Adolescent mental health predicts quitting smoking in adulthood: a longitudinal analysis

Tomas Hemmingsson\textsuperscript{1,2}, David Kriebel\textsuperscript{3}, Per Tynelius\textsuperscript{4}, Finn Rasmussen\textsuperscript{4}, Ingvar Lundberg\textsuperscript{1,2}

\textbf{Objectives:} Several studies have reported an association between cigarette smoking and psychiatric illness. A common finding is that the prevalence of psychiatric illness among former smokers is much lower than among current smokers and is often similar to that among never-smokers. There are two alternative causal explanations for this association: either improved mental well-being results from smoking cessation; or those with poorer mental well-being are less successful at smoking cessation. The objective was to analyse a unique longitudinal data set to shed light on the direction of causality and to distinguish between these alternative explanations. \textbf{Methods:} Information on smoking status and indicators of poor mental well-being from childhood and adolescence was collected at age 18 in 1969 from 49 321 men at compulsory conscription for military service. Follow-up data on smoking status were collected among a random subset (n = 694) who participated in one or more annual national Swedish Surveys of Living Conditions in 1981–2001. \textbf{Results:} Approximately half of the smokers at age 18 in 1969 had quit by the time they were resurveyed (1981–2002). Those who had not quit and who reported smoking more than 10 cigarettes/day at age 18 (called persistent heavy smokers), were more likely to have had childhood and adolescent indicators of poor mental health measured at age 18 in 1969 than non-smokers or quitters. \textbf{Conclusion:} Our findings indicate that men who would subsequently be successful at smoking cessation reported better mental health and a lower prevalence of childhood mental health indicators at age 18 than persistent heavy smokers.

\textbf{Keywords:} adolescent mental health, smoking, smoking cessation, social function

Several well-established risk factors for later health outcomes such as depression, alcohol consumption and social isolation have frequently been shown to be more common among smokers.\textsuperscript{1,2} Smoking rates in Sweden declined dramatically from the 1970s and onwards, much as they did in other western countries,\textsuperscript{3} and there is evidence that those who stopped smoking during this period were different from those who continued to smoke with regard to some personality features and life circumstances.\textsuperscript{4} In previous studies, smoking cessation has been related to socio-economic background,\textsuperscript{5} adult social class,\textsuperscript{6,7} daily amount and years spent smoking,\textsuperscript{4,7} housing conditions\textsuperscript{8} and age\textsuperscript{7,8} It has also been reported that smoking cessation is associated with mental wellbeing.\textsuperscript{9} An association between cigarette smoking and psychiatric illness has been frequently reported. It is a common finding that the prevalence of psychiatric illness and rate of suicide is much lower among former smokers than among current smokers. In addition, the occurrence of psychiatric illness among former smokers is often similar to that among never-smokers.\textsuperscript{7} The literature is fairly consistent in finding that former smokers, like non-smokers, report better mental well-being than current smokers,\textsuperscript{10–13} but there is not yet strong evidence making it possible to distinguish between two alternative causal explanations for this association\textsuperscript{7}: either

(i) Those with high mental well-being are more successful at smoking cessation, or
(ii) Improved mental well-being results from smoking cessation.

We have previously shown that the prevalence of smoking at age 18–20 was strongly related to several measures of low mental well-being, substance abuse and early childhood stressors in a cohort of about 50 000 Swedish men interviewed at the time of military conscription in 1969.\textsuperscript{14} When these men were followed up over 25 years, the incidence of suicide was found to be strongly related to smoking at age 18–20. We found, however, that this association disappeared after controlling for low mental well-being and substance abuse at age 18–20, and for markers of childhood emotional and psychological stresses. One limitation of this study was that smoking was only known at age 18–20, while the cohort was followed for suicide for about 25 more years, during which some of the smokers certainly quit. We were interested, therefore, in investigating the association between indicators of mental health in late adolescence and smoking cessation in this cohort.

