

Smoking bans: Influence on smoking prevalence

Margot Shields

Abstract

Objectives

This article reports trends in smoking prevalence and smoking restrictions in Canada since 2000, and examines associations between home and workplace restrictions and smoking cessation.

Data sources

Data are from the Canadian Tobacco Use Monitoring Survey and the longitudinal component of the National Population Health Survey.

Analytical techniques

Trends in smoking prevalence and smoking restrictions were calculated. Associations between home and workplace smoking restrictions and smoking cessation were examined in the context of the Transtheoretical Model, which proposes that smokers go through five distinct stages in attempting to quit. The likelihood of current and former smokers being at specific stages was studied in relation to smoking restrictions at home and at work. Longitudinal data were used to determine if home and workplace smoking restrictions were predictors of quitting over a two-year period.

Main results

Since 2000, Canadian smokers have faced a growing number of restrictions on where they can smoke. Bans at home and at work were associated with a reduced likelihood of being in the initial "stages of change," and an increased likelihood of being in the latter stages. Smokers who reported newly smoke-free homes or workplaces were more likely to quit over the next two years, compared with those who did not encounter such restrictions at home or at work.

Keywords

Smoking prevalence; tobacco use; environmental tobacco smoke (ETS); smoking cessation; stages of change

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The health hazards of exposure to environmental tobacco smoke (ETS) are well documented.¹ As the 21st century began, smoking restrictions were proliferating, with provinces and major cities passing legislation to ban smoking in public places (Appendix Table A). By 2003, such laws were in effect in over 300 municipalities across Canada.²

The increase of smoking restrictions in public places raises an important question: how are legislated bans associated with smoking practices in the home? Citing the "last refuge" model, opponents of such legislation contend that restrictions in public places, particularly recreational venues, result in more smoking at home, and thereby increase the exposure of non-smoking family members to ETS.³ Alternatively, advocates of smoke-free legislation maintain that public bans actually encourage smoking restrictions in the home. This belief is consistent with the "social diffusion model," which suggests that public bans raise smokers' awareness of the harmful effects of ETS, so that they voluntarily impose bans in their homes.³

Several studies have shown that workplace restrictions are associated with a lower prevalence of smoking among workers, and also with smoking cessation.^{4,9} While the impact of home restrictions has not been studied as extensively,^{3,6,10-12} some evidence indicates that they are even more strongly associated with quitting than are workplace bans.⁶

Typically, studies of associations between smoking bans and cessation have considered only quitting as the outcome. However, according to the Transtheoretical Model (TTM),^{13,14} smokers go through five distinct stages in their attempts to quit. Advocates of the TTM argue that examining bans in relation to the “stages of change” is a more sensitive measure of progress. These five stages are precontemplation, contemplation, preparation, action, and maintenance:

- Smokers in the *precontemplation* stage have no plans to quit in the foreseeable future. They may wish to quit, but are not seriously thinking of doing so.
- At the *contemplation* stage, smokers recognize the problem and are seriously thinking about addressing it, usually within the next 6 months. These smokers will not necessarily quit within 6 months and may remain at the contemplation stage for a long time.
- The *preparation* stage involves a firm commitment to quit. Smokers at this stage have taken some initial steps to alter their behaviour and have immediate plans to quit.
- At the *action* stage, smokers have quit. Typically, the action stage is defined as being abstinent anywhere from one day to 6 months.
- *Maintenance* is the stage where ex-smokers work to prolong abstinence and become successful quitters.

This article describes the extent to which smokers in Canada have faced restrictions in their homes since the year 2000. Factors associated with the likelihood that smokers would live and work in environments where smoking is restricted are explored. A second objective is to examine whether smoking restrictions at home and at work are associated with smokers’ and former smokers’ being at specific phases of the stages of change.

Longitudinal data are used to determine if the imposition of new smoking restrictions is associated with quitting and with lower smoking intensity.

METHODS

Data sources

Cross-sectional

The cross-sectional estimates for smoking prevalence and smoking restrictions are from the Canadian Tobacco Use Monitoring Survey (CTUMS).¹⁵ The survey, which has been conducted annually since 1999, covers the household population aged 15 or older in the 10 provinces; it excludes residents of the territories and full-time residents of institutions. All interviews are by telephone, and proxy responses are not accepted.

Data are collected in two waves: from February to June, and from July to December. In addition to a file for each wave, an annual file is produced. Smoking trends in this article are based on the annual files for 2000 to 2005 and the wave 1 file for 2006. Responding sample sizes were:

Year	Sample size	Smokers
2000	20,415	5,632
2001	21,788	5,612
2002	23,341	5,443
2003	21,300	4,876
2004	20,275	4,438
2005	20,840	4,394
2006 (wave 1)	9,954	2,075

In 2005, the household response rate was 79.2%, and the person response rate was 84.1%, for an overall response rate of 66.6%.

Longitudinal

The analyses of associations between smoking restrictions and quitting are based on longitudinal data from the household component of the National Population Health Survey (NPHS). The NPHS, which began in 1994/1995, collects information about the health of Canadians every two years. The household component covers the population aged 12 or older living in private households in the 10 provinces, excluding people on Indian reserves, in the territories, on Canadian Forces bases, and in some remote areas.

In 1994/1995, 20,095 respondents were selected for the longitudinal panel. The response rate for this panel was 86.0%, yielding 17,276 respondents who were re-interviewed every two years. Based on these 17,276 individuals, the response rates for subsequent cycles were: 92.8% for 1996/1997 (cycle 2); 88.3% for 1998/1999 (cycle 3); 84.8% for 2000/2001 (cycle 4); 80.5% for 2002/2003 (cycle 5); and 77.4% for 2004/2005 (cycle 6). These analyses used the cycle 6 (2004/2005) longitudinal “square” file, which contains records for all responding members of the original panel, regardless of whether information about them was obtained in all subsequent cycles.

More detailed descriptions of the NPHS design, sample and interview procedures can be found in published reports.^{16,17}

Analytical techniques

Estimates of smoking prevalence and smoking restrictions from 2000 to 2006 were based on weighted cross-sectional data from the CTUMS.

With data from the 2005 CTUMS, cross-tabulations and logistic regression were used to study characteristics associated with smokers’ living and working in environments with smoking restrictions. The 2005 CTUMS was also used to examine whether the presence or absence of restrictions at home and at work was associated with smokers’ and former smokers’ being at the earlier or later “stages of change.”

Relationships between restrictions and quitting over a two-year period were examined with data from cycles 1 to 6 (1994/1995 to 2004/2005) of the NPHS. These analyses used “pooling of repeated observations,” combined with logistic regression.

