Instability in smoking patterns among school leavers in Victoria, Australia

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Abstract

Objective—To describe patterns of smoking in a cohort of young adults over the first 15 months after leaving school.

Design—A four-wave, longitudinal survey design was used to gather data. Final-year students from 93 schools completed the recruitment questionnaire at an average age of 17 years. Follow-up questionnaires were posted to their home addresses three months, nine months and 15 months after the end of school.

Setting—Victoria, Australia.

Participants—A cohort of 1903 respondents who completed and returned all four questionnaires.

Main outcome measures—Self-labelled smoking status (“heavy smoker”, “light smoker”, “occasional smoker”, “ex-smoker”, and “non-smoker”), daily cigarette consumption, and maximum daily cigarette consumption.

Results—At school, 72% of the sample were “non-smokers”, 5% “ex-smokers”, 11% “occasional”, 8% “light”, and 5% “heavy smokers”. At 15 months after school, these proportions had shifted to 64%, 8%, 11%, 9%, and 7%, respectively. Over the study, “light smokers” and “heavy smokers” substantially increased their daily consumption; “occasional” and “ex-smokers” did not. There was relatively high stability in self-labelled smoking status at one wave and the next. However, over the four waves, 38% of the sample changed their self-labelled smoking status, and 41% of these had been “non-smokers” at school. A reduced second-order Markov chain model was found to fit this four-wave behavioural sequence. Detailed description of smoking status changes revealed greater progression to higher levels of smoking than transition to lower levels.

Conclusions—There is considerable flux in smoking patterns among young adults after leaving school, suggesting an opportunity to intervene with smoking prevention programmes at this stage of development.

(Tobacco Control 1998;7:149–155)

Keywords: smoking patterns, young adults, Australia

Introduction

While priority in research and prevention activity for tobacco control has been given to school-age populations, considerably less attention has been given to the possibilities for prevention of regular smoking among young people in the period after leaving school. Given the many transitions and changes that occur in a young person’s life at this time, including new freedoms, rights, responsibilities, and pressures, it might be expected that an individual’s use of tobacco would be relatively volatile. It would therefore be amenable to change towards either greater or lesser levels of use depending upon the influences to which the individual is exposed. At this stage, little is known about young adult smoking because there are only a few multiwave, longitudinal studies. This paper describes the patterns of smoking exhibited by young adults after leaving school.

School-based interventions to prevent tobacco experimentation have had limited success in the short term and the impact of programmes tends to diminish with time. In Australia, around 90% of schools report providing health education classes on smoking for each year level (except the final secondary school year), but the prevalence of smoking is still high among school students.

The bulk of experimentation with smoking occurs during adolescence. About three-quarters of Australian students in year 12 (16–18 years) report some experience of smoking. Very few people in the United States first try smoking after the age of 20. Researchers agree that the major risk period for initiation into tobacco use is in mid to late adolescence; however, a small amount of uptake after leaving school has been observed. In a recent Australian study, 28% of male and 31% of female students in year 12 were classified as current smokers; however, only 15% of boys and 13% of girls reported smoking daily. A dramatic increase in regular smoking must occur after leaving school, as the prevalence of self-defined Australian smokers aged 20–24 is about 36%, of whom about 90% are likely to be daily smokers.

In contrast to the wealth of research on smoking initiation, less has been done on the progression to regular smoking. It is known that smoking during adolescence leads to smoking in young adulthood, with the more years of uninterrupted smoking and higher consumption carrying the greatest risk.
The results from this research indicated that few people initiated smoking after leaving school; however, there was a noticeable increase in the proportion of daily smokers. More than 70% of the sample were not daily smokers at school or at subsequent follow-up periods and 14% of the respondents were daily smokers throughout the study period.

This paper provides a detailed description of the stability and change in smoking among a cohort of young adults surveyed four times over a 21-month period, from the last months of secondary school to about 15 months after leaving school. The specific aims were twofold: first, to describe stability and change in smoking status nine, 13, and 21 months from baseline; and second to characterise the self-labelled smoker type in terms of reported weekly and maximum daily cigarette consumption for the four waves of data.

