One-year predictors of smoking initiation and of continued smoking among elementary schoolchildren in multiethnic, low-income, inner-city neighbourhoods

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Abstract

***Objective*—To identify one-year predictors of smoking initiation among never-smokers, and of continued smoking among ever-smokers.**

***Design*—Two sequential cohorts of grade 4 and 5 children. Data were collected as part of Coeur en sante St Louis du Parc, a non-randomised controlled trial to evaluate the impact of a school-based heart health promotion programme.**

***Setting*—24 inner-city elementary schools located in multiethnic, low-income neighbourhoods in Montreal.**

***Subject*—1824 schoolchildren aged 9–12 years with baseline and one-year follow-up data.**

***Main outcome measures*—Changes in smoking behaviour over a year; the ability of baseline data to predict smoking initiation and continued smoking a year later was investigated in logistic regression analyses.**

***Results*—The prevalence of ever-smoking was 21.1% at baseline and 30.2% at one-year follow up. One in six never-smokers initiated smoking; one in three ever-smokers continued smoking. Predictors of initiation included age (odds ratio (OR) = 1.6, 95% confidence interval (CI) = 1.3 to 2.0), male gender (OR = 1.5 (95% CI = 1.1 to 2.0)), friends who smoke (OR = 2.3 (95% CI = 1.7 to 3.3)), sibling(s) who smoke (OR = 1.9 (95% CI = 1.2 to 3.1)), father/mother who smokes (OR = 2.2 (95% CI = 1.6 to 3.0)), and frequent high fat/"junk food" consumption (OR = 1.6 (95% CI = 1.1 to 2.1)). Age and friends who smoke were also independent predictors of continued smoking in both genders. In addition, in boys, current smokers at baseline were 2.6 times (95% CI = 1.4 to 5.0) more likely to continue smoking than past smokers. In girls, being overweight was associated with continued smoking (OR = 3.5 (95% CI = 1.6 to 7.6)).**

***Conclusions*—Smoking prevention programmes should address parental and sibling influences on smoking, in addition to refusal skills training. Among girls, weight-related issues may also be important.**

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Keywords: children, smoking initiation predictors

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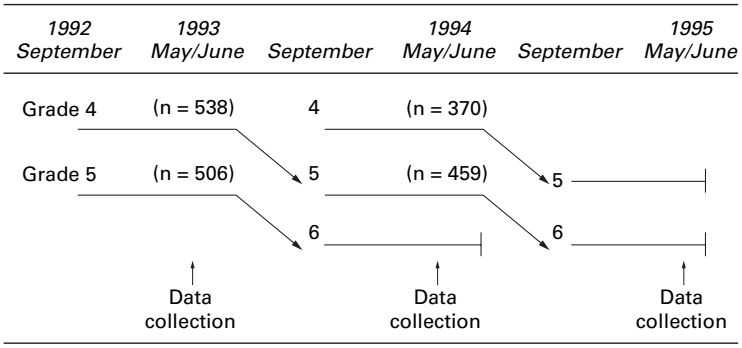
Introduction

Although smoking prevalence among North American adolescents declined sharply in the 1970s, the decline slowed significantly in the 1980s, and appears to have levelled off in the 1990s.[1 2] Approximately 24–27% of Canadians aged 15–19 years are smokers.[3] In 1993, 45% of eighth-graders (13–14 years), 56% of 10th-graders (15–16 years), and 62% of 12th-graders (17–18 years) in the United States had tried cigarettes; 8%,14%, and 19%, respectively, smoked daily.[4] Smoking onset among children and adolescents remains a major public health problem.

