The Impact of Smoking Legislation: New Evidence from Canada

by

Sabina Postolek

An essay submitted to the Department of Economics
in partial fulfillment of the requirements for
the degree of Master of Arts

Queen's University
Kingston, Ontario, Canada

August 2009

ACKNOWLEDGEMENTS

I would like to express my sincere thanks and appreciation to Casey Warman. Without his knowledge, guidance, and support this essay would not have been possible. I would also like to thank Christopher Carpenter for his comments on an earlier draft of this essay and Jeff Moon for his assistance in acquiring the Postal Code Conversion File (PCCF). In addition, I am most grateful to Statistics Canada for providing access to the necessary datasets and many thanks to the Department of Economics, Queen's University, Kingston.

CONTENTS

1 INTRODUCTION

With an increase in the awareness of the detrimental effects of second-hand smoke, the early 1990's marked a defining moment in the campaign to eliminate environmental tobacco smoke. Beginning with a ban on smoking in all federal workplaces, by the late 1990's municipalities and provinces across Canada began, not only banning smoking in workplaces, but also in public places such as shopping malls, restaurants, bars, bingo halls and casinos. Moreover, as of May 2008, all Canadian provinces and territories except for Prince Edward Island and the Yukon have legislation banning smoking in all public places (Health Canada 2008). The primary purpose of imposing these types of bans was to eliminate the harmful effects of second-hand smoke (SHS) (Non-Smokers' Rights Association 2005); however, it is also thought that these types of bans may affect own smoking behaviours such as prevalence and intensity.

There have been many studies, primarily in the US, which have addressed whether smoking bans in workplaces and public places are negatively related to smoking prevalence, intensity, and SHS exposure and the findings have been mixed (e.g. Albers et al. 2007; Bitler et al. 2009, Carpenter 2009; Hammond et al. 2004; Shields 2007; Stephens et al. 2001; Tauras 2006). Using a quasi-experimental framework and expanding on previous research in several ways, our study looks to address the question of whether smoking bans in public places and workplaces have a significant effect on own smoking behaviour and SHS exposure in Canada. Firstly, many of the studies which have examined smoking bans characterize locations by whether a smoking law is present or not. Our study not only looks at law presence but also considers the strength/restrictiveness of the law; this allows us to examine whether law magnitude has an effect on smoking behaviours and exposure to SHS. Secondly, given the large number of smoking laws which were imposed in Canada over the

last several years, our study has more variation in smoking law data than previous studies. Lastly, and potentially the most important contribution of this study, is our ability to isolate the impact of smoking laws in Canada. Previous research has relied solely on the variance in smoking laws between cities or provinces/states. However, a cross-locational research design, where outcomes for residents of cities with smoking laws are compared to outcomes for residents in locations without smoking laws, may be problematic if the decision to adopt a smoking law is correlated with individual preferences.[1] In other words, there may be unobserved characteristics about individuals that are correlated with both the preference for adopting smoking laws and their own smoking behaviour. In our study we are able to remove this possible endogeneity by considering the onset of provincial laws and removing cities that adopted smoking laws prior to the provincial legislation and comparing the impact to those cities that chose not to enact laws before provincial regulation.

To preview, we found that public place smoking laws across Canada for the most part do not significantly reduce the prevalence and intensity of smoking in adult Canadians; although, we did find some evidence of a small reduction in the number of cigarettes smoked by daily smokers in locations that were forced, due to provincial legislation, to enact smoking laws. However, smoking laws appear to have reduced the likelihood of individuals being exposed to SHS by around nine percent, with stronger smoking laws being more effective. That is, we found that public place smoking laws may not be very effective at influencing own smoking behaviour, but do appear to reduce exposure to SHS. Further, when we compared the impact of smoking laws for cities that enacted a law prior to the provincial law versus cities that did not have smoking laws prior to provincial legislation, we

[1] As well, studies that examine state/provincial variation in laws usually look at the incorrect level of geography as most smoking laws are usually implemented at a lower level of geography (such as city level) at the time that these studies were conducted.

found a much larger reduction in the exposure to SHS in locations that were forced by the province to enact restrictions.

When we evaluated the effect of workplace smoking restrictions on own smoking behaviour, we found that these types of smoking restrictions do have an effect on smoking behaviour. Individuals who reported complete smoking bans at their place of employment were 17 percent less likely to smoke than individuals in workplaces with zero smoking restrictions. Additionally, individuals who reported working under complete smoking restrictions consumed half as many cigarettes a day than those individuals employed at workplaces with zero smoking restrictions. Furthermore, when we examined whether smoking laws and workplace restrictions were related, we found that there was a positive relationship between smoking laws and workplace smoking restrictions. That is, a workplace is 12 percent more likely to have a full smoking restriction if the workplace is located in an area covered by a gold smoking law.

The paper proceeds as follows. In section II, a brief review of the relevant literature is presented. This is followed by section III which describes the data being used and outlines the empirical approach. In section IV the main results are presented, and section V provides conclusions and future recommendations.

2 PREVIOUS RESEARCH

Over the last 20 years there has been a large amount of research conducted on the effects of smoking bans on own smoking behaviour and exposure to SHS in adults. Most of this research has focused on workplace bans but some literature pertaining to public place bans has also emerged. Most of these studies, mainly generated in the United States, Great Britain, and Australia, have found a negative relationship between smoking bans and

smoking outcomes.

The introduction of smoking bans in workplaces in the 1980's and 1990's brought about an influx of literature examining the effect of these restrictions on smoking prevalence, intensity, and exposure to SHS. Chapman et al. (1999) examined the findings of 19 studies in the United States and Australia which reported the effects of workplace bans. Eighteen of these studies reported declines in daily smoking rates ranging from 5-36 percent, while 17 reported declines in smoking prevalence ranging from 7-50 percent when workplace smoking restrictions were present. Similarly, Fichtenberg and Glantz (2002) examined 24 studies conducted in Australia, Canada, Germany, and the United States and found that workplace smoking restrictions reduced daily smoking rates by 3.1 cigarettes a day and decreased overall smoking prevalence by 3.8 percent among adults. Findings from comprehensive studies such as these often look at state/provincial-level data. A potential issue arises in that most smoking regulations are implemented at the local level, not at the state or provincial level. To address this issue, Carpenter (2009), using a quasi-experimental framework and cross-sectional data from 1997-2004, examined the effect of workplace smoking restrictions on exposure to SHS at the local-level in Ontario, Canada. He found that smoking restrictions significantly impacted blue collar workers (who were just recently exposed to workplace smoking bans) and reduced exposure to SHS by 28-33 percent in all workers. Carpenter (2009) did not examine the effect of these bans on smoking prevalence. Shields (2007) however examined the effect of workplace bans on smoking prevalence not only in Ontario, but nationally. Using local-level cross-sectional and longitudinal data, Shields found that workplace smoking bans significantly decreased the prevalence of smoking in Canadian adults.

Several other studies found similar findings to those discussed above. For instance,

Evans et al. (1999) examined the impact of workplace smoking bans on the prevalence and intensity of adult smokers in the United States in the early 90's. They found that workplace smoking bans decreased the prevalence of adult smokers by 5 percent and decreased daily cigarette consumption in smokers by 10 percent or 2.5 cigarettes a day. Chaloupka (1992) also examined the effect of workplace smoking restrictions in the United States at the state-level and found that clean indoor air laws reduced smoking intensity among adults. In general, the literature reports that workplace smoking restrictions are effective at decreasing the prevalence and intensity of smoking and decreasing ones exposure to SHS.

Shortly after the implementation of workplace smoking bans, regulation banning smoking in public places began to emerge. Provinces and municipalities enacted these bans differently but generally they applied to shopping malls, restaurants, bars, bingo halls, casinos, sporting venues, etc. In Canada, starting in around the year 2000, several cities began to limit or ban smoking in public places; and by 2004, provincial governments began enacting smoking laws. As of May 2008, all provinces and territories except for Prince Edward Island and the Yukon have explicit laws restricting smoking in public places[2] and currently, in the United States, 25 states and 216 municipalities ban smoking in restaurants and 19 states and 132 municipalities ban smoking in bars (Americans for Nonsmoker's Rights 2009). Smoking bans in public places are becoming more common since they, like workplace bans, appear to decrease the prevalence and intensity of smoking; as well as, the exposure to SHS.

One of the earliest studies conducted on public place smoking bans was by Wasserman et al. (1991) who, using cross-sectional data from a national United States survey spanning 1970-1985, found that smoking restrictions in public places significantly reduced

[2] This translates to over 99 percent of Canada's population being governed by an explicit smoking law.

the daily cigarette consumption among smokers. Furthermore, they found that if smoking restrictions were increased from only minor locations (such as waiting rooms and libraries) to full smoking restrictions then overall per capita smoking would decrease by approximately six percent. Emont et al. (1993) who considered both prevalence and intensity of smoking found that clean air legislation (both in public and workplaces) in the United States lead to a decrease in smoking prevalence and consumption in adults. More recently, Yurekli and Zhang (2000) examined the effect of smoke-free legislation on the demand for cigarettes in the United States from 1970-1995. They found that, on average, cigarette consumption was reduced by 4.7 packs per capita in states with smoking laws. Taurus (2006), using United States data from 1992-1999 on over 540,000 adults, found a decrease in smoking intensity of between 5-8 percent but found no effect on smoking prevalence. Most recently, Bitler et al. (2009), examined the effect of venue-specific state clean indoor air laws (SCIALs) and their impact on adult smoking behaviour from 1992-2003. They found that when examined together, SCIALs do significantly reduce the prevalence of smoking among adults in the United States.

Canadian studies on public place smoking bans are rather limited. Stephens et al. (1997) who used a cross-sectional national survey, and Hammond et al. (2004) using local data from Windsor, Ontario, both found a significant decrease in smoking prevalence when public place smoking bans were present. Stephens et al. (2001) considered the effect of public place bans on both prevalence and intensity using the longitudinal NPHS; and found a decrease in smoking intensity in both males and females, but reported only a significant decrease in smoking prevalence for women.

Although generally there is consensus that both work and public place smoking bans decrease the prevalence and intensity of smoking, some differences in findings and

conclusions (as presented above) exist due to variation in data, estimation methods, and/or measurement error. Additionally, although the findings presented above are specific to adults, similar results were identified when teenagers and young adults were examined (e.g. Chaloupka and Wechsler 1997; Siegel et al. 2005; Wakefield et al. 2000).

