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Original Research

# Patterns of adolescent smoking and later nicotine dependence in young adults: A 10-year prospective study

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SUMMARY

*Objectives:* There is considerable variability in progression from smoking initiation to established smoking. This paper addresses the extent to which different patterns of adolescent smoking, including periods of cessation, predict smoking status in young adults.

*Study design:* Ten-year, eight-wave prospective cohort study of a state-wide community sample in Victoria, Australia.

*Methods:* Participants were 1520 students from 44 secondary schools, initially aged 14 to 15 years. Adolescent smoking and quitting patterns were assessed during Waves 1–6 with self-reported frequency of use and a 7-day retrospective diary. The Fagerstrom Test for Nicotine Dependence (ND) was used to assess ND at the age of 24 years (Wave 8).

*Results:* The prevalence of ND in young adults was 16.9% for all adolescent smokers, with prevalence rates of 6.8% and 26.7% for adolescent non-daily and daily adolescent smokers, respectively. Maximum smoking levels, onset of daily smoking, duration of smoking, escalation time and duration of cessation during adolescence predicted later ND. Daily smokers who ceased smoking for at least two waves (≥12 months) had a level of risk similar to adolescents who had never smoked.

*Conclusions:* Quitting smoking as an adolescent substantially alters the risk for later ND. For adolescents who become daily smokers, quitting for 12 months should be the aim in tobacco control and clinical interventions.



## Introduction

Smoking remains the most common cause of preventable deaths, with an estimated 5 million deaths attributed to tobacco-induced diseases per year worldwide.[1] Although smoking rates in adults have dropped,[2] smoking rates during adolescence and young adulthood remain high.[3] Twenty-five percent of adolescent daily smokers have developed nicotine dependence (ND) by young adulthood.[4] However, the natural history of smoking in adolescence is variable, with phases of cessation, reduced use and relapse common.[5] Given this variability in the course of smoking, it is surprising that smoking patterns during adolescence have received little attention as predictors of later smoking and ND. There has been some speculation that the frequency and duration of adolescent smoking, rates of escalation of use, age of onset

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and quitting attempts might predict adult ND.[6–10] However, to date, there is little empirical evidence to support this speculation. The aim of the present paper is: (1) to identify the patterns of adolescent smoking and cessation that predict young adult ND; and (2) to consider these predictors within adolescent smokers stratified by maximal adolescent smoking.

## Methods

### *Procedure and sampling*

Between August 1992 and March 2003, the Victorian Adolescent Health Cohort study, an eight-wave cohort study of adolescent and young adult health in the Australian state of Victoria, was conducted. Data collection protocols of this study were approved by the Royal Children's Hospital Ethics in Human Research Committee. The cohort was defined with a two-stage cluster sample in which two classes were selected at random from each of 44 schools drawn from a stratified frame of all schools (government, Catholic and independent) in the state (total number of students 60,905). School retention rates to Year 9 in the year of sampling were 98%. One class from each school entered the cohort in the latter part of the ninth school year (Wave 1), and the other class 6 months later, early in the tenth school year (Wave 2). Participants were subsequently reviewed at 6-month intervals during adolescence (Waves 3–6), with two follow-up waves in young adulthood aged 20–21 years (Wave 7) and 24–25 years (Wave 8) (Fig. 1). At Waves 1–6, participants self-administered the questionnaire on laptop computers,[11] with telephone follow-up of those absent from school. Data collection in Waves 7 and 8 was undertaken with computer-assisted telephone interviews.