The process leading to regular smoking generally progresses through five fairly well-defined stages over two to three years irrespective of the age at which smoking first begins. In the *preparatory stage*, attitudes and beliefs about the utility of smoking are formed. In the *trying stage*, the individual smokes the first few cigarettes. In the *experiment stage*, the individual smokes repeatedly but irregularly. In the *regular use stage*, the individual smokes at least weekly across a variety of situations and personal interactions. Finally the *addiction/dependent smoker stage* is characterised by a physiological need for nicotine.[1 5] The process rarely begins before age 11—most children smoke their first cigarette between 11 and 15 years of age, although a small proportion wait until their late high school years or later.[6] About a third to a half of young people who experiment with cigarettes become regular users.[1 2]

Many authors have advocated early intervention to prevent or delay the onset of smoking,[7–10] but prevention programmes have generally targeted adolescents rather than younger children.[11] There is a need for research that examines tobacco use among young children, to identify risk factors at each of the very early stages of onset that are amenable to preventive intervention.[2 11] However, to date, few studies have investigated predictors of progress through the early stages of smoking onset in longitudinal study designs. In addition, despite substantial evidence of a higher prevalence of smoking among young people[12 13] and adults[14–20] of low socioeconomic status, few studies have focused specifically on the patterns of smoking onset in this high-risk group.



Description of study cohort and timing of data collection.

As part of the evaluation of the impact of Coeur en santé St Louis du Parc, a school-based heart health promotion programme, we collected data on changes in smoking behaviour from year to year among young children attending inner-city elementary schools located in multiethnic, low-income neighbourhoods in Montreal, Canada. This report describes the one-year predictors of smoking initiation among never-smokers, as well as the one-year predictors of continued smoking among ever-smokers in this young population.

Methods

This study is a secondary analysis of data collected as part of Coeur en santé St Louis du Parc, a five-year, non-randomised, controlled trial to evaluate the impact of a school-based heart health promotion programme on children aged 9–12 years. For this trial, all eight elementary schools located in St Louis du Parc, a low-income, multiethnic, neighbourhood in central Montreal, were designated intervention schools. Two comparison schools were matched to each intervention school (for a total of 16 comparison schools) based on the mother tongue of students in the school as compiled by the Department of Intercultural Affairs of the Montreal Catholic School Commission, and a school-specific composite poverty index.[21] Comparison schools were selected from among the remaining 327 elementary schools in Montreal.

Data to evaluate the impact of the Coeur en santé St Louis du Parc programme on student smoking, dietary, and physical activity behaviours were collected in surveys conducted in the classroom each May/June from 1993 to 1997, among all grade 4, 5, and 6 students (aged 9–12 years) for whom informed parental consent had been obtained, in the 24 study schools, including special education and learning impaired students. Over the five years of data collection, data were collected from a total of 11 195 students—80.9% of eligible students completed the in-class questionnaire (the proportion ranged from 75.0–83.8% over the five years); 3.5% (range 2.6–4.4%) were absent on the day of questionnaire administration; and 15.6% (range 11.8–22.4%) did not participate because their parents did not provide consent.

In 1993, data were also collected directly from parents in self-administered parent questionnaires sent home with each student. Taking siblings into account, data were collected from mothers or fathers in 67.5% of families represented in the May/June 1993 database.

SUBJECTS

For the study reported here, we identified two sequential cohorts of grade 4 and 5 students aged 9–12 years with one-year follow-up data, from the first three years of data collected for the Coeur en santé St Louis du Parc project. None of the subjects included in this assessment had been exposed to the Coeur en santé St Louis du Parc programme. Specifically, one cohort consisted of students in grades 4 and 5 for whom we had data from May/June 1993 and one-year follow-up data from May/June 1994. The second cohort consisted of students in grades 4 and 5 for whom we had data from May/June 1994 and one-year follow-up data from May/June 1995 (figure 1). A total of 363 students were included in both cohorts because we had data for them for all three years (1993–1995). For these students, 1993 "baseline" data were used to predict smoking status in 1994, and 1994 "baseline" data were used to predict smoking status in 1995.

Of 2804 grade 4 and 5 students aged 9–12 years in the two cohorts at "baseline", one-year follow-up data were collected from 1873 subjects (66.8%). Census data show that there is relatively high mobility among residents in St Louis du Parc. In 1991, 55% reported that they had lived in a different dwelling five years previously, compared with 48% in Montreal.[22]

PROCEDURE

Data were collected at each data collection period in two visits to each school. During the first visit, anthropometric measures including height and weight were obtained by lay interviewers who had been trained according to a standardised protocol.[23] In the May/June 1993 survey only, students were then given an envelope containing two questionnaires to be taken home and completed by their parents/caretakers, and returned to the classroom teacher. This questionnaire collected data on the sociodemographic characteristics and lifestyle behaviours of parents/caretakers.

