The impact of e-cigarettes bans on smoking habits and self-assessed health: evidence from the Canadian Tobacco Alcohol and Drugs (CTADS)

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I. Summary

Legislation may be an effective way to change people's consumption habits and to create anticipated and unanticipated externalities. To decrease smoking behaviour and its consequences on health, policies are implemented by the government. These regulations encourage smoke-free public spaces and reduce the prevalence and the intensity of smoking. This study is the first to our knowledge to examine the causal effect of bans on electronic cigarettes' use and its externalities on smoking habits and self-assessed health. Using nationally representative data on over 29 719 Canadian respondents across all 10 provinces between 2013 and 2015, we exploit a natural experiment to observe the variation in e-cigarettes smoking prevalence in Nova Scotia after a ban was introduced on May 31st, 2015. We find evidence of a statistically significant reduction in smoking behaviour. Our results suggest that an e-cigarette smoking ban is associated with a 7.4 percentage point reduction among regular e-cigarette smokers, which is robust to multiple controls. Additionally, general health has improved by 1.6 percentage point but there is no evidence of improvement in self-assessed mental health.

1. Introduction

One of the leading causes of death in Canada is malignant neoplasms also known as cancer. For both men and women, lung cancer is the most prevalent of these cancers and is most of the time due to high tobacco use.[1] In 2017, approximately 21,100 Canadians died of lung cancer which represents 26% of all cancer deaths (Canadian Cancer Society, 2017). Despite the robust correlation between this important risk factor – smoking tobacco – and its significant and direct consequences on health, people continue to use diverse types of tobacco products. In 2015, nearly 15 percent (4.6 million) of Canadians aged 15 years and older reported having used at least one tobacco product in the past 30 days. Beyond the typical cigarettes and cigars, the use of modern electronic cigarettes, commonly known as e-cigarettes, has risen exponentially and has spread widely since it was first introduced in 2004. Overall in 2015, 3.9 million (13%) of Canadians aged 15 years and older reported having tried an e-cigarette at least once[2].

E-cigarettes are smoking devices designed to look like a regular cigarette and to provide a similar sensation as smoking. They use containers filled with an e-liquid. That liquid is made of nicotine, flavorings, and other chemicals. The person inhales a vapor that comes from the conversion of the e-liquid by a heating device in the electronic cigarette. That is why using e-cigarettes is also known as vaping (WHO, 2014). The quantity of carbon monoxide and tar that people inhale is not the same as they would with a regular cigarette since e-cigarettes don't burn tobacco. However, there still is an unhealthy dose of nicotine and other chemicals that are consumed with e-cigarette use, though lesser than a regular cigarette. E-cigarettes can lead to nicotine addiction when it is used by non-smokers. This is particularly important since a simple

[1] For evidence on the ten leading causes of death in Canada in 2013, see Statistics Canada (2017)

[2] For own calculations see Section 4

exposure can initiate a person to start smoking after using e-cigarettes. E-cigarette use is strongly associated with cigarette smoking behaviour, including smoking initiation at follow-up (Hammond et al., 2017). There are several reasons for e-cigarettes consumption. Indeed, people use them for recreational use and to help cut down or quit smoking. Given that people are not well informed about the components of e-cigarettes, they believe that vaping is healthier than smoking. However, the health risk of vaping and the long-term health effects are uncertain since not all e-liquids are sold with nicotine.

As the possible toxicant exposure of e-cigarettes, the individual risk and the health effects remain unanswered, policies concerning these products vary across the world. The legal status of e-cigarettes is currently pending in many countries. Using data from the World Health Organisation and the Organisation for Economic Co-operation and Development, Kennedy et al. (2017) found that 68 countries out of 123 countries used policies to regulate e-cigarettes on a national level. Among them, 22 countries regulate e-cigarettes using existing laws; 25 countries implemented new policies; 7 countries adjusted current regulation; 14 countries used a combination of new/revised and existing regulation. Common policies consist of a control on minimum age to purchase, vape-free public places ban and constraint in marketing. Currently in Canada, like regular cigarettes, e-cigarettes are legal. However, unlike regular cigarettes, restrictions on their usage are few possibly because of the lack of knowledge about their safety, effectiveness for harm reduction and cessation, and total impact on public health. Since the impact of e-cigarettes on public health is unclear, it presents specific challenges for jurisdictions to determine how to regulate these products (Kennedy et al. 2017). The federal government has not applied any regulations or fiscal policies concerning the sale or the use of e-cigarettes; these restrictions are mainly on the provincial or municipal level. On the other hand, cigarettes are

taxed at the federal and provincial levels. However, Nova Scotia was one of the first provinces to put in place regulations on vaping and e-cigarette sales.[3] A legislation that treats e-cigarettes in the same way as tobacco cigarettes came into effect on May 31st, 2015. There will be a restriction on its display and marketing. First, e-cigarettes cannot be sold to minors or possessed by minors. They will not be used in indoor public places or workplaces and any venue where smoking is banned in Nova Scotia. Also, under the Tobacco Access Act, they must be kept out of sight, unless the store does not permit minors to enter. E-cigarettes cannot be promoted and there is no, display, no signage or advertising allowed outside of the store. These restrictions will also include a prohibition of sales to all in pharmacies, or anywhere else tobacco sales are banned. However, adults in Nova Scotia will continue to have access to e-cigarettes from most current vendors.

In this paper, we first study the effect of smoking bans in indoor public places or workplaces in Nova Scotia on the prevalence of e-cigarettes smoking to identify an effect that may plausibly be interpreted as causal. Second, we are interested in the spillover effect of e-cigarettes ban on cigarette consumption as one of the outcomes of interest. Third, we look at the short-term and self-assessed outcomes on the general and mental health of Canadians. The available research on e-cigarettes ban is limited because of few longitudinal data available for examining temporal associations. There are no data on electronic nicotine delivery systems use for many countries (WHO, 2014). Within the broad literature on smoking prevalence, a few papers focus on estimating electronic-cigarettes consumption decisions. To our knowledge, there is no paper that examines the bans' effects on e-cigarettes smoking behaviour. This paper extends the literature

[3]For more information on Tobacco Control in Nova Scotia, see https://novascotia.ca/dhw/healthy-communities/tobacco-act-amendments.asp

by providing evidence of a causal impact between an electronic-cigarettes ban and its externalities on smoking behaviour using Nova Scotia natural experiment. With data from the Canadian Tobacco Alcohol and Drugs of 2013 and 2015, we exploit the repeated cross-section design of the above to support our identification strategy. Using a difference-in-difference method, we quantify the consequences of the ban on e-cigarette consumption. Our findings suggest that e-cigarettes bans reduce the smoking behaviour in the months following the adoption of the policy. This impact is robust to the inclusion of many controls. Next, the estimates yield evidence that e-cigarette smoking bans affect smoking regular cigarettes behaviour. Finally, we found statistically significant evidence of improvement of general health and no evidence in mental health following a smoking ban.

This paper is structured as follow. Section 2 presents the literature review. We described our main empirical identification strategy and difference-in-difference estimator in Section 3. In section 4, we describe our data and provide an analysis of the relationship between e-cigarettes bans and our outcomes of interest. Section 5 describes the main results and robustness strategy. Last, section 6 concludes.

