

Prevalence of Smoking Associated with Pregnancy in Three Southern Ontario Health Units

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ABSTRACT

Objectives: The objectives of this study were to determine the prevalence of pregnancy-associated smoking among women residing in three Southern Ontario Health Units and to examine potential risk factors for smoking during pregnancy, using an existing data collection mechanism.

Methods: During May 2001, questions about pregnancy-associated smoking were asked during the telephone follow-up of postpartum women living in the three health units in Southern Ontario; this follow-up is routinely conducted by public health nurses. Socio-demographic data were also obtained. Data from 1,134 women were analyzed concerning smoking before and after the occurrence of the pregnancy was known, during each trimester, and immediately postpartum.

Results: The rates of smoking before and after the pregnancy was known, in the first, second, and third trimesters, and immediately postpartum were 17.8%, 10.4%, 9.6%, 8.7%, 8.1%, and 7.9%, respectively. For all six estimates of smoking, Canadian-born women had rates 2.5 to 4 times higher than those of women born outside Canada. Age less than 25 years and lower educational attainment were also independent risk factors for smoking during pregnancy.

Conclusions: The Ontario Tobacco Strategy goal of eliminating smoking in pregnancy has not yet been realized. Ongoing smoking cessation programs among pregnant women are needed as part of a comprehensive strategy to reduce the overall prevalence of smoking. In planning such programs, particular attention should be paid to the needs of women who are Canadian-born, have lower educational attainment, and are under the age of 25.

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

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It is well established that smoking in pregnancy is associated with adverse outcomes for both mothers and their offspring.¹ One goal of the Ontario Tobacco Strategy is the elimination of smoking in pregnancy.² However, no mechanism is in place to routinely monitor pregnancy-associated smoking on a province-wide basis, and recent provincial estimates have not been published. Consequently, progress toward this goal has not been gauged.

Various studies have estimated the prevalence of smoking at some point during pregnancy, including population-based surveys in the United States³⁻⁵ and Canada.^{6,7} Because cessation of smoking during pregnancy is common, with quit rates from 16% to 46% being reported in recent North American surveys,^{4,6,8,9} single estimates of smoking at particular points in pregnancy do not portray how smoking rates vary around and across the pregnancy period. Indeed, pregnancy-associated smoking is a complex and variable behaviour, characterized by patterns of repeated cessation and relapse, as well as fluctuations in smoking intensity.⁹

The objectives of this study were to estimate the prevalence and describe the variability of pregnancy-associated smoking among women residing in three Southern Ontario health units containing 35% of Ontario's population,¹⁰ and to assess potential risk factors for such smoking. Information on prevalence is fundamental to monitoring progress toward the goal of eliminating pregnancy-associated smoking in Ontario, and the identification of risk factors could assist smoking cessation program development and implementation.

METHODS

To obtain the data, we utilized the routine telephone follow-up of postpartum women that is conducted in all health units in Ontario by public health nurses, usually within 96 hours of delivery. Our study took place in the three health units of Toronto, Peel and Durham. Nurses made three attempts to contact each mother before considering her to be a non-respondent. During the study period (May 2001), the three health units received 2,068 notifications of births from area hospitals and 1,376 (67%) of the mothers were successfully contacted. Of these, 1,134 (83%) agreed to be interviewed.

To assess pregnancy-associated smoking, a questionnaire (available from the first author) was developed. Questions addressed smoking before and after the woman knew about the pregnancy, during each trimester, and immediately postpartum. Nurses also asked about the woman's place of birth, length of time in Canada (if the woman had been born elsewhere), ethnic origin, and educational attainment. The mother's age was obtained from the birth notification received by the health unit from the delivery hospital. This information was missing for 81 women. The questionnaire, which was pre-tested, was kept very short so as not to add significantly to the length of the interview.

All data were entered into MS Access,¹¹ and analyzed using SPSS version 10,¹² including tests for interactions. Statistical significance was set at $p < 0.05$.