For the present investigation, we have used data on smoking and quitting behaviours during the years 1981–2002 for the subset of 694 members of the original Swedish 1969 conscription cohort who also participated in the Swedish Surveys of Living Conditions. We have investigated how smoking cessation in adulthood was associated with indicators of poor mental health measured in late adolescence. Our objective was to provide evidence that might help to distinguish which of the earlier mentioned causal explanations is more likely to underlie the association between mental health and smoking cessation.

\textbf{Methods}

\textbf{Study population}

The study was based on data from a nation-wide survey of 49 321 young Swedish males aged 18–20, who were conscripted...
The conscripts were asked if they at least sometimes had 'sometimes' and 'never').

Information on smoking and other variables at the conscription survey in 1969

At conscription, all men were asked to complete two questionnaires. The first concerned with social background, behaviour and social adjustment, psychological factors and general health. The second dealt specifically with substance use, e.g. tobacco smoking, use of drugs and alcohol consumption. Cigarette smoking was classified into one of three levels (non-smokers, 1–10 cigarettes/day, >10 cigarettes/day).

The conscripts were asked if they at least sometimes had been on medication for nervous problems, and an affirmative answer was used as a measure of psychological difficulties. All conscripts were seen by a physician who diagnosed any disorders—physical or mental, according to the Swedish version of the International Classification of Disease (ICD), 8th revision (ICD-8). Conscripts with psychiatric disorders were also examined by a psychiatrist. Any psychiatrist—diagnosed mental illness according to the ICD-8 classification was used as a second measure of mental well-being in the present investigation.

Following specified instructions the variable ‘emotional control’ was assessed through face-to-face interview with a psychologist at conscription in five levels. Low emotional control, defined as a score of 1 or 2 on a scale from 1 (lowest) to 5 (highest) was reported for 20% of the cohort, and were allocated to subjects suffering from documented reduced function due to psychosomatic symptoms, who had low levels of stress tolerance and/or were full of anxiety, had problems controlling nervousness and channelling aggression, and showed an incapacity for emotional commitment. The ratings were checked for inter-rater reliability, in order to maintain high quality. Information on parental divorce, collected at conscription, was used as an indicator of conflicts among family members. The variable ‘contact with police and child welfare authorities’ (at least once) indicated problem behaviour and has been shown to be strongly related to later psychiatric diagnosis.

Alcohol consumption in grams of 100% alcohol/week was calculated on the basis of the answers to the questions on frequency and average consumed volume of beer, wine and strong spirits. A composite variable, ‘risky use of alcohol’, was constructed from affirmative answers to one or more of the following: consumption of at least 250 g of 100% alcohol/week, reporting the drinking of an ‘eye-opener’ during a hangover, having been apprehended by police for drunkenness, or having ‘often’ been drunk (the choices were: ‘often’, ‘rather often’, ‘sometimes’ and ‘never’).

Follow-up data on smoking

Members of the study group for this investigation were interviewed in at least one annual Survey of Living Conditions, randomly distributed between 1981 and 2002, depending solely on being sampled at random to a particular annual Survey of Living Conditions sample. In these surveys, respondents were asked if they were currently smokers or non-smokers. No information on the number of cigarettes smoked was available in these surveys. Figure 1 summarizes the study cohort and sub-cohort, and the conscription and subsequent surveys.

Data analysis

The representativeness of the sample of the conscription cohort for whom follow-up smoking data were available was...
evaluated by comparing the conscription prevalence of smoking and the important measures of mental well-being at conscription between the subset with follow-up smoking data, and the full conscription cohort.