Due to the limited amount of literature on the effects of public place smoking bans on smoking prevalence, intensity, and SHS, some gaps remain. Firstly, many of the studies do not consider local-level smoking restrictions which would be a more appropriate measure given that most smoking restrictions are put into action at a local-level (e.g. Chapman et al. 1999; Emont 1993; Wasserman et al. 1991; Yurekli and Zhang 2000).

Secondly, some earlier studies used cross-location variation in laws to compare the outcomes between people living in cities with smoking restrictions versus the outcomes of people living in locations without smoking restrictions; however, in order to identify the impact of smoking laws, there must be no selection on unobservables. Yet, it is very likely that the adoption of a smoking law by a city is not random and is related to sentiments and smoking behaviour within the location. One way researchers have attempted to get around this problem is by using a difference-in-differences approach using repeated cross-sectional data and comparing the outcomes of individuals in locations with and without smoking laws over time. By including location fixed effects, the time-invariant differences between the treatment and comparison groups are controlled for; while by including time fixed effects, the group-invariant changes over time are controlled for. Carpenter (2009) followed this methodology when examining the impact of workplace restrictions in Ontario. We too follow this methodology, but consider all of Canada in our analysis and examine not only smoking laws that affect workplaces, but also regulations that affect smoking in other public places. Furthermore, while Carpenter examined only one level of smoking law strength, we

look at different levels of smoking laws, and are able to determine if laws with greater restrictions are more effective in reducing smoking behaviour and exposure to SHS.

We also take another approach to avoid the possible correlation between unobservable characteristics and the adoption of smoking laws. Most provinces have recently enacted laws that ban smoking in all public places, thereby forcing workplaces and establishments in locations that had no previous laws in place to eliminate smoking. By re-estimating our results and eliminating cities that had local laws prior to the provincial smoking laws, this is another method of eliminating the possible correlation between unobservables and the smoking laws.

We make a further contribution to the literature by using panel data. Most studies use only cross-sectional data due to a lack of available longitudinal data (Emont 1993; Hammond et al. 2004; Stephens et al. 1997; Wakefield et al. 2000). While our main analysis is based on cross-sectional data, we also use a longitudinal data set that allows us to eliminate the individual fixed effects that may be correlated with the smoking laws by using the within estimator.

Finally, many studies have examined only a single smoking outcome, mainly smoking status (e.g. Albers et al. 2007; Carpenter 2009; Hammond et al. 2004; Stephens et al. 1997) or smoking intensity (e.g. Wasserman et al. 1991). There have been only a few studies which have examined both outcomes (e.g. Bitler et al. 2009; Emont 1993; Stephens et al. 2001; Taurus 2006). As well, many studies which examined smoking intensity did not use continuous cigarette consumption data (i.e. quantity of cigarettes smoked each day), but rather reported cigarette consumption as a categorical group and thus may have presented findings which would differ given continuous data (e.g. Chaloupka and Wechsler 1997; Emont 1992; Farkas 1999). Further, given that reducing SHS was the goal of most smoking

legislation, it is important to also examine this issue. Due to these gaps in the literature, the purpose of this research is to address these issues by studying explicitly the effects of public and workplace smoking restrictions on the prevalence and frequency of smoking and the exposure to SHS in Canada using national longitudinal and cross sectional surveys which include locational and individual-level information.

3 DATA DESCRIPTION AND EMPIRICAL APPROACH

In order to analyse the effects of smoking bans on the intensity and prevalence of smoking in Canada, data from both the Canadian Community Health Survey (CCHS) and the National Population Health Survey (NPHS) will be used. The CCHS is a large cross-sectional survey used to gather health-related information on Canadians over the age of 12 living in private households, excluding people on Indian reserves, on Canadian Forces bases, and in the territories. The survey is conducted biennially and its first cycle was released in 2001.[3] The NPHS is a longitudinal survey which was first conducted in 1994/95 and surveys the same respondents every two years. Like the CCHS, it gathers health-related data and covers those 12 years or older not living on Indian reserves, Canadian Forces bases, or in the territories. Given the longitudinal nature of the NPHS, a balanced panel design will be used for all estimations, although this will result in a substantial decrease in the available sample size.[4] Additionally, for the purposes of this study, the CCHS sample is restricted to only those respondents between the ages of 18 and 64 (i.e. those individuals who would be most affected by the implementation of smoking bans). Given the already reduced sample size of

[3] Starting in 2007, the CCHS is conducted annually.
[4] We also examined the sensitivity of the results using an unbalanced panel and find similar results.

the NPHS, all respondents over the age of 16 to 64 will be considered.[5]

To assess the impact of the smoking laws on own smoking behaviour, workplace restrictions, and SHS exposure; a difference-in-differences approach is employed which controls for unobserved time invariant area-specific heterogeneity through the inclusion of statistical area (SA)[6] fixed effects and for area-invariant time-specific effects with the inclusion of cycle fixed effects. The following two-way fixed effects model will be estimated:

$$(1) \qquad Y_{iat} = \alpha + \beta_1 X_{iat} + \beta_2 (Law)_{at} + Area_a + SurveyYear_t + \varepsilon$$

where Y_{iat} refers to either own smoking behaviour, workplace restriction presence, or SHS exposure as described above for individual *i* in area *a* in survey year *t*. X_{iat} is a vector of demographic controls (age, gender, marital status, education, and income). $Area_a$ is a vector of SA dummies, while $SurveyYear_t$ is a vector of survey year dummies. Law_{at} is an indicator variable which equals one if the respondent lives in a SA which is covered by a smoking law or workplace policy[7] and zero otherwise.[8] The coefficient of interest is β_2, which captures the effect of SA laws as measured by the change in outcomes for individuals living in an affected area relative to the associated change in outcomes for individuals living in a non-affected area. All models use sampling weights provided by the CCHS and NPHS, and standard errors are clustered by SA.[9] An underlying assumption of our model is that there

[5] We restrict our main sample for the NPHS to people who were age 16 to 64 in cycle 3 (1998/1999) and checked the sensitivity of this restriction using other age restrictions and again find similar results.
[6] SAs are either Census Metropolitan Areas (CMAs), places with populations of at least 100,000 people or Census Agglomerations (CAs), places with populations of at least 10,000 people.
[7] Smoking law and workplace smoking restrictions are publicly available from various sources such as Health Canada, The Ontario Tobacco Action Network, and the Non-Smokers' Rights Association of Canada.
[8] If the law is below the SAs level of geography, for example at the subdivision level, we use that law.
[9] See Bertrand et al. (2004) for a discussion of correcting standard errors for difference in difference models.

are no other shocks which could have affected the outcomes. That is, there are no other reasons why smoking behaviours, SHS exposure, or workplace smoking restrictions could have changed relatively between cities with and cities without laws over time, except explicitly from changes in SA smoking regulations.

Variation in the smoking laws comes from both laws implemented at the local level by municipal or city governments; as well as, at the provincial level. We re-estimate equation (1) using provincial variation in laws by removing any SAs which had a smoking law in place prior to provincial legislation in order to examine what impact the endogeneity of the laws had on our results. It is likely that there is less endogeneity in the implementation of the laws at the provincial level relative to the city or municipal level. We will also re-estimate the results removing locations once a provincial ban comes into effect. This allows for a closer examination of the impact of the laws for places that chose to implement smoking laws on their own prior to a provincial law. This comparison allows for the examination of both the impact of laws for those that chose to adopt laws and those that did not.

Using the analogy of training literature, usually it is only possible to observe the impact of training for people who decide to train and it is not possible to observe the effects of training for those that chose not to. Therefore comparing the outcomes of people who train to those who do not, does not give an accurate measure of the impact of training if it is not random who decides to participate in the training. We are fortunate to observe both the impact of training (adopting a smoking law) on both the people who decide to train (cities that adopt laws on their own prior to the provincial law) and those that do not want to undertake training (forced by the province to adopt a smoking law) and we are able to directly compare the different impact that "training" has on these two groups since we can separate out these effects.

Smoking prevalence, SHS exposure, and workplace restriction presence will be estimated using a probit regression as this is the most suitable method given that the dependant variable can only take on one of two values (smoker or non-smoker, exposure to SHS or no exposure to SHS, and workplace smoking restriction present or no workplace smoking restriction present).[10] Smoking intensity ("number of cigarettes smoked per day" by those identified as daily and occasional smokers) is a composite variable that equals daily cigarette consumption for all smokers (both occasional and daily) and equals 0 for all non-smokers.

In order to create the "smoking intensity" variable, daily cigarette consumption data for both daily and occasional smokers is required. All cycles of the CCHS asked respondents, who identified themselves as a "daily smoker", how many cigarettes a day they currently smoke and asked those who identified themselves as "occasional smokers", how many cigarettes they smoke a day on the days that they chose to smoke. Thus data from all cycles of the CCHS can be used to generate the "smoking intensity' composite variable for the CCHS data. Smoking intensity will be estimated using a negative binomial regression model when considering local laws in order to control for any over-dispersion in the data; although, we check the sensitivity of the results using zero-inflated negative binomial models and hurdle models. When we examine the impact of the smoking laws on people who are smokers, we use ordinary least squares. Although the NPHS asked "daily smokers" how many cigarettes they smoked in a day for all seven cycles, data on cigarette consumption for "occasional smokers" is only available beginning in cycle three. When we examine the impact of the laws on daily smokers in the NPHS, we use linear fixed effects models.

Locational smoking law information is obtained in both the CCHS and NPHS by

[10] For the NPHS, given the longitudinal nature of the data, we use both fixed effects logit models and fixed effects linear probability models to examine whether or not the laws had any impact on smoking status.

using postal codes to match the SAs or provincial information available in the datasets. Additionally, all models will contain demographic variables: age (in years), gender, marital status (3 categories: married/common-law (default), single never married, not married[11]), education (7 categories: less than high school (default), secondary school, some post secondary, college, bachelors, graduate degree, and education missing), and income[12].