2. Literature review

A considerable amount of literature exists on the impact and the externalities of regulations on regular cigarettes consumption. However, studies concerning vaping are generally related to its use for smoking cessation and are limited to three randomized controlled trials and a growing number of user surveys, case reports, and cohort studies (Knight-West and Bullen, 2016). Smokers report using e-cigarettes to lessen the risks of smoking. Unlike the scare research on e-cigarettes, there is an extended body of research on the deleterious effects of tobacco consumption and its well-known impact and externalities. Healthcare providers and regulators, as well as smokers, are interested to know if these devices can help smokers quit and if they are safe to use for this purpose. Because of imprecision due to the small number of trials, there is evidence with low confidence that electronic cigarettes can help smokers quit in the long-term. Findings suggest that 44% of e-cigarette users stop smoking for at least six months compared with 15% for 18 months (Hartmann-Boyce et al., 2016). However, electronic-cigarettes containing nicotine increased the chances to stop smoking in the long term compared to using those without nicotine. There is no significant difference in six-month abstinence rates between the e-cigarette and nicotine patch. Because e-cigarettes are a new field of interest and data has just been made available recently, the literature on e-cigarettes is slim and most studies are related to cigarettes smoking. There are two ways that can be used by policy makers to discourage people from smoking: taxes which relies on prices elasticities and prohibition which is direct intervention on behaviour.

2.1.The impact of taxes on cigarettes' use

The principal political explanation for higher tobacco taxes is the assumption that higher taxes will reduce smoking aside from the fact that the government raises revenue from sales, income and property taxes (Hines, 2007). Empirical evidence shows that taxes are an effective method towards moderate smokers in changing their consumption habits (Callison and Kaestner, 2014). Their findings suggest that increases in cigarette taxes are associated with small decreases in cigarette consumption. Building on this idea, Abadie, Diamond and Hainmueller (2010) explored the application of synthetic control methods by studying the effects of Proposition 99, a large-scale tobacco control program that was implemented in California in 1988 to enforce a 25-cent per pack state excise tax on the sale of tobacco cigarettes. The authors demonstrated that, following Proposition 99, tobacco consumption fell markedly in California relative to a comparable synthetic control region. They estimated that the annual per-capita cigarette sales were about 26 packs lower than what they would have been in the absence of Proposition 99 by the year 2000. The impact of fiscal policies on smoking behaviour varies with age. For adult smokers that are aged 18 to 74, a 10% tax increase is associated with a 0.3% to a 0.6% decrease in smoking participation and a 0.3% to a 0.4% decrease in smoking intensity. Therefore, it will take considerable tax increases, on the order of 100%, to decrease adult smoking by as much as 5%. Their results also show a negative, small and not usually statistically significant relationship between cigarette taxes and smoking participation or smoking intensity Additionally, Lewit and Coate (1982) found that the adult price elasticity of demand for cigarettes to be -0.42. The authors reported a smoking participation price elasticity estimate for adults ages 35 and over of -0.15 and a smoking intensity elasticity of -0.07. They also found that younger smokers responded more to prices change than older smokers and that most of the effect of price increases

was driving the decision to smoke. Evans and Farrelly (1998) reported no association between taxes and participation for adults over the age of 40 but also found that taxes had a greater impact on younger smokers. Also, Wasserman et al. (1991) found that both the smoking participation and smoking intensity price elasticities for adults were unstable over time. Price elasticities of demand for adults ranged from 0.06 in 1970 to -0.23 in 1985. Consequently, there is a consensus among policymakers that raising tobacco taxes reduces cigarette consumption among youth. Nevertheless, evidence that tobacco taxes reduce adult smoking is relatively sparse.

2.2.The impact of smoke-free policies on cigarettes' use

In addition to fiscal policies, smoking behaviors can be altered with the implementation of smoke-free policies which prohibit the use of tobacco in public areas such as restaurants, schools and workplaces. Smoke-free policies have various impacts on the person itself and potential spillovers on others in terms of health outcomes and behaviour. There are direct and indirect effects in the sense that there are effects on smokers themselves and effects on those who are around them whether they are smokers or non-smokers.

Firstly, Fichtenberg and Glantz (2002) focused on daily cigarette consumption and smoking prevalence to quantify the effects of smoke-free workplaces on smoking in employees and compare these effects to those achieved through tax increases. The authors found evidence that smoke-free policies reduce smoking prevalence by de-normalizing the perceptions about tobacco use. Their findings suggest a reduction in smoking prevalence of 3.8% and 3.1 fewer cigarettes smoked per day per heavy smoker which would be achieved by an increase in the tax on a pack of cigarettes $0.76 to $3.05 in the United States. Also, workplace smoking policies reduce smoking prevalence by 10 percent and daily consumption by 5 percentage points which can

explain the diminution in smoking among workers comparative to nonworkers (Evans, Farrelly and Montgomery, 1999). Furthermore, smoke-free policies may influence an individual's behavior by sending information and knowledge about certain consequences and by changing an individual's norms and imposing about using certain products (Brown and Moodie, 2009). Changing norms and attitudes through these policies results in perceiving smoking as an unacceptable behaviour among adults and adolescents. However, Brodeur (2013) and Jones et al. (2011) found no evidence that the introduction of local smoking bans in bars, restaurants and workplaces decrease the smoking prevalence. Also, Odermatt and Stutzer (2015) found that smoking bans in 40 European countries over time increase the life satisfaction of smokers who would like to quit.

Secondly, an additional advantage arising from smoke-free policies is the reduction in exposure to second-hand smoking. Indubitably, indoor smoking bans reduce exposure to second-hand smoke in workplaces, restaurants, and public spaces (Callinan et al., 2010). Kuehnle and Wunder (2017) reported improvements in self-assessed health among non-smokers living in households with at least one smoker following the introduction of smoking bans in Germany, but no health effects among smokers. Lee et al. (2017) found that indoor smoking ban legislation in South Korea has improved health outcomes on the public health, especially in cardiovascular and pulmonary diseases by the reduction of admission in hospitals. Also, public smoking bans have a statistically significant short-term positive impact on the well-being of married individuals, especially among women with dependent children (Yang and Zucchelli, 2018). Yet, the results on the impact of these policies show variations in opinions and the notion that smoke-free policies may impact smoking behaviour is not obvious, as outcomes are mixed. Literature has provided evidence that smoking ban can have perverse effects on non-smokers by displacing

smokers to private places where they contaminate non-smokers, especially young children (Adda and Cornaglia, 2010).

2.3.Smoking and peer effects

Peer influence plays a significant role in determining who smokes and who doesn't. Literature has found evidence of the impact of classmates in smoking cigarettes among adolescents. Mir and Dwyer (2009) examined the effect of an adolescent on individual behaviors during adolescents' transition into adulthood. They found that a 10% increase in the proportion of classmates who smoke will increase the likelihood of smoking by more than 3%. Also, an increase in smoking rates among an individual's close friends by 10% will increase the likelihood of smoking by 5%. They also found evidence to show that the influence of close friends from adolescence years continue to have an impact on smoking tendencies even when a transition to adulthood is made. A distinction is made between active and passive peer influence. Harakeh and Vollebergh (2012) studied the impact of imitation and pressure, respectively defined as passive and active peer influence, on young adult smoking. Their results showed that the interaction effect of peer pressure and peer smoking was not significant. However, peer smoking significantly projected the number of cigarettes smoked by young adults while peer pressure did not. Thus, passive peer influence affected young adult smoking rather than active peer influence.

