

## A B S T R A C T

This study examined the sociodemographic predictors of smoking cessation attempts among pregnant women, and compared the characteristics of women who successfully quit smoking during pregnancy with those who relapsed before their child was born. Data, which were derived from the National Longitudinal Survey of Children and Youth, indicate that 23.7% of Canadian mothers smoked at some point during their pregnancies, of whom only 15.8% attempted to quit. Maternal and paternal education were the strongest predictors of successful cessation, whereas women pregnant with their first child, those who drank during pregnancy, and those who immigrated to Canada were the most likely to relapse. This study represents an important first step in identifying Canadian women at highest risk of sustained smoking during pregnancy, and is useful for the design of effective interventions, tailored to meet their needs.

## A B R É G É

Cette étude décrit les caractéristiques socio-démographiques des femmes qui essaient d'arrêter de fumer durant leurs grossesses, celles qui réussissent à cesser de fumer et celles qui arrêtent mais recommandent avant que leurs enfants soient nés. L'information pour ce projet a été fournie par l'enquête longitudinale nationale du Canada sur les enfants et les jeunes, et révèle que 23,7 % de femmes canadiennes ont fumé durant leurs grossesses; parmi ces femmes seulement 15,8 % ont essayé de cesser. Les femmes et leurs époux avec des niveaux d'éducation plus avancés avaient la meilleure chance de réussir à abandonner leur dépendance alors que les femmes enceintes de leur premier enfant, celles qui buvaient pendant leur grossesse et celles qui ont immigré au Canada ont la plus grande probabilité de rechute. L'identification des femmes canadiennes qui sont en danger de fumer durant la grossesse est un pas important pour le développement d'interventions conçues pour satisfaire à leurs besoins.

# The Sociodemographic Predictors of Smoking Cessation Among Pregnant Women in Canada

Sarah K. Connor, BAH, MA,<sup>1</sup> Lynn McIntyre, MD, MHS, FRCPC<sup>2</sup>

Despite the emphasis that has been placed on smoking cessation for over three decades,<sup>1</sup> many Canadians continue to smoke. With more men quitting smoking than women, and teenage women being at greater risk than teenage men for starting to smoke,<sup>2</sup> smoking among Canadian women remains a serious problem. Furthermore, when women become pregnant, a significant number of them continue to smoke despite the well-documented risks of pregnancy complications and poor birth outcomes associated with cigarette use.<sup>3-7</sup>

More recently, long-term behavioural,<sup>8</sup> cognitive,<sup>9,10</sup> and health effects<sup>11</sup> have been reported in children exposed to pre- and post-natal tobacco smoke. Despite knowledge of these irreversible, yet completely preventable effects, the change in smoking behaviours and rates among pregnant women has been minimal over the last few years.<sup>12</sup> In Canada, the prevalence of smoking among pregnant women has been estimated to be close to 30%.<sup>13</sup> Several studies have suggested that smoking behaviours during pregnancy can be predicted by a woman's sociodemographic characteristics, with factors such as lower socioeconomic status, single parenthood, and more previous births, all indicating increased risk for smoking during pregnancy.<sup>12,14-18</sup>

The objectives of this study were to examine the sociodemographic predictors of smoking cessation attempts, and successful and unsuccessful cessation among pregnant women in Canada.

## METHODS

The data for this study came from the first wave of data collection of the National Longitudinal Study of Children and Youth (NLSCY), which was conducted in 1994 and released in 1996. The NLSCY is a joint project of Human Resources Development Canada (HRDC) and Statistics Canada. Statistics Canada's Labour Force Survey formed the sampling frame from which households with eligible children were randomly selected. From these households, one child aged 0-11 years was randomly chosen for participation in the survey; additional children from the same family (up to a maximum of 4 per household) were also randomly assigned for inclusion. This resulted in a sample of 13,349 households and 22,831 children who participated in the NLSCY. Canadians living in institutions or on First Nation Reserves are excluded from the survey.

In each household, the person most knowledgeable about the child (PMK) participated in a detailed interview. Only cases where the PMK or the spouse of the PMK was the child's biological mother (true in 98.6% of NLSCY households) were selected for this study because only biological parents could be expected to answer questions pertaining to maternal smoking behaviours during pregnancy. The survey was designed to inquire about smoking behaviours during pregnancy only from mothers with infants between the ages of 0 (newborn) and 23 months. This resulted in a sample of 4,580 infants (0-23 months) who were eligible for this analysis.