RESULTS

Prevalence of smoking

Two hundred and two (17.8%) of the women reported smoking before they knew they were pregnant (Table I). Of these, 84 (41.6%) quit upon finding out they were pregnant, while 118 (58.4%) smoked at some point after finding out. Thus, the period prevalence for smoking during recognized pregnancy was 10.4%. The smoking rates in the first, second and third trimesters, respectively, were 9.6%, 8.7% and 8.1%, while 7.9% smoked in the immediate postpartum period. Daily smokers comprised 79% (n=93) of the 118 women who smoked after they knew they were pregnant.

Of the 118 women who smoked after they knew they were pregnant, 23 (19.5%) had quit by the time of delivery. Of the 90 women who were smoking immediately postpartum, 71% reported trying to quit during their pregnancy. Of the 84 women who quit upon finding out they were pregnant, 8 (9.5%) had relapsed immediately postpartum. The variability in smoking status across the pregnancy period, with ongoing quitting and relapsing, is illustrated in Figure 1.

Amount smoked daily

The average number of cigarettes smoked each day by daily smokers who quit once they knew they were pregnant was 7.5 cig-

TABLE I

Prevalence of Smoking by Stage of Pregnancy (n=1,134)

Reported Smoking	Smokers	Percent	95% Confidence Interval
Before knowing of pregnancy	202	17.8	15.6-20.0
After knowing of pregnancy	118	10.4	8.6-12.2
During 1st trimester	109	9.6	7.9-11.3
During 2nd trimester	99	8.7	7.1-10.4
During 3rd trimester	92	8.1	6.5-9.7
Immediately postpartum	90	7.9	6.4-9.5

TABLE II

Prevalence of Smoking After Knowing of Pregnancy by Place of Birth, Age of Mother and Educational Attainment

Socio-demographic Characteristics	n	Smokers*	Percent	95% Confidence Interval
Place of Birth†				
Canadian-born	590	94	15.9	13.0-18.9
Foreign-born	527	24	4.6	2.8-6.3
Total†	1,117	118	10.6	8.8-12.4
Age of Mother (years)‡				
Under 19	30	10	33.3	16.5-50.2
20-24	152	33	21.7	15.2-28.3
25-29	300	26	8.7	5.5-11.9
30-34	363	27	7.4	4.7-10.1
35+	208	15	7.2	3.7-10.7
Total‡	1,053	111	10.5	8.7-12.4
Education§				
Less than high school	113	32	28.3	20.0-36.6
High school completed	256	33	12.9	8.8-17.0
Some community college	91	14	15.4	8.0-22.8
Community college completed/some university	361	31	8.6	5.7-11.5
Completed university	294	6	2.0	0.4-3.7
Total	1,115	116	10.4	8.6-12.2

* Smokers were women who smoked after finding out they were pregnant (n=118)

† 17 women did not provide information on place of birth.

‡ The ages of 81 women were not on the notification of birth received by the health unit.

§ 19 women did not provide information on education.

TABLE III

Risk of Smoking After Knowing of Pregnancy (n=118) by Mother's Place of Birth, Educational Attainment and Age (Unadjusted Odds Ratios, Adjusted* Odds Ratios and Confidence Intervals)

	Odds Ratio Unadjusted	Odds Ratio Adjusted*	95% Confidence Interval
Place of Birth			
Canada	4.0	4.2	2.6-7.0
Outside Canada	1.0		
Education			
High school education or less	3.5	3.4	2.2-5.4
Some university education / completed community college or higher	1.0		
Age of Mother (years)			
<25	3.6	2.4	1.5-3.8
≥25	1.0		

* Place of birth, education and age of mother are all in the model simultaneously.

arettes, compared to 9.6 cigarettes among daily smokers during the first trimester ($p=0.04$). Average daily consumption in the second and third trimesters and postpartum was 8.7, 9.3 and 8.2 cigarettes, respectively. None was significantly different from the average daily consumption during the first trimester.

Place of birth

Among Canadian-born and foreign-born women, 16% and 5%, respectively, smoked after finding out they were preg-

nant (Table II). Across the six measurement points, Canadian-born women had rates of smoking 2.5 to 4 times higher than those of women born outside Canada (Figure 2). There was no difference between these groups in amount smoked daily at any of the six measurement points.