Furthermore, social interaction and network are key factors in a person's decision to smoke. Chassin et al. (1986) examined whether the influence of peers or parents on smoking transition differed with age or sex on 6th–11th graders and found that parents and peers have a significant influence on adolescent behaviour and were predictive of higher levels of smoking. The initiation of smoking among youth who had never smoked before was more likely for students with more

smoking friends and parents, lower levels of parental support, and friends with lower expectations for their general and academic success. Additionally, the outcomes varied across gender. For girls, the transition from experimental to regular smoking was more likely if their friends had more positive attitudes toward their smoking and lower expectations for their general and academic success. For boys, the transition was more likely if their friends had higher expectations for their success. Liao et al. (2013) examined also the changes in friends' and parental influences on cigarette consumption but focusing on junior high school and high school as adolescents mentally develop differently across these two social environments. In both developmental periods, the effects of friends' and parental cigarette use remained significant in adolescent cigarette smoking. The importance of the effect of the parents remained relatively the same between the two periods. However, the friends' effect appeared to be in general higher during junior high school than high school. From 10th to 12th grade, the trends of both friends and parental influences decreased. Gender differences were also perceived. Among boys, friends' effect increased during high school compared to girls where friends' and parental effects were greater in their early high school years and decreased in magnitude during high school.

Among adults and couples, partners often have similar characteristics and behaviors. Smoking patterns are found to be significantly concordant for married pairs. Therefore, it is possible that a partner who doesn't smoke can influence his mate to stop smoking. On the other hand, having a smoker as a partner can influence the initiation of smoking, or return to smoking. Homish and Leonard (2005) observed the spousal influence on smoking behaviors in the United States among newly married couples. They found that a partner's smoking status influenced the other's smoking behaviour, even though the spousal influence is more significant on relapse than cessation. Husband's influence was greater than wife's influence since non-smoking wives were

more likely to resume smoking in the early years of their marriage if their partners were smokers. However, the smoking behaviour of a wife did not forecast husband initiation of smoking. These findings suggest that during the transition to marriage, spouses do influence their partners' behaviors. Women are more likely to resume smoking or return to smoking if their partners smoke.

Other factors can affect the spillover effect on partner's likelihood of smoking cessation. The maintenance of a smoking cessation is more easily attained when both partners are given information and support to quit smoking at the same time (Franks, Pienta and Wray, 2002). Takagi et al. (2014) studied the influence of spouses on smoking cessation by gender and education among Japanese couples. They found that, for men, a spouse's smoking status determines smoking cessation achievement. For women, however, the combination of educational attainment may matter in the interventions. Among men and women, being married to a current smoker decreased the likelihoods of quitting smoking. Among women only, the probability of quitting smoking is increased when married to a former smoker (Cobb et al., 2014). Compared with employment, unemployment was associated with nearly twice the subsequent odds of smoking, and with increased cigarette consumption among male, but not female, smokers (Arcaya et al, 2014). Therefore, spousal unemployment predicts changes in substance use behaviors, and that the direction of the change was substance-dependent. Additionally, Clark and Etilé (2006) found that individual current smoking behaviour and partner's past smoking are statistically independent. Their findings suggest that all the correlation in smoking status works through the correlation in individual effects.

2.4.The impact of e-cigarettes availability

In the last two years, there is one strand of the literature that has developed on e-cigarettes on the impact of their availability. Many researchers looked at the change in the availability of e-cigarettes. Rose et al. (2014) studied their accessibility in United States retail outlets. With data from two national samples of tobacco retailers, they found evidence that e-cigarettes are more likely available in areas with a weak tax on e-cigarettes and smoke-free policies. Their results showed that tobacco, pharmacy and convenience stores were more likely to sell e-cigarettes than liquor stores. They also found a relationship between income and ethnicity and e-cigarettes availability. Neighbourhoods with higher median household income and a lower percentage of African–American and Hispanic residents were most likely selling e-cigarettes. Their findings also suggested that the price of traditional cigarettes was inversely related to e-cigarette availability. A Canadian study by David Hammond et al. (2015) suggested that 76% of the retail outlets sold e-cigarette products. However, e-cigarettes with nicotine were mainly sold in vape shops and online outlets, signifying limited compliance with prevailing regulations. The demand for conventional cigarettes was the lowest in those with greater frequency of e-cigarette use. When both products were available together, daily e-cigarette users purchased more e-cigarettes, but e-cigarettes served as a substitute for cigarettes in all groups regardless of the frequency of use (Snider, Cummings and Bickel, 2017). From 2012 to 2013, the presence of interior increased from 12.7% to 50.6% and exterior advertising also significantly increased from 7.6% to 22.8% (Wagoner et al., 2014).

Another side of the literature focuses on the availability of the different forms of e-cigarettes. Because of the rapid evolution of the e-cigarette industry, new products are constantly developed and marketed. E-cigarettes with and without nicotine are usually accessible and advertised in

many retail outlets in Canada. The majority (94%) of convenience stores, grocery stores and tobacconist shops selling e-cigarettes sold nicotine-free products only. In opposition, all the vape shops retailed at least one nicotine-containing e-cigarette product (Hammond et al., 2015). Most e-cigarettes and e-liquids do not include warning labels (Chacon et al., 2018). Moreover, e-cigarettes including rechargeable kits and disposables more than doubled in 11 college communities in North Carolina and Virginia during a 1-year period.

Finally, there is evidence of an impact of e-cigarettes' prices on their consumption. A pack of cigarettes is more expensive than a refill cartridge but less expensive than a disposable e-cigarette. However, disposable e-cigarettes are comparable to 2 packs of cigarettes, causing the average per use price for disposable e-cigarettes to be lower. Pesko and Warman (2017) found that a 10% higher e-cigarette cartridge prices reduce current e-cigarette use by 18% and increase current cigarette consumption. The effect is greater for males and for older teenagers. As of today, there are four different generations of e-cigarettes which are distinct by their looks and the advancement of technology. Price of e-cigarettes differed significantly by generation. In addition, e-cigarette sales are also very responsive to own price changes. Disposable e-cigarettes appear to be substituted for reusable e-cigarettes. A rise of 10% in price decreases sales of disposable e-cigarettes by about 12%, and by approximately 19% for reusable e-cigarettes. Therefore, policies that aim to increase e-cigarette retail prices by limiting discounts and coupons and imposing a tax on e-cigarettes could possibly lead to significant reductions in e-cigarette sales. However, tax policies based on product type might lead to substitution between different types of e-cigarettes. Findings suggest that a 10% increase in reusable e-cigarette price would raise sales of disposable e-cigarettes by around 5% (Huang, Tauras and Chaloupka, 2014).