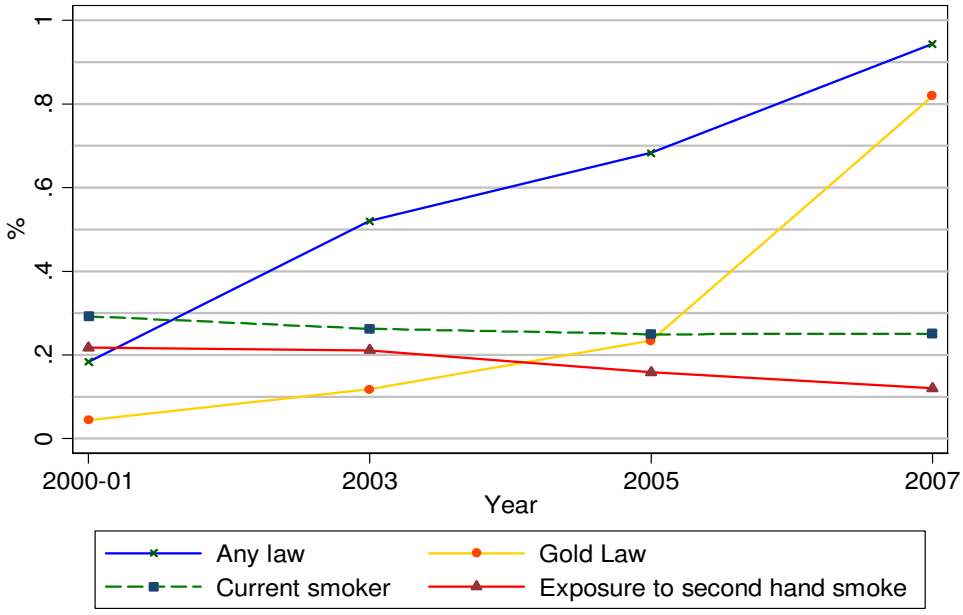
4 RESULTS

Figure 1 below depicts trends in smoking laws such as the percentage of people covered by gold laws and any law (gold, silver, or bronze)[13]; as well as, trends in current smoking status and exposure to SHS during the 2000-2007 period.[14] We find that at the start of the CCHS sample, less than 20 percent of people lived in a city covered by a smoking law and very few were covered by a gold law (only 5 percent). However, the percentage of people covered by a law increased rapidly throughout the period. By 2003, half the population was covered by a law; while 75 percent of the population was covered by a law by 2005 and over 90 percent by 2007. We further find that the percentage of people covered by a gold law grew less quickly during the first part of the period, but increased more rapidly than the "anylaw" curve between 2005 and 2007. We expect this since most provinces adopted gold laws during this latter period, thus forcing localities that did not have smoking laws in place to abide by the new provincial smoking restrictions and those cities which had

[11] "Not married" refers to those respondents who are divorced/widowed/separated.
[12] Income is a continuous variable in the CCHS but a dichotomous variable with 12 categories in all cycles of the NPHS
[13] Gold law refers to prohibition of smoking in all public places, including restaurants, bars, billiard halls, bingo halls, bowling alleys, and casinos/slots. There is no allowance for Designated Smoking rooms. Silver law refers to prohibition of smoking in most public places, including restaurants. One exemption is permitted among bars, billiard halls, bingo halls, bowling alleys, and casinos/slots. Designated Smoking Rooms are permitted. Bronze law refers to the banning of smoking in most public places, including restaurants. Two or more exemptions are permitted among bars, billiard halls, bingo halls, bowling alleys, and casinos/slots. Designated Smoking Rooms are permitted.
[14] Laws include both provincial and SA laws.

less stringent smoking laws to follow the new stricter provincial laws. Furthermore, there was also a large change in the percentage of people who smoked and who were exposed to SHS during this period. There was a 17 percent drop in the percentage of people who smoked over this period with the percentage of people who smoked dropping from 30 to 25 percent. The percentage of people who said that they had been exposed to SHS in a public place dropped by almost half, from around 21 percent to only 11 percent.

Figure 1: Trends in smoking laws, SHS exposure in a public place, and smoking status

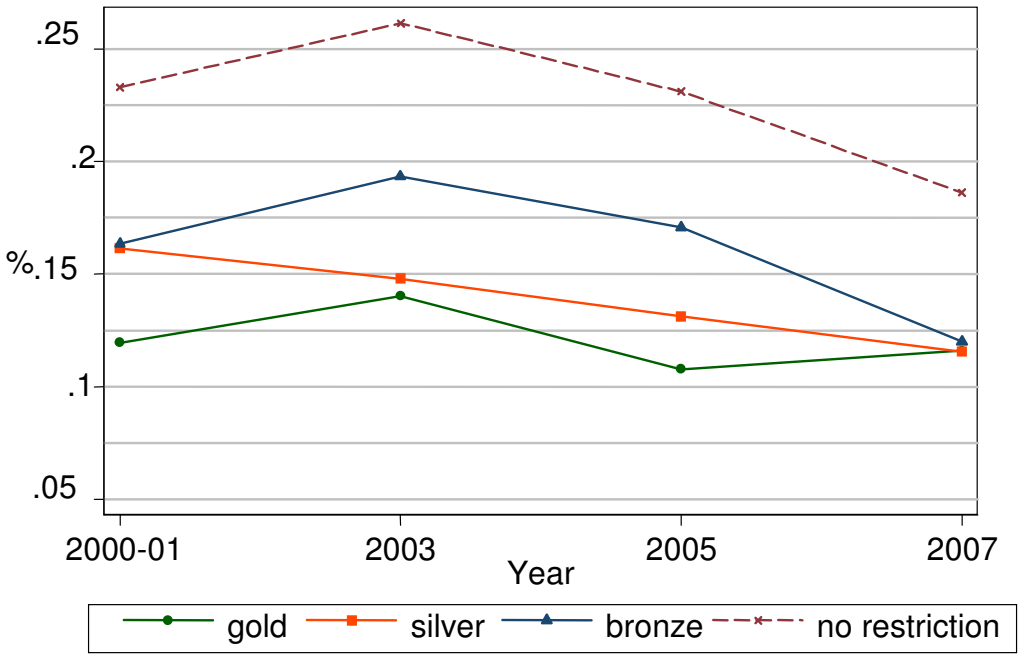


Source: CCHS 1.1, 2.1, 3.1, 2007

In Figure 2, we examine the percentage of people exposed to SHS in a public place taking into consideration the current smoking law in the SA at the time of the interview. We find that exposure to SHS decreased over the 2000-2007 period regardless of the strength of the smoking law. Additionally, the stronger the law, the less likely the respondent reported

being exposed to SHS in a public place[15].

Figure 2: Exposure to second hand smoke in a public place by strength of law



Although the reduction in the amount of smokers and exposure to SHS coincides with the increase in smoking laws, it is not possible from these graphs to determine a causal relationship between smoking behaviours/exposure and smoking laws. We next consider regression analysis that controls for both time and locational fixed effects to isolate the impact of smoking legislation on smoking prevalence and exposure to SHS.

[15] The increase in exposure to SHS for all the levels of laws in 2000 and 2003 is likely caused by SAs which switched from not having any law to being covered by a law but having a lower proportion of people exposed to SHS than the SAs remaining without a law, but a higher proportion than the SAs which already had an existing law. Therefore, the subtraction of these SAs that adopted a law increased the average number of people exposed to SHS in SAs that remained without a law, and the addition of these places pushed up the average number of people exposed to SHS in places with a law.

4.1 Smoking Outcomes

Smoking Status

We begin by examining the effectiveness of smoking laws in Canada at reducing smoking prevalence among adults. Given that "smoking status" is a dichotomous variable, we estimate the equation (1) using a probit model, and report the associated marginal effects. The format of most tables follows that of Table 1: the results of our simplest model, which looks to identify whether there is any relationship between smoking status and the three levels of smoking laws, includes only controls for age and age squared and is presented in column 1. In column 2, we add demographic controls such as marital status, education, and income, which are likely correlated with smoking status and may influence the adoption of smoking laws. In column 3, the results for the full model are presented, which includes demographic controls, year fixed effects, and SA fixed effects for the full sample. The same exercise is performed for the subsamples of males and females in columns 5 and 6, respectively. In column 4, we re-estimate column 3, using a dummy variable for whether or not there is any law present, and do not differentiate between the strength of the law.

In column 1 we find that there is a small, but statistically significant relationship between the laws and whether or not a person smokes; however, this impact decreases when we add demographic controls. Surprisingly, the silver law is larger in magnitude than the gold law. However, when we add time fixed effects and location fixed effects, we find that smoking laws do not significantly affect smoking status. We find similar results in column 4 when we re-estimate the model considering all three levels of smoking laws together; as well as in column 5 and 6 when male and female subsamples are used. This result is similar to the findings of Tauras (2005) and some of the workplace smoking ban studies examined by Fichtenberg and Glantz (2002) and Chapman et al. (1999).

Table 1: Marginal effects from probit model for smoking status, impact of both local and provincial laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Gold law	-0.036**	-0.025**	0.004		0.004	0.004
	[0.008]	[0.007]	[0.006]		[0.009]	[0.008]
Silver law	-0.060**	-0.047**	0.003		0.008	-0.001
	[0.013]	[0.013]	[0.005]		[0.006]	[0.007]
Bronze law	-0.033**	-0.018*	0.010*		0.013**	0.008
	[0.009]	[0.008]	[0.005]		[0.005]	[0.007]
Any Law				0.005		
				[0.004]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	230,065	230,065	230,065	230,065	107,164	122,901
R-squared	0.008	0.056	0.06	0.06	0.056	0.063
P-values from F-tests						
Gold=Silver	0.017	0.045	0.83		0.6	0.422
Gold=Bronze	0.756	0.248	0.362		0.189	0.709
Silver=Bronze	0.075	0.048	0.115		0.188	0.296

Notes: The dependent variable is 1 if the person is a smoker. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Smoking Intensity

To examine the effect of smoking laws on smoking intensity (i.e. daily consumption of cigarettes) both negative binomial and ordinary least squares (OLS) regressions were used. Beginning with the CCHS data, the results of the negative binomial regression with "smoking intensity" as the dependent variable are presented in Table 2, while the results of the OLS regression are reported in Table 3. The format of Table 2 and 3 is analogues to that of Table 1.

Examining the results of the full model estimated using the negative binomial regression (Columns 3, 5, and 6 of Table 2), we find our coefficients of interest are negatively-related to smoking intensity, but are insignificant for the full sample; as well as,

for the subsamples of males and females. We further find that even when all local smoking laws are considered together (column 4), the coefficient of interest ("Any law") is negatively-related to smoking intensity, but does not have a significant effect on cigarette consumption. This indicates that once we control for time fixed effects and SA fixed effects, smoking laws did not significantly impact smoking intensity in adult Canadians from 2000 to 2007.