Age of mother

The rate of smoking after finding out about the pregnancy was higher in younger age groups (Table II). Teenagers had the highest rate at 33%, while women ages

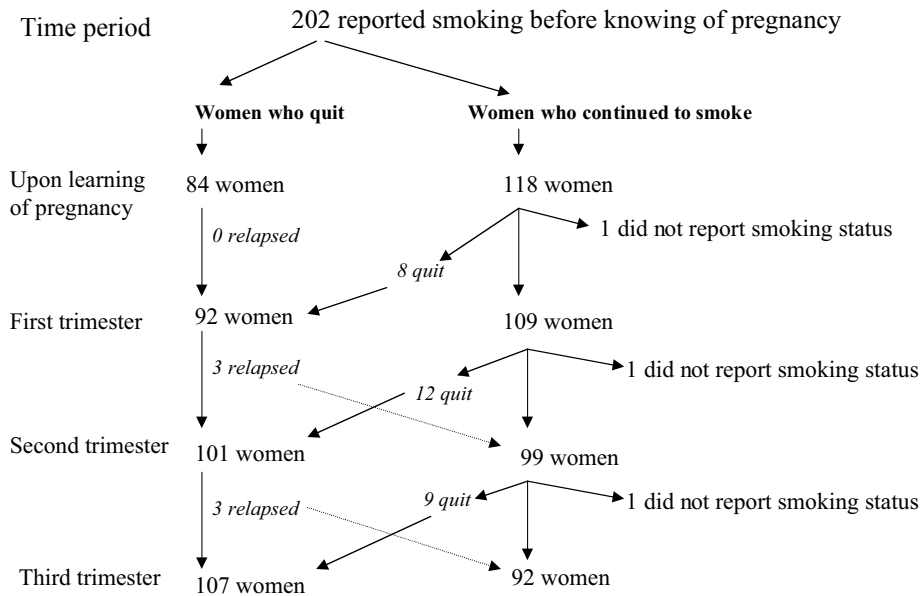


Figure 1. Variability in smoking status across pregnancy

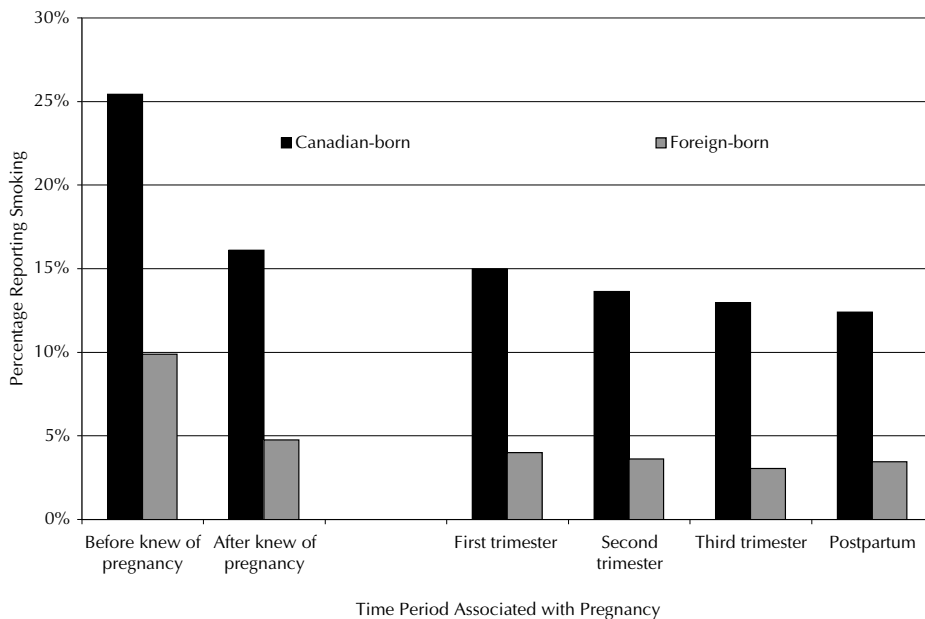


Figure 2. Rates of smoking in the pregnancy-associated time periods by maternal place of birth

20-24 had a rate of 22%. Smoking rates among women age 25 and older were significantly lower compared to these younger mothers, with a progressive decline with advancing years. There was no association between the place of birth and age of mother. Both variables were acting independently.