3. Identification Strategy

We used the difference-in-difference (DD) estimators because our data include information on a group affected by the policy and a group that is not affected. Also, we have a baseline and at least one round of follow-up data. The key identification assumptions in our empirical strategy are that there is no anticipation effect and that in the absence of treatment the trends are parallel. Difference-in-difference estimators assume that in absence of treatment the difference between control and treatment groups would be constant over time. This can be represented graphically in a linear modeling context by ''parallel trends'' in outcome levels between treatment and control groups in absence of a treatment. The difference-in-difference method provides a systematic way to estimate the intervention effect and can work well for ex-post evaluations of natural experiments (Angrist and Pischke, 2009).

The major assumption is that treated would have evolved the same way as untreated without the ban. In other words, in the absence of the treatment, the difference between the two groups would be the same (Abadie, 2005). Also, there should not be other tobacco control policies or health policies simultaneously with the smoking bans. We made sure that no policies occurred at the same time impacting the e-cigarettes consumption. Nova Scotia was the first province to enact a tobacco and electronic cigarette sales act and was followed by other provinces. However, during the years 2013 and 2015 available in the data, few provinces enacted a ban. New Brunswick passed the law on July 1st, 2015 and Prince Edward Island in October 1st, 2015. In November 2015, Quebec and Manitoba also implemented a similar ban. Given that the control group would be contaminated if we keep these four provinces, we drop individuals who were surveyed after the ban from our sample. We ensured that for all those provinces that individuals were interviewed after the ban are not any different in terms of characteristics. Table 3 shows

that there is no difference in variables, thus, the groups evolved in the same way. Consequently, we did not include potential confounding factors at the provincial level that would violate the common trend assumption.

Nova Scotia is the province affected by the ban and five of the Canadian provinces are the control group. The quality of the control group and the likelihood that both groups have similar trends will determine the reliability of the results. In the descriptive statistics part, we check for differences in the characteristics of the control and treatment group. Overall, we find no statistical difference between the composition of these two groups. To identify the causal effect of e-cigarettes' ban on smoking behaviour and self-assessed health, we use a dummy decision by individual *i*, living in a province *p*, to smoke or not in year *t*. we estimate in our initial model:

$$SB_{i,p,t} = \propto_s + \beta Post_t + \gamma NS_p + \delta Post * NS_{p,t} + \emptyset X_{i,p,t} + \varepsilon_{i,p,t} \quad (1)$$

$$AH_{i,p,t} = \propto_s + \beta Post_t + \gamma NS_p + \delta Post * NS_{p,t} + \emptyset X_{i,p,t} + \varepsilon_{i,p,t} \quad (2)$$

Here, the smoking behaviour ($SB_{i,p,t}$) and self-assessed health outcomes ($AH_{i,p,t}$) by individual *i* in province *p* on year *t* are a function of dummy variables for whether the respondent lives in the province affected by the ban, NS_p; dummy variables for whether the respondent is interviewed after the policy was introduced, $Post_t$; individual controls, $X_{i,p,t}$; and an error term, $\varepsilon_{i,p,t}$. We define the *Post* variable according to the enactment date in Nova Scotia (Table 2). In this model, the key coefficient δ measures the difference-in-difference identifying the causal effect of e-cigarette smoking bans on smoking behaviours and health effects (i.e., the change in Y before and after the treatment for the treated with respect to the controls).

Our primary outcome of interest is the use of e-cigarettes. As mentioned earlier, there are several questions concerning the consumption of e-cigarettes. We observe if respondents used it

in the past 30 days, or as a smoking cessation aids, or as a substitute for when they were not able to smoke cigarettes. Our secondary outcome represents the effect of e-cigarettes ban on cigarettes smoking to provide evidence of externalities. The dependent variables are if the person currently smokes cigarettes and if it is daily. Our third outcome is the self-assessed health effects. Because the dependent variable is not continuous, we dichotomize the variable of self-assessed health. We use a linear probability model to interpret the regression as modeling the probability that the dependent variable equals one.

4. Data and descriptive statistics

4.1. Tobacco, alcohol, and drug use database

In this paper, the empirical analysis is based on individual data from the Canadian Tobacco Alcohol and Drugs (CTADS), a survey of Canadians who are older than 15 years old when they are interviewed. The survey is designed explicitly to measure tobacco, alcohol, and drug use at the provincial level. This general population survey is carried out every 2 years and combines the tobacco content from the Canadian Tobacco Use Monitoring Survey (CTUMS), conducted from 1999 to 2012, and the drug and alcohol content from the Canadian Alcohol and Drug Use Monitoring Survey (CADUMS), conducted from 2008 to 2012. The CTADS is performed by Statistics Canada on behalf of Health Canada and is more efficient than the CTUMS and CADUMS in the collection of data because it is a way to record the use of various addictive products and substances at the same time. The survey is a sample survey with a repeated cross-sectional design. It provides detailed information on measures of consumption undertaken in a two-phase stratified random sample of telephone numbers. To increase the representation in the

sample of individuals, households are selected using Random Digit Dialing in the first phase. In the second phase, one or two individuals are selected based upon household composition.

Considering the institutional setting discussed above, we base the core of our empirical analysis on the two waves of the CTADS available; 2013, which has 14 565 observations, and 2015 with 15 154 observations. The person response rate for the CTADS, February to December 2013 Annual Summary was 81.8% and 79.0% in 2015. To establish an exhaustive list of different usage of e-cigarettes, we construct province-level variables of smoking behaviour covering the years 2013 and 2015. The initial sample has 29 719 observations and we used 17 526 observations after dropping four provinces (8,314 in 2013 and 9,212 in 2015).

4.2.Variables

Dependent variables

Measurement of smoking behaviour and self-assessed health condition is derived from a series of specific questions respondents are asked about each drug and tobacco products and their level of health respectively. The outcome variables consist on dummy variable if the respondent has ever used e-cigarettes, if it was used in the past 30 days and if it was used as a smoking cessation aid or when unable to smoke cigarettes. Because the survey was adjusted in 2015, some questions are missing in 2013 in comparison to the following year. Consequently, the frequency of use of e-cigarettes, whether this was every day, occasionally or not, is not included in this analysis. For the cigarettes consumption, respondents were asked if they currently smoke cigarettes and if they are daily smokers. Finally, the health outcome variables measure the level of health and the mental health.

The questions used to construct the outcome variables are:

- Ever used e-cigarettes: The first question asked regarding e-cigarette is: "Have you ever tried an electronic cigarette, also known as an e-cigarette?" The answers are collected in the form of a dummy variable equals to 1 for yes and equals to 0 for no. It measures the e-cigarette smoking prevalence over the months when the survey was taking place. The ban should affect the intensity with which the number of people who have tried e-cigarettes increases.

- Used e-cigarettes in the last 30 days: Respondents were asked to answer this following question "In the past 30 days did you use an electronic cigarette, also known as an e-cigarette?" This variable is binary and takes a value of 1 if yes and 0 otherwise. We expect that this variable will be affected by the comprehensive ban of electronic cigarettes in the treated group as it identifies regular users.

- Used e-cigarettes as a smoking cessation aid: Respondent were explicitly asked: "In the past two years, did you ever use the e-cigarette as an aid while attempting to quit smoking?" A positive response to this question was coded as 1 and 0 for a negative response. A change in the answers to this question allows me to identify the change in perception of e-cigarette's use.