Associations between *workplace* restrictions and quitting were based on four cohorts of pooled observations. Time 1 for these cohorts was 1996/1997, 1998/1999, 2000/2001 and 2002/2003, and time 2 was the respective follow-up interview two years later. For each cohort, all employed smokers aged 15 or older who reported no workplace smoking restrictions at time 1 were selected. (The 1994/95 NPHS did not include the question on smoking restrictions at work.) These smokers were

considered to be quitters if, in the follow-up interview two years later, they reported that they did not smoke. Sample sizes were:

Cohort	Time 1	Time 2	Employed smokers with no workplace restrictions (Time 1)	Employed quitters (Time 2)
1	1996/1997	1998/1999	448	50
2	1998/1999	2000/2001	423	71
3	2000/2001	2002/2003	282	43
4	2002/2003	2004/2005	211	43
Total			1,364	207

With this pooled set of observations, quitting was examined in relation to the imposition of new workplace restrictions. Quit rates among smokers who reported total and partial smoking restrictions at time 2 were compared with quit rates among those who continued to report no restrictions. Since both quitting and new workplace restrictions were considered only at the end of the two-year period, it is not known if quitting occurred before or after the new restrictions were imposed. However, this is not a serious limitation, since workers often quit smoking in anticipation of forthcoming workplace restrictions.⁵

Logistic regression was used to determine if associations between new workplace restrictions and quitting remained when smoking intensity, occupation and socio-economic characteristics were taken into account. These control variables were measured as of time 1.

A slightly different approach was used to examine associations between quitting and the imposition of new smoking restrictions at *home*. Rather than an explicit question about smoking restrictions in the home, the NPHS asks respondents if anyone in the household “smokes regularly inside the home.” In this analysis, a smoker was defined as living in a smoke-free home if the response to this question was “no.” However, the results could easily be confounded, because it would be common for a household to become smoke-free after one of its members had quit. It was necessary, therefore, to consider data from three consecutive NPHS cycles in order to establish that quitting took place after the home had become smoke-free.

This analysis was based on four cohorts of pooled observations. Time 1 for these cohorts was 1994/1995, 1996/1997, 1998/1999 and 2000/2001, and time 2 was the follow-up interview two years later. Each cohort consisted of smokers who reported that they did not live in smoke-free homes at time 1 and continued to smoke at time 2. They were defined as living in a “newly smoke-free home” if, at time 2, they reported they lived in a smoke-free home. Smoking status at time 3 was used to calculate quit rates.

Cohort	Time 1	Time 2	Time 3	Smokers at time 1 and time 2 not living in smoke-free homes at time 1	Quitters (Time 3)
1	1994/1995	1996/1997	1998/1999	2,732	288
2	1996/1997	1998/1999	2000/2001	2,349	294
3	1998/1999	2000/2001	2002/2003	1,913	300
4	2000/2001	2002/2003	2004/2005	1,469	222
Total				8,463	1,104

Quit rates (at time 3) among smokers who reported living in “newly smoke-free home” (at time 2) were compared with those for smokers who continued to live (at time 2) in homes that were not smoke-free. Logistic regression was used to determine if associations between living in a “newly smoke-free home” and quitting remained when smoking intensity and socio-economic characteristics were taken into account. All of these control variables were measured as of time 1.

To account for the survey design effects of the CTUMS and NPHS, standard errors and p-values were estimated, and significance tests were performed using the bootstrap technique.¹⁸⁻²⁰ The level of significance was set at $p < 0.05$. For the longitudinal analysis, use of the design-based bootstrapping technique for repeated observations, which eliminates the problem of dependence among observations derived from the same individuals, ensured that the variance was not underestimated.²¹

Definitions

Smokers were identified based on the question, “At the present time, do you smoke cigarettes every day, occasionally or not at all?” Those who said they

smoked every day or occasionally were defined as *current smokers*.

Former smokers were respondents who reported that they had smoked at least 100 cigarettes in their lives, but currently did not smoke.

For the analyses based on CTUMS data, smoking restrictions in the home were determined with the question: “Is smoking cigarettes allowed inside your home?” Those who responded “yes” were asked, “Is smoking cigarettes inside your home restricted in any way?” Smokers were defined as living in homes with:

- *total smoking restrictions* if they responded “no” to the first question.
- *partial smoking restrictions* if they responded “yes” to the first question and “yes” to the second.
- *no smoking restrictions* if they responded “yes” to the first question and “no” to the second.

The NPHS asks respondents if anyone in the household “smokes regularly inside the home.” Smokers were defined as living in a *smoke-free home* if the response to this question was “no.”

Both the CTUMS and NPHS ask employed smokers: “At your place of work, what are the restrictions on smoking?” The choices (read to respondents) are:

1. Restricted completely.
2. Allowed in designated places.
3. Restricted only in certain places.
4. Not restricted at all.

Smokers who indicated the first choice were classified as having *total smoking restrictions* at work; those who indicated the second or third choice were classified as having *partial smoking restrictions*; and those who indicated the fourth choice were classified as having *no restrictions*. The 1994/1995 NPHS did not include this question, and in 1996/1997, it was asked only of daily smokers.

In the 2005 CTUMS, the following questions were used to classify current smokers into the first three categories of the stages of change:

1. Are you seriously considering quitting smoking within the next 6 months?
2. Are you seriously considering quitting within the next 30 days?

3. In the past year, how many times did you stop smoking for at least 24 hours because you were trying to quit?

Smokers who answered “no” to the first item were defined as being in the *precontemplation* stage. Those who responded “yes” to the first item and either “no” to item 2 or “zero” to item 3 were defined as being in the *contemplation* stage. The *preparation* stage was defined as a positive response to items 1 and 2 and a response greater than zero to item 3. The last two stages of change were based on former smokers who had quit in the past 5 years: those who had quit in the past 6 months were defined as being at the *action* stage; otherwise, they were defined as being in the *maintenance* stage.

The CTUMS determined *smoking intensity* by asking smokers how many cigarettes they had smoked each day the previous week. Based on these responses, average daily cigarette consumption was determined. Occasional smokers who had not smoked in the past 30 days were excluded. The NPHS asked daily smokers how many cigarettes they smoked per day. Four categories of smoking intensity were defined: heavy (25 or more), moderate (10 to 24), light (less than 10), and occasional smoker.

For both the CTUMS and NPHS, respondents were grouped into *education* categories according to the highest level they had attained. The response categories differed somewhat between the two surveys.

For both the CTUMS and NPHS, *occupation* was categorized as white-collar (administrative, professional and clerical), sales or service, and blue-collar, based on the 1991 Standard Occupational Classification.²²

For the analyses using NPHS data, *household income* groups were derived by calculating the ratio between the total household income from all sources in the previous 12 months and Statistics Canada’s low-income cutoff (LICO) specific to the number of people in the household, the size of the community, and the survey year. These adjusted income ratios were then grouped into quintiles (5 groups, each containing one-fifth of the total population).

