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Original article

## Predictors of Cigarette Smoking Initiation in Early, Middle, and Late Adolescence



Jennifer O'Loughlin, Ph.D.<sup>a,b,c,\*</sup>, Erin K. O'Loughlin, M.A.<sup>b,d</sup>, Robert J. Wellman, Ph.D.<sup>e</sup>, Marie-Pierre Sylvestre, Ph.D.<sup>a,b</sup>, Erika N. Dugas, M.Sc.<sup>b</sup>, Miguel Chagnon, M.Sc.<sup>a</sup>, Hartley Dutczak, M.Sc.<sup>b</sup>, Johanne Laguë, M.D., M.Sc.<sup>c</sup>, and Jennifer J. McGrath, M.P.H., Ph.D.<sup>f</sup>

<sup>a</sup> Department of Social and Preventive Medicine, School of Public Health, University of Montréal, Montréal, Quebec, Canada

<sup>b</sup> Centre de Recherche du Centre Hospitalier de l'Université de Montréal, Montréal, Quebec, Canada

<sup>c</sup> Institut national de santé publique du Québec, Montréal, Quebec, Canada

<sup>d</sup> Department of Exercise Science, Concordia University, Montréal, Quebec, Canada

<sup>e</sup> Department of Family Medicine and Community Health, University of Massachusetts Medical School, Worcester, Massachusetts

<sup>f</sup> Department of Psychology, PERFORM Centre & Psychology Department, Concordia University, Montréal, Quebec, Canada

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### ABSTRACT

**Purpose:** Little is known about age-related differences in risk factors for cigarette smoking initiation. We identified predictors of initiation in early, middle, and late adolescence from among sociodemographic factors, indicators of smoking in the social environment, psychological characteristics, lifestyle indicators, and perceived need for cigarettes.

**Methods:** Data were drawn from a longitudinal study of 1,801 children recruited at age 10–11 years from 29 elementary schools in Montreal, Canada. Multivariable logistic regression within a generalized estimating equations framework was used to identify predictors among never smokers across three 2-year windows: age 11–13 years ( $n = 1,221$ ); age 13–15 years ( $n = 737$ ); and age 15–17 years ( $n = 690$ ).

**Results:** Among the 18 risk factors investigated, two differed across age. Friends' smoking, a strong risk factor in early adolescence (odds ratio [95% confidence interval] = 5.78 [3.90–8.58]), lost potency in late adolescence (1.83 [1.31–2.57]). Depressive symptoms, a risk factor in early and middle adolescence (1.60 [1.26–2.02] and 1.92 [1.45–2.54], respectively), were inversely associated in late adolescence (.76 [.58–1.00]). Sex, TV viewing, and weight-related goals were not associated with initiation at any age. All other factors were significant in two or three age groups.

**Conclusions:** Most risk factors for smoking initiation were stable across age. Tobacco control interventions may be robust for risk factors across age groups and may not need adjustment. At all ages, interventions should focus on eliminating smoking in the social environment and on reducing the availability of tobacco products.

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### IMPLICATIONS AND CONTRIBUTION

Risk factors for smoking initiation were relatively stable across age throughout adolescence, obviating the need to tailor the risk factors targeted in tobacco control interventions for specific age groups. Interventions should focus on eliminating smoking in the social environment and reducing access to tobacco products.

**Conflicts of Interest:** The authors have no conflicts of interest to disclose.

\* Address correspondence to: Jennifer O'Loughlin, Ph.D., Department of Social and Preventive Medicine, School of Public Health, University of Montreal, 850 rue Saint-Denis, Bureau S02-370, Montréal, Quebec H2X 0A9, Canada.

E-mail address: [jennifer.oloughlin@umontreal.ca](mailto:jennifer.oloughlin@umontreal.ca) (J. O'Loughlin).

Most smokers begin smoking during childhood or early adolescence [1,2], with initiation at younger ages conferring a higher risk of continued smoking, nicotine dependence [3,4], and long-term sustained smoking into adulthood [5]. However, few longitudinal studies differentiate risk factors for cigarette smoking initiation across age during adolescence, although such studies could provide critical information for the development of tobacco

control interventions for adolescents. In a recent systematic review of 53 longitudinal studies of smoking initiation in adolescents, which identified 98 conceptually distinct predictors of initiation [6], only two studies investigated risk factors by age. Mahabee-Gittens et al. [7] studied the influence of peer smoking and family factors on initiation in seven cohorts of never smokers, aged 10–16 years at baseline. Peer smoking was positively associated with initiation at every age from age 12 to 17 years, but the protective influence of parent-youth connectedness, parental monitoring, and punishment differed at different ages. In the second study, Harakeh et al. [8] followed 11-year-old never smokers for 4 years and found that two aspects of neurocognitive functioning differentially predicted smoking initiation at age 13 and 15 years.