- Used e-cigarettes as a substitute when not able to smoke: Canadians answered the following question: "Have you ever used e-cigarettes when you were not able to smoke or when you wanted to smoke fewer cigarettes? (For example, in a meeting, on a plane, at

school?).'' Sometimes smokers use e-cigarettes even when they are not attempting to quit smoking. This variable allows me to capture the impact of e-cigarettes smoking ban on cigarette smoking behaviour. A restriction on e-cigarette use could influence those who are not trying to stop smoking.

- Presently smoke cigarettes: In the CTADS, respondents were asked: ''At the present time, do you smoke cigarettes every day, occasionally or not at all?'' We code the answer to this question as a dummy variable that is equal to 1 if they answered every day and occasionally and is equal to 0 if they answered not at all. This outcome measures the cigarette smoking prevalence over the month of the survey. This question allows me to identify if a ban on e-cigarette would affect the intensity with which the number of people who smoke regular cigarettes changes.

- Daily Smokers: Canadians were asked: ''During the past 30 days, did you smoke every day?''. The answer was reported as a dummy variable that takes a value of 1 if they smoke every day and zero otherwise. This question allows me to see if an e-cigarette ban has an impact on the number of regular smokers since most adults using e-cigarettes are current cigarette users (Kennedy et al., 2017).

- General health: Respondents were asked: ''In general, would you say your health is...?''. The answer to this question is presented in five categories: excellent, very good, good, fair and poor. We dichotomize and code the answer for good health as 1 if it is excellent, very good and good and zero otherwise. We expect that this variable will be affected by

the comprehensive ban of electronic cigarettes in the treated group as it identifies the general level of health.

- Mental health: Respondents were asked: "In general, would you say your mental health is…?". This variable was reported as a dummy variable for good mental health that takes a value of 1 if the respondent answered excellent, very good, good and zero otherwise. This outcome captures the self-assessed level of mental health. We expect that this variable will be affected by the comprehensive ban of e-cigarettes in the treated group as it identifies the mental health.

Variable of Interest

The independent variable of interest is the interaction variable "$Post * NS$". The variable "NS"takes a value of 0 if the individual interviewed lives in Nova Scotia and takes a value of 1 if he lives in the other provinces of Canada. The variable "$Post$" takes a value of 0 if the respondent answered the questionnaire before May 31st, 2015 and takes a value of 1 if the interview was done after May 31st, 2015 if Nova Scotia. For a difference-in-difference strategy, this variable allows to estimate the average treatment effect on treated, in other words, it also identifies the impact of the e-cigarettes bans on smoking behaviour. The data set we use contains data from January 2013 to December 2015. On April 28th, 2015, the Nova Scotia House of Assembly amend the Tobacco Access Act to ban the sale of flavoured tobacco, e-cigarettes and waterpipes. The changes made to the province's tobacco control legislation were effective May 31st, 2015, a month after. Yang and Zucchelli (2015) found that there are no anticipation effects on people's behaviour even if the ban is expected. Legislation in Nova Scotia regarding indoor

smoking bans targeted different establishments: indoor or workplaces[4]. Prior to May 2015, there were no regulations at the provincial level concerning indoor smoking bans across Canada for e-cigarettes. The data set contains information before the ban – from January 2013 to May 2015 – and data after the ban – from June 2015 to December 2015. The selection of households was made from a random sample of telephone numbers which allows me to use the late data of 2015 as data post ban. This natural experiment provides the kind of randomisation needed to identify causal effects of comprehensive smoking bans on perceived smoking behaviour and personal health.

Controls

In the quest for identifying causal effects between the ban and smoking behaviour, we use different controls which are variables determining the treatment and correlated with the outcome and variables uncorrelated with the treatment but correlated with the outcome. Since there are multiple variables that vary across time and might influence the smoking behavior, we control for the following ones:

- Age: Age is a key factor when it comes to smoking, to its initiation and dosage. Several authors study the smoking behaviour across different age categories. Chen and Millar (1998) found evidence that smoking initiation during early adolescence was associated with greater daily cigarette consumption. To compare the outcome for distinct groups in the population, we use two distinct ways of defining age categories. We separate our data by 5 years from 15 to 40 years old and then by 10 years categories.

[4] For details on the policy see Table 2

- Gender: Generally, men tend to use all tobacco products at higher rates than women (Jamal et al., 2016) more specifically nearly five times (Guindon and Boisclair, 2013). However, the ratios of female-to-male smoking prevalence differ worldwide. Women smoke at approximately the same rate as men in high-income countries like Australia, Canada, the United States of America and most countries of western Europe. On the other hand, women smoke much less than men in many low and middle-income countries. For example, 33.3% of French men are reported to be current smokers, compared to 26.5% of women. In opposition, 66.0% of men are reported to be current smokers, compared to only 3.1% of women in China (WHO, 2008). In this paper, gender is a dummy variable that takes a value of one to indicate a female.

- Marital status: This variable allows controlling for the difference between individuals because of their marital status. The CTADS provides information about whether a respondent is married, separated or single. This variable takes a value of 1 if the respondent lives with another person (married or common-law) and a value of 0 if the respondent is single. Cho et al. (2008) examined the effect of marital status on smoking in Korea. They found that smoking rates were higher for unmarried men and women in comparison to the married one. Their results also suggest that marital status has an influence on smoking behaviour for both men and women.

- Employment status: Literature has found evidence of a causal effect between income and smoking behaviour. A change in household income is not associated with smoking behaviour

but a change in income that shifts a household across the poverty threshold has an impact on smoking behaviour (Young-Hoon, 2012). Also, there is abundant evidence of the association between education and smoking. For example, in the United States, the decline in smoking prevalence from 1974 to 1985 in the National Health Interview Survey has happened five times higher among the most educated than among the least educated (Pierce et al., 1989). Halpern et al. (2001) looked at the impact of smoking status on workplace absenteeism and productivity. The results suggest that current smokers had significantly greater absenteeism than those who never smoked. Also, workplace productivity is increased, and absenteeism is decreased among former smokers as compared to current smokers. The information that is available in the CTADS on socioeconomic status is whether a respondent is employed, absent from work or self-employed. Given that the database does not include information on a household's income and education level, we only use employment as a proxy.

4.3.Descriptive Statistics

Since it was first introduced, electronic cigarettes' use has grown quickly (WHO, 2014). Our smoking data are consistent with the general rapid increase in e-cigarettes smoking. It suggests that the proportion has gone up from 7.74% to 13.88%. Table 1 shows the summary statistics for the variables. Summary statistics are weighted by the survey weight of a person to make the analysis sample representative of the target population. Weighting summary statistics and regression results allow avoiding the distortion of summary statistics or regression results (Solon, Haider and Wooldridge, 2015). Looking at Table 1a, we notice that the level of e-cigarette use in Nova Scotia was in average 10.28%. Among them, 19.56% have used it in the 30 days prior to the survey. Half of the consumers use it as a smoking cessation aid and 36.73% used it as a substitute for regular cigarettes. Originally, e-cigarettes were designed to help people quit

smoking cigarettes. Hartmann-Boyce et al. (2018) found evidence that trading cigarettes with other nicotine delivery devices can transfer cigarette addiction to nicotine addiction which is not solving the problem. 80.9% of Canadians indicated that they knew what their e-cigarettes contained, and this knowledge remained the same at follow-up survey (82.2% in 2015). Among them, the percentage of those using e-cigarettes with nicotine has more than doubled (26.4% in 2013 compared to 47.6% in 2015) and those using it without nicotine has reduced (54.5% in 2013 compared to 34.6% in 2015). Additionally, there is a decrease in the smoking rate in Canada for all age category. 12.9% of Canadians are current smokers and 6.9% are daily smokers. Overall, 91.2% of Canadians reported having a good health and 95.2%, a good mental health.

