therefore, even if smoking bans at home and at work do not have an immediate impact on quitting, the reduced consumption associated with smoke-free environments may eventually make quitting easier.

Physical and emotional health

Even allowing for the strong influence of addiction indicators, a number of health factors played a role in the likelihood of smoking cessation (Tables 2 and 3).

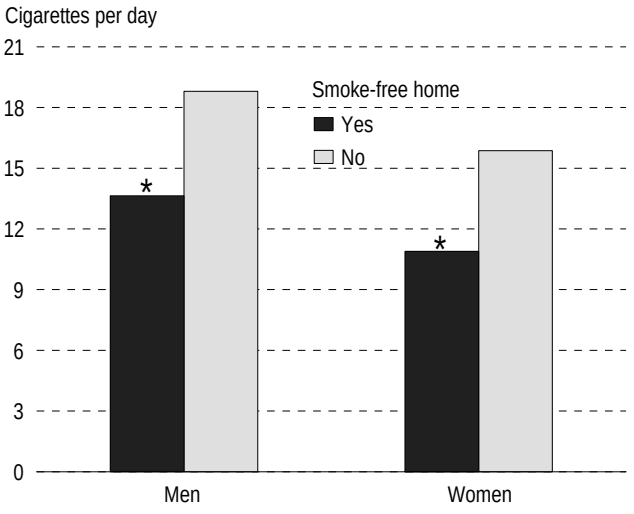
Daily smokers who had been newly diagnosed with a vascular condition (heart disease, high blood pressure, stroke or diabetes) had more than twice the odds of quitting, compared with those who had not developed such conditions. However, pre-existing vascular conditions were not associated with

Table 4
Percentage of population reporting smoking restrictions, by sex and smoking status, Canada excluding territories, 2003

	Men	Women
	%	
Smoke-free home (population aged 18 or older)		
Total	56	58*
Daily smoker	32	24*
Occasional smoker	54†	53†
Non-smoker	63†	65†*
Smoking banned at work (workers aged 18 to 54)		
Total	57	75*
Daily smoker	43	62*
Occasional smoker	52†	73†*
Non-smoker	62†	78†*

Data source: 2003 Canadian Community Health Survey
** Significantly different than estimate for men (p < 0.05)*
† Significantly higher than estimate for previous category (p < 0.05)

Chart 2
Average number of cigarettes smoked per day, by household smoking restrictions and sex, daily smokers aged 18 or older, Canada excluding territories, 2003



Data source: 2003 Canadian Community Health Survey
** Significantly lower than estimate for "no" (p < 0.05)*

Persistent smokers

Obviously, the first step that smokers must take in successful cessation is to decide to quit. In this article, those who had yet to take that step are called "persistent" smokers. They were identified by having replied "no" to the question, "Are you seriously considering quitting within the next 6 months?" In the "stages of change" model, these smokers would be "precontemplators" (see *Stages of change).*

Analysis of 1996/97 NPHS data revealed that half of daily smokers (51% of men and 53% of women) had no plans to quit in the immediate future. And indeed, two years later, just 19% of the men and 13% of the women in this group reported that they had tried to quit or had actually quit. This compared with 31% of daily smokers who had been seriously considering quitting in 1996/97.

In the 2003 CCHS, the question that identified persistent smokers was asked in only three provinces. In each of these provinces, the percentage of daily smokers not planning to quit had declined substantially since 1996/97: from 60% to 35% in Newfoundland; from 60% to 37% in Québec; and from 49% to 35% in Saskatchewan.

In 2003, for women, but not men, being a persistent smoker was strongly associated with cigarette consumption. Women who smoked 25 or more cigarettes a day had about twice the odds of being persistent smokers, compared with light smokers (Appendix Tables A and B). Surprisingly, men whose cigarette consumption was in the moderate range were actually less likely to be persistent smokers than those who were light smokers; for men who were heavy smokers, there was no significant difference.

For both sexes, living in a home where smoking was banned reduced the odds of being a persistent smoker, although the relationship was not significant for men when the effects of the other variables were taken into account.

Elderly people had around twice the odds of being persistent smokers, compared with people aged 30 to 64. At older ages, smokers may be particularly resistant to quitting, so special intervention programs may be required to convince them to consider doing so.[28]

While some associations were found between socio-economic status and being a persistent smoker, the only one that remained significant when the effects of the other factors were taken into account was not having graduated from secondary school for men. As well, men living in households with young children were less likely to be persistent smokers than those in households without young children.

Analytical techniques

Daily and occasional smoking prevalence rates from 1994/95 to 2003 were estimated using cross-sectional data from the National Population Health Survey (NPHS) and the Canadian Community Health Survey (CCHS).

The analyses of factors associated with smoking cessation and relapse were based on longitudinal data from cycles 1 to 5 (1994/95 to 2002/03) of the NPHS. For both sets of analyses, "pooling of repeated observations" combined with logistic regression analysis was used.[12,29] This method is particularly useful in predicting the short-term risk of an event where the risk factors associated with the event may change over time.[12] While trying to quit, smokers may relapse several times before succeeding, and risk factors such as emotional support and stress levels may vary.[4]

The analysis of factors associated with smoking cessation was based on daily smokers aged 18 or older. Quitting was defined as a transition from being a daily smoker to a non-smoker between two consecutive NPHS cycles.

The analysis used four cohorts of pooled observations. The baseline years for these four cohorts were 1994/95, 1996/97, 1998/99 and 2000/01. For each baseline year, all daily smokers aged 18 or older were selected. They were considered to be quitters if, in the follow-up interview two years later, they reported not smoking at all.