During the second visit to each school, students completed a questionnaire administered by two interviewers in French or English according to the language of instruction in the school. Data collected in these student questionnaires, which took 30–45 minutes, included sociodemographic characteristics of the student (date of birth; gender; family composition; language(s) spoken; number of years lived in Canada; country(ies) of birth for the subject, mother, and father; and employment status of the mother and father), lifestyle behaviours (smoking status, level of physical activity, consumption of "junk food", sedentary behaviour), and finally, selected psychosocial characteristics related to these lifestyle behaviours. A detailed description of data collection procedures and study variables is available.[24 25] The following paragraphs provide details on selected study variables.

MEASURES

An income sufficiency variable was created based on data collected in parents' questionnaires, by adjusting the total household income by the number of people in the household, and comparing this to the 1991 Canadian Census definitions of poverty.[22] Subjects were categorised into high, sufficient, or insufficient household income.

Two variables were created to study the possible influence of cultural factors and ethnicity on smoking onset. First, "family origin" was attributed to each subject using an algorithm based on the country(ies) of birth for the mother, father, and student, and the language(s) spoken by the student. Family origins were grouped into categories based on language similarity or geographic proximity of the countries of birth, or both. Second, "per cent lifetime in Canada" was calculated as years lived in Canada divided by age (in years). Subjects were categorised into less than 25% of lifetime, 25–49%, 50–74%, 75–99%, and 100%. Children in the 100% category included those who had been born and had lived all their lives in Canada.

Student smoking status was measured in two items adapted from previous research[26]: (a) *Have you ever smoked a cigarette, even just a puff?* Response categories included "No"; "Yes, 1 or 2 times"; "Yes, 3 to 10 times"; and "Yes, more than 10 times"; and (b) *Check the one box below which describes you best.* Response categories included: "You have never smoked"; "You have smoked, but not at all in the past year"; "You smoked once or a couple of times in the past year"; "You smoke a couple of times each month"; "You smoke a couple of times each week"; and "You smoke every day". Students were categorised as never-smokers if they reported no smoking at all. Ever-smokers included past smokers (those who had smoked but not at all in the past year) and current smokers. Current smokers included those trying smoking (those who had smoked once or twice in the past year), experimenters (students who had smoked three or more times in the past year, but did not smoke on a regular basis), and regular smokers (students who smoked a couple of times each month or each week and those who reported smoking every day). Smoking initiation was defined as movement from never-smoked at baseline to any level of smoking at the one-year follow up.[27] "Continuing smokers" included ever-smokers at baseline who reported current smoking in the one-year follow up.

Data on the smoking behaviour of friends, siblings, and parents were obtained in the student questionnaires. Agreement between students' reports of parents' smoking status and parents' self-reports of smoking obtained in 1993 when parents completed a self-administered parent questionnaire, was excellent for mothers, and very good for fathers ($\kappa = 0.82$ and 0.72, respectively).[28] The Spearman rank correlation coefficient between mother who smokes and father who smokes was 0.30; $p = 0.0001$. Therefore, we created a single variable "mother and/or father who smokes" (yes, no) for analysis. Similarly, the correlation between brother and sister smoking was $r = 0.17$; $p = 0.0001$. We created a single variable, "sibling(s) who smokes" (yes, no) for analysis. Body mass index (BMI) was computed by weight (kg)/height (m).^{2} Students were categorised according to age-specific and gender-specific BMI percentiles obtained from the National Health and Nutrition Examination Survey II (NHANES II) conducted in the United States.[29] "Not overweight" included students whose BMI was less than the 85th age-specific and gender-specific percentile. "Overweight" included students at or over the 85th age-specific and gender-specific percentile.[30 31]