As mentioned, one important identifying assumption is that our treatment and control groups evolved similarly over time. To verify it, we computed means of our demographic and socioeconomic variables by whether the respondent was interviewed before or after the ban and by whether he/she was part of the treated group or the control group. We calculated the difference before and after for each group. Then, we tested the null hypothesis of no difference between treated and control groups before and after the ban. Table 1b provides the summary statistics of the independent variables before and after the policy in the control and the treatment group. The average age of Nova Scotian is 47.28 years old and 45.53 years old for the rest of Canadians, and there are slightly more women than men. In the CTADS, a higher percentage of males (16% or 2.3 million) than females (10% or 1.6 million) reported current smoking. The percentage of people living with someone is 62.0% in Nova Scotia. In the rest of Canada, 64.8% live with someone compared to 68.0% that live alone before the ban. For the employment status, the percentage of employed and self-employed is approximately the same across both groups.

There is a significant difference in the mean of age between both groups before and after the ban but there is no difference between the other variables. Taken all together, we found that the groups evolved in the same way which allows for identifying assumptions to hold.

Table 1a. Descriptive statistics, weighted variables

Variable	Means
Outcome variables	
E-cigarette consumption	
Ever used	0.1028
	(0.3037)
Used in the last 30 days	0.1956
	(0.3968)
Used as a smoking cessation aid	0.5085
	(0.5001)
Used as substitute	0.3673
	(0.4822)
Cigarette consumption	
Current smoker	0.1297
	(0.3359)
Daily smoker	0.6889
	(0.4630)
General Health	
Good	0.9122
	(0.2829)
Mental Health	
Good	0.9521
	(0.2136)
Independent variables	
Age	45.6021
	(18.4986)
Female	0.5068
	(0.4999)
Marital status	
Living with someone	0.6549
	(0.4754)
Employment status	
Employed	0.5905
	(0.4918)

N= 17,526 observations for both years (8,314 in 2013 and 9,212 in 2015). Standard deviations are given in parentheses.

Table 1b. Descriptive statistics, weighted independent variables

Variable	Nova Scotia	Rest of Canada[a]	t[b]
Means before May 31st, 2015			
Age	47.2809	45.5331	2.00**
	(18.6142)	(18.4506)	
Female	0.5089	0.5048	0.18
	(0.5000)	(0.5000)	
Marital status			
Living with someone	0.6200	0.6478	-1.23
	(0.4855)	(0.4777)	
Employment status			
Employed	0.5599	0.5953	-1.52
	(0.4965)	(0.4909)	
Means after May 31st, 2015			
Age	48.3815	45.4966	2.19**
	(18.8831)	(18.5959)	
Female	0.5332	0.5112	0.62
	(0.4992)	(0.4999)	
Marital status			
Living with someone	0.6420	0.6803	-1.16
	(0.4797)	(0.4664)	
Employment status			
Employed	0.5424	0.5819	-1.13
	(0.4985)	(0.4933)	

N= 17,526 observations for both years (8,314 in 2013 and 9,212 in 2015). Standard deviations are given in parentheses.
[a]Rest of Canada except for New Brunswick, Prince Edward Island, Manitoba and Quebec.
[b]Test of equality of means in Nova Scotia and the rest of Canada.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

5. Results

We first described the results of the regressions of the effect of the electronic cigarettes bans on smoking behaviour. Tables 3 contains the results of Equation (1) when controlling for all the variables. The first column is difference-in-difference estimates for Canadians who have ever tried e-cigarettes. There is an overall statistically significant increase of e-cigarettes smoking in Nova Scotia by 7.7 percentage point, which is coherent with an overall increase in the consumption of e-cigarettes. The coefficient of interest shows a decrease of 4.5 percentage point of smoking prevalence which is statistically significant at the 1% level. The first column of Table 5 shows the results of the controls from Table 4 column 1. All the coefficients are statistically significant except for employment status. We found that the consumption decreases as age increases. As expected, female and those who live with someone are less likely to consume e-cigarettes. In columns 2 and 3 of Table 4, we computed the difference-in-different for other e-cigarettes smoking behaviour. The results suggest that a ban reduces the prevalence of smoking e-cigarettes by 7.4 percentage point which is statistically significant at the 5% level. However, there is no evidence of a change in behaviour for those who use e-cigarettes as a help to quit smoking. The controls for the regressions are shown in Table 5. None of the coefficients are statistically different from 0. Thus, age, gender, marital status and employment status have no impact on these outcomes. Also, there is an increase of 7.1 percentage point, significant at the 10% level, of those who use e-cigarettes as a substitute for regular cigarettes which is only significant for Canadians aged between 15 and 24. There is a perverse effect on those who are not trying to stop smoking.

Second, the last two columns of Table 4 show the results of regular smoking behaviour. As mentioned, bans can have positive externalities and generate perverse effects on smoking

behaviour. Since more than half of e-cigarettes consumers use it as a substitute for when they can't smoke, we observed the impact of the ban on regular cigarettes. Results show a statistically significant reduction of cigarette smoking behaviour. However, there is a general decline in cigarette smoking observed in the data. According to the Canadian Tobacco, Alcohol and Drugs Survey (CTADS), the prevalence of current cigarettes smoking in 2015 was 13% (3.9 million smokers), a decrease from 15% (4.2 million smokers) in 2013 and the lowest national smoking rate ever recorded. Our findings suggest that the ban caused a reduction of 4.3 percentage point among current smokers. The results may not be caused by the impact of the policy alone but could be amplified by the decline of cigarettes smoking. However, using false enactment dates in Table 8, we found a smaller and not statistically significant coefficient, which supports the impact of the ban. Also, the impact of the ban on daily smokers is not statistically significant. For both current and daily smokers, the effect of the ban reduces with age.

Last, we described the results of our third outcome in Tables 5 and 6. Our results suggest that a ban on e-cigarettes improved the self-assessed health. We divided our dependent variables into two categories and we dichotomized them; respondents who answered having a good health and a good mental health. There is evidence of an increase of 1.6 percentage point of those who reported having good health after the ban was implemented. Yet, there is no evidence of change in health for those with good mental health.

In addition to controlling for sociodemographic characteristics, we used unemployment data to control for province economic characteristics that vary over time. The inclusion of these variables should not change by much the estimated effect if the common trend assumption holds. Table 6 and the last two columns of Table 7 support this assumption as the values of coefficients and their level of significance are similar when the controls are included and when they are

excluded. We estimated the effect of a placebo reform, using false enactment dates that should not influence smoking behaviour and health. Hence, we expect treatment effects of the placebo reform to be close to zero while large, significant effects would cast doubt on the interpretation that the causal effect of smoking bans was measured. Table 8 shows the placebo reform in October 2013. The coefficient of interest is not significant for most of the coefficients and there are no large, significant effects. Last, to allow for correlation between unobserved factors within provinces, we cluster standard robust errors at the highest cluster level: the province level (Angrist and Pischke, 2009). Given that there are only ten provinces in Canada, there are very few cluster units which may lead to an additional autocorrelation. This issue can be resolved by using wild score bootstrapping (Cameron, Gelbach, and Miller, 2008).