Sample sizes for daily smokers and quitters

			Daily smokers (baseline)		Quitters (follow-up)	
Cohort	Baseline	Follow-up	Men	Women	Men	Women
1	1994/95	1996/97	1,650	1,701	146	180
2	1996/97	1998/99	1,538	1,532	189	157
3	1998/99	2000/01	1,325	1,413	180	195
4	2000/01	2002/03	1,095	1,145	178	181
Total			5,608	5,791	693	713

Logistic regression analysis was then used on this pooled set of observations to examine smokers' characteristics at the baseline year in relation to having quit two years later. Unadjusted odds were calculated to examine the individual relationship of each factor to quitting, and multiple logistic regression analysis was used to estimate the effect of each factor conditional on the effects of a combination of factors. Variables entered into the multivariate model, which were selected based on the literature and availability in the NPHS, included smoking behaviours, chronic conditions, health behaviours, psycho-social factors, and socio-economic characteristics (see *Definitions*). Certain variables that the literature suggests may be related to smoking cessation and relapse were not included in every NPHS cycle. In such cases, the logistic regression models were run only on the cohorts for whom information was collected for in the baseline year. These variables were: timing of the first cigarette of the day (cohorts 2, 3, 4), workplace smoking bans (cohorts 2, 3, 4), emotional support (cohorts 1, 2) and chronic stress (cohorts 1, 4).

The analysis of factors associated with relapsing was similar. For each of the four baseline years, former daily smokers aged 18 or older were selected (did not currently smoke but in the past had smoked daily). A "relapser" was defined as a former daily smoker who reported smoking daily at their follow-up interview two years later.

Sample sizes for former daily smokers and "relapsers"

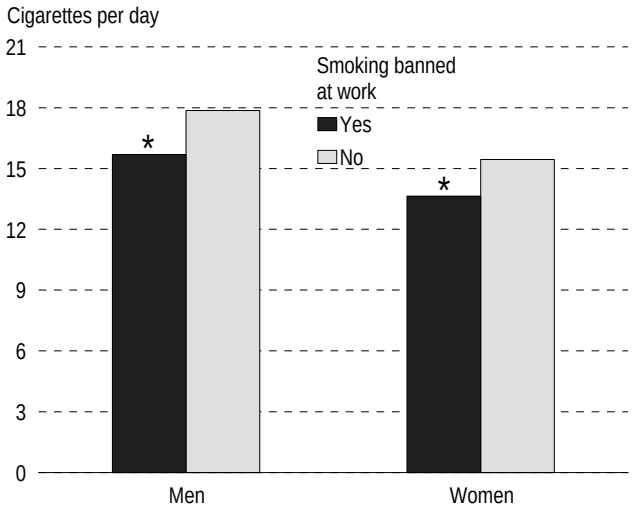
			Former daily smokers (baseline)		"Relapsers" (follow-up)	
Cohort	Baseline	Follow-up	Men	Women	Men	Women
1	1994/95	1996/97	1,602	1,429	68	69
2	1996/97	1998/99	1,595	1,449	72	84
3	1998/99	2000/01	1,522	1,382	67	48
4	2000/01	2002/03	1,575	1,551	54	64
Total			6,294	5,811	261	265

The number of years since quitting was a strong predictor of relapse. Therefore, in the first set of regressions, relapsing was examined in relation to each risk factor, controlling for years since quitting. In the second set, the additional variables were similar to those used in the quitting models, and again, associations with variables only asked at certain NPHS cycles were studied based on the applicable cohorts.

The analysis of factors associated with having no plans to quit in the next six months (persistent smokers) was based on 2003 CCHS cross-sectional data for Newfoundland, Québec and Saskatchewan. In these provinces, the sample sizes for daily smokers were 3,606 for men and 3,833 for women. Of these daily smokers, 1,311 men and 1,538 women had no plans to quit. Again, logistic regression was used, and the unadjusted and adjusted odds associated with being a persistent smoker were estimated with models similar to those using for quitting.

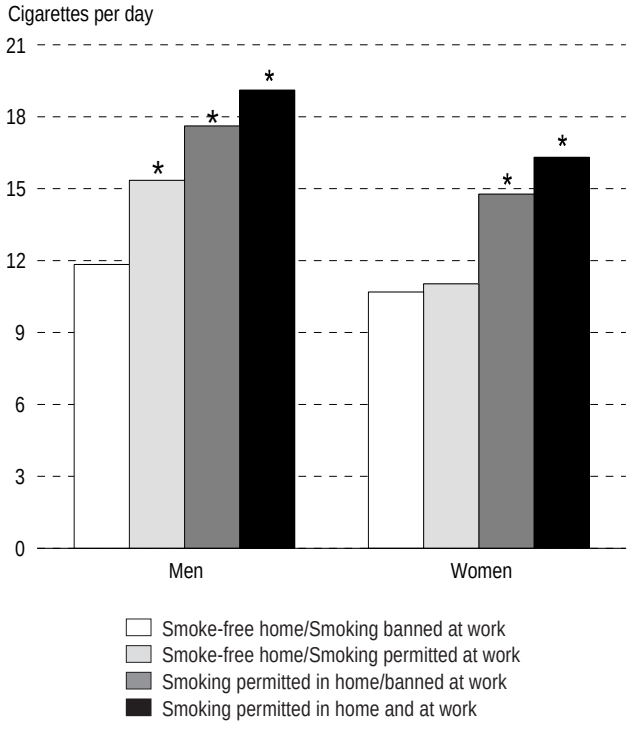
Variances on smoking prevalence rates, quitting rates, relapse rates, differences between rates and on odds ratios were calculated using the bootstrap technique, which accounts for survey design effects.[30-32]