RESULTS

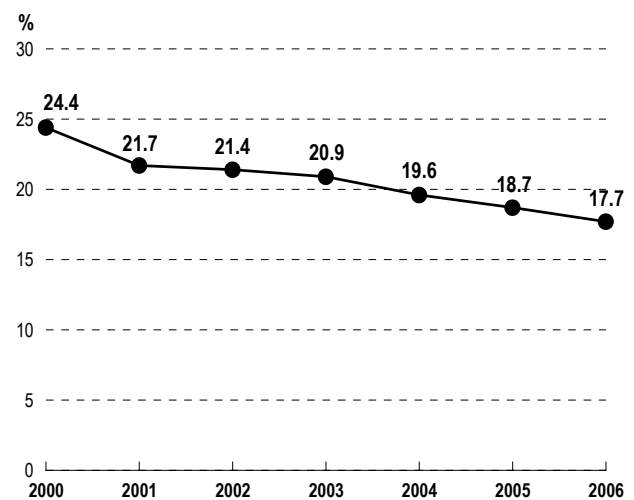
Prevalence of smoking and smoking restrictions

Between 2000 and 2006, the prevalence of smoking (daily and occasional) in Canada declined by almost seven percentage points from 24.4% to 17.7% (Chart 1). During the same period, the percentage of smokers reporting that they lived in homes where smoking was totally banned rose from 27% to 43%, with the sharpest increases occurring between 2001 and 2004 (Chart 2). The upturn was even more pronounced among those in households with a child younger than 15; from 2001 to 2004, this percentage rose from 35% to 55%.

In addition to the 40% of smokers who reported total home bans in 2005 (Chart 2), another 26% reported partial restrictions (Chart 3). When asked how smoking was restricted, the majority (71%) reporting partial restrictions said that smoking was allowed only in certain rooms (data not shown).

As well, the vast majority of employed smokers faced at least some restrictions at work: 42% reported that smoking was totally banned; 37% reported that it was allowed only in designated areas;

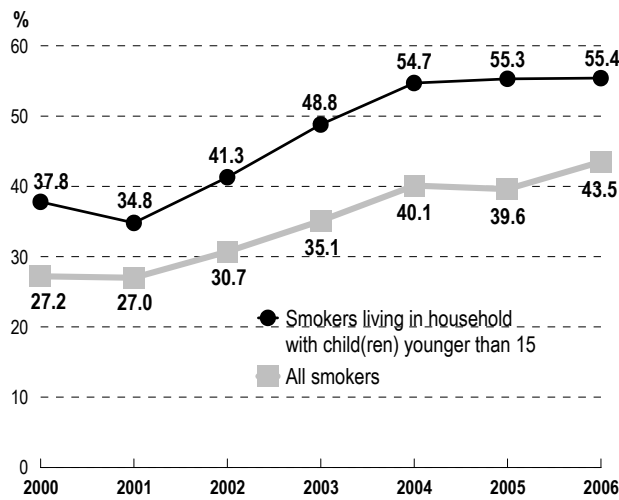
Chart 1
Percentage who smoke daily or occasionally, household population aged 15 or older, Canada excluding territories, 2000 to 2006



Note: The estimate for 2006 is based only on data collected during the first half of the year.

Source: 2000 to 2006 Canadian Tobacco Use Monitoring Survey

Chart 2
Percentage of smokers living in smoke-free homes, by presence of child(ren) younger than 15, household population aged 15 or older, Canada excluding territories, 2000 to 2006



Note: The estimate for 2006 is based only on data collected during the first half of the year.
Source: 2000 to 2006 Canadian Tobacco Use Monitoring Survey

9% said it was restricted only in certain places; and just 12% reported no restrictions at all (Chart 3). Methodological problems preclude the estimation of meaningful trends in total workplace bans, but it is possible to trace the percentage of employed smokers facing no restrictions. In 1998/1999, when the NPHS had asked the same question, 24% of employed smokers reported no restrictions at work (data not shown), double the 2005 CTUMS estimate.

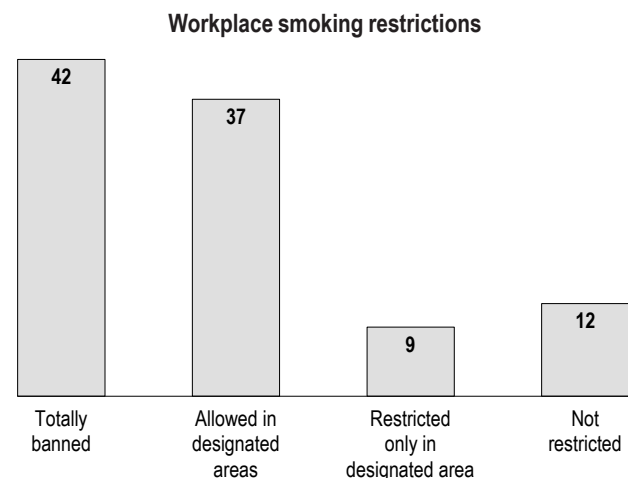
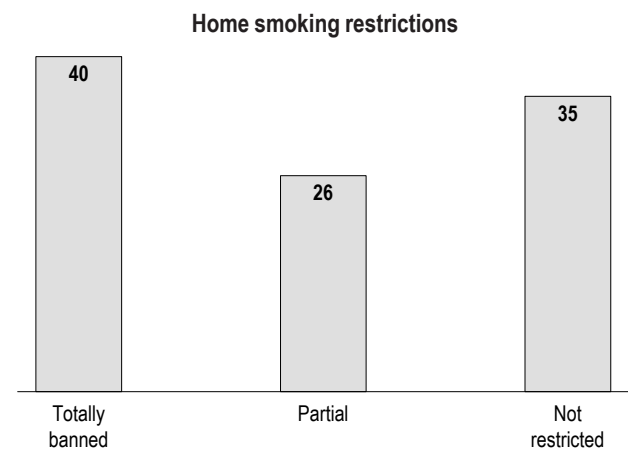
Characteristics of smokers facing restrictions

In 2005, male smokers were more likely than their female counterparts to report total bans at home: 43% versus 36% (Table 1).

The likelihood of smokers' reporting total bans at home fell with age from 54% of 15- to 24-year-olds to 22% of seniors (65 or older).

Having smoking restrictions at home was related to education. Fewer than one-quarter (24%) of smokers with less than secondary graduation lived in homes where smoking was totally banned, compared with 42% of those with postsecondary graduation.

Chart 3
Percentage distribution of smokers, by home and workplace smoking restrictions, household population aged 15 or older, Canada excluding territories, 2005



Note: Estimates for workplace smoking restrictions based on smokers employed at anytime in past 12 months.
Source: 2005 Tobacco Use Monitoring Survey

As noted earlier, the presence of children was a particularly strong determinant of a total ban on smoking in the home; 55% of smokers living with a child younger than 15 were in smoke-free homes, compared with 33% of those who did not live with children.