Educational attainment

The rate of reported smoking after finding out about the pregnancy was inversely related to educational attainment (Table

II). There was no interaction between education and place of birth. However, there was a strong interaction between age and education, with older women tending to have much higher educational attainment.

Multivariate analysis

A logistic regression analysis was conducted with 'smoking after knowing about the pregnancy' ($n=118$)/'no smoking' as the dependent variable (Table III). Each of the variables 'place of birth', 'educational attainment', and 'age' significantly

improved the model even with the other two factors present in the model, indicating that each factor was independently related to the prevalence of smoking. The adjusted odds-ratio was highest for place of birth, followed by education, and then age.

DISCUSSION

The rate of smoking (10.4%) among pregnant women after they knew they were pregnant is consistent with the findings of recent Canadian⁷ and U.S. national surveys,⁴ in which about 12% of women reported smoking during their most recent pregnancy. Further, as already noted, US^{3,5} and Canadian¹³ surveys document substantial declines in smoking during pregnancy over the last decade. Most of these declines have been attributed to decreases in smoking rates among women in the child-bearing years, and not to increased rates of smoking cessation related to pregnancy.^{3,13}

Of the women who smoked before knowing they were pregnant, 45% (92/202) had quit by the end of the first trimester, and 53% (107/202) had quit by the time of delivery. These quit rates are consistent with the 46% quit rate during pregnancy found in an American survey of 115,000 postpartum women living in 10 states,⁴ and are higher than the quit rates previously reported among samples of Canadian women.^{6,8} Nonetheless, substantial numbers of women continue to smoke throughout pregnancy, putting themselves and their fetus at risk of adverse health outcomes.¹

Postpartum relapse is common. Data from the Pregnancy Risk Assessment Monitoring System (PRAMS) survey in the United States indicate that 50% of women who quit during pregnancy relapsed within six months of delivery and 75% were smoking at one year.^{4,14} Although exposure to environmental tobacco smoke causes significant health impacts in infants and children,^{15,16} the findings suggest that women may not be as aware of these risks as they are of the risks of smoking during pregnancy. Specific interventions to address relapse are needed.

The percentage of daily smokers (79%) among women who smoked after they found out they were pregnant is consistent with population-based estimates for daily smoking among women smokers in

Ontario.¹⁷ The average number of cigarettes smoked by daily smokers during the first trimester was 9.6, substantially higher than the average 7.5 cigarettes per day smoked by women who quit when they found out they were pregnant. This suggests that those who quit early might have been lighter smokers. The reported averages of daily consumption across the pregnancy spectrum, however, were generally lower than the average reported by women smokers in Ontario (15.2 cigarettes).¹⁷ This may represent under-reporting of consumption in the face of social stigmatization and/or because of faulty recall. Alternatively, it is possible that some women who cannot quit cut down during pregnancy.

Consistent with other reports, lower educational attainment was identified as a risk factor for smoking during pregnancy.^{3-6,9,18} One study in a nationally representative cohort of pregnant women in the United States showed that education-related disparities in smoking worsen during pregnancy.¹⁹ Further, risk factors for smoking in pregnancy clustered, with a gradient in smoking rates that ranged from 6% in women with none of the five independent risk factors that were assessed (low income, less education, living with another smoker, depressive symptoms, and alcohol consumption) to 58% in women with four of the five factors. A strong gradient of smoking risk associated with adverse socioeconomic circumstances was also found in a British study.²⁰

Another risk factor for smoking during pregnancy was younger age, consistent with findings of national surveys in Canada⁷ and the United States.⁵ In the Canadian survey, smoking rates were three times higher among women ages 15-24 compared to older women.