Chart 3
Average number of cigarettes smoked per day, by workplace smoking restrictions and sex, employed daily smokers aged 18 to 54, Canada excluding territories, 2003



Data source: 2003 Canadian Community Health Survey
** Significantly lower than estimate for "no" (p < 0.05)*

Chart 4
Average number of cigarettes smoked per day, by workplace and household smoking restrictions and sex, employed daily smokers aged 18 to 54, Canada excluding territories, 2003



Data source: 2003 Canadian Community Health Survey
** Significantly higher than estimate for previous category(ies) (p < 0.05)*

quitting. This accords with other research showing that a long-standing illness is not related to smoking cessation,[14,19] but that recently detected health problems may provide the needed incentive.[8,12] Somewhat surprisingly, neither a pre-existing nor a newly diagnosed respiratory condition (chronic bronchitis, emphysema or asthma) was associated with quitting.

The relationship between weight and smoking is complex. Although overweight and obese smokers may wish to quit because of the added health risks, concern about subsequently gaining even more weight may be a deterrent. Based on NPHS data, daily smokers who were overweight or obese were no more or less likely to quit than were those whose weight was in the normal range.

Consistent with the literature,[14,21,23,33] heavy drinking reduced the likelihood of smoking cessation for both sexes. However, when the other factors were taken into account, the relationship did not remain significant for men.

Moderate or high psychological distress and low emotional support reduced the odds that male smokers would quit. Neither distress nor emotional support affected female smokers' odds of quitting. For women, chronic stress was more important; those who reported six or more stressors had half the odds of quitting, compared with women who reported no stressors or just one.

Socio-demographic factors

Socio-economic status has repeatedly been related to smoking cessation.[3,8,12-14,17,19,21-23,28] And based on analyses of NPHS data, higher levels of education and household income were associated with quitting for both sexes, even when the effects of the other variables were taken into account (Tables 2 and 3).

Men's odds of quitting did not vary by age. By contrast, women aged 18 to 29 had high odds of quitting, compared with those aged 30 to 64. Younger women's advantage may, in part, be attributable to plans to become pregnant or to being pregnant. Women are more likely to stop smoking during pregnancy than at any other time in their lives.[5] Another possibility is that medical

Definitions

To classify smokers, the National Population Health Survey (NPHS) and the Canadian Community Health Survey (CCHS) asked:

1. At the present time do you smoke cigarettes daily, occasionally or not at all?
2. Have you ever smoked cigarettes daily?

Daily smokers were those who answered "daily" to question 1; *occasional smokers* were those who answered "occasionally." *Former daily smokers* were those who answered "not at all" to question 1 and "yes" to question 2.

Smoking cessation and *relapsing* were defined by comparing successive pairs of cycles of the NPHS, which is conducted every two years. For each pair of cycles, smoking status was derived for the baseline and follow-up interviews. *Quitters* were those who reported smoking cigarettes daily at the baseline interview and not at all at the follow-up interview. *Relapsers* were former daily smokers at the baseline interview who reported that they smoked daily two years later at the follow-up interview.

Daily smokers who responded "no" to the following question were defined as *persistent smokers*: "Are you seriously considering quitting within the next 6 months?" In the 1996/97 NPHS, all daily smokers were asked this question, but in the 2003 CCHS, the question was asked in just three provinces: Newfoundland, Québec and Saskatchewan.

Smoking intensity was assessed by asking daily smokers and former daily smokers the number of cigarettes smoked each day. *Light smokers* were those who answered 1 to 9; *moderate smokers*, 10 to 24; and *heavy smokers*, 25 or more.

The timing of the *first cigarette of the day* was established with the question: "How soon after you wake up do you smoke your first cigarette?" The possible response categories were: within 5 minutes; 6 to 30 minutes; 31 to 60 minutes; and more than 60 minutes.

Age of smoking initiation was established with the question: "At what age did you begin smoking cigarettes daily?" Responses were grouped into two categories: younger than 18, and 18 or older.

For the analyses based on NPHS data, a *smoke-free home* was defined as a response of "no" to the question: "Does anyone in this household smoke regularly inside the house?" For the analyses based on CCHS data, two questions were used to identify *smoke-free homes*: "Are there any restrictions against smoking cigarettes in your home?" Those who responded "yes" were asked: "How is smoking restricted in your home?" The possible responses were: smokers are asked to refrain from smoking in the house; smoking is allowed in certain rooms only; smoking is restricted in the presence of young children; or other restriction. Respondents were defined as living in smoke-free homes if they said that smokers were asked to refrain from smoking in the house.

Workplace smoking restrictions were measured by asking employed respondents if smoking at their place of work was: restricted completely; allowed only in designated areas; restricted only in certain places; or not restricted at all. The "restricted completely" group was compared with the other three categories combined.

Respondents were asked if they had "any long-term health conditions that have lasted or are expected to last six months or more that have been diagnosed by a health professional." The interviewer then read a checklist. Two groups of *chronic conditions* were considered in this analysis: *vascular* (high blood pressure, heart disease, the effects of a stroke, and diabetes) and *respiratory* (asthma and chronic bronchitis or emphysema). In the analysis of quitting smoking, three categories were considered for each group of conditions: those who had one or more newly diagnosed condition(s) between the baseline and follow-up interviews; those who did not have a new condition but had reported at least one condition at the baseline year, and those with no conditions.

Weight was defined in terms of body mass index (BMI), which was calculated by dividing weight in kilograms by the square of height in metres. BMI is not calculated for pregnant women. Based on the World Health Organization's standards,[34] BMI was grouped into two categories: overweight or obese (BMI 25.0 or more) and not overweight (less than 25.0).