Women were asked if they had smoked during their pregnancy with the child under study and if they had, they were asked to identify the stages of pregnancy in

1. School of Health and Human Performance, Dalhousie University, Halifax, Nova Scotia
2. Professor, Faculty of Health Professions, Dalhousie University, Halifax, Nova Scotia

**Correspondence:** Dr. Lynn McIntyre, Professor, Faculty of Health Professions, Dalhousie University, 5968 College Street, Halifax, Nova Scotia, B3H 3J5, Tel: 902-494-3327, Fax: 902-494-1966, E-mail: Lynn.McIntyre@dal.ca

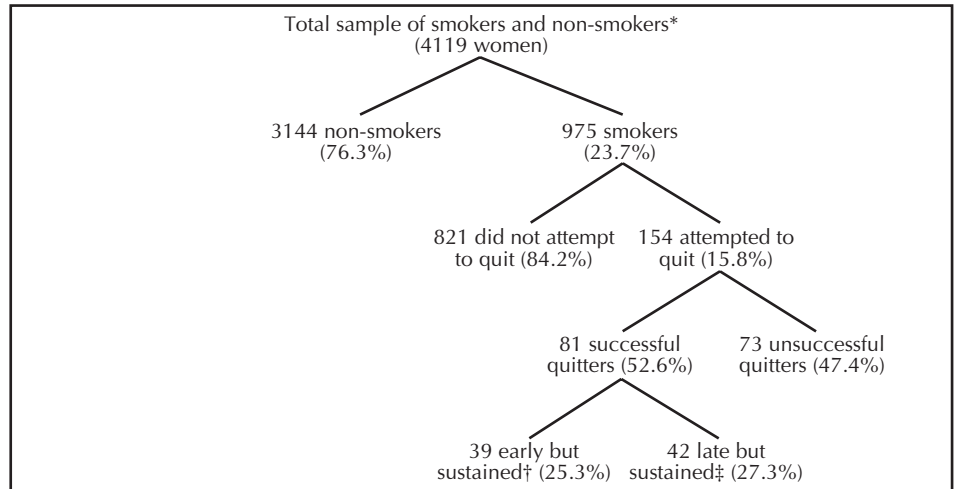
which they had smoked (first, second, and/or third trimesters, or throughout the entire pregnancy). Only 4,119 of the women had complete data on the smoking variables and could therefore be included in the analysis (See Figure 1 for the distribution of smokers).

Although the NLSCY included a wide variety of sociodemographic and other variables, many of these were suppressed to protect the confidentiality of respondents and prevent their identification (for instance, the father's smoking status). Only variables included in the publicly released (non-suppressed) data set could be used in this analysis, and such variables presumed to be related to tobacco use were included. The independent variables used to predict pregnant women's smoking behaviours are listed in Table I.

Logistic regression analyses were conducted to determine the relationship between smoking status (dependent variable) and sociodemographics (independent variable) reported for the woman's last pregnancy, with model selection continuing until only variables with a significance level less than 0.05 remained in the equation. Results are based on weighted data recommended by Statistics Canada guidelines in order to derive meaningful estimates that are representative of all children in Canada.<sup>19</sup> All calculations were performed using the Statistical Package for the Social Sciences (SPSS) computer program.

**RESULTS**

The data indicate that 23.7% of the Canadian mothers in the sample smoked at some point during their pregnancies. The sociodemographics of these pregnant smokers were similar to those reported in other Canadian studies.<sup>12,13</sup> The majority of pregnant women who smoked (84.2%) did so throughout their entire pregnancies, leaving only 15.8% of mothers attempting to quit. Women who tried to quit were further subdivided according to the time period during pregnancy when the quit attempt was made (see Figure 1). Successful quitters were those women who had reported smoking at the onset of pregnancy but had stopped smoking by the time the child was born, whereas unsuccessful quitters were



\* of the women who had complete data on the smoking variables  
 † quit during first trimester  
 ‡ quit after first trimester

**Figure 1.** Smoking status of women during their pregnancies

**TABLE I**  
**NLSCY Sociodemographic and Other Variables Used in Analyses of Smoking Cessation in Pregnancy**

Maternal Variables	Paternal Variables	Other Variables
- mother's age group (15-24, 25-29, 30-34, 35-39, 40+) reference 15-24 years	- father's education (in years) (reference < 10 years)	- child's birth order (first-born or not)
- mother's education (in years) (reference < 10 years)	- father's education (missing)*	- household income†
- mother's education (missing)*	- father's occupation‡	
- mother's employment status (employed or unemployed)	- father's occupation (missing)*	
- mother's occupation‡		
- mother's occupation (missing)*		
- mother's marital status (single or two-parent family)		
- immigration status of mothers (immigrant or Canadian-born)		