When examined in a multivariate model, associations between these socio-demographic characteristics and total smoking bans in the home generally persisted. An exception was that when these other factors were taken into account, older

Table 1
Percentage of and adjusted odds ratios for smokers' living in smoke-free homes, by selected characteristics, household population aged 15 or older, Canada excluding territories, 2005

	%	Adjusted odds ratio	95% confidence interval
All smokers	39.6
Sex			
Men	42.1*	1.3*	1.1 to 1.6
Women†	36.2	1.0	...
Age group			
15 to 24	53.6*	3.1*	2.0 to 4.9
25 to 34	52.6*	2.0*	1.9 to 2.1
35 to 44†	38.1	1.0	...
45 to 54	25.7*	0.7	0.2 to 2.5
55 to 64	24.2*	0.9	0.4 to 2.0
65 or older	22.1*	1.2	0.6 to 2.1
Education (age 25 or older)			
Less than secondary graduation†	23.7	1.0	...
Secondary graduation or some postsecondary	36.1*	1.9	0.6 to 5.8
Postsecondary graduation	42.1*	2.4*	1.3 to 4.3
Child(ren) younger than 15 in household			
Yes	55.3*	2.7*	2.2 to 3.3
No†	32.6	1.0	...

† Reference category

* Significantly different from estimate for reference category ($p < 0.05$)

... not applicable

Source: 2005 Canadian Tobacco Use Monitoring Survey

smokers were just as likely as 35- to 44-year-olds to report a total ban.

In the workplace, female smokers were more likely than their male counterparts to report total smoking bans: 49% versus 38% (Table 2). Compared with 35- to 44-year-olds, both younger and older smokers were less likely to report total workplace bans.

As was the case for home restrictions, reporting workplace smoking bans was related to education. The percentage of employed smokers reporting total bans ranged from 30% of those who had not completed secondary school to 53% of those who had postsecondary graduation.

Occupation was associated with workplace smoking restrictions. Smokers in white-collar and sales/service jobs were more likely than those in blue-collar jobs to report total bans at work.

Even when examined in a multivariate model, associations between these socio-demographic

Table 2
Percentage of and adjusted odds ratios for smokers' working in smoke-free workplaces, by selected characteristics, household population aged 15 or older, Canada excluding territories, 2005

	%	Adjusted odds ratio	95% confidence interval
All smokers	42.3
Sex			
Men	37.8*	0.8*	0.7 to 0.9
Women†	49.4	1.0	...
Age group			
15 to 24	35.8*	0.5*	0.3 to 0.9
25 to 34	36.7*	0.5	0.2 to 1.0
35 to 44†	54.2	1.0	...
45 to 54	42.9*	0.6	0.2 to 2.3
55 or older	39.6*	0.6*	0.3 to 0.9
Education (age 25 or older)			
Less than secondary graduation†	29.5	1.0	...
Secondary graduation or some postsecondary	41.4*	1.3*	1.2 to 1.5
Postsecondary graduation	52.8*	2.0*	1.8 to 2.2
Occupation			
White-collar	48.9*	2.0*	1.8 to 2.2
Sales/Service	48.6*	2.3*	2.1 to 2.6
Blue-collar†	28.3	1.0	...

† Reference category

* Significantly different from estimate for reference category ($p < 0.05$)

... not applicable

Note: Employed at any time in past 12 months

Source: 2005 Canadian Tobacco Use Monitoring Survey

characteristics and workplace smoking restrictions remained.

Smoking restrictions and the stages of change

Questions in the 2005 CTUMS made it possible to classify current and former smokers into the five stages of change proposed by the Transtheoretical Model.^{13,14} Placement at specific stages was examined in relation to smoking restrictions at home and at work (Table 3).

In homes where smoking was totally banned, 44% of the combined group of smokers and former smokers (had quit in the past five years) were at the early stages (precontemplation or contemplation), compared with 70% of those in homes with no restrictions. And in smoke-free homes, 42% were at the late stages (action or maintenance), compared with just 15% of those in homes with no restrictions.

Table 3

Percentage distribution of current and former[†] smokers, by stage of change and home and workplace smoking restrictions, household population aged 15 or older, Canada excluding territories, 2005

	Total	Precontemplation	Contemplation	Preparation	Action	Maintenance
	%	%	%	%	%	%
Smoke-free home						
Total	100.0	22.6*	21.8*	13.5	8.2*	33.9*
Partial	100.0	35.5*	31.3*	16.0*	4.8	12.4*
No [‡]	100.0	40.7	29.4	14.4	4.5	11.0
Smoking banned at work						
Total	100.0	26.2*	26.6*	14.3	8.5*	24.3*
Partial	100.0	32.2	26.7*	15.3	5.3	20.6*
No [‡]	100.0	31.6	30.7	15.3	5.1	17.3

[†] Quit in past 5 years

[‡] Reference category

* Significantly different from estimate for reference category ($p < 0.05$)

Note: Estimates for workplace smoking restrictions based on smokers/former smokers employed at anytime in past 12 months

Source: 2005 Canadian Tobacco Use Monitoring Survey

Workplace smoking restrictions were also associated with smokers' and former smokers' position in the stages of change (Table 3), although the associations were not as strong as for household

restrictions. In workplaces where smoking was totally banned, 53% were at the precontemplation or contemplation stage, compared with 62% of those facing no restrictions. As well, 33% of the

Table 4

Odds ratios relating home smoke-free status and other selected characteristics to being at beginning or final stages of change, current and former[†] smokers, household population aged 15 or older, Canada excluding territories, 2005

	Precontemplation				Action/Maintenance			
	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Home smoking restrictions								
Total	0.3*	0.3 to 0.4	0.3*	0.3 to 0.4	3.9*	3.6 to 4.4	4.5*	3.9 to 5.1
Partial	0.9*	0.8 to 0.9	0.9	0.8 to 1.0	1.1	0.9 to 1.4	1.2*	1.0 to 1.4
None [‡]	1.0	...	1.0	...	1.0	...	1.0	...
Sex								
Men	1.2	0.8 to 1.7	1.2	0.8 to 1.9	0.9	0.7 to 1.1	0.8	0.6 to 1.0
Women [‡]	1.0	...	1.0	...	1.0	...	1.0	...
Age group								
15 to 34	0.9	0.7 to 1.2	1.1	0.9 to 1.4	1.1	0.4 to 2.7	0.8	0.5 to 1.3
35 to 54 [‡]	1.0	...	1.0	...	1.0	...	1.0	...
55 or older	0.7	0.4 to 1.2	0.6*	0.5 to 0.9	1.8	0.7 to 4.1	1.9*	1.0 to 3.5
Education								
Less than secondary graduation [‡]	1.0	...	1.0	...	1.0	...	1.0	...
Secondary graduation or some postsecondary [†]	0.9	0.6 to 1.4	1.0	0.6 to 1.5	1.1	0.5 to 2.5	1.1	0.5 to 2.2
Postsecondary graduation	0.6*	0.5 to 0.7	0.6*	0.5 to 0.8	1.9*	1.2 to 2.8	1.7*	1.3 to 2.2
Child(ren) younger than 15 in household								
Yes	0.8*	0.8 to 0.9	0.9	0.7 to 1.1	1.0	0.7 to 1.4	0.9	0.7 to 1.1
No [‡]	1.0	...	1.0	...	1.0	...	1.0	...