Table 2: Negative binomial regression results for smoking intensity, impact of both local and provincial laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Gold law	-0.287**	-0.243**	-0.006		0.002	-0.008
	[0.065]	[0.061]	[0.049]		[0.037]	[0.081]
Silver law	-0.444**	-0.370**	-0.029		0.002	-0.061
	[0.087]	[0.085]	[0.049]		[0.062]	[0.050]
Bronze law	-0.281**	-0.189**	0.018		0.026	0.019
	[0.071]	[0.056]	[0.029]		[0.041]	[0.039]
Any Law				-0.002		
				[0.026]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	230,062	230,062	230,062	230,062	107,134	122,928
P-values from F-tests						
Gold=Silver	0.055	0.066	0.758		0.991	0.557
Gold=Bronze	0.959	0.473	0.671		0.662	0.754
Silver=Bronze	0.043	0.011	0.14		0.462	0.105

Notes: The dependent variable is a continuous variable representing number of cigarettes consumed per day for those identified as either daily or occasional smokers. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

One consideration of the negative binomial model is whether the assumptions of the model are realistic. Although the negative binomial model improves on the possible problem of overdispersion[16] by including a parameter to capture possible unobserved heterogeneity,

[16] This issue often plagues the Poisson model.

the assumption that the decision to have zero cigarettes versus a positive number of cigarettes is the same, may be incorrect. We therefore also estimated the results from Table 2 using a hurdle model and a zero-inflated negative binomial model. The hurdle model allows for "whether or not to smoke" and "how many cigarettes to smoke" to be a two part decision process.[17] The zero inflated negative binomial model allows for excess zeros and allows for the zeros to be generated by two different processes, with some individuals always smoking zero cigarettes while other individuals are observed to smoke zero cigarettes but they have a nonzero probability of smoking a positive number of cigarettes. In neither case do we find any evidence that the smoking laws had any impact on the number of cigarettes consumed once time effects and locational effects were controlled for (results not shown).

We next re-estimated the above model using an OLS regression and reduced the sample size to include only those individuals who had identified themselves as ever being a daily smoker. By restricting our sample to only those adults who would be most affected by the onset of a smoking law, we would expect to obtain a more accurate estimate of the true impact of smoking laws on smoking intensity. Considering the findings from this estimation in Table 3, we find results analogues to those identified in the negative binomial regression – smoking laws do not appear to have a significant effect on smoking intensity.

[17] The first part of the decision of whether or not to smoke is estimated by a probit regression (this is identically to Table 1) and the second part of the decision is estimated using a zero truncated negative binomial model.

Table 3: Ordinary least squares regression results for smoking intensity, impact of both local and provincial laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Gold law	-0.062**	-0.061**	-0.044		-0.071	-0.004
	[0.021]	[0.021]	[0.036]		[0.058]	[0.050]
Silver law	0.039	0.040	0.022		0.054	-0.015
	[0.029]	[0.032]	[0.045]		[0.094]	[0.070]
Bronze law	0.168	0.169+	0.133		0.143	0.114+
	[0.102]	[0.099]	[0.104]		[0.137]	[0.069]
Any Law				0.027		
				[0.065]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	62,636	62,636	62,636	62,636	30,908	31,728
R-squared	0.03	0.04	0.04	0.04	0.05	0.04
P-values from F-tests						
Gold=Silver	0.002	0.003	0.156		0.104	0.866
Gold=Bronze	0.032	0.026	0.111		0.112	0.203
Silver=Bronze	0.125	0.101	0.213		0.291	0.236

Notes: The dependent variable is a continuous variable representing number of cigarettes consumed per day for those identified as ever being a daily smoker. All regressions include controls for age and age squared. Columns 2, 3, and 4 also include a male dummy. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Provincial Variation

As discussed earlier, one of the potential reasons for these insignificant findings may be due to the possibility of policy endogeneity, whereby localities might adopt a smoking law in response to unobserved characteristics which may be correlated with smoking behaviour. We investigate the sensitivity of the results by removing locations that adopted smoking laws prior to the provincial laws and rely on provincial variation in laws as the policy endogeneity problem is less likely to be a concern at the provincial level.

While we use city fixed effects to control for the possible unobserved time invariant area-specific heterogeneity that may be correlated with the local laws, another method is to re-estimate the results presented in Tables 1, 2 and 3 using only provincial laws and

removing any SAs that adopted a smoking law prior to the onset of provincial smoking legislation. Results of the estimation of the probit marginal effects for whether or not a person smokes can be found in Table 4, the negative binomial results for number of cigarettes smoked can be found in Table 5, and the OLS results for number of cigarettes smoked for people who have ever identified themselves as a daily smoker are presented in Table 6. We also re-estimate the results by removing cities once the provincial ban comes into place which allows us to examine of the impact of the laws for places that chose to implement smoking regulation on their own prior to the provincial law. Comparing these to subsets of the sample allows us to uncover the impact of laws for those that chose to adopt laws and those that did not. The results of this analysis can be found in Tables 7, 8, and 9.

We find that when controlling for this possible endogeneity of the laws by removing the cities that had a law prior to a provincial law, only the silver smoking laws are statistically significant in explaining smoking status (Table 4). For the negative binomial regression for number of cigarettes smoked, not including location or time fixed effects (columns 1 and 2 of Table 5); we find that both the gold and silver laws are statistically significant, although the gold law is only significant once additional demographic controls are included. However, once we added in the location and time fixed effects, the impact of the laws decreased to zero (column 3). We ran the same re-estimation technique on those individuals who had ever identified themselves as a daily smoker (see Table 6). The results presented in Table 6 indicate that smoking laws do not reduce smoking intensity among those identified as ever being a daily smoker.

Table 4: Marginal effects from probit model for smoking status, forced by province to implement smoking laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Provincial Gold Law	-0.003	-0.001	0.008		0.012	0.004
	[0.010]	[0.007]	[0.015]		[0.017]	[0.018]
Provincial Silver Law	-0.041**	-0.045**	-0.009		0.012	-0.028
	[0.013]	[0.011]	[0.015]		[0.020]	[0.017]
Provincial Any Law				0.002		
				[0.013]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	110,344	110,344	110,341	110,341	51,445	58,896
R-squared	0.006	0.05	0.053	0.053	0.054	0.054
P-values from F-tests						
Gold=Silver	0.001	0.000	0.320		0.986	0.146

Notes: The dependent variable is 1 if the person is a smoker. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Locations that had adopted a law prior to a provincial law of the same strength are omitted. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Table 5: Negative binomial regression results for smoking status, forced by province to implement smoking laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Provincial Gold Law	-0.075	-0.092*	0.009		0.008	0.014
	[0.054]	[0.041]	[0.079]		[0.080]	[0.106]
Provincial Silver Law	-0.216**	-0.257**	0.006		0.126	-0.124
	[0.061]	[0.062]	[0.077]		[0.093]	[0.098]
Provincial Any Law				0.008		
				[0.069]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	110,344	110,344	110,344	110,344	51,446	58,898
P-values from F-tests						
Gold=Silver	0.012	0.002	0.971		0.255	0.185

Notes: The dependent variable is a continuous variable representing number of cigarettes consumed per day for those identified as either daily or occasional smokers. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Table 6: Ordinary least squares regression results for smoking status, forced by province to implement smoking laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Provincial Gold Law	-0.042	-0.049	-0.008		-0.041	0.043
	[0.031]	[0.032]	[0.059]		[0.109]	[0.068]
Provincial Silver Law	0.012	0.022	-0.049		0	-0.109
	[0.046]	[0.045]	[0.080]		[0.105]	[0.086]
Provincial Any Law				-0.022		
				[0.054]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	31,687	31,687	31,687	31,687	15,569	16,118
R-squared	0.03	0.04	0.04	0.04	0.05	0.05
P-values from F-tests						
Gold=Silver	0.273	0.151	0.626		0.741	0.207

Notes: The dependent variable is a continuous variable representing number of cigarettes consumed per day for those identified as ever being a daily smoker. All regressions include controls for age and age squared. Columns 2, 3, and 4 also include a male dummy. Locations that had adopted a law prior to a provincial law of the same strength are omitted. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

When we re-estimate the results in order to assess the impact of smoking laws on smoking status for cities which implemented smoking legislation prior to the onset of provincial regulation, we find similar results to those presented above. Results of this estimation of the probit marginal effects for whether or not a person smokes can be found in Table 7, the negative binomial results for number of cigarettes smoked can be found in Table 8, and the OLS results for number of cigarettes smoked for people who have ever identified themselves as a daily smoker are presented in Table 9. We find that when we evaluate the impact of smoking regulations on smoking status for cities which implemented smoking laws before provincial legislation (Table 7) that both the gold and silver smoking law are statistically significant in explaining smoking status when time and locational fixed effects are not considered (Table 7, column 1 and 2); however, once fixed effects are included, we find that both silver and gold laws no longer have a significant effect on

smoking status (column 3). For the negative binomial regression for number of cigarettes smoked, we find a similar pattern to that identified in the probit model when location or time fixed effects are not included (columns 1 and 2 of Table 8); we find that both the gold and silver laws are statistically significant. However, when location and time fixed effects are added, the impact of the laws decreases to zero (column 3). Again, we ran the same re-estimation technique on those individuals who had ever identified themselves as a daily smoker (see Table 9). The results indicate that smoking laws do not reduce smoking intensity among those identified as ever being a daily smoker.

Therefore, we find that our main variables of interest, smoking laws, do not affect the prevalence or intensity of smoking among adults in Canada. Even when we re-estimate the results controlling for any possible endogeneity effects by removing cities that adopted smoking laws on their own, we find that smoking laws still do not have a significant effect on smoking intensity in those identified as occasional or daily smokers or in our reduced sample of those identified as ever being a daily smoker.