Canadian-born women in the study had much higher smoking rates during pregnancy than women who were foreign-born. This may reflect the much lower percentage of smokers among foreign-born compared to Canadian-born women in the general population.²¹ Dramatically lower rates of prenatal tobacco use among foreign-born women were also found in an analysis of year 2000 birth certificates from all states in the United States except California.⁵

This study has limitations. First, the data on smoking associated with pregnan-

cy are based on self-report. They were not biologically validated. The social stigma associated with smoking during pregnancy may have biased respondents toward under-reporting, especially when the health status of the fetus is, as yet, unknown,⁴ or among higher educated women, who may be more knowledgeable about the risks of smoking in pregnancy. Although a non-smoking misclassification rate of 26% was reported among pregnant women in a smoking cessation trial,²² misclassification rates appear to be lower in general population samples. In a recent Swedish study, 6% of women attending a prenatal clinic, who reported themselves as non-smokers, were likely smokers, based on serum cotinine measurements.²³ A similar estimate (5.5%) was obtained in a US study, and it was virtually identical to one obtained from a pregnancy cohort in the 1960s,²⁴ suggesting that the accuracy of self-reported cigarette smoking among pregnant women has been consistent, and that lower rates of smoking during pregnancy and the declines in pregnancy-associated smoking rates observed in the United States^{3,5} and Canada¹³ are real.

Second, reporting was retrospective and recall, quite apart from bias, may have been deficient, particularly regarding details such as amount smoked. Third, there may have been a response bias. Only 55% of eligible women were interviewed. Because of their particular risk profiles, women at high risk of pregnancy-associated smoking may be under-represented among the respondents. Thus, our findings may underestimate smoking prevalence. Indeed, the rate of 'smoking before pregnancy was known' (18%) was somewhat lower than the population smoking rate of 21% among women in Ontario at the same time.¹⁷ Fourth, to keep the questionnaire short, only three potential risk factors were examined.

Finally, because smoking associated with pregnancy is complex and fluctuating,⁹ its measurement is not straightforward. Our data are particularly limited in that they do not adequately assess postpartum relapse. A standard protocol for the measurement of pregnancy-associated smoking among Canadian women should be developed, perhaps under the auspices of Health Canada, as has already been done for

smoking in general.²⁵ Such an instrument would enable the systematic monitoring of pregnancy-associated exposure to tobacco smoke, which in turn could inform policy and program development.

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RÉSUMÉ

Objectifs : L'étude visait à déterminer la prévalence du tabagisme associé à la grossesse chez des femmes résidant dans trois services de santé du sud de l'Ontario et à examiner les facteurs de risque potentiels du tabagisme durant la grossesse à l'aide d'un mécanisme de collecte de données existant.

Méthode : En mai 2001, nous avons posé des questions sur le tabagisme associé à la grossesse lors d'un suivi téléphonique auprès de femmes ayant accouché et vivant dans les trois services de santé du sud de l'Ontario; il s'agissait du suivi systématiquement effectué par les infirmières de santé publique. Nous avons également obtenu des données socio-démographiques. Nous avons analysé les réponses de 1 134 femmes aux questions sur le tabagisme avant et après l'annonce de la grossesse, à chaque trimestre et tout de suite après l'accouchement.

Résultats : Les taux de tabagisme étaient de 17,8 % avant et de 10,4 % après l'annonce de la grossesse, de 9,6 % au premier trimestre, de 8,7 % au deuxième trimestre, de 8,1 % au troisième trimestre et de 7,9 % tout de suite après l'accouchement. Pour ces six estimations, les femmes nées au Canada avaient des taux de tabagisme de 2,5 à 4 fois supérieurs à ceux des femmes nées à l'étranger. Le fait d'avoir moins de 25 ans et un faible niveau d'instruction étaient aussi des facteurs de risque indépendants du tabagisme durant la grossesse.

Conclusions : L'objectif de la Stratégie antitabac de l'Ontario, qui est d'éliminer le tabagisme durant la grossesse, n'est pas encore atteint. Il faudrait offrir aux femmes enceintes des programmes continus de renoncement au tabac dans le cadre d'une stratégie globale de réduction de la prévalence du tabagisme. En planifiant de tels programmes, il faudrait accorder une attention particulière aux besoins des femmes de moins de 25 ans nées au Canada dont le niveau d'instruction est faible.

Coming Events / Activités à venir

To be assured of publication in the next issue, announcements should be received by **June 1, 2004** and valid as of **August 31, 2004**. Announcements received after **June 1, 2004** will be inserted as time and space permit.
Pour être publiés dans le prochain numéro, les avis doivent parvenir à la rédaction avant le **1^{er} juin 2004** et être valables à compter du **31 août 2004**. Les avis reçus après le **1^{er} juin 2004** seront insérés si le temps et l'espace le permettent.

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