

Implications of a Public Smoking Ban

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ABSTRACT

Objectives: Legislation to ban smoking in public places is currently a major area of interest across Canada. The main objectives of the study were to 1) determine the effect of the smoking ban on incidence of acute myocardial infarction, 2) determine if the new legislation altered population-based smoking prevalence, and 3) measure public support for the public smoking ban.

Methods: The city of Saskatoon initiated a public smoking ban on July 1, 2004. We retrospectively reviewed all hospital discharges for acute MI from July 2000 to June 2005. We reviewed CCHS survey information on smoking prevalence for Saskatoon, Saskatchewan and Canada from 2003 to 2005. We prospectively contacted 1,255 Saskatoon residents by telephone to determine support for the public smoking ban.

Results: The age-standardized incidence rate of acute MI fell from 176.1 (95% CI 165.3-186.8) cases per 100,000 population (July 1, 2000 to June 30, 2004) to 152.4 (95% CI 135.3-169.3) cases per 100,000 population (July 1, 2004 to June 30, 2005). Smoking prevalence in Saskatoon fell from 24.1% in 2003 (95% CI 20.4-27.7) to 18.2% in 2005 (95% CI 15.7-20.9) while smoking prevalence in Saskatchewan remained unchanged at 23.8% (95% CI 22.6-25.3) and Canada reduced from 22.9% (95% CI 22.5-23.3) to 21.3% (95% CI 20.8-21.8). Seventy-nine percent of Saskatoon residents believed the smoking ban was a good idea.

Interpretation: The public smoking ban in Saskatoon, Canada, is associated with reduced incidence rates of acute MI, lower smoking prevalence and high levels of public support.

Key words: Tobacco smoke pollution; myocardial infarction; smoking cessation—legislation and jurisprudence; prevalence studies

La traduction du résumé se trouve à la fin de l'article.

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Legislation to ban smoking in public places is currently a major area of interest across Canada with all provinces enacting some form of legislation. The purpose of the current study is to look at the overall impact of a public smoking ban on rates of acute myocardial infarction, smoking prevalence and public support.

Two separate meta-analyses suggest that exposure to second-hand smoke increases the risk of fatal and non-fatal coronary heart disease in non-smokers by 25% (RR = 1.25; 95% CI 1.17-1.32) to 30% (RR = 1.30; 95% CI 1.22-1.38).^{1,2} One review suggests the cardiovascular effects of second-hand smoke are nearly as damaging as those of smoking itself.³ Unlike with lung cancer, the risk of acute myocardial infarction (MI) associated with exposure to second-hand smoke is non-linear, increasing rapidly with relatively small doses such as those received from second-hand smoke.³⁻⁷ A recent study observed a 40% reduction in acute MI during a six-month period after a small American city initiated a public smoking ban.⁸ This study, however, had some methodological concerns including small sample size, short intervention period, brief historical trend and no information on intervention compliance or whether or not smoking habits were affected by the ban.⁹

The association between workplace legislation and reduction in smoking prevalence is well documented.¹⁰⁻¹³ One systematic literature review indicates smoke-free workplaces have reduced smoking prevalence by 3.8% (95% CI 2.8%-4.7%) and reduced smoking amounts by 3.1 cigarettes per day in continuing smokers.¹⁴ The association between public smoking bans and general population smoking prevalence is less known. Italy observed an 8.9% reduction in tobacco sales, and 80% of those who quit smoking in Ireland indicated the public smoking ban helped them quit.^{15,16}

Regrettably, most of the research on public smoking bans has been conducted prior to legislation change. A Health Canada report found 77-79% overall support for bans on smoking in public places in Quebec, Ontario and Saskatchewan prior to smoking ban implementation.¹⁷

The City of Saskatoon, Canada, implemented a city-wide public smoking ban on July 1, 2004 (Bylaw 8286). The new

bylaw prohibits smoking or holding lighted tobacco products in any enclosed public space that is open to the public or to which the public is customarily admitted or invited. The bylaw also applies to outdoor seating areas for restaurants and licensed premises. The previous bylaw was restricted to enclosed government buildings.

The objectives of the study were to: 1) determine the effect of the smoking ban on incidence of acute myocardial infarction, 2) determine if the new legislation is associated with changes in population-based smoking prevalence, 3) measure general population support for the public smoking ban and business trends, and 4) measure business compliance.