Table 7: Marginal effects from probit model for smoking status, impact on cities who adopted smoking regulation prior to provincial legislation, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Provincial Gold Law	-0.038**	-0.025**	0.007		0.003	0.011
	[0.009]	[0.007]	[0.007]		[0.012]	[0.011]
Provincial Silver Law	-0.053**	-0.035**	-0.001		0.003	-0.004
	[0.012]	[0.011]	[0.006]		[0.007]	[0.010]
Provincial Any Law				0.005		
				[0.005]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	173089	173089	173089	173089	80782	92307
R-squared	0.008	0.055	0.058	0.058	0.055	0.061
P-values from F-tests						
Gold=Silver	0.342	0.283	0.108		0.988	0.086

Notes: The dependent variable is 1 if the person is a smoker. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Locations that had adopted a law prior to a provincial law of the same strength are omitted. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Table 8: Negative binomial regression results for smoking intensity, impact on cities who adopted smoking regulation prior to provincial legislation, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Provincial Gold Law	-0.253**	-0.208**	0.039		0.018	0.063
	[0.055]	[0.044]	[0.033]		[0.041]	[0.058]
Provincial Silver Law	-0.364**	-0.286**	-0.015		0.02	-0.059
	[0.091]	[0.085]	[0.032]		[0.043]	[0.046]
Provincial Any Law				0.004		
				[0.026]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	173089	173089	173089	173089	80782	92307
P-values from F-tests						
Gold=Silver	0.315	0.367	0.136		0.968	0.002

Notes: The dependent variable is a continuous variable representing number of cigarettes consumed per day for those identified as either daily or occasional smokers. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Table 9: Ordinary least squares regression results for smoking intensity, impact on cities who adopted smoking regulation prior to provincial legislation, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Provincial Gold Law	-0.045	-0.033	-0.048		-0.014	-0.062
	[0.030]	[0.029]	[0.047]		[0.077]	[0.077]
Provincial Silver Law	0.048	0.051	-0.018		0.014	-0.053
	[0.041]	[0.044]	[0.065]		[0.139]	[0.099]
Provincial Any Law				0.018		
				[0.079]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	46955	46955	46955	46955	23247	23708
R-squared	0.03	0.04	0.04	0.04	0.05	0.04
P-values from F-tests						
Gold=Silver	0.066	0.086	0.586		0.822	0.873

Notes: The dependent variable is a continuous variable representing number of cigarettes consumed per day for those identified as ever being a daily smoker. All regressions include controls for age and age squared. Columns 2, 3, and 4 also include a male dummy. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Longitudinal Data

We also examined the impact of smoking laws on smoking status using the NPHS which is a longitudinal data source. We first estimated whether the person smoked including all locations (Table 10), then re-estimated the results excluding locations that had a smoking law prior to the provincial law (Table 11), and finally re-estimated the results removing locations once a provincial smoking law came into effect (Table 12). The results presented were calculated using a fixed effect linear probability model. First examining whether or not a person smoked, controlling only for age and removing the individual fixed effects, we find that smoking laws appear to reduce the probability that someone smokes (see Table 10). A gold law decreases the probability of smoking by almost five percent, while the silver and bronze laws decrease the probability of smoking by almost five and four percent respectively

(although, we can only reject the equality of the coefficients for the gold and bronze laws, and only at the 10 percent level). Once we add additional controls (column 2 of Table 10), the impact of the laws falls to only around a one percent decrease in the probability of smoking. Further, when we account for locational fixed effects, the sign flips, and the probability of smoking appears to increase with the laws. When we eliminate cities that adopted smoking laws prior to the provincial law (see Table 11), the impact of the smoking laws shrink in magnitude and are no longer statistically significant. When we eliminate the provincial laws (see Table 12), the impact of the smoking laws is similar in magnitude to the results presented in Table 10, although the effects are insignificant and wrong signed.

We examined several different specifications to further explore the possible impact of the smoking laws on own smoking behaviour. We did find that smoking regulations had an impact on people who were daily smokers, but only in locations that did not adopt a law prior to the provincial law (Table 13). When we include locational and time fixed effects, smoking laws reduce smoking in individuals who were daily smokers at the beginning of the sample by around 1.25 cigarettes per day (results for the sample using only laws at the city level are not shown).[18]

From the results discussed above on the effects of smoking laws on both smoking status and smoking intensity, smoking laws in Canada do not appear, for the most part, to have a significant effect on own smoking behaviour among adults over the period of 2000-2007 in the CCHS or 1994-2007 in the NPHS.[19] Although this result may appear surprising, given the highly addictive nature of smoking and the ability to smoke in non-regulated places, the sheer presence of smoking laws may not be enough to encourage individuals to

[18] With cycle but not city fixed effects, the coefficient on the gold law is -1.37 and is statistically significant at the 5 percent level.

[19] When we restrict the sample to people age 18 to 34, we do find some evidence that the smoking laws reduced smoking in some models.

reduce or quit smoking. However, the implementation of smoking laws was not intended to fight own smoking behaviour but rather was imposed to address exposure to SHS (Non-Smokers' Rights Association 2005)[20]. Thus we will now examine whether local smoking laws have an impact on exposure to SHS in public places[21] among adults in Canada from 2000-2007.

Table 10: Coefficients from a linear probability model with individual fixed effects removed for smoking status, impact of both local and provincial laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Gold law	-0.054**	-0.011*	0.010		0.033**	-0.01
	[0.004]	[0.005]	[0.007]		[0.011]	[0.009]
Silver law	-0.048**	-0.011+	0.013+		0.025*	0.003
	[0.006]	[0.006]	[0.007]		[0.011]	[0.009]
Bronze law	-0.038**	-0.012	0.011		0.02	0.002
	[0.008]	[0.008]	[0.009]		[0.014]	[0.011]
Any Law				0.011*		
				[0.006]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	27,868	27,868	27,868	27,868	12,319	15,549
Number of ids	4,010	4,010	4,010	4,010	1,773	2,237
P-values from F-tests						
Gold=Silver	0.394	0.974	0.664		0.503	0.185
Gold=Bronze	0.088	0.937	0.900		0.440	0.339
Silver=Bronze	0.318	0.959	0.841		0.787	0.974

Notes: The dependent variable is 1 if the person is a smoker. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy.
+ significant at 10%; * significant at 5%; ** significant at 1%

[20] Canada's Non-Smokers' Rights Association notes that "the creation of a smoke-free law has a single purpose: to protect people from the known health hazards of exposure to SHS."
[21] There is no information on second hand smoke in public places in the NPHS.

Table 11: Coefficients from linear probability model with individual fixed effects removed for smoking status, impact on cities who were forced to implement smoking laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Provincial Gold Law	-0.006	-0.002	0.004		0.025	-0.014
	[0.008]	[0.008]	[0.012]		[0.019]	[0.016]
Provincial Silver Law	-0.009	-0.006	0.013		0.015	0.012
	[0.010]	[0.010]	[0.011]		[0.017]	[0.015]
Provincial Any Law				0.009		
				[0.010]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	13,649	13,649	13,649	13,649	6,030	7,619
Number of ids	2,128	2,128	2,128	2,128	943	1,185
P-values from F-tests						
Gold=Silver	0.804	0.711	0.513		0.629	0.137

Notes: The dependent variable is 1 if the person is a smoker. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Locations that had adopted a law prior to a provincial law of the same strength are omitted. + significant at 10%; * significant at 5%; ** significant at 1%

Table 12: Coefficients from linear probability model with individual fixed effects removed for smoking status, impact on cities that adopt smoking laws prior to provincial legislation, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Provincial Gold Law	0.006	0.008	0.012		0.031*	-0.005
	[0.010]	[0.010]	[0.011]		[0.016]	[0.015]
Provincial Silver Law	0.007	0.008	0.011		0.028+	-0.001
	[0.009]	[0.009]	[0.009]		[0.015]	[0.012]
Provincial Any Law				0.013+		
				[0.007]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	23142	23142	23142	23142	10175	12967
Number of ids	4006	4006	4006	4006	1772	2234
P-values from F-tests						
Gold=Silver	0.964	0.966	0.91		0.864	0.808

Notes: The dependent variable is 1 if the person is a smoker. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Locations that had adopted a law prior to a provincial law of the same strength are omitted. +significant at 10%; * significant at 5%; ** significant at 1%

Table 13: Coefficients from linear regression with individual fixed effects removed for number of cigarettes smoked per day for people who smoked daily at the beginning of the survey, impact on cities who were forced to implement smoking laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Provincial Gold Law	1.196*	1.220**	-1.248+		-1.568	-0.812
	[0.471]	[0.470]	[0.669]		[1.054]	[0.843]
Provincial Silver Law	1.406*	1.409*	0.198		0.029	0.593
	[0.576]	[0.574]	[0.618]		[0.953]	[0.800]
Provincial Any Law				-0.434		
				[0.532]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	3616	3616	3616	3616	1706	1910
Number of ids	554	554	554	554	259	295
P-values from F-tests	0.21	0.22	0.25	0.25	0.28	0.24
Gold=Silver	0.746	0.769	0.046		0.154	0.131

Notes: The dependent variable is a continuous variable representing number of cigarettes consumed per day for those identified as ever being a daily smoker. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Locations that had adopted a law prior to a provincial law of the same strength are omitted. + significant at 10%; * significant at 5%; ** significant at 1%

4.2 Second Hand Smoke Exposure

To examine the effect of smoking laws on exposure to SHS we estimate our model using a probit regression and present the marginal effects. The format of Table 14 follows that of the previous tables – the first two columns contain the results with only demographic controls. In column 3, we present the results from the full model which includes demographic controls and time and SA fixed effects, while in column 4, results from the re-estimation of the full model combining all three laws into one variable are reported. In columns 5 and 6, we present the findings for the full model for the subsamples of males and females, respectively.

The estimates in column 4 of Table 14 provide evidence that smoking laws are

associated with a statistically significant decrease in the likelihood of an individual reporting that they were exposed to SHS in a public place. Specifically, smoking laws decrease the likelihood an individual reported being exposed to SHS by 6.3 percent. Furthermore, in column 3, we confirm that stronger smoking laws are more effective at reducing exposure to SHS, with gold laws reducing exposure to SHS by almost 8 percent, while the presence of silver laws reduced smoking by around 6 percent and bronze laws by 4 percent. Previous research has indicated that smoking regulations tend to be more effective with the male population (e.g. Chaloupka 1992; Carpenter 2009); in columns 5 and 6, we confirm this finding. All of the smoking law estimates for males are larger than the female sample estimates, and highly significant. The difference in the apparent effectives of smoking laws on an individual's likelihood of reporting exposure to SHS in males versus females is surprising, since it is unlikely that gender alone is responsible for these differences. Carpenter (2009) found similar results when examining workplace restrictions and exposure to SHS. He found that this effect could be attributed to occupation. White collar workers reported less exposure to SHS versus blue collar workers, primarily since blue collar workers had less restrictive smoking policies in their workplaces. Although not perfectly related, our results could have a similar explanation in that males may have been more apt to spend time in non-regulated locations prior to the onset of smoking laws and thus the onset of these types of regulations resulted in a larger effect for males than females.