[†] Quit in past 5 years

[‡] Reference category

* Significantly different from estimate for reference category ($p < 0.05$)

... not applicable

Source: 2005 Canadian Tobacco Use Monitoring Survey

Table 5

Odds ratios relating workplace smoking restrictions and other selected characteristics to being at beginning or final stages of change, current and former[†] smokers, household population aged 15 or older, Canada excluding territories, 2005

	Precontemplation				Action/Maintenance			
	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Workplace smoking restrictions								
Total	0.7*	0.6 to 0.8	0.8*	0.6 to 0.9	1.7*	1.5 to 2.0	1.3*	1.1 to 1.6
Partial	0.9	0.6 to 1.3	0.9	0.5 to 1.6	1.2	0.9 to 1.7	1.1	0.7 to 1.8
None [‡]	1.0	...	1.0	...	1.0	...	1.0	...
Sex								
Men	1.2	0.8 to 1.8	1.0	0.9 to 1.2	0.8*	0.7 to 1.0	1.0	0.8 to 1.3
Women [‡]	1.0	...	1.0	...	1.0	...	1.0	...
Age group								
15 to 34	0.9	0.7 to 1.3	0.9	0.8 to 1.0	1.0	0.5 to 2.2	1.1	0.9 to 1.3
35 to 54 [‡]	1.0	...	1.0	...	1.0	...	1.0	...
55 or older	0.9	0.7 to 1.0	0.8*	0.6 to 0.9	1.4*	1.2 to 1.6	1.6*	1.4 to 1.9
Education								
Less than secondary graduation [‡]	1.0	...	1.0	...	1.0	...	1.0	...
Secondary graduation or some postsecondary	0.9	0.6 to 1.3	0.9	0.7 to 1.0	1.2	0.5 to 2.8	1.2	0.7 to 2.2
Postsecondary graduation	0.6*	0.5 to 0.7	0.6*	0.5 to 0.7	2.1*	1.4 to 3.1	2.1*	1.8 to 2.4
Occupation								
White-collar	0.6*	0.5 to 0.8	0.7*	0.6 to 1.0	2.1*	1.4 to 3.0	1.7	1.0 to 3.0
Sales/Service	0.8	0.4 to 1.5	0.9	0.5 to 1.5	1.4	0.7 to 3.0	1.3	0.6 to 3.0
Blue-collar [‡]	1.0	...	1.0	...	1.0	...	1.0	...

[†] Quit in past 5 years

[‡] Reference category

* Significantly different from estimate for reference category ($p < 0.05$)

... not applicable

Note: Estimates for workplace smoking restrictions based on smokers/former smokers employed at anytime in past 12 months.

Source: 2005 Canadian Tobacco Use Monitoring Survey

combined group of current and former smokers in workplaces where smoking was totally banned were at the action or maintenance stage, compared with 22% of those who reported no restrictions at work.

The relationship between living in a smoke-free home and being at the first two or the final two stages of change was examined in multivariate models controlling for sex, age, education, and the presence of children in the household (Table 4). The associations observed in the bivariate analysis persisted when these variables were taken into account. Similarly, the associations between workplace smoking bans and being at the early and late stages of change remained in the multivariate analysis (Table 5).

Bans precede cessation

Longitudinal data from the first six cycles of the NPHS (1994/1995 to 2004/2005) were used to determine if the imposition of new smoking

restrictions was associated with quitting. Quitters were defined as those who reported that they were smokers in one cycle (time 1), but when they were re-interviewed two years later (time 2), reported that they did not smoke.

The introduction of new workplace smoking bans was associated with quitting. Fully 27% of smokers who reported no workplace restrictions at time 1, but then reported that smoking was totally restricted at work during the follow-up interview two years later, had quit (data not shown). This was more than double the quit rate of 13% among those who continued to face no restrictions at work. Even when other potential confounders were taken into account, the association persisted (Table 6).

The NPHS does not ask an explicit question about smoking restrictions in the home. Rather, respondents are asked if anyone in the household “smokes regularly inside the home.” For this

analysis, a smoker was defined as living in a smoke-free home if the response to this question was “no.” It would, however, be common for a household to become smoke-free after one of its members had quit. Therefore, to clearly establish the temporal ordering of events, it was necessary to consider data from three consecutive NPHS cycles, and thereby ensure that quitting occurred after a home became

Table 6
Odds ratios relating changes in workplace smoking restrictions and other selected characteristics to employed smokers' quitting in a two-year period, household population aged 15 or older, Canada excluding territories, 1996/1997 to 2004/2005

	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Smoking restricted at work (at end of two-year period)[†]				
Totally	2.4*	1.5 to 3.7	2.3*	1.4 to 3.9
Partially	1.3	0.8 to 2.1	1.1	0.7 to 1.8
No [‡]	1.0	...	1.0	...
Cigarettes per day				
25 or more (heavy)	0.5*	0.3 to 0.9	0.5*	0.3 to 0.9
10 to 24 (moderate) [‡]	1.0	...	1.0	...
1 to 9 (light)	0.9	0.4 to 1.9	1.0	0.5 to 2.1
Occasional smoker	4.4*	2.6 to 7.5	4.4*	2.4 to 7.9
Sex				
Men	1.5	0.9 to 2.3	1.7*	1.0 to 2.8
Women [‡]	1.0	...	1.0	...
Age group				
15 to 34	1.2	0.8 to 1.8	0.9	0.6 to 1.4
35 to 54 [‡]	1.0	...	1.0	...
55 or older	1.3	0.7 to 2.4	1.0	0.6 to 1.8
Education				
Less than secondary graduation	1.0	...	1.0	...
Secondary graduation [‡]	1.0	0.6 to 1.7	1.1	0.6 to 1.9
Some postsecondary	0.9	0.5 to 1.4	0.9	0.6 to 1.6
Postsecondary graduation	1.0	0.6 to 1.7	0.9	0.5 to 1.6
Household income quintile				
1 Lowest	0.9	0.4 to 1.7	1.2	0.6 to 2.2
2	0.8	0.4 to 1.5	0.9	0.5 to 1.8
3 [‡]	1.0	...	1.0	...
4	1.5	0.8 to 2.7	1.4	0.8 to 2.7
5 Highest	1.0	0.6 to 1.9	1.0	0.6 to 1.8
Occupation				
White-collar	1.0	0.7 to 1.6	0.9	0.6 to 1.5
Sales/Service	0.9	0.5 to 1.5	0.8	0.5 to 1.4
Blue-collar [‡]	1.0	...	1.0	...