Frequency of consumption of 10 high fat/"junk food" items/groupings was measured by the question: "During the past week from Monday to Sunday, how often did you eat the following foods . . . hot dogs, hamburgers, fried chicken (Kentucky Fried Chicken), bacon or sausages, French fries/poutine, donuts/cakes/pastries, candy/chocolate bars, soft drinks, ice cream, and potato chips/fritos/doritos." Responses to each item were scored 1 (every day, often, three or more times), 2 (once, a couple of times, once or twice), or 3 (never), and summed to create a "high fat/junk food score". The internal reliability coefficient (Cronbach's α) of the score was 0.77. Scores ranged from 10 to 30 (mean = 22.3 (SD 3.7)), with lower scores indicating higher high-fat/junk food consumption. Subjects were categorised into frequent (10–21), occasional (22–23), and infrequent (24–30) high fat/junk food consumption. In a previous validation study among 81 adult volunteers, the correlation between a similar "junk food" score and percentage total energy from saturated fat as measured in diet history, was 0.48.[32]

ANALYSIS

Baseline or follow-up data on smoking status, or both, were missing for 49 of the 1873 subjects. Therefore, the analyses reported here are based on a total of 1824 subjects.

One-year predictors of smoking initiation among never-smokers at baseline were identified in multiple logistic regression analysis in which the dependent variable was never-smoked *vs* ever-smoked at one-year follow up. All students who reported ever smoking at baseline were excluded from these analyses. Potential predictors investigated included sociodemographic characteristics of students and their parents, lifestyle behaviours and BMI of the student, and smoking behaviours of family members and friends. Because of the large proportion of missing data for parents' education and for household income, these variables included a "missing" category. All exposures associated with the dependent variables in univariate analyses, were entered into the models concurrently. Only those significant at $p \leq 0.05$ in stepwise procedures were retained. Analyses were completed using the BMDP statistical package.[33] Because both the univariate and multivariate analyses suggested that the

Table 1 Comparison of selected characteristics of study subjects and children lost to follow up, Montreal, Canada, 1993–1995

	Study subjects (n = 1824)	*Children lost to follow up (n = 931)*	*p*
Male (%)	50.0	50.1	0.98
Mean age (SD) (years)	10.5 (0.8)	10.6 (0.9)	0.02
Mean no (SD) persons/household	4.6 (1.5)	4.6 (1.7)	0.90
Two-parent family (%)	73.4	69.4	0.03
Born in Canada (%)			
Subject	64.5	53.1	0.00
Mother	27.6	24.3	0.07
Father	23.3	22.1	0.49
Family origin (%)			0.02
Europe	22.5	18.8	
Central America/Caribbean	21.7	19.8	
Canada	20.8	19.5	
Asia	14.7	19.0	
Arabic-speaking countries	5.2	6.4	
South America	4.6	4.5	
Other	10.6	11.8	
Employed (%)			
Father	84.3	83.0	0.41
Mother	66.6	59.0	0.00
Smoke (%)			
Subject	21.1	20.6	0.77
Mother	25.4	25.6	0.91
Father	45.7	47.1	0.48
Sibling(s)	10.8	12.3	0.24
Friends	26.1	27.6	0.40

predictors of smoking initiation did not differ by gender, these analyses combine boys and girls.

We also investigated predictors of continued smoking among the 229 boys and 156 girls who had ever smoked at baseline. The dependent variable was whether or not the subject was a current smoker at the one-year follow up. All subjects who were never-smokers at baseline were excluded from these analyses. In addition to the variables investigated as potential predictors of smoking initiation described above, we also investigated baseline smoking status as a potential independent predictor in these models. Both the univariate and multivariate analyses suggested that the predictors of continued smoking differed by gender. Therefore, these analyses are presented separately for boys and girls.

Use of the odds ratio as the parameter of interest in a prospective longitudinal study is somewhat controversial,[34] in part because it could overestimate the relative risk if the outcome studied is not rare. However, because the outcome of interest in this study was binary, because risk estimates and odds estimates are mathematically co-dependent, and because of its common usage and ease of interpretation, we report here the odds ratio.

Results

Table 1 shows the sociodemographic characteristics of study subjects and highlights their ethnic diversity. A total of 104 countries of birth were reported by subjects for themselves and their parents. Almost half of the fathers (45.7%) and 25.4% of the mothers smoked. Children lost to follow up differed from those who remained in the study in several respects: they were slightly older, fewer lived in two-parent families, fewer were born in Canada, and fewer mothers were employed (table 1).