The prevalence (%) of seven indicators of lower mental well-being measured in 1969 was calculated for groups with different smoking status at baseline survey in 1969 as well as at follow-up in 1981–2002. For clarity of presentation, we used the following terminology to identify groups with differing smoking habits at conscription and then in subsequent surveys: never smokers; late smokers (those denying smoking at conscription, but reporting smoking on follow up); quitters (smokers at conscription who were no longer smokers at follow-up) and persistent smokers (reporting smoking both at conscription and at follow-up). The last group was further divided into those who were light smokers (1–10 cigarettes/day) at conscription who were still smokers at follow-up, and heavy smokers (more than 10 cigarettes/day) at conscription who were still smokers at follow-up. Prevalence ratios (PR) and 95% confidence intervals (CI) were used to compare the prevalence at conscription of the measures of mental wellbeing among groups with different smoking habits. Due to missing information for some variables the numbers from which the PR are calculated differs somewhat. Because of our interest in how childhood and adolescent mental health might affect quitting, we set quitters as the reference group, and compared persistent light and heavy smokers to them. Never-smokers were also compared to quitters in the same analyses.

**Results**

Of the 675 men with information on smoking status at conscription as well as during follow-up, 42.0% reported non-smoking at conscription in 1969. The remaining 58.0% (391) were smokers. This result agrees very well with the data for the full cohort—41.4% were non-smokers in 1969 (table 1). There was also good agreement between the full cohort and the sub-cohort with respect to the distribution of the variables on mental health measured at the conscription survey, as would be expected if the Survey of Living Conditions sampling was truly random, and if there was no important refusal bias (table 1).

### Table 1 Prevalence (%) of risk factors reported at age 18 in 1969 in the full cohort and the sample

<table>
<thead>
<tr>
<th>Smoking (%)</th>
<th>Full cohort</th>
<th>Sample</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full cohort</td>
<td>Sample **</td>
<td></td>
</tr>
<tr>
<td>Smoking (%)</td>
<td>48,527</td>
<td>675</td>
<td>58.6</td>
</tr>
</tbody>
</table>

Psychiatric diagnosis at Full cohort Full cohort Sample | 49,321 | 694 | 12.5 |

Medication for nervous problems Full cohort Sample Full cohort Sample | 48,882 | 686 | 11.5 |

Psychiatric medication use before age 18 at conscription 1969 | 56.6% (128) | 43.4% (98) | 100% (226) |

Parental divorce Full cohort Sample | 48,333 | 678 | 10.6 |

Child welfare contact with police and Alcohol consumption Full cohort Sample | 47,257 | 657 | 13.6 |

Child welfare contact with police and Alcohol consumption Full cohort Sample | 48,529 | 687 | 28.8 |

Drug use Full cohort Sample | 45,930 | 651 | 11.7 |

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*Based on those 49,321 included in the full conscription cohort **The sample included those in the full conscription cohort who also participated in one or more Surveys of Living Conditions

Table 2 Change in smoking status from conscription survey to follow up

<table>
<thead>
<tr>
<th>Smoking status at follow up, 1981–2002</th>
<th>Non-smoker</th>
<th>Smoker</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-smoker</td>
<td>93.7% (266)</td>
<td>6.3% (18)</td>
<td>100% (284)</td>
</tr>
<tr>
<td>Smoker</td>
<td>48.8% (191)</td>
<td>51.2% (200)</td>
<td>100% (391)</td>
</tr>
</tbody>
</table>

One-half (48.8%) of the smokers at age 18 in the sub-cohort reported that they were non-smokers, when they were surveyed between 1981 and 2002 (table 2). Among the non-smokers at baseline, only 18 (6.3%) reported that they were smokers at follow-up in 1981–2002. Because of this small number, these ‘late smokers’ were not studied further. In contrast, about 94% of non-smokers at baseline remained non-smokers at follow-up. Smokers of 10 or less cigarettes per day at baseline were much more likely to be non-smokers at follow-up (56.6%) than were smokers of more than 10 cigarettes per day (only 38.2% reported being non-smokers at follow up). Thus, heavy smokers at conscription were less likely (38.2%/56.6% = 0.68) to quit compared with light smokers.