[†] Based on employed smokers who faced no restrictions on smoking at work at beginning of two-year period

[‡] Reference category

* Significantly different from estimate for reference category ($p < 0.05$)

Source: 1996/1997 to 2004/2005 National Population Health Survey, longitudinal Health file (square)

smoke-free. The analysis is based on smokers who reported that they did not live in smoke-free homes at the first cycle (time 1) and continued to smoke at the second cycle (time 2). Smokers were defined as living in a “newly smoke-free” home if, at time 2, they reported that their home was smoke-free. Smoking status at the third cycle (time 3) was used to calculate quit rates. Among smokers in “newly smoke-free homes” (at time 2), 20% had quit (by time 3), compared with 13% of those who continued to live in homes that were not smoke-free (at time 2)

Table 7
Odds ratios relating change in home smoke-free status and other selected characteristics to smokers' quitting in a two-year period, household population aged 15 or older, Canada excluding territories, 1994/1995 to 2004/2005

	Unadjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Home newly smoke-free				
Yes	1.8*	1.4 to 2.3	1.6*	1.3 to 2.1
No [†]	1.0	...	1.0	...
Cigarettes per day				
25 or more (heavy)	0.9	0.8 to 1.1	0.9	0.8 to 1.1
10 to 24 (moderate) [†]	1.0	...	1.0	...
1 to 9 (light)	1.5*	1.2 to 1.9	1.4*	1.1 to 1.8
Occasional smoker	2.0*	1.6 to 2.7	1.9*	1.4 to 2.4
Sex				
Men	1.1	0.9 to 1.3	1.1	0.9 to 1.3
Women [†]	1.0	...	1.0	...
Age group				
15 to 34	1.0	0.8 to 1.2	0.9	0.8 to 1.1
35 to 54 [‡]	1.0	...	1.0	...
55 or older	1.2	1.0 to 1.5	1.3*	1.0 to 1.6
Education				
Less than secondary graduation	1.0	...	1.0	...
Secondary graduation [†]	0.9	0.7 to 1.2	0.9	0.7 to 1.2
Some postsecondary	1.3*	1.0 to 1.6	1.3*	1.0 to 1.6
Postsecondary graduation	1.2	0.9 to 1.5	1.1	0.8 to 1.4
Household income quintile				
1 Lowest	0.8	0.6 to 1.1	0.8	0.6 to 1.1
2	1.1	0.8 to 1.4	1.1	0.9 to 1.4
3 [†]	1.0	...	1.0	...
4	1.3	0.9 to 1.7	1.3	1.0 to 1.7
5 Highest	1.2	0.9 to 1.6	1.1	0.8 to 1.5
Child(ren) under age 12 in household				
Yes	0.9	0.8 to 1.1	1.0	0.8 to 1.2
No [†]	1.0	...	1.0	...

[†] Reference category

* Significantly different from estimate for reference category ($p < 0.05$)

... not applicable

Source: 1994/1995 to 2004/2005 National Population Health Survey, longitudinal Health file (square)

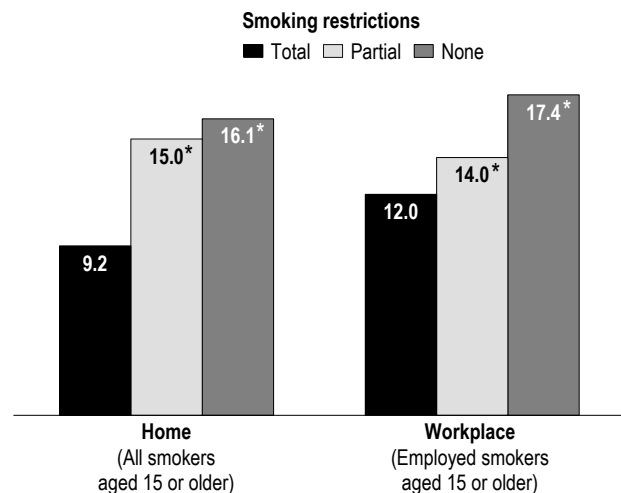
(data not shown). The higher likelihood of quitting for smokers in “newly smoke-free” homes persisted when the effects of other potential confounders were controlled (Table 7).

Smoking restrictions and smoking intensity

Home and workplace smoking restrictions were also associated with lower cigarette consumption. In 2005, smokers living in smoke-free homes averaged 9 cigarettes a day, compared with 15 a day for those facing partial restrictions, and 16 a day for those in homes without restrictions (Chart 4). The relationship was similar for workplace bans. Smokers in workplaces where smoking was totally banned averaged 12 cigarettes a day; those encountering partial bans, 14 a day; and those with no workplace restrictions, 17 a day.

Longitudinal NPHS data revealed that, even if they continued to smoke, daily smokers facing new home restrictions tended to decrease their consumption. Among daily smokers who did not live in a smoke-free home during the first cycle (time 1), those who reported that their home was smoke-free at the follow-up interview (time 2) averaged 2.0 fewer cigarettes a day than they had

Chart 4
Average number of cigarettes smoked per day, by home and workplace smoking restrictions, household population aged 15 or older who are smokers, Canada excluding territories, 2005



* Significantly higher than estimate for previous category(ies) ($p < 0.05$)

Note: Excludes occasional smokers who have not smoked in past 30 days.

Source: 2005 Canadian Tobacco Use Monitoring Survey

two years earlier. This compared with 0.4 fewer cigarettes a day among those who continued to live in homes that were not smoke-free (data not shown).

Among employed daily smokers who reported no workplace restrictions at time 1, those who reported total bans at time 2 averaged 2.1 fewer cigarettes a day. The average daily cigarette consumption of those still facing no restrictions did not change (data not shown).

DISCUSSION

From 2000 to 2006, the prevalence of smoking in Canada fell by close to 7 percentage points from 24.4% to 17.7%. Over the same period, smokers encountered a growing number of restrictions on where they are permitted to smoke. Legislation to ban smoking in public places was enacted by provinces and many communities across the country (Appendix Table A). Public bans may have motivated individuals to restrict smoking in their homes.