PATTERNS OF SMOKING ONSET

At baseline, 17.1% (95 % confidence interval (CI)) = 16.7 to 19.2) of girls and 25.1% (95% CI = 22.3 to 27.9) of boys had ever smoked; 15.5% (95% CI = 13.8 to 17.2) of all children were past smokers, 3.1% (95% CI = 2.3 to 3.9) were currently trying smoking, and 2.6% (95% CI = 1.9 to 3.3) were experimental/regular smokers. A year later, 25.7% of girls (95% CI = 22.8 to 28.5) and 34.6% of boys (95% CI = 31.6 to 37.7) had ever smoked; 19.1% of all children (95% CI = 17.3 to 20.9) were past smokers, 4.5% (95% CI = 3.6 to 5.5) were trying, and 6.5% (95% CI = 5.4 to 7.6) were experimental/regular smokers. Although a lower proportion of girls had ever smoked at baseline, the patterns of change over a year were similar among boys and girls.

Baseline smoking status was predictive of smoking status a year later (table 2). Most never-smokers (82.4%) remained never-smokers. Of particular interest, 50.0% of children trying smoking at baseline did not progress, while 50.0% continued to try or progressed to experimental/regular smoking. Also, there was a marked pattern of progression to experimental/regular smoking by past smoking experience. Only 2.6% of never-smokers reported regular/experimental smoking a year later; 16.3% of past smokers, 32.1% of those trying, and 38.3% of experimental/regular smokers at baseline reported experimental/regular smoking a year later. The patterns of progression were similar among boys and girls.

It is notable that the data in table 2 are reported exactly as the children responded in the questionnaires, and therefore provide information on misclassification related to self-reports of smoking status among young children. Of particular interest, 88 of 385 ever-smokers at baseline (22.8%), reported never having smoked in the one-year follow up. These subjects are misclassified either at baseline (that is, they reported having smoked at baseline when in fact they had never smoked) or at the one-year follow up (they had "forgotten" about earlier smoking experiences that they had correctly reported a year earlier). Comparison of the characteristics of these

Table 2 Smoking status at one-year follow up according to baseline smoking status among elementary schoolchildren in multiethnic, low-income, inner-city neighbourhoods, Montreal, Canada, 1993–1995 (n = 1824)

		Follow-up smoking status							
		Never smoked		*Past smoker*		*Currently trying*		*Currently experimental/ regular*	
Baseline smoking status	*Total n*	*%*	*95% CI*	*%*	*95% CI*	*%*	*95% CI*	*%*	*95% CI*
Never smoked	1439	82.4	80.4–84.4	12.1	10.4–13.8	2.9	2.0–3.8	2.6	1.7–3.4
Past smoker	282	25.2	20.1–30.2	49.3	43.5–55.1	9.2	5.8–12.6	16.3	12.0–20.6
Currently trying	56	10.7	2.6–18.8	39.3	26.5–52.1	17.9	10.9–27.9	32.1	19.9–44.4
Currently experimental/regular	47	23.4	11.3–35.5	29.8	16.7–42.9	8.5	0.5–16.5	38.3	24.4–52.2

CI = confidence interval.

Table 3 Univariate associations between selected variables and smoking initiation and continuation among elementary schoolchildren in multiethnic, low-income, inner-city neighbourhoods, Montreal, Canada, 1993–1995