Animal models have also provided evidence of age differences in vulnerability to smoking, and more specifically that exposure to nicotine may be more influential in early adolescence. Compared with mice exposed in middle or late adolescence, those exposed in early adolescence developed a strong preference for nicotine solution over tap water, self-administered more nicotine, and increased consumption to compensate when the nicotine concentration was reduced. In addition, the mice exposed early developed greater nicotine-induced arousal than those exposed later [9].

In humans, differences in risk factors for cigarette smoking initiation across age during adolescence are highly plausible for several reasons. The physical and hormonal transformations experienced during puberty could constitute risk factors in and of themselves or alternatively, heighten sensitivity to other risk factors in the social environment (e.g., [10,11]). In addition, the transition from elementary to high school, which usually occurs around age 12–13 years, entails changes in school cultures, increased academic demands, and shifts in peer groups [12]. This transition can be difficult to negotiate for some students, with declines in academic achievement and self-esteem, and increased social anxiety [13]. These challenges are exacerbated among youth at risk because of social, economic, familial, or neighborhood challenges [13]. As with puberty, these issues could constitute risk factors in and of themselves or they could increase sensitivity to other risk factors.

If the risk factors for smoking initiation do indeed differ by age, then the design of smoking prevention interventions that target such risk factors may need to be tailored to different age groups. This issue could be one underpinning of the modest effects observed in randomized controlled trials of smoking prevention programs, which generally adopt a “one size fits all” approach. For example, a meta-analysis of 49 randomized controlled trials of school-based smoking prevention programs, including youths aged 5–18 years in 19 countries, reported an overall significant effect with an average 12% reduction in smoking initiation compared with controls at longest follow-up but no effect for all trials pooled at  $\leq 1$  year [14]. If risk factors for initiation do differ across age during adolescence, the effects of an intervention focused on these risk factors could be attenuated or even adverse at ages when the risk factors are differentially influential [15].

Because little is known about age-related differences in risk factors for cigarette smoking initiation, our objective in this study was to determine whether a range of established predictors of initiation differ between early (by age 13 years), middle (by age 15 years), and late (by age 17 years) adolescence. These age groupings have distinct psychological and cognitive needs and capacities

which could necessitate differing approaches to substance use prevention interventions [15].

## Methods

### *The AdoQuest I study*

Data were available in AdoQuest I (2005–2011), a prospective study of fifth grade students ( $n = 1,801$ ; age 10–11 years at inception), which investigated the natural course of the co-occurrence of health-compromising behaviors in children [16]. A random sample of 40 schools with more than 90 students enrolled in fifth grade was identified from among all French language schools in greater Montreal. To assure equal representation of students of high, middle, and low socioeconomic status (SES), schools were stratified into groupings defined by tertiles of an indicator [17] based on maternal education, parental employment, and a measure of low family income that accounts for family size and area of residence [18,19]. An equal number of schools were selected into each grouping, and 29 schools (72.5% of those invited), including 10 in the first, 10 in the second and nine in the third groupings, agreed to participate. Students were recruited from all fifth grade classes in the 29 schools. Participants provided assent and their parents/guardians provided informed consent. The study received approval from the ethics and protection review boards of Concordia University and the Centre de Recherche du Centre Hospitalier de l'Université de Montréal.

Using data collection methods adapted from the Canadian Youth Smoking Survey [20], we collected baseline data in cycle 1 from fifth grade students ( $n = 1,801$ ) in Spring 2005 using classroom-administered, self-report questionnaires. Data on cigarette smoking initiation were collected in five follow-up cycles spanning 7 years. Cycles 2 and 3 were conducted in Fall 2005 ( $n = 1,543$ ; 86% of baseline) and Spring 2006 ( $n = 1,837$ , 99% of 1,859 participants, 58 of whom joined in sixth grade) when students were in sixth grade, using the same data collection methods as cycle 1. Students then transitioned to more than 100 high schools. Cycle 4 was conducted in seventh grade in 2006–2007 ( $n = 1,026$ ). Cycle 5 was conducted in ninth grade in 2008–2009 ( $n = 1,233$ ). Finally, cycle 6 was conducted in 11th grade (the last year in high school) in 2010–2011 ( $n = 1,249$ ). In the high school cycles, self-report questionnaires were mailed to participants' homes with stamped, addressed return envelopes. The mean age of participants in cycle 1 was 10.7 years (standard deviation [SD] = .60) and 16.8 years (SD = .50) in cycle 6. Participants completed a mean of 4.6 years of the six possible cycles (SD = 1.4); those who missed a cycle were retained in subsequent cycles. Parents also completed mailed self-report questionnaires in 2006–2007 and again in 2008–2009.

### *Present study*

To attain the objectives for the present study, we conducted three sets of analyses, stratified by age, ensuring that the time span between measurement of exposures and the outcome was no longer than 2 years. Initiation was modeled among never smokers in (1) early adolescence (fifth grade; mean[M] age = 11.2 years [SD = .39]) with the outcome measured in sixth and seventh grades (cycles 2–4); (2) middle adolescence (seventh grade; M age = 12.8 years [SD = .39]) with the outcome measured

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