METHODS

All information on acute myocardial infarction (MI) is sent directly from each hospital in Saskatoon to Strategic Health Information Planning Services (SHIPS) for data entry and coding. The positive predictive value of a primary diagnosis for a cardiovascular event from hospital discharge records in Saskatchewan is 90%.¹⁸ Non-Saskatoon residents were not included as each patient is entered by home address. Transfers between hospitals were only counted as one case. ICD-10 codes were used. De-identified individual information on each case of acute MI was provided from SHIPS to the lead researcher from July 1, 1996 to June 30, 2005. The population numbers for the denominator were taken directly from the Saskatchewan Health Insurance Registry.

The conversion from ICD-9 to ICD-10 coding in April of 2000 resulted in a distinct jump of discrete counts (Table I). This non-linear pattern is now better described by a step function model than a linear model.^{19,20} As such, data prior to 2000 are provided for information purposes alone. Stratification was used to test for confounding by age, gender and previous MI in the unadjusted rates.²¹ The unadjusted incidence rates were then directly age-standardized to the 2001 Canadian population.

The age-standardized incidence rate of acute MI per 100,000 population in the first full year of the public smoking ban (July 1, 2004 to June 30, 2005) was compared to the previous four years (July 1,

2000 to June 30, 2004) to determine absolute differences in incidence rates. An incidence rate ratio and confidence intervals were used to determine if the differences observed were significant.²¹

In 2003 and 2005, Statistics Canada administered the Canadian Community Health Survey.^{22,23} In Saskatoon, Statistics Canada randomly polled 1,301 residents in 2003 and 1,244 residents in 2005 on smoking prevalence for current daily or occasional smokers. Changes in smoking prevalence in Saskatoon from 2003 to 2005 were compared to Saskatchewan and Canada with a paired samples t-test.

In July of 2005 (one year after the introduction of the public smoking ban), the Saskatoon Health Region conducted a random telephone survey with a sample of 1,255 Saskatoon adult residents on their behaviours and attitudes with regard to the public smoking ban. The names and phone numbers were provided by a third party specializing in generating random lists of phone numbers. The original sample included an equal gender split and equal numbers of residents from each of the 10 electoral wards in Saskatoon.

Business compliance to the public smoking ban was measured by reviewing warnings and tickets issued by public health inspectors to eligible business establishments.

All data were entered and analyzed on SPSS 13.0.²⁴ Ethics approval was obtained from the University of Saskatchewan Behavioural Research Ethics Board.

RESULTS

Incidence of acute MI

Comparing the last four years prior to the public smoking ban to the first year after the public smoking ban, the age-standardized incidence rate of acute MI went from 176.1 (95% CI 165.3-186.8) cases per 100,000 population (July 1, 2000 to June 30, 2004) to 152.4 (95% CI 135.3-169.3) cases per 100,000 population (July 1, 2004 to June 30, 2005). The detailed results appear in Table I. The incidence rate ratio is 0.87 (95% CI 0.84-0.90). In other words, the incidence rate of acute MI post smoking-ban legislation was 13% lower than that prior to legislation.

In practical terms, the first year of the public smoking ban resulted in 32 (95%

CI 20-43) fewer hospital separations for acute MI (312) compared to the mean number of separations from the previous four years (344).

Smoking prevalence

Smoking prevalence in Saskatoon fell from 24.1% in 2003 (95% CI 20.4-27.7) to 18.2% in 2005 (95% CI 15.7-20.9). Comparatively, smoking prevalence in Saskatchewan remained unchanged from 2003 to 2005 at 23.8% (95% CI 22.6-25.3) while that in Canada reduced from 22.9% in 2003 (95% CI 22.5-23.3) to 21.3% in 2005 (95% CI 20.8-21.8). The relative reduction in smoking prevalence from 2003 to 2005 was 24.5% in Saskatoon, vs. 0% in Saskatchewan and 7.0% in Canada. The relative reduction is statistically significant when comparing Saskatoon to Saskatchewan ($p=0.000$) and Saskatoon to Canada ($p=0.000$).

In 2005, the Saskatoon Health Region conducted an additional phone survey. The Health Region contacted 1,939 residents with 1,255 (64.7%) agreeing to participate in the survey. There was no difference between the responders and non-responders in terms of gender ($p=0.246$). In July of 2005, 243 out of 1,255 residents indicated that they were currently a smoker (19.4%; 95% CI 16.9-21.8). From the sample of 1,255 residents chosen at random, 77 out of 1,255 Saskatoon residents reported that they quit smoking in the last year. Of those 77 smokers who quit smoking, 22 (28.6%) indicated that the smoking ban was the primary reason for quitting smoking. Furthermore, 57 additional residents out of 243 current smokers (23.5%) indicated that they had reduced the amount they smoked as a direct result of the public smoking ban by a mean of 6.6 cigarettes per day (mode of 2 per day).