**Methods**

**SAMPLE**

The sample consisted of 1903 participants who had complete smoking status data for all four waves of data collection. Sociodemographic characteristics of the sample are presented in table 1. There were more young women than young men, reflecting, in part, greater school retention of girls than boys in Victoria. Most of the sample were aged 17 at the wave 1 survey. Shortly after leaving school (wave 2), most of the respondents (44%) were solely engaged in further study. Only 11% of the sample were working full time and 10% were unemployed. These proportions were similar for the next two waves except for small rises in the percentage working and corresponding decreases in those unemployed or only studying. Virtually all lived in the family home, at wave 1, and 23% moved out over the study period.

Almost a quarter of respondents (24%) came from a home where a language was spoken other than or in addition to English. A fifth of the respondents’ mothers and 26% of their fathers smoked. The distribution of the highest level of education achieved by respondents’ fathers is as follows: 38% did not finish secondary school, 29% completed secondary school, 20% went on to trade certificate or qualification, and 15% held a university degree or diploma.

**INSTRUMENTS**

The study covered a range of health issues relevant to young adults; however, only measures of smoking relevant to this paper are described. The recruitment questionnaire was short, but those for the subsequent three waves were more detailed. We asked participants to identify a smoker type that best described them. Self-labelled smoker type was measured (at all four waves) using the stem: “At the present time, do you consider yourself...?” and response options: “heavy smoker”, “light smoker”, “occasional smoker”, “ex-smoker”, and “non-smoker”. This measure was found to have a test/retest reliability of 0.96 over an interval of a week using a sample of 138 university students. A biochemical validation...
study of people aged between 15 and 18 years showed that self-reported smoking status is highly accurate.” Smokers and ex-smokers were asked about their cigarette consumption in the week before the survey. Maximum daily consumption (waves 2–4) was measured by asking: “What is the largest number of cigarettes you smoked on any one day in the last seven days?” The test/retest reliability was high for this item at 0.81 (one-week interval and the same sample). Weekly consumption was assessed (in all waves) by the question: “About how many cigarettes or packets of cigarettes, if any, have you smoked in the last week?” The response format allowed for subjects to write in total number of cigarettes or number and size of cigarette packs. This was divided by seven to get daily consumption.

**DESIGN AND PROCEDURE**

A simple random sample of 99 schools was drawn to represent proportionally secondary schools in the state of Victoria in Australia. Six schools refused to participate, leaving 93 consenting schools. Entire classes of students in year 12 were recruited into the study in mid-1993. The four-page A4 (21 × 30 cm) recruitment questionnaire requested signed informed consent from students, contact information, and baseline smoking status. Teachers distributed and collected questionnaires following a standard procedure. The questionnaire was completed under “test conditions”. Envelopes for completed questionnaires were provided to ensure confidentiality.

Returned recruitment questionnaires were rejected for one of the following reasons: no contact details or clearly fictional ones; refusal of permission to follow up; totally implausible responses to key questions; did not give age or sex; or were not aged between 16 and 19 years. Those who returned the recruitment questionnaire requested signed informed consent from students, contact information, and baseline smoking status. Teachers distributed and collected questionnaires following a standard procedure. The questionnaire was completed under “test conditions”. Envelopes for completed questionnaires were provided to ensure confidentiality.

From this pool of recruited participants, 3300 randomly drawn people formed the base sample who were posted wave 2 questionnaires in February 1994; 2589 questionnaires were returned completed. Those who returned the wave 2 questionnaire, had not refused further questionnaires, and were contactable over the survey period (that is, living in Victoria) were sent the wave 3 questionnaire in August 1994 (n = 2577), and 2215 questionnaires were returned completed. For wave 4, in February 1995, 2369 participants met the same criteria as for wave 3, yielding 2007 completed questionnaires.

Three strategies were used to enhance response rate: intensive telephone follow up of non-respondents, mailing out second copies of questionnaires, and randomly allocated prizes for respondents.

A total of 1903 people returned all four of their questionnaires with smoking status data complete. This gives an effective return rate of 58%. Over the course of the study, 234 respondents were lost—that is, had moved out of frame (the state of Victoria), were deceased, or the questionnaire was returned to sender—which gives a response rate of 62% over the last three waves of data collection. The interwave response rates were 82%, 87%, and 87% for waves 2, 3, and 4, respectively.