Heavy drinking was measured by asking respondents the number of times in the past year they had had five or more alcoholic drinks on one occasion. Those who reported that this had occurred at least once a month were classified as heavy drinkers. (In cycle 1, NPHS respondents were asked the exact number of times in the past year they had had five or more drinks on one occasion. Heavy drinkers were defined as those who reported 12 or more times.)

Psychological distress was based on responses to the following:

During the past month, about how often did you feel:

... so sad that nothing could cheer you up?
... nervous?
... restless or fidgety?
... hopeless?
... worthless?
... that everything was an effort?

Each question was answered on a five-point scale: all of the time (score 4), most of the time (3), some of the time (2), a little of the time (1), or none of the time (0). The possible range of scores was 0 to 24. High distress was defined as a score of 7 or more (an

Definitions - continued

average score per item of over 1), moderate distress as 1 to 6, and low distress as 0.

Four "yes/no" questions were used to measure perceived *emotional support*.

- Do you have someone you can talk to about your private feelings or concerns?
- Do you have someone you can really count on in a crisis situation?
- Do you have someone you can really count on to give you advice when you are making important personal decisions?
- Do you have someone who makes you feel loved and cared for?

Respondents were classified as having low emotional support if they answered "no" to at least one question.

Chronic stress was measured by asking respondents to reply "true" or "false" to 17 statements:

1) You are trying to take on too many things at once.
2) There is too much pressure on you to be like other people.
3) Too much is expected of you by others.
4) You don't have enough money to buy the things you need.
5) Your partner doesn't understand you.
6) Your partner doesn't show enough affection.
7) Your partner is not committed enough to your relationship.
8) You find it is very difficult to find someone compatible with you.
9) One of your children seems very unhappy.
10) A child's behaviour is a source of serious concern to you.
11) Your work around the home is not appreciated.
12) Your friends are a bad influence.
13) You would like to move but you cannot.
14) Your neighbourhood or community is too noisy or too polluted.
15) You have a parent, child or partner who is in very bad health and may die.
16) Someone in your family has an alcohol or drug problem.
17) People are too critical of you or what you do.

Respondents were classified as having high stress if they replied "true" to 6 or more items, moderate stress (2 to 5), and low stress (1 or 0).

In the 2003 CCHS, *self-perceived stress* was measured by asking, "Thinking about the amount of stress in your life, would you say most days are: not at all stressful? not very stressful? a bit stressful? quite a bit stressful? extremely stressful?" Respondents who indicated the last two categories were classified as having high self-perceived stress.

Three *age groups* were established for this analysis: 18 to 29, 30 to 64, and 65 or older.

Respondents were grouped into four education categories based on the highest level attained: less than secondary graduation, secondary graduation, some postsecondary, and postsecondary graduation.

Household income was based on the number of people in the household and total household income from all sources in the 12 months before the interview.

Household income group	People in household	Total household income
Lowest	1 to 4	Less than $10,000
	5 or more	Less than $15,000
Lower-middle	1 or 2	$10,000 to $14,999
	3 or 4	$10,000 to $19,999
	5 or more	$15,000 to $29,999
Middle	1 or 2	$15,000 to $29,999
	3 or 4	$20,000 to $39,999
	5 or more	$30,000 to $59,999
Upper-middle	1 or 2	$30,000 to $59,999
	3 or 4	$40,000 to $79,999
	5 or more	$60,000 to $79,999
Highest	1 or 2	$60,000 or more
	3 or more	$80,000 or more

professionals urge women of reproductive age to stop smoking if they are taking oral contraceptives.

Male smokers in homes with young children were more likely to quit than were those in households without young children. For female smokers, the presence of young children in the household was not associated with smoking cessation, possibly because those most likely to quit had already done so during pregnancy.

Relapse rates

Not every smoker who quits quits for good. A number of attempts over several years may be needed before achieving abstinence.[6,16] In the

NPHS, it was possible to identify non-smokers who reported that in the past they had smoked cigarettes daily. When they were re-interviewed two years later, some of these former smokers had resumed daily smoking. They were defined as "relapsers." Over the eight years from 1994/95 to 2002/03, the two-year relapse rate was relatively stable at approximately 4% for both sexes (Table 5).

Relapsing was strongly associated with the length of time since quitting. Approximately 20% of those who had quit for two years or less started smoking again within the next two years. By contrast, 5% who had quit for three to five years resumed smoking, and among those who had quit for more than five years, the figure was 1% (Chart 5).

The factors related to relapsing were not necessarily the same as those related to quitting. In other words, circumstances and characteristics that are significant at one "stage of change" may not be important at another.

Although high cigarette consumption was strongly associated with a reduced likelihood of quitting, the relationship with relapsing was not as clear (Tables 6 and 7).[8,12,16,20,35] For instance, women who had been moderate or heavy smokers were more likely to relapse than were those who had been light smokers, but the pattern was not the same for men. While men who had been moderate smokers were more likely to relapse than those who had been light smokers, those who had been heavy smokers were no more or less likely to relapse.

The presence of smokers in the household or in the immediate social environment of a former smoker has been identified as a predictor of relapse.[16,35] And according to the results of the analysis of NPHS data, men living in smoke-free homes had lower odds of relapsing than did men in homes where other members smoked. However, living in a smoke-free home was not related to relapsing among women.