From a total sample of 2032 students, 1943 (95.6%) participated at least once during the first six (adolescent) waves. In Wave 8, 1520 subjects (75% of the initial sample, 78% of adolescent participants) were interviewed between April 2002 and June 2003. Response rates are shown in Fig. 1. Reasons for non-completion at Wave 8 were refusal ($n = 269$), loss of contact ($n = 151$) and death ($n = 7$). Characteristics of Wave-8 non-completers were examined in a logistic regression model. Males were over-represented [odds ratio (OR) 1.7, 95% confidence interval (CI) 1.3–2.1], as were those who were smokers at study inception (OR 1.4, 95% CI 1.1–1.7). The mean (standard deviation) ages at Waves 1 and 8 were 14.9 (0.5) and 24.1 (0.6) years, respectively. Most respondents were born in Australia and living in an urban region. There was a slight over-representation of females (Table 1).

### *Measures*

Adolescent smoking patterns (Waves 1–6) were assessed at each wave using self-reported frequency of use over the previous 6 months, together with a 7-day retrospective diary. For each wave, adolescents were categorized on the basis of frequency into never smokers, ex-smokers, non-daily smokers (adolescents smoking on less than 6 days in the past week) and daily smokers (smoking on 6 or 7 days of the past week). Daily smokers were subcategorized into those who, on average, smoked up to 10 cigarettes per day and those who, on average, smoked more than 10 cigarettes per day.[4,12] This categorization (never smokers, ex-smokers, non-daily smokers and daily smokers) at each wave was summarized as maximum level of smoking, which represented the highest smoking category reported in the adolescent waves. Escalation time was defined as the number of waves between onset of any smoking and onset of daily smoking. Duration of cessation was defined as the number of consecutive waves of non-smoking after smoking in at least one wave, with a separate category for adolescents who ceased smoking at Wave 6 (because of unknown relapse or success after quitting at Wave 6).

ND at Wave 8 was measured using the Fagerstrom Test for Nicotine Dependence (FTND).[13] ND was defined as a score of 4 or more on the FTND,[12] corresponding to a cut-off point of 6/7 on the Fagerstrom Tolerance Questionnaire.[14]

### *Statistical analyses*

Data collection was undertaken at a developmental point when young people are difficult to trace because of high mobility. There were few missing data on individual measures, but those individuals who missed waves led to potential bias in the summary measures calculated from these data. To address this potential bias and to handle missing data, the multiple imputation method was used, with five complete datasets imputed under the multivariate mixed

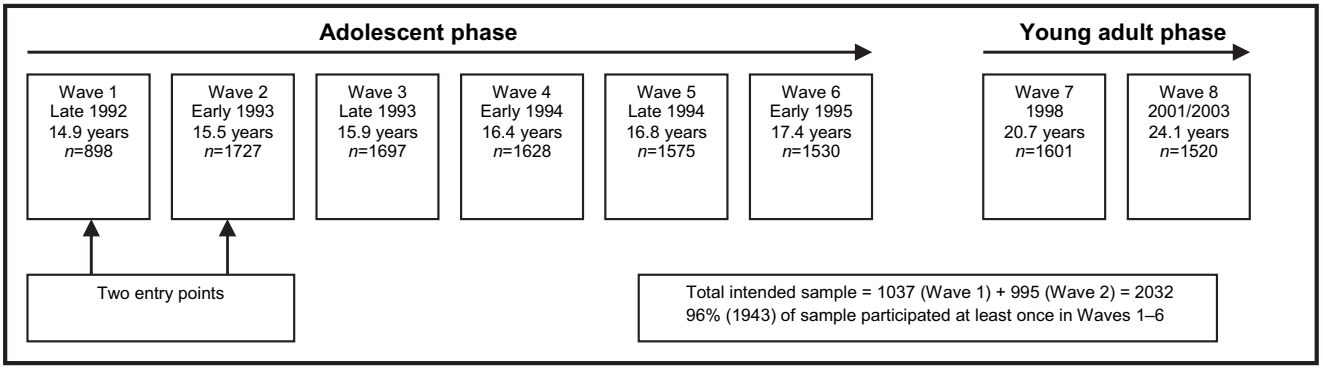


**Fig. 1 – Sampling and ascertainment in the Victorian Adolescent Health Cohort, 1992–2003.**