\* Note: (missing) variables refer to derived variables constructed based on respondents who refused to answer, answered 'not applicable', or 'not stated' for those variables. These individuals were given a score of one for the (missing) variables and the rest of the respondents were given scores of zero, in order to create dichotomous variables.  
 † Income categories are as follows (in thousands of dollars); no income, under 10, 10 to 14.999, 15 to 19.999, 20 to 29.999, etc... to a maximum of 80 or more per year.  
 ‡ Occupational categories ranked from 1 to 16 based on the Pineo classification for occupational prestige, 1=lowest prestige, 16=highest prestige.

those who had quit but were smoking again before the child was born (e.g., smoked in the first and third trimester).

**Who are the women who attempt to quit smoking during pregnancy?**

Although the percentage of women who attempted to quit smoking during pregnancy was quite small, there were significant

differences between the sociodemographic characteristics of these women and those of the smoking mothers who made no attempt at cessation. Results of the logistic regression analyses for cessation attempts are depicted in Table II. Odds ratios can be interpreted as being the increase or decrease in odds for a one-unit increase in the independent variable. For

**TABLE II**  
**Odds Ratios of Mothers Attempting Cessation During Pregnancy for Significant Sociodemographic Variables**

	Odds of Cessation Attempt	95% C.I.	p value
Mother's education (<10yrs=1)	1.14	1.05 to 1.23	0.0020
Father's education (<10yrs=1)	1.10	1.00 to 1.20	0.0470
Mother's age group (15-24=1)	0.95	0.92 to 0.98	0.0009
Drinking during pregnancy (drinker=1)	1.71	1.14 to 2.56	0.0088
Mother's immigration status (immigrant=1)	4.58	2.28 to 9.18	0.0001
Father's unemployment (unemployed=1)	0.40	0.17 to 0.96	0.0395

Reference: Smoking throughout pregnancy

**TABLE III**  
**Odds Ratios of Mothers Quitting Smoking and Relapsing Before the Child is Born for Significant Sociodemographic Variables**

	Odds of Relapsing	95% C.I.	p value
Household income	1.02	1.00 to 1.03	0.0083
Mother's age group (15-24=1)	0.94	0.89 to 0.98	0.0093
Child's birth order (not first-born=1)	0.50	0.29 to 0.87	0.0132
Drinking during pregnancy (drinker=1)	1.86	1.07 to 3.24	0.0274
Immigration status (immigrant=1)	10.48	4.83 to 22.75	0.0001

approximately continuous variables (such as occupation level), a one-unit increase can be interpreted as the change in odds for an increase from the lowest level on the scale to the next level above it.

Four of the independent variables were associated with an enhanced probability of cessation attempts. The strongest effect was seen in the immigration variable, with immigrant women being 4.58 times more likely to attempt to give up cigarettes than non-immigrant women. Increases in both the mother's and father's educational levels were also predictors of whether a woman would try to quit smoking. In addition, alcohol use during pregnancy was positively related to a woman's likelihood of making a cessation attempt.

The remaining variables in Table II were shown to decrease a woman's likelihood of trying to give up cigarettes during her pregnancy. Women with spouses who were unemployed were at higher risk of continued cigarette use, making no attempts at quitting, and a mild association was demonstrated between the mother's older age group and her decreased odds of attempting to quit.

#### Who are the women who successfully quit smoking during pregnancy and who are the women who relapse?

Early and sustained quitters were those women who successfully quit smoking in

their first trimester and remained smoke-free for the duration of their pregnancies. On logistic regression, the only sociodemographic variable found to be related to a woman's ability to be an early, sustained quitter was her educational level. For each additional year of the mother's education, her probability of quitting early in the pregnancy and remaining smoke-free increased, odds ratio=1.24 [Confidence Interval 1.07 to 1.43,  $p=0.0047$  M\*].

Women who smoked during the second trimester only, or during the first and second trimesters only, were classified as being late, but sustained (and therefore successful) quitters. The only predictor of whether a woman would fall into this category was the educational level attained by her spouse. As father's years of schooling increased, odds of late, sustained cessation in his pregnant spouse also increased (OR=1.20; C.I.=1.02 to 1.41,  $p=0.0314$  M).