Public opinion

One year after the public smoking ban intervention, there appears to be a consensus among Saskatoon residents that second-hand smoke bothers them and is dangerous, smoking bans are a good idea and that smoking bans are worthwhile even if there are potential business reductions. In terms of self-reported behaviour, the smoking ban in Saskatoon increased attendance at restaurants, pubs, bars and nightclubs. Only bingo halls had reported reduced atten-

dance, although only a very small percentage of the Saskatoon population frequented bingo halls (Table II). The change in attendance was not statistically significant.

With regards to enforcement and intervention compliance with the new bylaw, 914 out of 924 eligible business establishments were inspected by a public health inspector within the first six months of the new public smoking ban. Out of 914 inspections, only 13 establishments required an initial warning for non-compliance with regard to posting signs or removing ashtrays. Re-inspection resulted in one ticket being issued during the first year of intervention.

INTERPRETATION

The global burden of second-hand smoke is significant. Passive smoking is responsible for over 22,000 deaths in the European Union and 35,000 deaths in the United States annually.^{3,25}

The city of Saskatoon experienced a reduction in the incidence rate of age-standardized acute myocardial infarction in the first year of the public smoking ban in comparison to the previous four years. The reduction observed in Saskatoon (13%) was lower than previously found in Helena, Montana (40%).^{7,8} Perhaps this can be partially explained due to changes in study design like length of intervention follow-up.

Consistent with previous reports on workplace legislation, the public smoking ban in the city of Saskatoon was associated with a reduction in smoking prevalence from 24.1% in 2003 to 18.2% in 2005 at a time when smoking prevalence in the province remained unchanged at 23.8%. It is therefore possible to suggest that interventions targeted at individual smokers had reached a plateau in Saskatchewan and population-based strategies like public smoking bans are required as part of a broad spectrum of strategies to further reduce the prevalence of smoking.²⁶ A number of residents who quit smoking during the intervention year (28.6%) directly attributed the smoking ban to their decision to quit smoking. Another group of smokers (22.6%) reduced the amount they smoked by an average of 6.6 cigarettes per day.

Consistent with other jurisdictions, there appears to be support within the gen-

TABLE I

Incidence of Acute Myocardial Infarction (MI) in Saskatoon Residents by Twelve-month Interval from July 1, 1996 to June 30, 2005

| Time period | Acute MI | % Male | Average Age | Previous MI% | Crude Rate per 100,000 Population | Age-adjusted Rate (95% CI) |
|----------------|----------|--------|-------------|--------------|-----------------------------------|----------------------------|
| Jul 96-Jun 97 | 267 | 60% | 70 | 16% | 131.3 | 155.6 (136.9-174.2) |
| Jul 97-Jun 98 | 306 | 62% | 70 | 15% | 151.3 | 172.4 (153.1-191.7) |
| Jul 98-Jun 99 | 285 | 64% | 69 | 14% | 138.4 | 152.3 (134.9-170.3) |
| Jul 99-Jun 00* | 281 | 63% | 68 | 16% | 132.6 | 152.9 (135.0-170.7) |
| Jul 00- Jun 01 | 351 | 65% | 71 | 15% | 169.9 | 183.6 (164.4-202.8) |
| Jul 01-Jun 02 | 323 | 64% | 71 | 14% | 154.4 | 165.8 (147.8-183.9) |
| Jul 02-Jun 03 | 362 | 63% | 70 | 15% | 172.2 | 184.7 (165.7-203.8) |
| Jul 03-Jun 04† | 341 | 60% | 72 | 18% | 165.1 | 170.1 (152.0-188.1) |
| Jul 04-Jun 05 | 312 | 61% | 71 | 16% | 148.2 | 152.4 (135.3-169.3) |

* Change in coding from ICD-9 to ICD-10 occurred April 2000

† Implementation date of public smoking ban was July 1, 2004

TABLE II

Results of July 2005 Phone Survey of 1,255 Saskatoon Residents

A. Opinion

| | | |
|--|-------------------|-------|
| 1. Does second-hand smoke bother you? | Yes | 69.3% |
| | No | 30.4% |
| | Do not know | 0.3% |
| 2. Second-hand smoke is dangerous. | Strongly agree | 34.4% |
| | Agree | 58.3% |
| | Disagree | 5.5% |
| | Strongly disagree | 0.2% |
| | Do not know | 1.6% |
| 3. Was there a business reduction? | Yes | 40.9% |
| | No | 44.6% |
| | Do not know | 14.6% |
| 4. If answered yes to question 3, is business reduction worthwhile for potential health effects? | Yes | 61.3% |
| | No | 31.5% |
| | Do not know | 7.2% |
| 5. Was the public smoking ban a good idea? | Yes | 79.0% |
| | No | 17.7% |
| | Do not know | 3.3% |