In 1998/99, for the first time, the NPHS asked both smokers and non-smokers about workplace smoking bans. Although sample sizes were too small for this variable to be considered in the multivariate models, it was possible to calculate two-year relapse rates. Women who worked in locations where smoking was banned were less likely to relapse than were those who could smoke at work. By contrast, relapse rates for men were similar, regardless of workplace smoking restrictions (data not shown).

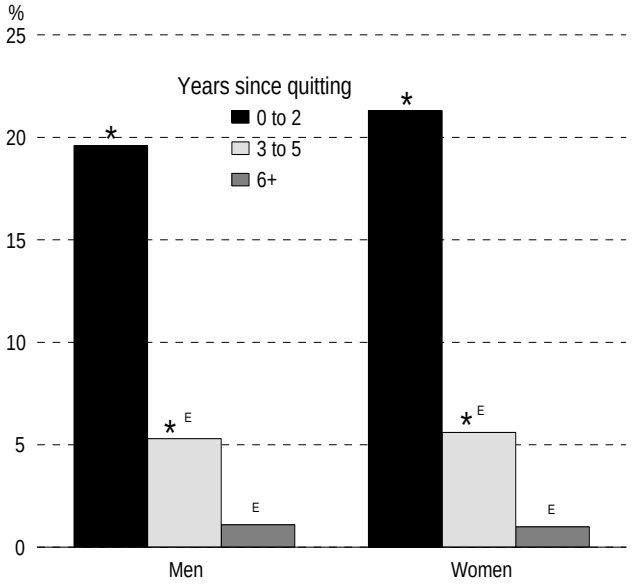
Women, but not men, with a respiratory condition had low odds of relapsing. For men, being overweight or obese reduced the odds of relapse, but for women, weight was not significant.

Table 5
Two-year relapse rates among former daily smokers, by sex, household population aged 18 or older, Canada excluding territories, 1994/95 to 2002/03

	Both sexes	Men	Women
	%	%	%
Overall two-year relapse rate	4.2	3.8	4.7
1994/95 to 1996/97	4.2	3.6[E]	4.9
1996/97 to 1998/99	4.7	4.1	5.5
1998/99 to 2000/01	4.0	4.3	3.6[E]
2000/01 to 2002/03	4.0	3.3	4.7[E]

Data source: 1994/95 to 2002/03 National Population Health Survey, longitudinal sample, Health file (square)
E Coefficient of variation 16.6% to 33.3%

Chart 5
Two-year relapse rates, by years since quitting and sex, former daily smokers aged 18 or older, Canada excluding territories, 1994/95 to 2002/03



Data source: 1994/95 to 2002/03 National Population Health Survey, longitudinal sample, Health file (square)
** Significantly higher than estimate(s) for subsequent group(s) (p < 0.05)*
E Coefficient of variation 16.6% to 33.3%

Some studies have found that alcohol use was related to taking up smoking again,[16,21,33] but based on NPHS data, heavy drinking was not a significant factor for either sex.

Emotional support was not associated with relapsing among former daily smokers. However, women with at least moderate chronic stress or high psychological distress were more likely to start smoking again than were those with low levels of stress and psychological distress.

Women aged 18 to 29 were more likely than middle-aged women to quit, yet they were also more likely to relapse. Male and female former smokers aged 65 or older were less likely than middle-aged people to relapse, but this association disappeared when the other factors were taken into account.

Although men in households with young children were more likely to quit smoking, they were also more likely to relapse. However, when all the other factors were considered, this association only approached significance (p=0.052).

Table 6
Odds ratios relating selected characteristics of male former daily smokers to relapsing in a two-year period, household population aged 18 or older, Canada excluding territories, 1994/95 to 2002/03

	Adjusted odds ratio‡	95% confidence interval	Adjusted odds ratio§	95% confidence interval
Men				
Years since quitting				
0 to 2	23.0*	15.5,34.1	18.9*	12.0,29.7
3 to 5	5.2*	3.1, 8.9	4.3*	2.4, 7.6
6+†	1.0	...	1.0	...
Cigarettes per day (before quitting)				
1 to 9 (light)†	1.0	...	1.0	...
10 to 24 (moderate)	2.2*	1.2, 3.9	2.1*	1.2, 3.7
25 or more (heavy)	1.6	0.8, 3.0	1.6	0.8, 3.2
Age of smoking initiation				
Younger than 18	1.1	0.7, 1.8	1.1	0.7, 1.7
18 or older†	1.0	...	1.0	...
Smoke-free home				
Yes	0.6*	0.4, 0.9	0.6*	0.4, 0.9
No†	1.0	...	1.0	...
Chronic condtions				
Vascular				
One or more	0.8	0.5, 1.2	1.0	0.6, 1.6
None†	1.0	...	1.0	...
Respiratory				
One or more	1.2	0.7, 2.2	1.3	0.7, 2.5
None†	1.0	...	1.0	...
Body mass index (BMI)				
Not overweight (< 25)†	1.0	...	1.0	...
Overweight/Obese (≥ 25)	0.7*	0.5, 1.0	0.6*	0.5, 0.9
Heavy drinking				
Yes	1.2	0.8, 1.7	1.1	0.7, 1.5
No†	1.0	...	1.0	...
Psychological distress				
Low†	1.0	...	1.0	...
Moderate	1.1	0.8, 1.6	1.0	0.7, 1.5
High	1.0	0.5, 1.8	0.9	0.5, 1.7
Low emotional support††				
Yes	0.8	0.5, 1.5	0.9	0.5, 1.6
No†	1.0	...	1.0	...
Chronic stress‡‡				
0 to 1 stressor (low)†	1.0	...	1.0	...
2 to 5 stressors (moderate)	1.1	0.6, 1.9	1.0	0.5, 1.8
6 or more stressors (high))	1.3	0.6, 2.7	1.0	0.4, 2.3
Age group				
18 to 29	1.2	0.7, 1.9	1.0	0.7, 1.7
30 to 64†	1.0	...	1.0	...
65 or older	0.5*	0.3, 0.9	0.5	0.3, 1.1
Education				
Less than secondary graduation	1.0	0.6, 1.6	1.1	0.6, 1.8
Secondary graduation	1.2	0.6, 2.1	1.1	0.6, 1.9
Some postsecondary	1.2	0.7, 2.0	1.1	0.6, 1.8
Postsecondary graduation†	1.0	...	1.0	...
Household income				
Low/Lower-middle	1.4	0.9, 2.2	1.4	0.9, 2.4
Middle/Upper-middle/High†	1.0	...	1.0	...
Child(ren) aged 5 or younger in household				
Yes	1.6*	1.0, 2.5	1.5	1.0, 2.4
No†	1.0	...	1.0	...