As we did with smoking prevalence and smoking intensity, we re-estimated the above model considering only SAs which did not have smoking laws in place prior to the onset of provincial legislation (see Table 15). This allowed us to control for, or greatly reduce, any possible endogeneity bias. Our findings are similar to those presented in Table 14; however, the magnitude of the effects has increased. Specifically, smoking laws decreased

the likelihood an individual reported being exposed to SHS by 8.7 percent when controlling for this endogeneity effect, versus initial findings of 6.3 percent. Additionally, in column 3 of Table 15, we once again confirm that stronger smoking laws are more effective at reducing reports of exposure to SHS; with gold laws reducing exposure to SHS by almost 12 percent among the full sample (initial results reported a decrease of only 7.7 percent). Moreover, we also find that the effectiveness of local smoking laws on males increased in magnitude when potential endogeneity is account for. Again, the gold law estimate for males is significant and larger than the female estimate (columns 5 and 6 respectively).

We also re-estimated the results to consider the impact of smoking regulation on SAs which adopted smoking laws prior to provincial regulation (see Table 16). Our findings are similar to those presented in Table 15; although, the magnitude of the effects has decreased. This decrease in the magnitude of the effects may not be surprising as these SAs may have had a stronger view towards the negative effects of smoking and thus the reason why they adopted smoking regulations prior to provincial legislation to begin with. Specifically, smoking laws decreased the likelihood an individual reported being exposed to SHS by only 3.8 percent when examining SAs which enforced smoking laws prior to provincial laws, versus 8.7 percent in SAs which had to implement smoking regulations after provincial legislation dictated to do so. Additionally, in column 3 of Table 15, we once again confirm that stronger smoking laws are more effective at reducing reports of exposure to SHS; however, the magnitude of the effect has decreased. Gold laws reduced exposure to SHS by only 5.7 percent among this sample, while SAs who did not have smoking regulations in place prior to provincial legislation reported a 12 percent decrease in SHS exposure. In addition, we also find that the effectiveness of local smoking laws on males and females is significant; although, the magnitude of this effect decreases when evaluating the impact of

smoking laws on SAs who adopted smoking regulation prior to provincial law. Again, the gold law estimate for males is significant and larger than the female estimate (Table 16; columns 5 and 6 respectively).

Given the analysis above, we find that smoking laws do have a significant effect on respondents reporting exposure to SHS. Specifically we find that, when we remove locations that implemented smoking restrictions prior to the provincial laws in order to try to isolate for the impact of unobserved SA specific preferences for local smoking laws, Canadian adults are 8.7 percent less likely to report being exposed to SHS when a smoking law is present. Furthermore, we find that the stronger this smoking law, the less likely an individual will report exposure to SHS. The highest level smoking law (i.e. gold-level laws) reduces exposure to SHS by almost 14 percent among males and 10 percent for females in Canada when compared with no smoking law presence.[22] Males appear to be more affected by smoking laws than females, although this may be due to other exogenous factors (such as occupation[23]) not accounted for in this analysis. Therefore from the results presented above, it appears that implementing smoking laws did reduce exposure to SHS among adult Canadians over the period 2000-2007.

[22] When we restrict the sample to people 18 to 35, the magnitude of the coefficients is slightly larger with the gold law reducing exposure by more than 15 percent for males and 12 percent for females.

[23] There is no occupational variable in the 3.1 CCHS Master file data. However, when we re-estimate the results (omitting cycle 3.1) restricting the sample to people working in the service sector, the place where the laws are most likely to have an impact at work, we find that the gold law reduces SHS by around 15 percent overall, and 22 percent for males, but only 8 percent for females.

Table 14: Marginal effects from probit model for exposure to SHS in a public place, impact of both local and provincial laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Gold law	-0.111**	-0.107**	-0.077**		-0.090**	-0.065**
	[0.011]	[0.011]	[0.011]		[0.014]	[0.010]
Silver law	-0.092**	-0.088**	-0.057**		-0.068**	-0.047**
	[0.009]	[0.009]	[0.008]		[0.012]	[0.007]
Bronze law	-0.049**	-0.044**	-0.040**		-0.052**	-0.030**
	[0.010]	[0.011]	[0.010]		[0.013]	[0.009]
Any Law				-0.063**		
				[0.015]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	163,221	163,221	163,221	163,221	73,720	89,501
R-squared	0.038	0.054	0.06	0.06	0.06	0.059
P-values from F-tests						
Gold=Silver	0.053	0.064	0.034		0.082	0.032
Gold=Bronze	0.000	0.000	0.000		0.003	0.000
Silver=Bronze	0.000	0.000	0.054		0.186	0.024

Notes: The dependent variable is 1 if the person was exposed to SHS. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Table 15: Marginal effects from probit model for exposure to SHS, impact on cities forced to implement smoking regulations, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Provincial Gold Law	-0.144**	-0.142**	-0.118**		-0.135**	-0.104**
	[0.007]	[0.006]	[0.009]		[0.017]	[0.008]
Provincial Silver Law	-0.122**	-0.124**	-0.018		-0.027	-0.012
	[0.010]	[0.010]	[0.015]		[0.021]	[0.018]
Provincial Any Law				-0.087**		
				[0.014]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	76,291	76,291	76,288	76,288	34,770	41,472
R-squared	0.038	0.055	0.066	0.065	0.065	0.066
P-values from F-tests						
Gold=Silver	0.028	0.081	0.000	0.000	0.000	0.000

Notes: The dependent variable is 1 if the person was exposed to SHS. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Locations that had adopted a law prior to a provincial law of the same strength are omitted. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Table 16: Marginal effects from probit model for exposure to SHS, impact on cities who adopted smoking laws prior to provincial legislation, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5)	(6)
					Males	*Females*
Gold law	-0.102**	-0.097**	-0.057**		-0.071**	-0.045**
	[0.012]	[0.013]	[0.011]		[0.014]	[0.011]
Silver law	-0.089**	-0.083**	-0.041**		-0.056**	-0.027*
	[0.010]	[0.010]	[0.013]		[0.016]	[0.011]
Bronze law	-0.054**	-0.048**	-0.022		-0.040*	-0.007
	[0.013]	[0.013]	[0.015]		[0.019]	[0.014]
Any Law				-0.038*		
				[0.015]		
Additional Controls						
marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	120,976	120,976	120,976	120,976	54,807	66,160
R-squared	0.029	0.048	0.056	0.056	0.053	0.057
P-values from F-tests						
Gold=Silver	0.234	0.247	0.164		0.277	0.139
Gold=Bronze	0.000	0.000	0.025		0.092	0.013
Silver=Bronze	0.007	0.007	0.049		0.190	0.017

Notes: The dependent variable is 1 if the person was exposed to SHS. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Once a provincial law is adopted, observations from that province are dropped. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Seasonal Effects

It is likely that smoking laws may have a different level of impact on reducing exposure to SHS depending on the season. For example, in the winter months, smokers are likely more apt to smoke inside than in the summer months, increasing the potential impact of the laws during the winter. The impact of the season may also differ depending on the strength of the law. While the bronze and silver laws allow for designated smoking rooms, the gold laws do not, suggesting that there might be a larger seasonal effect for the gold laws. To investigate this, we next re-estimate the results of the impact of smoking laws on reducing SHS exposure taking into account possible seasonal effects. We restrict the results to our preferred specification which includes demographic controls; as well as location and

time fixed effects, and we include seasonal dummies and interact these with the different smoking laws. In column 1 we present the results with both SA and provincial laws included, in column 2, we present the results with only the provincial laws, while in column 3, the impact of the SA laws on their own are presented.

Not surprisingly, exposure to SHS in public places is lower in warmer months, possibly since people are more likely to smoke outside (for example, people are around 2.5 percent less likely to report being exposed to SHS in the summer months). When we examine all laws or just SA laws, we find that gold laws are more effective in the winter months, with the reduction in exposure to SHS being lower during the spring, summer, and fall months (see columns 1 and 3 of Table 17). We find less seasonal effect when we remove the SAs that had a smoking law prior to the provincial law, with the laws having a larger impact in the spring time.

4.3 Workplace Restrictions

Although there does not appear to be a significant relationship between public place smoking bans and own smoking behaviour, there may exist a relationship between own smoking behaviour and workplace restrictions as previous research has indicated (e.g. Carpenter 2009; Chapman et. al. 1999; Fichtenberg and Glantz 2002). Furthermore, there may also be a relationship between smoking laws and the implementation of workplace smoking restrictions. Although the local law dates available do not perfectly correspond to workplace restrictions for all SAs, we are able to examine these relationships using information in the CCHS. The following question was asked of people currently working, "At your place of work, what are the restrictions on smoking: (restricted completely, allowed in designated areas, restricted only in certain places, or not restricted at all)?".

Table 17: Marginal effects from probit model for exposure to SHS, Seasonal Effects

	All Laws	Provincial Laws	SA Laws
gold	-0.098**	-0.114**	-0.081**
	[0.012]	[0.014]	[0.016]
silver	-0.075**	-0.034	-0.047*
	[0.008]	[0.023]	[0.019]
bronze	-0.025+		-0.004
	[0.013]		[0.018]
gold x spring	0.048*	-0.033*	0.045*
	[0.019]	[0.015]	[0.018]
silver x spring	0.043**	0.018	0.012
	[0.012]	[0.021]	[0.013]
bronze x spring	-0.008		-0.017*
	[0.006]		[0.007]
gold x summer	0.043**	0.008	0.031*
	[0.016]	[0.018]	[0.015]
silver x summer	0.047**	0.021	0.014
	[0.013]	[0.025]	[0.009]
bronze x summer	0.001		-0.004
	[0.006]		[0.008]
gold x fall	0.052**	0.005	0.037+
	[0.018]	[0.020]	[0.019]
silver x fall	0.041**	0.026	0.009
	[0.010]	[0.025]	[0.014]
bronze x fall	-0.031**		-0.040**
	[0.007]		[0.008]
spring	-0.022**	-0.019*	-0.017*
	[0.005]	[0.008]	[0.008]
summer	-0.025**	-0.029**	-0.025**
	[0.005]	[0.006]	[0.007]
fall	-0.017**	-0.024**	-0.014*
	[0.004]	[0.005]	[0.007]
Observations	161319	75706	119181
R-squared	0.062	0.067	0.057

Notes: The dependent variable is 1 if the person was exposed to SHS. All regressions include controls for age and age squared, marital status, education, income, locational and time fixed effects. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Smoking Status

In Table 18, we show the estimates of the effect of workplace smoking restrictions on smoking status over the period 2000-2007 for adults in Canada. Given that smoking status is a dichotomous variable (either 1 if the respondent is a smoker or 0 if otherwise) outcomes are estimated using a probit model and marginal effects are reported. In column 3

we report results from the full model that includes demographic controls, year fixed effects, and SA fixed effects for the full sample. Columns 4 and 5 report results for the subsamples of males and females, respectively.