According to Statistics Canada's National Population Health Survey, in 1996/1997, 86% of Canadians aged 15 or older were aware that environmental tobacco smoke can cause health problems in non-smokers; among smokers, 75% reported such awareness. However, at that time, only 17% of smokers reported that their home was smoke-free. By 2006, the figure was 43%, and even higher—55%—for smokers living with children, a finding that has been observed in other studies.^{10,11,23,24}

Public bans may convey a powerful message to smokers and non-smokers alike. Such bans may have raised smokers' sense of personal responsibility and induced them to accept, or even impose, restrictions in their homes to protect non-smoking family members and guests. As well, public bans may have empowered non-smokers, giving them justification for insisting on similar restrictions in their homes, especially if children are present.

Data from the Canadian Tobacco Use Monitoring Survey show that total smoking bans, both at home and at work, were associated with a reduced likelihood of being in the initial “stages of change” proposed by the Transtheoretical Model (TTM), and a greater likelihood of being in the latter stages. A

key premise of the TTM is that at each stage, smokers weigh the pros and cons of moving to the next stage. Smoking restrictions may tip the balance toward the pro side. For example, having to go outside, particularly during the cold Canadian winter, may cause smokers to consider quitting and deter former smokers from relapsing. Home restrictions may be particularly helpful to former smokers. Studies of recidivism have found that former smokers' exposure to smoking can promote relapse.²⁵ This may be especially true during social occasions. However, if a home ban is in place, such exposure is reduced. Finally, smoking restrictions may cause smokers to feel ostracized, and thereby support a decision to change their behaviour.

Consecutive cycles of longitudinal data from the National Population Health Survey show that smokers in "newly smoke-free" homes were more likely to have quit two years later, compared with those in homes that were not smoke-free. Similarly, among employed smokers, the imposition of new workplace restrictions was associated with quitting. And even among people who continued to smoke daily, new restrictions at home and at work were associated with reduced cigarette consumption.

Limitations

Some limitations should be considered when interpreting the results of this study. Estimates of the prevalence of smoking restrictions are based on self-reported data. Social desirability may cause respondents to report restrictions in the home even when they do not exist, particularly if children reside in the household. In 2000, a review of the literature found general concordance between parental reports of exposure to environmental tobacco smoke among children and biological measures.²⁶ However, a more recent American study based on households with two or more adults found inconsistencies in reports of smoking bans in 12% of households.²⁷

The CTUMS and NPHS questions about household smoking restrictions differed. The CTUMS questions made it possible to determine if smoking in the home was totally banned, partially restricted, or not restricted. The NPHS only asked if any household member regularly smoked inside the house. Smokers who responded negatively to

this question were classified as living in smoke-free homes. In the longitudinal analysis, a stronger association with quitting might have been observed if it had been possible to compare smokers in homes with bans to those in homes where smoking was not restricted at all.

The definition of quitting used in the longitudinal analyses required only that people who had initially reported that they were smokers report that they did not smoke two years later. Consequently, this group could include people who had quit the day before the follow-up interview along with those who had not smoked for close to two years. The extent to which such diversity among quitters affected associations with smoking restrictions is not known.

Prevalence rates in this study were based on data from the CTUMS. Smoking prevalence can also be estimated from Statistics Canada's Canadian Community Health Survey (CCHS) and the cross-sectional component of the NPHS. While trends based on CTUMS data are similar to those derived from the other two surveys in that prevalence is declining, CTUMS smoking rates are consistently lower.²⁸ The questions about smoking in the CCHS and the NPHS are asked in the context of a general health survey rather than in a survey specifically about smoking. A study carried out to determine why the rates differ suggested that people are more inclined to talk about smoking when the topic is part of a broader survey.²⁹

Workplace smoking restrictions were measured by asking employed respondents if smoking at their place of work was banned completely, allowed only in designated areas, restricted only in certain places, or not restricted at all. The intent of the question is to measure smoking restrictions inside the workplace. Somewhat unexpectedly, CTUMS data show a sharp decrease since 2004 in the percentage of smokers responding "restricted completely," and a sharp increase in those responding "allowed only in designated areas." However, recent qualitative testing of this question conducted with focus groups revealed that, in some cases, if outdoor areas are designated for smokers, respondents indicate the second category even when smoking is totally banned inside. Starting in 2007, the wording of this question will be changed to avoid confusion.

Conclusion

The debate about whether health-related behaviour is shaped more by individual choice or by structural variables is long-standing.^{30,31} While quitting is, of course, an individual decision, a smoking ban may facilitate decision-making. The enactment of legislation to restrict smoking in public places

coincided with increases in the percentage of smokers reporting restrictions at home. As well, smoking restrictions—both at home and in the workplace—are associated with smoking cessation. Thus, public bans may encourage individuals to adopt similar practices in their homes that ultimately reduce the prevalence of smoking. ●

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Appendix

Table A

Smoking ban legislation in Canadian provinces and municipal bylaws in selected cities†

Province/City	Date implemented/ amended	Scope
Newfoundland and Labrador	July 1, 2005	The <i>Smoke-free Environment Act</i> bans smoking in all workplaces and public places, including bars, bingo halls, bowling alleys and casinos. Smoking is prohibited on bar and restaurant patios. Designated smoking rooms are permitted only in workplaces that are not open to the public.
Prince Edward Island	December 18, 2002	The <i>Smoke-free Places Act</i> bans smoking in all public places and workplaces. Restaurants and bars are permitted to have designated smoking rooms, but food cannot be served in these rooms.
Nova Scotia	December 1, 2006	The <i>Smoke-free Places Act</i> prohibits smoking in all workplaces and public places including outdoor restaurant and patio bars. The only exception is that in nursing homes and residential care facilities, designated smoking rooms are permitted.
	January 1, 2003	As of 2003, smoking prohibited in all provincial government work sites. Smoking also restricted in restaurants, bingo halls and bars until 9 p.m.
Halifax	April 19, 2003	Smoking banned in public places, including restaurants, bars, bingo halls and casinos. Designated smoking rooms permitted in bars and casinos (occupying a maximum of 25% of "drinking area"). Minors not allowed in these rooms, and no food service provided. Tobacco bars exempt.
New Brunswick	October 1, 2004	The <i>Smoke-free Places Act</i> prohibits smoking in enclosed indoor working places and public places including restaurants, bingo halls, bowling alleys, casinos and bars.
Fredericton	July 1, 2003	Smoking banned in all public places including restaurants, bars, billiard halls, bingo halls and bowling alleys. Designated smoking rooms not permitted.
Quebec	May 31, 2006	The <i>Tobacco Act</i> prohibits smoking in all indoor workplaces and public places including restaurants, bars, bingo halls, bowling alleys and casinos. All private designated smoking rooms will be eliminated by 2008.
Ontario	May 31, 2006	The <i>Smoke-free Ontario Act</i> prohibits smoking in all enclosed workplaces and public places including restaurants, bingo halls, bowling alleys, casinos and bars. Designated smoking rooms permitted only in long-term care facilities and other types of residential facilities.
Barrie	December 31, 2006	Smoking ban extended to bingo halls, with no provision for designated smoking rooms.
	June 1, 2003	Smoking banned in public places including restaurants, bars, billiard halls and bowling alleys. No designated smoking rooms permitted. Bingo halls exempt.
Hamilton	June 1, 2004	Smoking ban extended to bars, billiard halls, bingo halls, casinos and slots. Designated smoking rooms permitted in bars and billiard halls (occupying a maximum of 25% of the seating area), and in casinos and slots (occupying a maximum of 50% of the area).
	June 1, 2002	Smoking banned in restaurants and bowling alleys. Designated smoking rooms permitted in restaurants and bowling alleys (occupying a maximum of 25% of the seating area). In bars and billiard halls, smoking restricted to designated smoking areas (occupying a maximum of 25% of seating area). In bingo hall, casinos and slots, smoking restricted to designated smoking areas (occupying a maximum of 50% of seating area).
Kingston	May 1, 2003	Smoking banned in all public places including restaurants, bars, billiard halls, bingo halls and bowling alleys. Designated smoking rooms permitted in bingo halls only (occupying a maximum of 50% of seating area). Smoking banned on outdoor patios.