	Initiation† (n = 1439)		Continued smoking‡			
			Boys (n = 229)		Girls (n = 156)	
	n*	%	n*	%	n*	%
Age (years)						
9	173	9.3	21	14.3	15	26.7
10	595	14.4	69	23.2	61	21.3
11	535	20.7	99	36.4	59	45.8
12	133	30.1	39	43.6	20	30.0
Gender						
Male	683	20.8	229	31.4	ND	ND
Female	756	14.7	ND	ND	156	32.0
Grade						
4	728	14.6	96	20.8	61	14.7
5	711	20.7	133	39.1	95	43.2
Family status						
Two-parent	1071	16.8	168	35.7	100	32.0
Single-parent/other	368	19.8	61	19.7	56	32.1
Family origin						
Canada	276	23.2	53	34.0	43	39.5
Europe	302	18.2	59	33.9	41	31.7
Central America/Caribbean	321	14.0	33	33.3	33	30.3
Other	511	16.6	79	27.8	36	27.8
% Lifetime in Canada						
<100	447	17.2	72	31.9	38	28.9
100	856	17.9	141	32.6	105	36.2
Income sufficiency						
Insufficient	260	18.8	37	29.7	28	39.3
Sufficient/high	159	16.3	23	34.8	24	25.0
Missing	1020	17.4	169	31.4	104	31.7
Mother's education						
Secondary or less	336	20.5	46	28.3	39	25.6
More than secondary	187	13.4	23	34.8	24	41.7
Missing	916	17.4	160	31.9	93	32.3
Father's education						
Secondary or less	230	22.6	33	39.4	16	25.0
More than secondary	159	11.3	18	27.8	19	21.0
Missing	1050	17.4	178	30.3	121	34.7
Father employed						
Yes	1085	17.5	176	30.7	112	33.0
No	210	16.2	22	36.4	23	26.1
Mother employed						
Yes	893	18.0	150	31.3	102	33.3
No	466	17.4	65	30.8	43	34.9
Baseline smoking status						
Past smoker	ND	ND	168	25.6	114	25.4
Currently trying	ND	ND	31	51.6	25	48.0
Currently experimental/regular	ND	ND	30	43.3	17	52.9
Friends who smoke						
None/don't know	1148	13.9	121	24.0	75	21.3
Few/most/all	285	32.3	108	39.8	81	42.0
Mother who smokes						
No	1096	15.8	151	30.5	91	33.0
Yes	319	24.1	75	33.3	61	31.1
Father who smokes						
No	783	12.6	90	30.0	67	34.3
Yes	594	23.4	122	32.8	74	28.4
Brother(s) who smoke(s)						
No	1365	17.3	195	28.7	129	31.0
Yes	69	24.6	32	43.7	26	34.6
Sister(s) who smoke(s)						
No	1387	16.9	208	28.8	128	31.2
Yes	47	40.4	19	52.6	27	33.3
Mother encourages non-smoking						
No	249	16.9	40	42.5	30	36.7
Yes	1169	17.7	186	28.5	120	32.5
Father encourages non-smoking						
No	443	17.4	75	37.3	51	27.4
Yes	916	17.1	136	28.7	89	34.8
High fat/"junk food" consumption						
Frequent	648	22.5	129	34.9	69	34.8
Occasional	260	14.6	37	16.2	35	34.3
Infrequent	362	14.4	34	35.3	35	28.6
Physical activity						
Infrequent	535	14.0	57	28.1	66	31.8
Occasional	316	15.8	35	22.9	26	26.9
Frequent	588	21.8	137	35.0	64	34.4
Television programmes/day						
⩾6	384	21.6	88	32.9	58	29.3
4–5	355	17.2	50	24.0	42	38.1
2–3	510	16.7	69	34.8	41	26.8
0–1	188	12.2	21	33.3	15	40.0
Overweight						
No	860	18.9	144	33.3	82	21.9
Yes	548	16.1	76	27.6	69	43.5

*Totals for each potential predictor differ because of missing data (ND=no data).
†Includes never-smokers at baseline who moved to any level of smoking at one-year follow up.
‡Includes ever-smokers at baseline who reported current smoking at one-year follow up.

*Table 4 Independent predictors of smoking initiation among elementary schoolchildren in multiethnic, low-income, inner-city neighbourhoods, Montreal, Canada, 1993–1995 (n = 1224)**

Independent predictor	OR†	95% CI
Age	1.6	1.3–2.0
Gender		
Female	ref.	
Male	1.5	1.1–2.0
Friends who smoke		
None/don't know	ref.	
Few/most/all	2.3	1.7–3.3
Sibling(s) who smoke		
No	ref.	
Yes	1.9	1.2–3.1
Father/mother who smokes		
No	ref.	
Yes	2.2	1.6–3.0
High fat/"junk food" consumption		
Infrequent/occasional	ref.	
Frequent	1.6	1.1–2.1

*Excludes 215 subjects with missing data.
†Adjusted odds ratios (OR) and 95% confidence intervals (95% CI) obtained from multiple logistic regression analyses containing all independent predictors.