6. Conclusion

In this paper, we identify the causal effect of e-cigarettes ban on smoking behaviour and self-assessed health using data from the Canadian Tobacco Alcohol and Drugs. The main empirical results are that a ban reduces the consumption of e-cigarettes by approximatively 4.5 percentage point, which is robust to multiple controls. The main results are a decrease of nearly 7.4 percentage point in e-cigarettes' use among those who tried it 30 days before the survey took place. There is also a significant reduction of daily smokers after the ban. We find no evidence that an e-cigarette ban has consequences for consumers who used it to quit smoking but there is evidence for those who used it when they can't smoke regular cigarettes. Additionally, a ban on e-cigarettes improved health by increasing the proportion of those with a good health but there is no evidence that the ban has an impact on the level of mental health.

To conclude, our study has two main limitations. First, there is a temporal aspect in our empirical model that needs to be considered. Because the data on electronic cigarettes are little, our time frame of 2013 and 2015 allows evaluating the impact on a limited number of observations before and after the implementation of the ban. Consequently, our estimates must be interpreted as relatively short-term effects. Second, for data reasons, we were not able to examine the extent to which smokers change the intensity with which they smoke. Notwithstanding these limitations, this research paper has implications for smoke-free policy on electronic cigarettes, and our results can serve as an appropriate foundation for future studies.

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8. Tables and figures

Table 2. Dates of Enactment of provincial Smoking Bans in Canada and their implications

Provinces	Date of enactment	Name of the Act	Implications
British Colombia	September 1st, 2016	Tobacco and Vapour Products Control Act	- No sale and supply to minors. - No sales wherever tobacco sales are banned. - No e-cigarettes smoking anywhere smoking is banned. - No e-cigarettes smoking in cars with children under 16. - No e-cigarettes smoking within six meters of doors, air intakes and open windows.
Alberta	No provincial legislation to date		
Saskatchewan	No provincial legislation to date		
Manitoba	November 5th, 2015	The Non-Smokers Health Protection and Vapour Products Act	- No e-cigarettes smoking in public places - No e-cigarettes smoking in cars with children under 16. - There are exemptions for vaping where e-cigarettes are sold and designated smoking/vaping rooms.
Ontario	January 1st, 2016	Electronic Cigarettes Act	- No sales wherever tobacco sales are banned. - No e-cigarettes smoking in cars with children under 16. - No e-cigarettes smoking in or on school property, daycares, private home daycares and sports arenas.
Quebec	November 26th, 2015	Tobacco Control Act	- No sales wherever tobacco sales are banned. - No e-cigarettes smoking anywhere smoking is banned. - No e-cigarettes smoking in cars with children under 16. - No e-cigarettes smoking on restaurant patios, on sports fields and within nine meters of doors, air intakes and open windows.
Nova Scotia	May 31st, 2015	Smoke-free Places	- No sale and supply to minors.

		Act and Tobacco Access Act	- No possession minors. - No sale in pharmacies. - No e-cigarettes smoking anywhere smoking is banned. - No e-cigarettes smoking in cars with children under 19. - No e-cigarettes smoking on restaurant patios, on school property and within four meters of doors, air intakes and open windows.
New Brunswick	July 1st, 2015	Tobacco and Electronic Cigarette Sales Act	- No sale and supply to minors. - No sales wherever tobacco sales are banned. - No e-cigarettes smoking in public places and workplaces. - No e-cigarettes smoking in cars with children under 16. - No e-cigarettes smoking on school property, on restaurant patios and within three meters of doors, air intakes and open windows.
Prince Edward Island	October 1st, 2015	Tobacco and Electronic Smoking Device Sales and Access Act	- No sale and supply to minors. - No sales wherever tobacco sales are banned. - No e-cigarettes smoking in public places and workplaces. - No e-cigarettes smoking in cars with children under 19. - No e-cigarettes smoking on construction site, on restaurant patios between 10 pm and 3 and within 4.5 meters of doors, air intakes and open windows.
Newfoundland and Labrador	June 7th, 2016	Smoke-Free Environment Act, Tobacco and Vapour Products Control Act	- No sale to minors. - No e-cigarettes smoking in public places and workplaces. - No e-cigarettes smoking in cars with children under 16.

Notes: Information on individual provinces was compiled from original law texts.

Table 3. Descriptive statistics, weighted independent variables

Variable	Nova Scotia	Excluded provinces[a]	t[b]
Means before May 31st, 2015			
Age	47.2809	46.506	-1.19
	(18.6142)	(18.4739)	
Female	0.5089	0.5037	-0.30
	(0.5000)	(0.5000)	
Marital status			
Living with someone	0.6200	0.6186	-0.08
	(0.4855)	(0.4857)	
Employment status			
Employed	0.5599	0.5647	0.28
	(0.4965)	(0.4958)	
Means after May 31st, 2015			
Age	48.3815	46.8124	-1.40
	(18.8831)	(18.4487)	
Female	0.5332	0.5089	-0.80
	(0.4992)	(0.5000)	
Marital status			
Living with someone	0.6420	0.6819	1.41
	(0.4797)	(0.4658)	
Employment status			
Employed	0.5424	0.5558	0.44
	(0.4985)	(0.4985)	

N= 29,719 observations for both years (14,565 in 2013 and 15,154 in 2015). Standard deviations are given in parentheses.

[a]Excluded provinces are New Brunswick, Prince Edward Island, Manitoba and Quebec.

[b]Test of equality of means in Nova Scotia and the rest of Canada.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Table 4. Relationship between Smoking behaviour and e-cigarettes ban: 2013-2015

	Ever used e-cigarette	Use in the last 30 days	Use e-cig as help	Use e-cig as a substitute	Current smoker	Daily smoker
NS	0.0774***	-0.0232**	0.0036	-0.0465**	0.0696***	0.0851***
	(0.0141)	(0.0096)	(0.0462)	(0.0139)	(0.0086)	(0.0105)
POST	0.0367***	0.0283	0.0175	-0.0824**	0.0084*	-0.1001**
	(0.0017)	(0.0227)	(0.0273)	(0.0259)	(0.0034)	(0.0363)
NS*POST	-0.0455***	-0.0743**	-0.0712	0.0970*	-0.0434***	-0.0650
	(0.0029)	(0.0233)	(0.0412)	(0.0436)	(0.0028)	(0.0400)
Controls	✓	✓	✓	✓	✓	✓
Observations	17 468	2 666	1 222	1 379	17 526	2 727
R-square	0.0566	0.0217	0.0345	0.0518	0.0222	0.0905

Note: Each column is from a separate OLS regression. Robust standard errors are in parenthesis, adjusted for clustering by province. The controls include a dummy that is equal to one if the respondent a female, a dummy that is equal to 1 if the respondent is married, a dummy that is equal to 1 if the respondent is separated and a dummy that is equal to 1 if the respondent is single. Employment status controls include dummies variables for being employed, absent from work or self-employed. The dependent variable is smoking behaviour for e-cigarettes and regular cigarettes. All the regressions are weighted using CTADS weights.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 5. Controls regressions