B. Behaviour

Do you frequent the following businesses more or less as a result of the smoking ban?

| | Restaurants and Pubs | Bars and Nightclubs | Bingo Halls |
|-----------------|----------------------|---------------------|-------------|
| About the same | 70.5% | 29.9% | 6.8% |
| I do not attend | 5.3% | 51.2% | 88.8% |
| More often | 15.0% | 11.1% | 0.9% |
| Less often | 8.6% | 7.3% | 3.1% |
| Do not know | 0.6% | 0.5% | 0.5% |

eral population for public smoking bans. In Saskatoon, 79% of residents believed the bylaw was a good idea. In Italy, 90% of residents were either moderately or strongly in favour of smoke-free areas in public places and 83% of Irish residents indicated that their smoke-free law was a good or very good idea.^{15,16}

There are a number of limitations to the current study. First, the study is a before and after ecological study and not a randomized trial. Any finding must be seen as associative, and not cause and effect, as there can be many reasons why changes were observed. Second, the study does not include information on individual expo-

sure to second-hand smoke for those who had an acute MI. However, the authors did include information on community intervention compliance. Third, the authors cannot say with certainty whether the reduction in acute MI is due to the smoking ban because there is no control city and we did not examine time trends to see if the secular decline in MI incidence was accentuated after the ban.

Initial results suggest that public smoking bans are associated with reductions in rates of acute myocardial infarction and smoking prevalence while maintaining high levels of public support with minimal impact on business.

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RÉSUMÉ

Objectifs : Les lois interdisant le tabagisme dans les lieux publics suscitent beaucoup d'intérêt au Canada. Notre étude visait principalement à : 1) déterminer l'effet de l'interdiction du tabagisme sur l'incidence des infarctus aigus du myocarde (IAM), 2) déterminer si les nouvelles lois ont modifié la prévalence du tabagisme dans la population et 3) mesurer l'appui à l'interdiction du tabagisme dans les lieux publics.

Méthode : La ville de Saskatoon interdit le tabagisme dans les lieux publics depuis le 1^{er} juillet 2004. Nous avons examiné rétrospectivement toutes les sorties d'hôpitaux des patients ayant subi un IAM entre juillet 2000 et juin 2005. Nous avons examiné les données de l'Enquête sur la santé dans les collectivités canadiennes (ESCC) sur la prévalence du tabagisme à Saskatoon, en Saskatchewan et au Canada de 2003 à 2005. Prospectivement, nous avons contacté par téléphone 1 255 résidents de Saskatoon pour déterminer leur appui à l'interdiction du tabagisme dans les lieux publics.

Résultats : Le taux d'incidence des IAM, sans strate d'âges, a chuté. Il est passé de 176,1 cas pour 100 000 habitants (IC de 95 % = 165,3–186,8) du 1^{er} juillet 2000 au 30 juin 2004 à 152,4 cas pour 100 000 habitants (IC de 95 % = 135,3–169,3) du 1^{er} juillet 2004 au 30 juin 2005. La prévalence du tabagisme à Saskatoon a également chuté, passant de 24,1 % en 2003 (IC de 95 % = 20,4–27,7) à 18,2 % en 2005 (IC de 95 % = 15,7–20,9), tandis que la prévalence du tabagisme en Saskatchewan est restée inchangée à 23,8 % (IC de 95 % = 22,6–25,3); à l'échelle du Canada, elle a diminué, passant de 22,9 % (IC de 95 % = 22,5–23,3) à 21,3 % (IC de 95 % = 20,8–21,8). Soixante-dix-neuf p. cent des résidents de Saskatoon considéraient l'interdiction du tabagisme comme une bonne idée.

Interprétation : L'interdiction du tabagisme dans les lieux publics à Saskatoon, au Canada, est associée à des taux d'incidence réduits d'IAM, à une moindre prévalence du tabagisme et à des niveaux élevés d'appui du public.

Mots clés : pollution par la fumée du tabac; infarctus du myocarde; renoncement au tabac – lois et jurisprudence; études de prévalence