Referring to column 3 in Table 18, we find that workplace smoking restrictions are associated with a statistically significant decrease in the likelihood of an individual being a smoker. Furthermore, we find that stronger workplace restrictions lead to a larger likelihood of being a non-smoker. For instance, a complete workplace restriction reduces the probability of an individual being a smoker by approximately 17 percent, with males and females being affected almost equally; while a workplace restriction which only restricts smoking in certain areas reduced the probability of an individual being a smoker by only approximately 2 percent. These findings are similar to those identified by Fichtengerg and Glantz (2002) and Shields (2007).

Table 18: Marginal effects from probit model for smoking status considering workplace smoking restrictions, impact of both local and provincial laws, people aged 18 to 64

	(1)	(2)	(3)	(4) *Males*	(5) *Females*
Workplace Restriction 1	-0.221**	-0.174**	-0.171**	-0.171**	-0.179**
	[0.005]	[0.005]	[0.005]	[0.006]	[0.009]
Workplace Restriction 2	-0.077**	-0.061**	-0.060**	-0.064**	-0.061**
	[0.006]	[0.006]	[0.005]	[0.006]	[0.006]
Workplace Restriction 3	-0.034**	-0.024**	-0.021*	-0.018	-0.032**
	[0.008]	[0.008]	[0.009]	[0.011]	[0.011]
Additional Controls					
Marital status, education, income		Yes	Yes	Yes	Yes
City fixed effects			Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes
Observations	169,379	169,379	169,379	84,918	84,461
R-squared	0.031	0.064	0.068	0.068	0.068

Notes: The dependent variable is 1 if the person is a smoker. All regressions include controls for age and age squared. Columns 2 and 3 also include a male dummy. Workplace restriction 1 = smoking restricted completely; workplace restriction 2 = smoking permitted in designated areas only; workplace restriction 3 = smoking restricted in only certain locations. Robust standard errors in brackets are clustered on SAs. +significant at 10%; * significant at 5%; ** significant at 1%

Smoking Intensity

Given that workplace restrictions affect the likelihood of being a smoker, we investigated whether workplace restrictions would also affect the intensity of cigarette consumption among those who identified themselves as smokers. We would expect that individuals employed at a workplace with stronger smoking restrictions be more likely to smoke fewer cigarettes a day then those employed at a workplace with weaker or no smoking restrictions. The results of this analysis are shown in Table 19. In column 3, we show the estimates for smoking intensity, controlling for demographic variables, SA fixed effects, and time fixed effects, for the three different levels of workplace restrictions. Similar to the results for smoking status, we find those individuals whose place of employment had stronger smoking restrictions, consumed fewer cigarettes a day. Examining the results in more detail using *incident rate ratios* (IRRs), we find that when holding all other variables constant, individuals employed in a workplace which restricted smoking completely smoked almost half as many cigarettes as those individuals employed in a workplace with no smoking restrictions (calculated as e^{β}). Additionally, we find that the weaker the workplace smoking restriction, the more individuals are likely to smoke. That is, for individuals employed in workplaces with smoking restrictions in only certain places, those individuals smoked 0.87 cigarettes for every 1 cigarette a smoker consumed in a workplace with no smoking restrictions; while those working under complete smoking restrictions only consumed 0.41 cigarettes for every 1 cigarette a smoker consumed in a workplace with no smoking restrictions.

Table 19: Negative binomial regression results for smoking intensity considering workplace smoking restrictions, impact of both local and provincial laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5)
				Males	*Females*
Workplace Restriction 1	-1.114**	-0.911**	-0.889**	-0.883**	-0.970**
	[0.045]	[0.034]	[0.030]	[0.038]	[0.034]
Workplace Restriction 2	-0.441**	-0.361**	-0.350**	-0.353**	-0.415**
	[0.022]	[0.020]	[0.015]	[0.018]	[0.032]
Workplace Restriction 3	-0.199**	-0.175**	-0.137**	-0.091*	-0.295**
	[0.032]	[0.027]	[0.030]	[0.037]	[0.076]
Additional Controls					
Marital status, education, income		Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes
Observations	169,379	169,379	169,379	84,918	84,461

Notes: All regressions include controls for age and age squared. Columns 2 and 3 also include a male dummy. Workplace restriction 1 = smoking restricted completely; workplace restriction 2 = smoking permitted in designated areas only; workplace restriction 3 = smoking restricted in only certain locations. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

When we re-estimated our full model for the male and female subsamples, we find that in general both genders are affected similarly by workplace restrictions with respect to smoking intensity; although males did appear to be affected slightly more. We find that males working under full smoking restrictions smoked 0.41 cigarettes (females working under full smoking restrictions smoked 0.37 cigarettes) for every 1 cigarette a male (female) smoked in a workplace with no smoking restrictions, holding all other variables constant. When we look at workplaces that only allowed smoking in certain places, we find the incidence of smoking increases, with males consuming 0.70 cigarettes for every 1 cigarette a male smoked in a workplace with no smoking restrictions, while under the same workplace restriction, females smoke 0.66 cigarettes for every 1 cigarette a female smoked in a workplace with no smoking restrictions.

Ban Presence

So far we have shown that workplace smoking restrictions reduced the prevalence and intensity of smoking among adult Canadians over the period of 2000-20007. However it is also important to identify whether there is any link between smoking laws and respondents' reporting a smoking restriction at their place of work. Table 20 is presented in the same format as previous tables and reports the results of this analysis. The estimates reported in column 4 provide evidence that smoking laws are associated with a statistically significant increase in the likelihood that an individual reports a work-area smoking ban. Specifically, smoking laws significantly increased the likelihood that an individual reported that smoking is completely banned at their workplace by almost 5 percent, and by around 6.6 percent for gold laws. The one surprising result is that bronze laws have a stronger relation to a complete workplace law than silver laws. One potential explanation for this finding is that workplaces that have bronze level laws may be more likely to be workplaces where a large number of people smoke, such as blue collar occupations; however, we could not explore this due to data limitations. There does not appear to be much of a difference in the effect for males and females.

Controlling for the possibility of endogeneity caused by the fact that the decision to adopt a local smoking law could be correlated with individual preferences, we eliminated SAs which had smoking laws in place prior to the onset of provincial smoking laws; we re-estimated the model and report our results in Table 21. The estimates in column 4 of Table 21 confirm our findings above, that smoking laws are associated with a statistically significant increase in the likelihood that an individual reported a work-area smoking ban in the full sample; however, when we examine the impact on places that were forced to implement smoking restrictions, we find that the magnitude of the effect is larger.

Specifically, smoking laws significantly increased the likelihood that an individual reported that smoking is completely banned at their workplace by 5.9 percent, versus 4.9 percent when we did not control for the possible endogeneity of the smoking law. Furthermore, we find that males are 12.2 percent more likely to report a complete smoking ban at work when gold-level provincial legislation is in place, while females are only 11.1 percent more likely to report a complete smoking ban at their place of work. However, when we considered silver-level provincial bans, we find that the results are significant but wrong signed.

We also estimated the impact of smoking regulation on SAs which adopted laws prior to provincial legislation and report our results in Table 22. We find results similar to those of SAs which were forced to implement smoking laws, but the magnitude of the effect has decreased. When we consider both time and locational fixed effects, smoking laws significantly increased the likelihood that an individual reported that smoking is completely banned at their workplace by 2.7 percent when bronze level laws were present and over 3 percent when gold laws were considered. We found that the presence of any level of law increased the likelihood of an individual reporting a complete smoking ban at their workplace by 2.4 percent. Furthermore, we found that males, despite the level of law, are between 2.5 and 5 percent more likely to report a complete smoking ban at their workplace, while females are only 3 percent more likely to report a complete smoking ban at their place of work and only when gold level laws are present. Therefore, similar to the results presented above, males appear to be more affected than females by the presence of smoking regulations.

From the workplace smoking restriction analysis reported above, in general we confirm the pattern in previous research that there is a strong relationship between the strength of workplace smoking restrictions and both smoking prevalence and smoking

intensity (Carpenter 2009; Chaloupka 1992; Fichtenberg and Glantz 2002; Shields 2007). Furthermore, we confirm Carpenter's (2009) findings, that there is a statistically significant relationship between smoking laws and workplace smoking restrictions. Although our findings suggest only a modest relationship between smoking laws and workplace restrictions, we suspect that these estimates would increase in magnitude and reflect those of Carpenter's (2009) if we could eliminate any possible measurement errors by re-estimating our model using more accurate workplace smoking ban data.