Women who smoked and relapsed during pregnancy included those who smoked in the third trimester only, the first and third trimesters, or the second and third trimesters only. Four variables were significantly related to the mother's probability of relapse (Table III): mother's younger

\* M = Marginal Estimate – In accordance with Statistics Canada's Data Release Guidelines, results should be used and interpreted with caution because of the high degree of error associated with the estimate. (Ref:19)

age group; child is first-born; mother drinks alcohol during pregnancy; and mother is foreign-born. These variables are similar to those seen as predictors of cessation attempts with only the spousal and maternal educational variables remaining predictive of successful cessation.

## DISCUSSION

Results of this study reveal information about both smoking cessation attempts in pregnancy, and ultimate cessation success among pregnant smokers. Our first finding is the relatively low smoking cessation attempt rate for pregnant smokers in Canada – only 16%. We could not find other population-based studies of smoking cessation attempts in pregnancy but this low rate clearly dispels the generally held belief that pregnancy is a "critical moment" in which women reassess their smoking behaviour.

The second finding in this study presents the profile of the pregnant woman who is motivated to quit smoking, presumably for the good of her fetus. We found that factors that independently favoured cessation included higher educational achievement of the father and mother, a mother who is foreign-born, and one who concurrently consumes alcohol. Those who were least likely to quit smoking had unemployed spouses.

Our third finding presents the only independent predictor of successful cessation from among our variables, namely higher education of the mother and/or of her spouse. Our analysis supports the conclusions of several authors<sup>13,15,20-22</sup> indicating that lower levels of education are associated with decreased cessation. Although studies have provided support for the hypothesis that fathers in higher social groups (according to their occupations) have spouses who smoke less often than those in other occupational categories,<sup>16,23</sup> few studies have examined the role of the father's educational levels in his spouse's smoking behaviours. Results from this study provide additional insight into ways that spouses (who have perhaps been overlooked as a source of influence in the past) can, through their employment status and educational levels, have an effect on their partners' risk factors for cigarette use and their quitting attempts during pregnancy.



The fact that more women who drink make cessation attempts, but are also more likely to relapse, points to a gap in reinforcing mechanisms to help women maintain their cessation gains. It may be simply too difficult to give up both alcohol and tobacco simultaneously, or continued alcohol use may impair cessation sustainability.

Studies by Cnattingius and colleagues<sup>15</sup> and Dodds<sup>12</sup> showed that mothers who were having their first child were less likely to smoke during pregnancy than those who had previously given birth to one or more infants. While first-born children in the NLSCY also had fewer mothers who smoked in pregnancy than later born children (data not shown), we also found that first-time smoking mothers who attempted cessation were also more likely to relapse before their child was born than other quitting mothers. It is possible that first-time mothers find the stresses associated with a first pregnancy overwhelming, and therefore, revert back to tobacco use as a way of coping. Providing more support to first-time mothers with a focus on early prenatal services and education about the risks of smoking might be helpful in increasing cessation rates.

The literature also suggests that unmarried women are more likely to smoke during pregnancy than their married counterparts,<sup>12,17,20</sup> a finding that was replicated in the NLSCY (single parents 2.25 times more likely to smoke [data not shown]). Perhaps social support (which often comes in the form of a spouse) can play an important role in helping a woman make the decision to quit and, when she does, to successfully adjust to some of the physiological, psychological, and social changes that are common when one quits smoking.

Although not available for the NLSCY analysis, other important predictors of continued smoking or relapse during or after pregnancy include having a spouse or partner who smokes,<sup>18,23,24</sup> early age of onset of smoking,<sup>15,21</sup> and heavier smoking prior to pregnancy.<sup>15,16,18,21,23,25</sup> Additionally, women experiencing planned versus unplanned pregnancies,<sup>20</sup> and those consuming lower intakes of coffee (under three cups a day)<sup>23</sup> seem more likely to cease smoking during pregnancy. Mother's intention to breast- as opposed to formula-feed her child has also been associat-

ed with significantly higher odds of cessation during pregnancy as well as a substantially lower risk of post-partum relapse.<sup>22</sup>

## CONCLUSION

Using the only Canadian database of its kind that includes the characteristics of Canadian women who quit smoking and relapse at different stages during their pregnancies, we found significant differences between mothers who attempted to quit smoking during pregnancy and those who did not. Because pregnant women who quit and stay smoke-free appear to be systematically different from those who quit and relapse, any program designed to encourage cessation must have two main components: one to initiate cessation among smokers, and a second component designed to help those at risk of relapse to sustain their attempts and remain smoke-free.