Data source: 1994/95 to 2002/03 National Population Health Survey, longitudinal sample, Health file (square)
† Reference category
‡ Adjusted for years since quitting
§ Adjusted for years since quitting, cigarettes per day, age of smoking initiation, smoke-free home status, chronic conditions (vascular and respiratory), BMI, heavy drinking, psychological distress, age, education, household income and children 5 or younger in household (see Analytical techniques*)*
†† Based on cohorts 1 and 2 (see Analytical techniques*)*
‡‡ Based on cohorts 1 and 4 (see Analytical techniques*)*
** p < 0.05*
··· Not applicable

Table 7
Odds ratios relating selected characteristics of female former daily smokers to relapsing in a two-year period, household population aged 18 or older, Canada excluding territories, 1994/95 to 2002/03

	Adjusted odds ratio‡	95% confidence interval	Adjusted odds ratio§	95% confidence interval
	Women			
Years since quitting				
0 ro 2	25.9*	17.0,39.5	18.3*	11.1,30.1
3 to 5	5.7*	3.2,10.3	4.4*	2.4, 8.2
6+†	1.0	...	1.0	...
Cigarettes per day (before quitting)				
1 to 9 (light)†	1.0	...	1.0	...
10 to 24 (moderate)	2.2*	1.3, 3.6	2.5*	1.5, 4.3
25 or more (heavy)	2.4*	1.4, 4.1	2.9*	1.6, 5.4
Age of smoking initiation				
Younger than 18	1.6*	1.1, 2.4	1.2	0.8, 1.8
18 or older†	1.0	...	1.0	...
Smoke-free home				
Yes	0.9	0.5, 1.4	1.0	0.6, 1.6
No†	1.0	...	1.0	...
Chronic conditions				
Vascular				
One or more	0.5*	0.3, 0.9	0.7	0.4, 1.1
None†	1.0	...	1.0	...
Respiratory				
One or more	0.6	0.3, 1.0	0.5*	0.3, 1.0
None†	1.0	...	1.0	...
Body mass index (BMI)				
Not overweight (< 25)†	1.0	...	1.0	...
Overweight/Obese (≥ 25)	1.0	0.7, 1.4	1.1	0.8, 1.5
Heavy drinking				
Yes	1.6	0.9, 2.8	1.4	0.7, 2.5
No†	1.0	...	1.0	...
Psychological distress				
Low†	1.0	...	1.0	...
Moderate	1.0	0.7, 1.5	0.9	0.6, 1.4
High	2.0*	1.1, 3.4	1.7*	1.0, 2.8
Low emotional support††				
Yes	1.4	0.7, 2.7	1.6	0.8, 3.0
No†	1.0	...	1.0	...
Chronic stress‡‡				
0 to 1 stressor (low)†	1.0	...	1.0	...
2 to 5 stressors (moderate)	2.1*	1.2, 3.6	1.9*	1.1, 3.4
6 or more stressors (high))	2.5*	1.3, 4.6	2.8*	1.4, 5.6
Age group				
18 to 29	1.8*	1.2, 2.8	2.1*	1.3, 3.4
30 to 64†	1.0	...	1.0	...
65 or older	0.6*	0.3, 1.0	0.7	0.4, 1.3
Education				
Less than secondary graduation	1.2	0.7, 2.0	1.3	0.8, 2.2
Secondary graduation	1.1	0.7, 1.9	1.1	0.6, 1.8
Some postsecondary	1.4	0.9, 2.0	1.3	0.8, 1.9
Postsecondary graduation†	1.0	...	1.0	...
Household income				
Low/Lower-middle	1.2	0.8, 1.7	1.2	0.8, 1.7
Middle/Upper-middle/High†	1.0	...	1.0	...
Child(ren) aged 5 or younger in household				
Yes	1.1	0.8, 1.7	0.9	0.6, 1.3
No†	1.0	...	1.0	...

Data source: 1994/95 to 2002/03 National Population Health Survey, longitudinal sample, Health file (square)
† Reference category
‡ Adjusted for years since quitting
§ Adjusted for years since quitting, cigarettes per day, age of smoking initiation, smoke-free home status, chronic conditions (vascular and respiratory), BMI, heavy drinking, psychological distress, age, education, household income and children 5 or younger in household (see Analytical techniques*)*
†† Based on cohorts 1 and 2 (see Analytical techniques*)*
‡‡ Based on cohorts 1 and 4 (see Analytical techniques*)*
** p < 0.05*
··· Not applicable

Concluding remarks

In 2003, 19% of the Canadian population aged 18 or older were daily smokers. Although this was down 7 percentage points from the early 1990s, it is still high in light of the serious health effects of smoking.[3]

A recent study found that the gap in life expectancy between smokers and non-smokers has widened over the past few decades.[2] Recent cohorts of smokers took up the habit at earlier ages and smoked substantially more cigarettes over their lifetime resulting in increased mortality rates. This disturbing trend underscores the importance of smoking cessation programs for all ages and the value of gaining an understanding of the stages a smoker goes through on the journey to quitting.