London	July 1, 2003	Smoking banned in all public places, including restaurants, bars, billiard halls, bingo halls and bowling alleys. Designated smoking rooms not permitted.
Ottawa	August 1, 2001	Smoking banned in all public places including restaurants, bars, billiard halls, bingo halls, bowling alleys and slots. Designated smoking rooms not permitted.
Toronto	June 1, 2004	Smoking banned in all public places. Designated smoking rooms permitted in restaurants, bars, billiard halls, bowling alleys, casinos and slots (occupying a maximum of 25% of floor space) and in bingo halls (occupying a maximum of 50% of floor space).
	June 1, 2001	Smoking banned in restaurants and bowling alleys. Designated smoking rooms permitted in restaurants and bowling alleys (occupying a maximum of 25% of floor space).
	October 8, 1999	Smoking restricted in public places, including restaurants, bars, billiard halls, bingo halls, bowling alleys, casinos and slots to designated smoking areas occupying a maximum of 25% of floor space.
Manitoba	October 1, 2004	The <i>Non-Smokers Health Protection Act</i> prohibits smoking in all indoor enclosed workplaces and in all public places, with the exception of group living facilities and designated hotel rooms. Designated smoking rooms not permitted.
Winnipeg	July 1, 2003	Smoking banned in all public places, including restaurants, bars, billiard halls, bingo halls and bowling alleys. No designated smoking rooms permitted. Smoking also banned in private clubs.
Saskatchewan	January 1, 2005	The <i>Tobacco Control Act</i> bans smoking in all enclosed public places, including restaurants, bingo halls, bowling alleys, casinos and bars. Designated smoking rooms not permitted. Smoking also prohibited at all provincial government work sites. The Occupational Health and Safety Regulations 1996 covers other workplaces, but does not protect workers from second-hand smoke.
Saskatoon	July 1, 2004	Smoking banned in all public places, including restaurants, bars, billiard halls, bingo halls, bowling alleys and outdoor patios. No designated smoking rooms permitted. Smoking also banned in private clubs and outdoor patios.
Alberta	January 1, 2006	<i>Smoke-free Places Act</i> prohibits smoking in all public places and workplaces where minors are permitted. No restrictions in bingo halls, bowling alleys, casinos and bars. Smoking may be permitted in any place where proprietor prohibits minors under 18, including offices and factories.
Calgary	January 1, 2008	Smoking banned in all public places, including bars, bingo halls, billiard halls, bowling alleys and casinos. Designated smoking rooms not permitted. Smoking also banned on outdoor patios. In July 2006, the effective date of this by-law was moved forward by one year to January 1, 2007, with some exceptions. Establishments that installed smoking rooms before July 1, 2006 permitted to continue to operate these rooms until January 1, 2008.
	March 1, 2003	As of March 1, 2003, a transitional phase of by-law was in place. Minors under 18 banned from smoking areas in establishments where smoking permitted.
Edmonton	July 1, 2005	Smoking ban extended to include total restrictions in all establishments including bars, bingo halls and casinos. No designated smoking rooms permitted.
	July 1, 2003	Smoking banned in public places that permit minors, including restaurants, billiard halls and bowling alleys. Bingo halls and casinos may have designated smoking rooms occupying a maximum of 65% of floor space and no minors permitted in these rooms. Bars exempt. Smoking banned on outdoor patios.
British Columbia	January 2008	Legislation for province-wide ban on smoking in public places announced for January 2008. No allowances for designated smoking rooms.
	May 1, 2002	The <i>Occupational Health and Safety Regulation (Environmental Tobacco Smoke Provisions)</i> prohibits smoking at all provincial government work sites. Designated smoking rooms required for all workplaces that choose to permit smoking. Employees of public entertainment facilities can choose not to serve in designated smoking rooms.
Vancouver	July 25, 2000	Smoking banned in all public places, including restaurants, bars, billiard halls, bingo halls, bowling alleys and casinos. Designated smoking rooms permitted (occupying a maximum of 10% of floor space).

[†] For more information on smoke-free legislation of other cities and municipalities, see Canadian Municipal By-laws Banning Smoking in Public Places. Health Canada. **Notes:** A "designated smoking room" is a room where smoking is permitted, and which is separately enclosed from the rest of the establishment and separately vented to the exterior. A "designated smoking area" is a contiguous area of an establishment where smoking is permitted, and which is not physically separate from the non-smoking area.

Sources: Health Canada. Public Smoking Bans by Province and Territory. Available at: http://www.hc-sc.gc.ca/hl-vs/tobac-tabac/res/news-nouvelles/fs-if/ban-interdiction-public_e.html. Accessed May 1, 2006
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Table B

Percentage of smokers living in homes where smoking totally restricted, by province, household population aged 15 or older, Canada excluding territories, 2005

	%	95% confidence interval
Canada	39.6	38.9 to 40.2
Newfoundland and Labrador	48.9*	46.9 to 50.8
Prince Edward Island	42.7*	40.3 to 45.1
Nova Scotia	45.3*	43.3 to 47.3
New Brunswick	38.1	35.8 to 40.3
Quebec	23.2*	21.4 to 25.1
Ontario	45.7*	42.9 to 48.5
Manitoba	39.7	37.6 to 41.8
Saskatchewan	40.5	38.3 to 42.7
Alberta	47.3*	45.8 to 48.7
British Columbia	51.8*	49.2 to 54.4

* Significantly different from estimate for Canada ($p < 0.05$)

Source: 2005 Canadian Tobacco Use Monitoring Survey