Variable	Ever used e-cigarette	Use in the last 30 days	Use e-cig as help	Use e-cig as a substitute	Current smoker	Daily smoker
Age						
15-19	0.1768***	0.1171	0.1851	0.2127***	0.0484***	-0.4893***
	(0.0102)	(0.1129)	(0.2853)	(0.0289)	(0.0045)	(0.0335)
20-24	0.2226***	0.0922	0.2895	0.2786***	0.1386***	-0.3913***
	(0.0148)	(0.0912)	(0.2357)	(0.0677)	(0.0139)	(0.0611)
25-29	0.1451***	0.0769	0.2277	0.1362	0.1320***	-0.3106***
	(0.0349)	(0.0722)	(0.3635)	(0.1082)	(0.0271)	(0.0609)
30-34	0.1097**	0.0617	0.3406	0.2819***	0.1445***	-0.3722***
	(0.0414)	(0.1437)	(0.3258)	(0.0193)	(0.0189)	(0.0552)
35-39	0.1209***	0.1236	0.4424	0.2414***	0.1579***	-0.2904*
	(0.0239)	(0.1154)	(0.3749)	(0.0277)	(0.0259)	(0.1262)
40-49	0.0759***	0.1086	0.2403	0.0812*	0.1389***	-0.1856***
	(0.0148)	(0.0972)	(0.2826)	(0.0360)	(0.0146)	(0.0383)
50-59	0.0571***	0.1220	0.3853	0.0235	0.1387***	-0.1028
	(0.0126)	(0.0677)	(0.3375)	(0.0641)	(0.0153)	(0.0562)
60-69	0.0356**	0.0233	0.2041	0.2065	0.0937***	-0.0699
	(0.0138)	(0.1054)	(0.2337)	(0.1072)	(0.0174)	(0.0623)
70-79	0.0145***	-0.0551	0.4020***	0.2505**	0.0603***	-0.1972***
	(0.0021)	(0.0986)	(0.0630)	(0.0939)	(0.0094)	(0.0242)
Female	-0.0235**	0.0647	-0.0326	-0.0357	-0.0403***	0.0301***
	(0.0066)	(0.0393)	(0.0221)	(0.0315)	(0.0073)	(0.004)
Marital status						
Living with someone	-0.0369***	0.0501	-0.0178	0.0393	-0.0649***	-0.0552
	(0.0067)	(0.0425)	(0.0324)	(0.0444)	(0.0089)	(0.0408)
Employment status						
Employed	0.0072	0.0279	-0.0794	0.0831	-0.0139*	-0.0080
	(0.0072)	(0.0757)	(0.0912)	(0.0648)	(0.0064)	(0.0312)

Note: This table reports the coefficients of the controls for respondents who have ever used e-cigarettes, those who used it 30 days prior to the census, who used e-cigarette as a substitute, who are current smokers and daily smokers. Robust standard errors are in parenthesis, adjusted for clustering by province.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Table 6. Relationship between Smoking behaviour and e-cigarettes ban: 2013-2015

	Ever used e-cigarette	Use in the last 30 days	Use e-cig as help	Use e-cig as a substitute	Current smoker	Daily smoker
NS	0.0731***	-0.0220**	0.0223	-0.0575**	0.0697***	0.0879***
	(0.0149)	(0.0055)	(0.0337)	(0.0188)	(0.0087)	(0.0101)
POST	0.0354***	0.0321	0.0051	-0.0773***	0.0058	-0.1149**
	(0.0009)	(0.0345)	(0.0156)	(0.0179)	(0.0048)	(0.0420)
NS*POST	-0.0495***	-0.0781*	-0.0417**	0.0714**	-0.0463***	-0.0152
	(0.0009)	(0.0348)	(0.0156)	(0.0179)	(0.0048)	(0.0420)
Controls						
Observations	17 468	2 666	1 222	1 379	17 526	2 727
R-square	0.0040	0.0021	0.0001	0.0056	0.0013	0.0141

Note: Each column is from a separate OLS regression. Robust standard errors are in parenthesis, adjusted for clustering by province. The controls include a dummy that is equal to one if the respondent a female, a dummy that is equal to 1 if the respondent is married, a dummy that is equal to 1 if the respondent is separated and a dummy that is equal to 1 if the respondent is single. Employment status controls include dummies variables for being employed, absent from work or self-employed. The dependent variable is smoking behaviour for e-cigarettes and regular cigarettes. All the regressions are weighted using CTADS weights.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Table 7. Relationship between self-assessed health and e-cigarettes ban: 2013-2015

	General health	Mental health	General health	Mental health
NS	-0.0289***	-0.0111***	-0.0367***	-0.0132***
	(0.0023)	(0.0025)	(0.0026)	(0.0027)
POST	0.00199	-0.0056	0.0014	-0.0061
	(0.0047)	(0.0056)	(0.0047)	(0.0059)
NS*POST	0.0163**	0.0083	0.0134**	0.0097
	(0.0048)	(0.0052)	(0.0047)	(0.0059)
Controls	✓	✓		
Observations	17 465	17 456	17 465	17 456
R-square	0.0529	0.0168	0.0005	0.0002

Note: Each column is from a separate OLS regression. Robust standard errors are in parenthesis, adjusted for clustering by province. All the regressions are weighted using CTADS weights.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Table 8. Relationship between Smoking behaviour and placebo enactment date

	Ever used e-cigarette	Use in the last 30 days	Use e-cig as help	Use e-cig as a substitute	Current smoker	Daily smoker	General health	Mental health
NS	0.0674***	-0.0821***	-0.0032	-0.0304	0.0555***	0.0492*	-0.0237***	-0.01381***
	(0.0117)	(0.0071)	(0.0648)	(0.0184)	(0.0083)	(0.024)	(0.0014)	(0.0016)
POST	0.0506***	-0.0562**	-0.0386	-0.0657	-0.0061	-0.0751	0.0042	-0.0136***
	(0.0044)	(0.0176)	(0.0224)	(0.0373)	(0.0037)	(0.0484)	(0.0036)	(0.0028)
NS*POST	-0.0220	0.0562**	-0.0155	0.0169	0.0055	0.0470	-0.0020	0.0082*
	(0.0045)	(0.0177)	(0.0369)	(0.0343)	(0.0037)	(0.0509)	(0.0033)	(0.0034)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Observations	17 468	2 666	1 222	1 379	17 526	2 727	17 465	17 456
R-square	0.0607	0.0264	0.0355	0.0499	0.0220	0.0869	0.0529	0.0176

Note: Each column is from a separate OLS regression where the false ban is in October 2013. Robust standard errors are in parenthesis, adjusted for clustering by province. The controls include a dummy that is equal to one if the respondent a female, a dummy that is equal to 1 if the respondent is married, a dummy that is equal to 1 if the respondent is separated and a dummy that is equal to 1 if the respondent is single. Employment status controls include dummies variables for being employed, absent from work or self-employed. The dependent variable is smoking behaviour for e-cigarettes and regular cigarettes. All the regressions are weighted using CTADS weights.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level