"misclassified" children with those of other ever-smokers, suggested that they were slightly younger and fewer were of Canadian family origin (data not shown). For the analyses reported here, these children are considered to have been ever-smokers at baseline who did not continue to smoke at the one-year follow up.

PREDICTORS OF SMOKING INITIATION

Over the one-year follow up, 14.7% of girls and 20.8% of boys who reported never smoking at baseline, initiated smoking. Table 3 shows the proportion of subjects who initiated smoking according to selected potential predictors. Table 4 shows that the independent predictors of initiation retained in the multivariate model included age, gender, friends who smoke, smoking by parents and siblings, and high fat/"junk food" consumption. None of the terms to test for interactions between each independent predictor and gender were significant, and an age × grade interaction term was not significant.

PREDICTORS OF CONTINUED SMOKING

At the one-year follow up, 32.0% of girls and 31.4% of boys who had ever smoked reported continued smoking. Table 5 shows that although age and friends who smoke were important predictors of continued smoking in both boys and girls, other predictors of continued smoking differed by gender. Boys who were current smokers at baseline were 2.6 times more likely to continue smoking than boys who were past smokers at baseline. In the model for girls, ever-smokers who were overweight were 3.5 times more likely to continue smoking than ever-smokers who were not overweight.

The variable "school" was included in the final models for smoking initiation and for continued smoking, to control for possible clustering related to homogeneity of students within schools. School was not significant in any model. Similarly, for the 363 students included in both the 1993 and 1994 cohorts, a variable to control for possible dependence

Table 5 Independent predictors of continued smoking among elementary schoolchildren in multiethnic, low-income, inner-city neighbourhoods, Montreal, Canada, 1993–1995

	Boys (n = 229)		*Girls (n = 156)*	
Independent predictor	*OR**	*95% CI*	*OR**	*95% CI*
Age	1.7	1.2–2.4	1.6	1.0–2.6
Friends who smoke				
None/don't know	ref.		ref.	
Few/most/all	1.8	1.0–3.3	2.7	1.2–5.7
Overweight				
No	ns		ref.	
Yes			3.5	1.6–7.6
Baseline smoking status				
Past smoker	ref.		ns	
Current smoker	2.6	1.4–5.0		

*Adjusted odds ratios (OR) and 95% confidence intervals (95% CI) obtained from multiple logistic regression analyses containing all independent predictors. Confidence intervals sometimes include unity because of estimations in p values and confidence intervals.
ns = Not significant (factor did not meet the significance criterion of $p \leq 0.05$).

between observations of the same subject, was not significant in any model. Finally, year of cohort (1993 or 1994) was not significant in the final models.

Discussion

This study is one of the first to examine the process of smoking onset longitudinally in young children in multiethnic, low-income, inner-city neighbourhoods. One of the more important findings is that one in six children aged 9–12 years who had never smoked, experimented with cigarettes over the one-year follow up. One in three children who had already tried smoking reported continued smoking. These data suggest that age 9–12 years is a critical period in the smoking onset process, at least in low-income, inner-city neighbourhoods, and that there is considerable need for prevention programmes for these age groups in these milieus.

Few studies have systematically differentiated predictors of smoking initiation from predictors of continued smoking among young children, from such a wide range of sociodemographic, anthropometric, behavioural, and psychosocial characteristics. Disentangling which factors are more important at each of these early stages of onset, could lead to more effective prevention programmes by identifying specific sub-groups to target with specific prevention messages. In particular, never-smokers and ever-smokers in this age range could be two distinct target groups, in need of different prevention programmes. Our results support the notion that, although age and smoking by friends are consistently important, the predictors of initiation and continuation do differ somewhat. Furthermore, there are important differences in the predictors of continued smoking between boys and girls. Programme planners will need to consider whether or not these differences warrant tailoring prevention programmes to specific subgroups.