Table 20: Marginal effects from probit model for presence of a complete workplace smoking law, impact of both local and provincial laws, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5) *Males*	(6) *Females*
Gold law	0.100**	0.092**	0.066**		0.064**	0.067**
	[0.011]	[0.011]	[0.012]		[0.016]	[0.010]
Silver law	0.063**	0.054**	0.023*		0.027*	0.018+
	[0.020]	[0.018]	[0.010]		[0.013]	[0.010]
Bronze law	0.067**	0.058*	0.045**		0.062**	0.026**
	[0.025]	[0.023]	[0.006]		[0.008]	[0.007]
Any Law				0.049**		
				[0.009]		
Additional Controls						
Marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	169,441	169,441	169,441	169,441	84,954	84,487
R-squared	0.017	0.063	0.077	0.077	0.069	0.047
P-values from F-tests						
Gold=Silver	0.112	0.080	0.001		0.031	0.000
Gold=Bronze	0.307	0.241	0.017		0.907	0.000
Silver=Bronze	0.868	0.885	0.003		0.005	0.246

Notes: The dependent variable is 1 if a complete workplace smoking restriction exists. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Table 21: Marginal effects from probit model for presence of a complete workplace smoking law, impact on cities forced to implement smoking regulations, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5)	(6)
					Males	*Females*
Provincial Gold Law	0.147**	0.147**	0.120**		0.122**	0.111**
	[0.015]	[0.016]	[0.017]		[0.024]	[0.017]
Provincial Silver Law	-0.01	-0.002	-0.056*		-0.050+	-0.060*
	[0.020]	[0.017]	[0.024]		[0.027]	[0.028]
Provincial Any Law				0.059**		
				[0.016]		
Additional Controls						
Marital status, education, income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	79,708	79,708	79,708	79,708	40,158	39,548
R-squared	0.016	0.063	0.077	0.076	0.071	0.051
P-values from F-tests						
Gold=Silver	0.000	0.000	0.000		0.000	0.000

Notes: The dependent variable is 1 if a complete workplace smoking restriction exists. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Locations that had adopted a law prior to a provincial law of the same strength are omitted. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

Table 22: Marginal effects from probit model for presence of a complete workplace smoking law, impact on cities who implemented smoking regulations prior to provincial regulation, people aged 18 to 64

	(1)	(2)	(3)	(4)	(5)	(6)
					Males	*Females*
Gold law	0.062*	0.054*	0.032*		0.034+	0.030*
	[0.027]	[0.022]	[0.014]		[0.019]	[0.013]
Silver law	0.072**	0.056**	0.01		0.024*	-0.007
	[0.022]	[0.020]	[0.011]		[0.012]	[0.016]
Bronze law	0.072**	0.062**	0.027**		0.050**	0.002
	[0.024]	[0.022]	[0.006]		[0.009]	[0.009]
Any Law				0.024**		
				[0.008]		
Additional Controls						
Marital status, Education, and Income		Yes	Yes	Yes	Yes	Yes
City fixed effect			Yes	Yes	Yes	Yes
Time fixed effects			Yes	Yes	Yes	Yes
Observations	127,681	127,681	127,681	127,681	64,294	63,387
R-squared	0.013	0.062	0.076	0.076	0.067	0.047
P-values from F-tests						
Gold=Silver	0.814	0.939	0.148		0.622	0.006
Gold=Bronze	0.809	0.821	0.692		0.381	0.003
Silver=Bronze	0.959	0.781	0.023		0.018	0.381

Notes: The dependent variable is 1 if a complete workplace smoking restriction exists. All regressions include controls for age and age squared. Columns 2, 3, and 4 include a male dummy. Robust standard errors in brackets are clustered on SAs. + significant at 10%; * significant at 5%; ** significant at 1%

5 CONCLUSION

Local smoking laws and workplace smoking restrictions have been implemented in Canada over the last several decades, with the primary intention of reducing individual's exposure to SHS. The potential health effects of such a policy are considered so beneficial that as of May 2008, all Canadian provinces and territories except for Prince Edward Island and the Yukon have legislation banning smoking in all public places (Health Canada 2008). Therefore it is important, from both an economic and public policy perspective, to examine whether these laws and restrictions truly decrease Canadian's exposure to SHS. Furthermore, given that these types of laws are expected to decrease ones exposure to SHS, there may also be additional benefits of such policies such as decreasing smoking prevalence and/or smoking intensity. Therefore, examining smoking laws and workplace restrictions in Canada and their effect on smoking prevalence, intensity, and exposure to SHS is critical in effectively evaluating the cost and benefits associated with such policies.

The overall findings in this area indicate that smoking bans, whether in the workplace or in public places, are negatively-related to SHS exposure. However, in terms of smoking prevalence and intensity, previous research has been mixed (e.g. Albers et al. 2007; Bitler et al. 2009; Carpenter 2009; Hammond et al. 2004; Shields 2007; Stephens et al. 2001; Tauras 2006; Wasserman et al. 1991). We looked to improve and add to the literature in several ways. First, we used a combination of both cross-sectional and longitudinal data in our analysis. The use of the longitudinal data allowed us to eliminate the individual fixed effects that may have been correlated with the smoking laws by using the within estimator. Additionally, we also considered the varying strengths of local laws and their effect on own smoking behaviour and exposure to SHS. Furthermore, in an attempt to eliminate the possible correlation between unobservables and smoking laws, we used both city and

provincial variations in smoking laws in our analysis.

We found that once we controlled for location fixed effects and time fixed effects, smoking laws did not appear to have an impact on whether a person smoked or the number of cigarettes smoked. However, as mentioned above, smoking laws were originally designed to reduce exposure to SHS, not tackle own smoking behaviours. When we examined the effect of smoking laws on SHS exposure, we found that local smoking laws had been very effective in reducing exposure to SHS in public places. Furthermore, the stronger the smoking laws, the greater the reduction in the exposure to SHS. To take our analysis one step further, we re-estimated our results and removed cities that had implemented a smoking law prior to the onset of provincial smoking legislation, in an attempt to eliminate the possible endogeneity of enacting a local law and smoking outcomes. Re-estimating our SHS exposure results, we found that the impact of gold laws were even stronger, suggesting that previous research which had considered only local laws, might have understated the true impact of smoking laws.

We also estimated the impact of workplace smoking restrictions on smoking outcomes of workers, and found that workplace restrictions had a very large impact on reducing the number of cigarettes smoked; as well as, whether or not a person smoked. Additionally, we found some evidence that smoking laws are related to workplace restrictions.

REFERENCES

Albers, A. B., Siegel, M., Cheng, D. M., Biener, L., and Rigotti, N. A. 2007. "Effect of smoking regulation in local restaurants on smokers' anti-smoking attitudes and quitting behaviours". *Tobacco Control* 16, 101-106.

Americans for Non-smokers Rights Foundation. 2009. *States, Commonwealths, and Municipalities with 100% Smoke-free Laws in Workplaces, Restaurants, or Bars*. Report available online at: http://www.no-smoke.org/pdf/100ordlist.pdf.

Bertrand, M., Duflo, E., and Mullainathan, S. 2004. "How much should we trust difference in differences estimates?" *Quarterly Journal of Economics* 119(1), 249-275.

Bitler, M., Carpenter, C., and Zavodny, M. 2009. "Venue-Specific Clean Indoor Air Laws and Occupation-Specific Outcomes". Working paper available online at http://web.merage.uci.edu/~kittc/

Buddelmeyer, H. and Wilkins, R. 2005. "The effects of smoking ban regulations on individual smoking rates". Institute for the Study of Labour (IZA) discussion paper no. 1737.

Carpenter, C. 2009. "The Effects of Local Workplace Smoking Laws on Exposure to Smoke at Work". *Journal of Human Resources*, forthcoming.

Chaloupka, F. J. 1992. "Clean indoor air laws, addiction, and cigarette smoking". *Applied Economics* 24, 193-205.

Chaloupka, F. J. and Wechsler, H. 1997. "Price, tobacco control policies and smoking among young adults". *Journal of Health Economics* 16, 359-373.

Chapman, S., Borland, R., Scollo, M., Brownson, R. C., Dominello, A., and Woodward, S. 1999. "The impact of smoke-free workplaces on declining cigarette consumption in Australia and the United States". *American Journal of Public Health* 89(7), 1018-1023.

Emont, S. L., Choi, W. S., Novotny, T. E., and Giovino, G. A. 1993. "Clean indoor-air legislation, taxation, and smoking Behaviour in the United States: An ecological analysis". *Tobacco Control* 2, 13-17.

Evans, W. N., Farrelly, M. C., and Montgomery, E. 1999. "Do workplace smoking bans reduce smoking?" *The American Economic Review* 89(4), 728-747.

Farkas, A. J., Gilpin, E. A., Distefan, J. M., and Pierce, J. P. 1999. "The effects of household and workplace smoking restrictions on quitting behaviours". *Tobacco Control* 8, 261-265.

Fichtenberg, C., and Glantz, S. 2004. "Effect of smoke-free workplaces on smoking behavior: Systematic review". *British Medical Journal* 325, 188-194.

Hammond, D., McDonald, P. W., Fong, J. T., Brown, K. S., and Cameron, R. 2004. "The Impact of Cigarette Warning Labels and Smoke-free Laws on Smoking Cessation: Evidence from former smokers". *Canadian Journal of Public Health* 95(3), 201-204.

Health Canada. 2008. Canadian Municipal By-laws Banning Smoking in Public Places. Available online at http: www.hc-sc.gc.ca/hl-vs/tobac-tabac/about-apropos/role/municip/ban-interdiction_e.html.

Levy, D. and Friend, K. 2003. "The effects of clean indoor air laws: what do we know and what do we need to know?" *Health Education Research* 18(5), 592-609.

Non-Smokers' Rights Association. 2005. "Compendium of 100% Smoke-Free Public Place Municipal Laws". July 2005 report.

Shields, M. 2007. "Smoking bans: Influence on smoking prevalence". *Health Reports* 18(3), 9-24.

Siegel, M., Albers, A. B., Cheng, D. M., Biener, L., and Rigotti, N. A. 2005. "Effect of local restaurant smoking regulation on progression to established smoking among youths". *Tobacco control* 14, 300-306.

Stephens, T., Pederson, L. L., Koval, J. J., and Kim, C. 1997. "The relationship of cigarette prices and no-smoking laws to the prevalence of smoking in Canada". *American Journal of Public Health* 87(9), 1519-1521.

Stephens, T., Pederson, L. L., Koval, J. J., and Macnab, J. 2001 "Comprehensive tobacco control policies and the smoking behaviour of Canadian adults". *Tobacco control* 10, 317-322.

Tauras, J. A. 2006. "Smoke-Free air laws, cigarette prices, and adult cigarette demand". *Economic Inquiry* 44(2), 333–342.

Wakefield, M. A., Chaloupka, F. J., Kaufman, N. J., Orleans, T. C., Barker, D. C., and Ruel E. E. 2000. "Effect of restrictions on smoking at home, at school, and in public places on teenage smoking: Cross sectional study". *British Medical Journal* 321(5), 333-337.

Wasserman, J., Manninh, W. G., Newhouse, J. P., and Winkler, J. D. 1991. "The effects of excise taxes and regulation on cigarette smoking". *Journal of Health Economics* 10, 43-64.

Yurekli, A. A., and Zhang, P. 2000. "The Impact of Clean indoor air laws and cigarette smuggling on demand for cigarettes: An empirical model". *Health Economics* 9, 159-170.