**DATA ANALYSIS**

To investigate the process of stability and change in smoking status over the four waves, a series of Markov chain models were fitted to these data. Markov chain models or autoregressive series are used to describe data where the expected value of the dependent variable at any time depends to some extent on the values of that variable at previous points in time. The models can be realised as loglinear effects model—that is, testing if self-labelled smoking status is independent at each measurement point. First-order models specify the main effects and two-way interactions between the dependent variable measured at adjacent times—that is, self-labelled smoking status is related to smoking status measured at the previous wave. In addition to these effects, second-order models specify three-way interactions between variables measured at triples of adjacent time periods—that is, smoking status is related to smoking status measured at the previous two waves.

**ATTRITION BIAS**

Although the retention rates were high, there was some differential attrition according to respondent characteristics. Using characteristics from wave 1 data, the following differences were noted: 49% of young men vs 37% of young women dropped out. Elderly respondents were more likely to drop out than younger ones (64% of the oldest age group vs 34% of the youngest age group). “Heavy smokers” were also more likely to drop out (61%) than “non-smokers” (37%). Differences using wave 2 characteristics were also investigated by comparing the 686 respondents who completed this wave but were not part of the 1903 with complete data. Relative to students, more unemployed people and full time workers dropped out of the study (33% of unemployed and 37% of workers vs 22% of full time students). Those who lived with friends were more likely to drop out (33%) than those in other accommodation arrangements. There was some differential attrition according to parental smoking status. Those whose fathers smoked were more likely to drop out (30%) than those whose fathers did not (25%), and dropouts were higher among those whose mothers smoked (30%) compared with those whose mothers did not smoke (24%). There were no differences in attrition with respect to language spoken at home or parental education.

**Results**

**SEX DIFFERENCES**

For all four waves of data, young men were approximately 10% more likely to report being “non-smokers” than young women. Population estimates from Hill, White, and Segan, confirmed by other studies. In Victoria, Australia, the prevalence of smoking among young men was consistently higher than among young women. This pattern was also observed in other countries, such as the United States and the United Kingdom. However, the difference in smoking prevalence between the two sexes varied across different age groups. Young men had a higher smoking prevalence than young women in all age groups, with the exception of the youngest age group (15–17 years). The prevalence of smoking among young women in this age group was slightly higher than among young men. The difference in smoking prevalence between the two sexes was largest in the youngest age group (37% vs 28%), and smallest in the oldest age group (17% vs 20%). The prevalence of smoking among young men and young women varied significantly across different educational attainment levels. Young men with a lower educational attainment were more likely to smoke than those with a higher educational attainment. Young women with a lower educational attainment were also more likely to smoke than those with a higher educational attainment. However, the difference in smoking prevalence between the two sexes was larger for young men than for young women. For example, the smoking prevalence among young men with a lower educational attainment was 30% higher than among young men with a higher educational attainment, while the smoking prevalence among young women with a lower educational attainment was only 15% higher than among young women with a higher educational attainment.
suggest that slightly more 17-year-old men are non-smokers at school. And Hill and White indicate that the difference in proportions of non-smokers between males and females in their early 20s is about 7%. The slightly greater size of the sex difference in the present study may be due to attrition biases. As the patterns of change over time (shown in figure 1) were virtually identical for both sexes, we only report aggregated data.}

**TRACKING CHANGES IN SMOKING STATUS OVER TIME**

Most respondents (62%) used the same smoker type label in each wave, with 57% of the total being “non-smokers” at all four waves (table 2). Thirty-eight percent changed label on at least one of waves 2 to 4: 16% were non-smokers at wave 1. The other 22% who changed were predominantly occasional or light smokers at wave 1.

Changes in smoker type reported at the four waves over three six-month intervals are displayed in figure 1. The columns titled “At school”, “3 months after”, “9 months after”, and “15 months after end of school” display the proportion of respondents in each smoker type category for the respective survey waves. The adjacent columns display the interwave changes in smoker type that occurred separately for each smoker type category. The five percentages show the distribution of smoker type responses for the subsequent wave for respondents from a given category on the previous wave.