There is considerable controversy over the relative contribution of parental, sibling, and peer smoking to the smoking onset process. Many studies substantiate the strong influence of peer smoking[1 5 35–44] evident as early as age 9.[43] Parental smoking is thought to be a weak predictor of onset.[6] It might lead children to try smoking, but be unrelated to smoking at a later age.[43] Sibling smoking is positively associated with younger siblings beginning to smoke, and like parental smoking, might be more influential in the early stages of cigarette use.[1] Family members and peers could exert influence in similar ways—through providing easy access to cigarettes, through communicating information about the physical and psychological effects of use, through modelling or demonstrating how to use cigarettes, and through conveying attitudes and social norms favourable to smoking.[11] Peer and sibling smoking could also exert influence through the need for social acceptance from peers as well as through direct pressure to smoke.[5]

The results reported here substantiate the importance of peer smoking in both smoking initiation and continued smoking—never-smokers with friends who smoke were more than twice as likely as never-smokers without friends who smoke, to initiate smoking. Similarly, ever-smokers with friends who smoke were approximately twice as likely to continue smoking. Indeed, most psychosocial smoking prevention programmes focus on refusal skills training on the premise that such training will have a suppressive effect on onset by enabling non-using adolescents to refuse offers of cigarettes from peers.[45]

In addition, our results support previous findings that smoking by family members is a strong determinant of initiation, although it appears to be less important to continued smoking. In fact, the strength of the association between family members smoking and smoking initiation was similar to that of friends smoking. Although further research is needed to determine which aspects of sibling and parental use are most important in influencing children's smoking,[11] this study provides compelling evidence for including elements to address familial influences in prevention programmes. More specifically, these results support the notion that it will not be sufficient to provide refusal skills training to children without taking the family environment into account. Intervention programmes must address the issue of exposure to smoking in the home. Minimally, prevention efforts should inform parents of the potential of their own smoking behaviour to influence the smoking behaviour of their offspring. More intense prevention efforts could include, in addition to parental education, cessation programmes for family members who smoke. Cessation programmes tailored to parents who smoke should emphasise the possible role modelling aspect of their behaviour, in smoking and possibly in their efforts to quit smoking.

A finding of considerable interest is that, whereas weight status was not associated with smoking initiation, overweight girls who had tried smoking were more than three times more likely to continue smoking than girls who were not overweight. Several studies have identified

subgroups of "weight control smokers" among adult females,[46–48] and there is evidence from both cross-sectional and longitudinal studies that adolescent girls use smoking for weight control.[49–51] The results reported here suggest that the association between smoking and weight status is evident even in pre-adolescent girls. Further research is needed to increase our understanding of how this association contributes to the smoking onset process in young girls, and whether or not smoking prevention programmes targeted at young girls should incorporate and emphasise healthy weight issues.

Interestingly, frequent consumption of high fat/"junk food" consumption was an independent predictor of smoking initiation, although it was unimportant to continued smoking in either boys or girls. This could indicate early clustering of unhealthy lifestyle behaviours.

Although there is considerable evidence of class-based differences in the prevalence of smoking, none of our indicators of social class including parents' education, household income, or parents' employment status, was associated with smoking onset. It is possible that missing data on parents' education and household income obscured the association. Alternatively, our results do support those of a recent longitudinal study of Danish children[52], which found no associations between either household income or parents' education and later smoking as adults.

Finally, cultural factors and ethnicity were not important in this study. Some authors have argued that ethnic differences disappear once socioeconomic status is taken into account[1]. Our results support the notion that once familial and peer smoking are taken into account, cultural factors and ethnicity are not influential in the smoking onset process.

LIMITATIONS

Because the study schools do not represent a random sample of schools and because of possible selection bias caused by subjects lost to follow up, the generalisability of results might be limited. Also the number of potential predictors of smoking onset studied was restricted because of time limitations related to administration of the questionnaire in-class. Future research should examine whether other variables reported to be associated with smoking in young people[1 11 53–67] are independent predictors of smoking initiation and continuation in this population.

Finally, this study did not use objective measures to validate self-reported smoking status of students. Nor did it use the bogus pipeline method which has been reported to enhance the validity of self-reports of smoking among the young.[68] However biochemical measures are not perfect indicators of tobacco use and controversy exists over the efficacy of the pipeline method.[69] In addition the reliability of self-reports of smoking by adolescents has generally been quite high (88–100%), with most inconsistencies occurring among subjects who use tobacco infrequently.[69]

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