Although sociodemographic characteristics to a large extent can be considered non-modifiable factors in a woman's life, understanding the target population for whom a cessation intervention is required is an extremely important step in developing a realistic, feasible, and effective program that can be suited to meet women's needs. Future research should build upon this study by incorporating more psychosocial, lifestyle, and other risk factors, and more complete data on certain variables (e.g., mother's exact age at time of pregnancy) to allow for a more in-depth analysis of the role these factors play in promoting or preventing tobacco cessation. Additional research is also required on effective cessation interventions and to determine the optimal time for such interventions in pregnancy.

## REFERENCES

1. U.S. Department of Health, Education, and Welfare – Public Health Service. Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service. Washington, 1964.
2. Canadian Council on Smoking and Health. A new start in life: About pregnancy and smoking. [Brochure]. Ottawa, 1993.
3. Macleod-Clark J, Maclaine K. The effects of smoking in pregnancy: A review of approaches to behavioural change. *Midwifery* 1992;8:19-30.
4. Dolan-Mullen P, Ramirez G, Groff J. A meta-analysis of randomized trials of prenatal smoking cessation interventions. *Am J Obstet Gynecol* 1994;171:1328-34.

5. Gupton A, Thompson L, Arnason RC, et al. Pregnant women and smoking. *Can Nurs* 1995;91:26-30.
6. Foy A. Cigarette smoking in pregnancy. *Med J Austr* 1988;148:377-78.
7. McIntosh ID. Smoking and pregnancy: Attributable risks and public health implications. *Can J Public Health* 1984;75:141-48.
8. Weitzman M, Gortmaker S, Sobol A. Maternal smoking and behavior problems of children. *Pediatrics* 1992;90:342-49.
9. Drews CD, Murphy CC, Yeargin-Allsopp M, et al. The relationship between idiopathic mental retardation and maternal smoking during pregnancy. *Pediatrics* 1996;97(4):547-53.
10. Sexton M, Fox NL, Hebel JR. Prenatal exposure to tobacco: II Effects on cognitive functioning at age three. *Int J Epidemiol* 1990;19:72-77.
11. Nova Scotia Department of Health. Smoke-free places: Towards healthier communities in Nova Scotia. [A discussion paper]. Halifax, 1997.
12. Dodds L. Prevalence of smoking among pregnant women in Nova Scotia from 1988 to 1992. *CMAJ* 1995;152:185-90.
13. Stewart PJ, Dunkley GC. Smoking and health care patterns among pregnant women. *CMAJ* 1985;133:989-94.
14. Connor SK, McIntyre LL. The predictors and outcomes of smoking and drinking during pregnancy among Canadian women. In: Willms D (Ed.) *Vulnerable Children*, Human Resources Development Canada, in press.
15. Cnattingius S, Lindmark G, Meirik O. Who continues to smoke while pregnant? *J Epidemiol Commun Health* 1992;46:218-21.
16. Isohanni M, Oja H, Moilanen I, et al. Smoking or quitting during pregnancy: Association with background and future social factors. *Scand J Soc Med* 1995;23:32-38.
17. Muhajarine N, D'Arcy C, Edouard L. Prevalence and predictors of health risk behaviours during early pregnancy: Saskatoon pregnancy and health study. *Can J Public Health* 1997;88:375-79.
18. Severson HH, Andrews JA, Lichtenstein E, et al. Predictors of smoking during and after pregnancy: A survey of mothers of newborns. *Prev Med* 1995;24:23-28.
19. Human Resources Development Canada & Statistics Canada. National Longitudinal Survey of Children and Youth, *User's Handbook and Microdata Guide*. Ottawa: Special Surveys Division, 1996.
20. Dejin-Karlsson E, Hanson BS, Ostergren P, et al. Psychosocial resources and persistent smoking in early pregnancy - a population study of women in their first pregnancy in Sweden. *J Epidemiol Commun Health* 1996;50:33-39.
21. Cnattingius S, Thorslund M. Smoking behaviour among pregnant women prior to antenatal care registration. *Soc Sci Med* 1990;31:1271-75.
22. O'Campo P, Faden RR, Brown H, et al. The impact of pregnancy on women's prenatal and postpartum smoking behavior. *Am J Prev Med* 1992;8:8-13.
23. Olsen J. Predictors of smoking cessation in pregnancy. *Scand J Soc Med* 1993;21:197-202.
24. Nafstad P, Botten G, Hagen J. Partner's smoking: A major determinant for changes in women's smoking behaviour during and after pregnancy. *Public Health* 1996;110:379-85.
25. Mas R, Escriba V, Colomer C. Who quits smoking during pregnancy? *Scand J Soc Med* 1996;2:102-6.

Received: June 8, 1998

Accepted: May 20, 1999