Analysis of data from the National Population Health Survey and the Canadian Community Health Survey shows that the factors associated with smoking cessation, relapsing and having no plans to quit were not necessarily the same. However, the number of cigarettes smoked each day emerged as one of the most important.

Limitations

For this article, smoking prevalence rates over the past 10 years were estimated based on data from the National Population Health Survey (NPHS) and the Canadian Community Health Survey (CCHS). The questions about smoking in both surveys were asked in the context of a general health survey. Smoking prevalence can also be estimated from Statistics Canada's Canadian Tobacco Use Monitoring Survey (CTUMS), which was designed to produce semi-annual smoking rates. Trends based on CTUMS data are similar to those in the NPHS and CCHS, in that prevalence is declining, but the CTUMS rates have been consistently lower.[36] A study carried out to determine why the rates differ suggested that people are more inclined to talk about smoking when the topic is included in a broader survey.[37]

The NPHS collects information about the smoking status of the selected respondent only; the smoking status of other household members is not known. Therefore, it was not possible to determine if the presence of other smokers in the household was related to quitting, relapsing or being a persistent smoker. Furthermore, if the effects of this variable could have been controlled, associations with smoke-free home status might have been altered.

Although self-perceived emotional support was examined in relation to various stages of smoking cessation, it is not known if the support was aimed at helping the smoker quit. Other studies have found that smoking-specific support is positively associated with quitting and negatively associated with relapsing.[38,39]

The definition of quitting used in this analysis required only that people who were smokers at the baseline interview did not smoke at the follow-up interview two years later. However, this group of "quitters" consists of people who quit the day before the follow-up interview, as well as those who had not smoked for close to two years. Similarly, former smokers who began smoking again may have relapsed the day before the follow-up interview or almost two years earlier. The extent to which such diversity among quitters and relapsers affected associations with baseline characteristics is unknown.

To maximize sample size and increase precision, the sample considered for the smoking cessation and relapse analyses comprised all respondents to cycle 1 of the NPHS, regardless of their response status in subsequent cycles. For the smoking cessation analysis, two-year quitting records were created for cases where a respondent was a daily smoker in the baseline year and smoking status was known in the follow-up interview (see *Analytical techniques*). Likewise for the relapse analysis, two-year relapse records were created for respondents who were former daily smokers at the baseline year and smoking status was known in the follow-up interview. If there was a non-response in either the baseline or follow-up interview, records were not created for inclusion in the analyses. The survey weights were based on the response status in cycle 1 and were not inflated to account for subsequent non-response. This could have biased the estimates if the characteristics of continuers in the longitudinal panel differed from non-respondents.

To assess the potential for non-response bias in the smoking cessation analysis, the characteristics of continuers and dropouts at the baseline interview were compared. (Continuers were those whose smoking status was known in the follow-up interview versus those who were excluded from the analysis owing to non-response in the follow-up interview.) In total, 12,750 respondents were identified as daily smokers across the four baseline interviews; 11,399 were included in the analysis, and 1,351 were excluded because of non-response in the follow-up interview (dropouts). For the relapse analysis, 13,083 former daily smokers were identified across the four baseline interviews; 12,105 were included in the analysis, and 978 were dropouts. In both cases, dropouts were slightly more likely to be men, to be young (18 to 29), and to have low incomes. For the quitting analysis, dropping out was also associated with having less than secondary graduation. Smoking intensity was not associated with dropping out in either analysis.

In some cases, small sample sizes precluded examining certain variables. For example, although being diagnosed with cancer may be related to quitting, sample sizes were too small to consider this variable. As well, small sample sizes necessitated broad age groups (18 to 29, 30 to 64, and 65 or older), which may have masked associations that would have been evident if finer age breakdowns had been possible.

Findings related to home and workplace smoking bans are particularly intriguing. Both types of ban were associated with reduced consumption. And given the strong link between cigarettes smoked per day and quitting, smoking bans may be an indirect means of reducing consumption and ultimately facilitating cessation.

The chances of relapse among former smokers diminished with time. This suggests that support in the early phases of quitting may be especially beneficial in strengthening the resolve of those who have made the difficult decision to stop smoking.

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Appendix

Table A
Odds ratios relating selected characteristics to persistent daily smoking among men, household population aged 18 or older, Newfoundland, Québec and Saskatchewan, 2003