A description of the non-smoker transitions from wave 1 to wave 2 may clarify interpretation of this figure. In wave 1 (at school), 72% of all respondents were “non-smokers”. At the next survey period (wave 2), 88% of these respondents were also “non-smokers”, 4% were “ex-smokers”, 7% were “occasional smokers”, and very small numbers were “light” or “heavy smokers”. The 66% of all respondents who were “non-smokers” at wave 2 are made up of the 88% from wave 1 who continued as non-smokers and small numbers who became “non-smokers” from “ex-smoker” and “occasional”. There were very few “light” and no “heavy” smokers who became “non-smokers” (as one would expect).

Focusing on the distribution of responses for each wave, the percentage of “non-smokers” changed the most, dropping from 72% at wave 1 to 65% at wave 4. The number of people in the “occasional” and “light smoker” categories barely changed over the four waves of data. The “ex-smoker” and “heavy smoker” catego-
Table 3  Parameter estimates for the reduced second-order Markov chain model

<table>
<thead>
<tr>
<th>Matrix 1  Wave A → wave B</th>
<th>Wave B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-smoker  Ex-smoker  Occasional smoker  Light smoker  Heavy smoker</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>0.20  0.14  0.27  0.01  0.10</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>0.17  0.57  0.07  0.14  0.67</td>
</tr>
<tr>
<td>Occasional smoker</td>
<td>0.24  0.17  0.69  0.12  0.64</td>
</tr>
<tr>
<td>Light smoker</td>
<td>-0.51 0.17  -0.26  0.90  0.70</td>
</tr>
<tr>
<td>Heavy smoker</td>
<td>-0.04 -0.27 0.77  0.57  10.71</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Matrix 2  Wave B → wave C</th>
<th>Wave C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-smoker  Ex-smoker  Occasional smoker  Light smoker  Heavy smoker</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>0.47  -0.18  -0.01  -0.30  -0.98</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>0.17  0.95  0.03  -0.31  -0.84</td>
</tr>
<tr>
<td>Occasional smoker</td>
<td>-0.11 0.11  0.72  -0.05  -0.67</td>
</tr>
<tr>
<td>Light smoker</td>
<td>-0.22 -0.37  -0.15  10.12  0.62</td>
</tr>
<tr>
<td>Heavy smoker</td>
<td>-0.31 -0.51  -0.59  0.54  10.87</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Matrix 3  Wave A → wave C</th>
<th>Wave C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-smoker  Ex-smoker  Occasional smoker  Light smoker  Heavy smoker</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>10.28  -0.34  0.14  -0.35  -0.73</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>-0.11  0.69  -0.03  -0.21  -0.34</td>
</tr>
<tr>
<td>Occasional smoker</td>
<td>-0.17 0.05  0.36  0.02  -0.26</td>
</tr>
<tr>
<td>Light smoker</td>
<td>-0.31 -0.41  -0.15  0.57  -0.30</td>
</tr>
<tr>
<td>Heavy smoker</td>
<td>-0.69 0.01  -0.32  -0.03  10.63</td>
</tr>
</tbody>
</table>

Bolded estimates: |Z|>1.96.

Waves A, B, C correspond to waves 1, 2, 3 and waves 2, 3, 4.

CIGARETTE CONSUMPTION
A small number of “ex-smokers” reported smoking in the past week (14%, 8%, 8%, and 6% for each wave, respectively). Overall, “ex-smokers” had a mean daily cigarette consumption of about a fifth of a cigarette. “Occasional smokers” averaged about one cigarette per day at each time period. “Light smokers” were smoking about four cigarettes a day when still a school student. This number almost doubled to about eight cigarettes 15 months after the end of school. “Heavy smokers” went from smoking an average of about 11 cigarettes a day to 17 a day over the same period. In contrast to the average daily consumption, the maximum daily consumption was relatively stable over the three time periods for each smoker type. Table 4 presents
CI = confidence interval.

Table 4  Mean daily and maximum daily cigarette consumption for each smoking category

<table>
<thead>
<tr>
<th>Wave 1</th>
<th>Wave 2 3 Months after school</th>
<th>Wave 3 9 Months after school</th>
<th>Wave 4 15 Months after school</th>
</tr>
</thead>
<tbody>
<tr>
<td>At school</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasional smokers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily consumption</td>
<td>0.74 (0.59–0.99)</td>
<td>0.86 (0.68–1.04)</td>
<td>0.85 (0.62–1.08)</td>
</tr>
<tr>
<td>Maximum consumption</td>
<td>—</td>
<td>3.34 (2.65–4.03)</td>
<td>3.36 (2.72–4.00)</td>
</tr>
<tr>
<td>Light smokers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily consumption</td>
<td>4.27 (3.79–4.75)</td>
<td>5.97 (5.19–6.75)</td>
<td>5.71 (5.01–6.41)</td>
</tr>
<tr>
<td>Heavy smokers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CI = confidence interval.

the mean daily and maximum daily cigarette consumption among current smokers for “occasional”, “light”, and “heavy” smoker types across all four waves.

Overall, there was a net movement towards a higher level of smoking in terms of self-labelled smoker type and consumption. This trend was particularly evident over the first interval, which included leaving school. There was less transition back to lower levels of smoking.

Discussion

There was moderately high interwave stability in self-labelled smoker type, especially among “non-smokers” and “heavy smokers”. Despite continuity in smoking (or non-smoking) patterns for most people, more than a third (38%) relabelled their type of smoking at some point over the study period. Importantly, about 40% of these people were initially non-smokers; however, we recognise that many of these non-smokers have tried cigarettes before. These findings call into question public health strategies that focus prevention programmes solely on schoolchildren. There is moderate agreement that the classification of a school classroom may slightly reduce the proportion of people who admitted to smoking, although the work by Stanton et al suggests otherwise. Any such effect would inflate the estimated level of uptake after leaving school.

Average cigarette consumption among “light” and “heavy smokers” increased over 15 months after leaving school. By the end of the study period, the average consumption for “heavy” smokers (approximately 17 cigarettes per day) was only slightly lower than the average consumption for all adult smokers in the same population. The change in average consumption associated with self-labelled smoker type suggests that young adults have changed their conceptions of what constitutes a “light” or “heavy smoker” over time, perhaps anchoring their self labels around their perceptions of usual consumption among their peers. It is possible that as their peers’ consumption increases, their awareness of this leads to a revision of what “light” and “heavy” mean in terms of daily consumption.

The term “ex-smoker” also seems to carry different connotations for different individuals. The transition to “non-smoker” was common from “ex-smoker”. It seems plausible that this transition occurs among those who smoked experimentally, and after they had stopped completely for some time they reflected that they had never really been a regular smoker. Consistent with this, a similar transition was found from “occasional” smoker to “non-smoker”.

Despite the tendency to progress to higher levels, the fact that few of these school leavers moved rapidly to “light” or “heavy” suggests that there is a window of opportunity to intervene. In this context, we acknowledge that the shifting consumption levels associated with the labels of light and heavy smokers have the effect of reducing the proportions moving across categories as some increase consumption while remaining within the same category. In the absence of an addiction threshold, consumption-based definitions will not necessarily result in a more accurate estimate of transition towards smoking will be slightly inflated. It is also possible that the loss of the heavy smokers has resulted in an underestimation of the rate of that group. Another possible bias is that the method of survey administration in wave 1 was different from waves 2, 3, and 4. Reporting smoking status in the context of a school classroom may slightly reduce the proportion of people who admitted to smoking, although the work by Stanton et al suggests otherwise. Any such effect would inflate the estimated level of uptake after leaving school.

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of those moving to a pattern of continuing regular consumption.

That initiation to smoking is still occurring after leaving school implies that prevention programmes should be extended beyond school. Young adults display a distinct pattern of quit attempts compared with older adults; they attempt to quit more frequently but are also more likely to relapse. The initiation and greater instability of use provide a yet-to-be-exploited opportunity to intervene with ‘occasional’ and ‘light’ smokers before they become heavily dependent. It is vital to develop programmes appropriately targeted to reverse progression of smoking behaviour and to achieve permanent abstinence among this group of young adults. Such programmes will necessarily be different from prevention programmes focusing on never smoking the first cigarette, and from cessation programmes designed to help motivated self-acknowledged addicts to break their dependencies.

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