	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio‡	95% confidence interval
Men				
Cigarettes per day				
1 to 9 (light)†	1.0	...	1.0	...
10 to 24 (moderate)	0.7*	0.5, 0.9	0.7*	0.5, 1.0
25 or more (heavy)†	1.2	0.8, 1.7	1.1	0.8, 1.7
First cigarette of day§				
Within 5 minutes of waking	1.0	0.7, 1.5	0.8	0.5, 1.3
6 to 30 minutes after waking	0.9	0.6, 1.3	0.8	0.6, 1.3
31 to 60 minutes after waking	0.7	0.5, 1.1	0.7	0.4, 1.2
More than an hour after waking†	1.0	...	1.0	...
Age of smoking initiation				
Younger than 18	1.2	0.9, 1.5	1.1	0.9, 1.4
18 or older†	1.0	...	1.0	...
Smoke-free home				
Yes	0.7*	0.5, 0.9	0.8	0.5, 1.2
No†	1.0	...	1.0	...
Smoking banned at work (workers aged 18 to 54)				
Yes	0.9	0.7, 1.3	1.0	0.7, 1.4
No†	1.0	...	1.0	...
Chronic conditions				
Vascular				
At least one	1.4*	1.0, 1.8	1.1	0.8, 1.5
None†	1.0	...	1.0	...
Respiratory				
At least one	1.0	0.7, 1.5	0.8	0.6, 1.1
None†	1.0	...	1.0	...
Body mass index (BMI)				
Not overweight (< 25)†	1.0	...	1.0	...
Overweight/Obese (≥ 25)	1.1	0.8, 1.4	1.1	0.8, 1.4
Heavy drinking				
Yes	0.9	0.7, 1.2	1.0	0.8, 1.4
No†	1.0	...	1.0	...
Self-perceived stress				
Low/Moderate†	1.0	...	1.0	...
High	0.9	0.7, 1.2	0.9	0.7, 1.2
Age group				
18 to 29	1.1	0.8, 1.5	1.2	0.9, 1.7
30 to 64†	1.0	...	1.0	...
65 or older	2.1*	1.5, 3.0	1.9*	1.2, 2.7
Education				
Less than secondary graduation	1.6*	1.2, 2.1	1.5*	1.1, 2.0
Secondary graduation	1.3	0.8, 1.9	1.3	0.8, 1.9
Some postsecondary	1.2	0.7, 2.0	1.3	0.7, 2.2
Postsecondary graduation†	1.0	...	1.0	...
Household income				
Low/Lower-middle	1.5*	1.0, 2.2	1.4	1.0, 2.0
Middle/Upper-middle/High†	1.0	...	1.0	...
Child(ren) aged 5 or younger in household				
Yes	0.6*	0.4, 0.9	0.6*	0.4, 0.9
No†	1.0	...	1.0	...

Data source: 2003 Canadian Community Health Survey
† Reference category
‡ Adjusted for number of cigarettes per day, age of smoking initiation, smoke-free home status, chronic conditions (vascular and respiratory), BMI, heavy drinking, age, education, household income and children 5 or younger in household
§ Based on Québec and Saskatchewan (not asked in Newfoundland)
** $p < 0.05$*
··· Not applicable

Table B
Odds ratios relating selected characteristics to persistent daily smoking among women, household population aged 18 or older, Newfoundland, Québec and Saskatchewan, 2003

	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio‡	95% confidence interval
Women				
Cigarettes per day				
1 to 9 (light)†	1.0	…	1.0	…
10 to 24 (moderate)	1.0	0.8, 1.3	0.9	0.7, 1.2
25 or more (heavy)	1.9*	1.4, 2.6	1.8*	1.3, 2.5
First cigarette of day§				
Within 5 minutes of waking	1.7*	1.2, 2.3	1.3	0.9, 1.8
6 to 30 minutes after waking	1.4*	1.0, 1.9	1.2	0.9, 1.7
31 to 60 minutes after waking	1.1	0.8, 1.6	1.0	0.7, 1.4
More than an hour after waking†	1.0	…	1.0	…
Age of smoking initiation				
Younger than 18	1.0	0.8, 1.3	1.0	0.8, 1.2
18 or older†	1.0	…	1.0	…
Smoke-free home				
Yes	0.6*	0.4, 0.9	0.7*	0.5, 1.0
No†	1.0	…	1.0	…
Smoking banned at work (workers aged 18 to 54)				
Yes	0.9	0.7, 1.2	1.1	0.8, 1.4
No†	1.0	…	1.0	…
Chronic conditions				
Vascular				
At least one	1.1	0.8, 1.4	1.0	0.7, 1.3
None†	1.0	…	1.0	…
Respiratory				
At least one	0.9	0.7, 1.3	0.8	0.6, 1.1
None†	1.0	…	1.0	…
Body mass index (BMI)				
Not overweight (< 25)†	1.0	…	1.0	…
Overweight/Obese (≥ 25)	1.1	0.9, 1.4	1.0	0.8, 1.3
Heavy drinking				
Yes	1.1	0.8, 1.5	1.1	0.8, 1.5
No†	1.0	…	1.0	…
Self-perceived stress				
Low/Moderate†	1.0	…	1.0	…
High	1.0	0.8, 1.3	1.1	0.9, 1.4
Age group				
18 to 29	1.0	0.8, 1.3	1.3	0.9, 1.7
30 to 64†	1.0	…	1.0	…
65 or older	1.7*	1.2, 2.3	1.7*	1.1, 2.5
Education				
Less than secondary graduation	1.4*	1.1, 1.8	1.3	0.9, 1.7
Secondary graduation	1.2	0.9, 1.7	1.2	0.9, 1.7
Some postsecondary	0.8	0.5, 1.3	0.8	0.5, 1.2
Postsecondary graduation†	1.0	…	1.0	…
Household income				
Low/Lower-middle	1.1	0.9, 1.5	1.1	0.8, 1.4
Middle/Upper-middle/High†	1.0	…	1.0	…
Child(ren) aged 5 or younger in household				
Yes	0.9	0.6, 1.2	1.0	0.7, 1.4
No†	1.0	…	1.0	…

Data source: 2003 Canadian Community Health Survey
† Reference category
‡ Adjusted for number of cigarettes per day, age of smoking initiation, smoke-free home status, chronic conditions (vascular and respiratory), BMI, heavy drinking, age, education, household income and children 5 or younger in household
§ Based on Québec and Saskatchewan (not asked in Newfoundland)
** $p < 0.05$*
··· Not applicable