The prevalence of indicators of poor mental well-being at conscription was higher in persistent heavy smokers than in quitters. In contrast, persistent light smokers did not show important differences in mental well-being compared to quitters. This latter observation is limited though, by the fairly small numbers of persistent light smokers, and the resulting wide CI on PR in table 3. Compared to quitters, persistent heavy smokers were nearly three times as likely to have reported psychiatric medication use before age 18 (PR = 2.8, 95% CI: 1.6–4.7). Excess risks between 50% and 80% in persistent heavy smokers were also observed for: psychiatric diagnosis, low emotional control, parental divorce, risky use of alcohol and contact with police and child welfare authorities.

Never smokers had generally better mental well-being at conscription than quitters (and also than persistent smokers). Non-smokers were less likely to report a psychiatric diagnosis than quitters (PR = 0.6, 95% CI: 0.3–1.0), markedly less likely to report risky use of alcohol (PR = 0.2, 95% CI: 0.1–0.5), and less likely to have reported childhood contact with policy or child welfare authorities and drug use (table 3).

### Discussion

In this longitudinal study, we found that smoking cessation at 30–50 years of age was associated with indicators of mental well-being measured at age 18. We have previously shown that these same indicators of mental well-being were strongly associated with smoking at age 18. For example, reported psychiatric medication use before age 18 was 3.6 times more prevalent in smokers of more than 20 cigarettes/day than in non-smokers, and intermediate levels of smoking showed intermediate prevalences of this mental health indicator. In the present longitudinal analysis, those who were heavy (more than 10 cigarettes/day) smokers at age 18 and did not quit smoking later in life reported more psychiatric medications, were given more psychiatric diagnoses, were determined by a psychologist to have lower emotional control, and reported more drug use, risky alcohol use, and childhood contact with...
believe that the measure of psychiatric illness used in this study the updated version number 10 of ICD is in use. However, we was classified according to the ICD, version 8. At present time, been greater than those observed.

smokers, thus suggesting that the true differences might have the mental health measures between quitters and persistent quitters might tend to diminish differences in prevalence of smoking. This misclassification of persistent smokers as smokers who subsequently quit were conducted during a time smoking at that time.18 In contrast, the surveys used to identify Thus, it is unlikely that there was serious under-reporting of smoking at that time.18 In contrast, the surveys used to identify smokers who subsequently quit were conducted during a time period when the dangers of smoking were well publicized. It is possible, therefore, that some participants in the follow-up surveys claimed to be non-smokers who were, in fact, still smoking. This misclassification of persistent smokers as quitters might tend to diminish differences in prevalence of the mental health measures between quitters and persistent smokers, thus suggesting that the true differences might have been greater than those observed.

The psychiatric diagnoses given at the conscription survey was classified according to the ICD, version 8. At present time, the updated version number 10 of ICD is in use. However, we believe that the measure of psychiatric illness used in this study quite well captures what would have been found using a more updated version of ICD, although the specific diagnoses would differ somewhat.

All conscripts met with a psychologist for a face-to-face interview, in order to assess level of emotional control. The purpose was to collect information, in order classify the 18-year old men into military position (e.g. privates and officers) for their compulsory service. We are not fully aware of a similar measure used in personality research today. However, we have previously reported strong associations between the measure of low emotional control and smoking, alcoholism,19 early retirement20 and mortality.16

<table>
<thead>
<tr>
<th>Lifetime smoking category</th>
<th>Never</th>
<th>Quitter</th>
<th>Persistent—Light</th>
<th>Persistent—Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969 smoking status</td>
<td></td>
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<tr>
<td>1981–2002 smoking status</td>
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<tr>
<td>n = 657</td>
<td></td>
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<tr>
<td>Psychiatric diagnosis, 1969 (n = 657)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Percent (n)</td>
<td>7.9% (21)</td>
<td>13.1% (25)</td>
<td>11.2% (11)</td>
<td>23.5% (24)</td>
</tr>
<tr>
<td>PR (95% CI)</td>
<td>0.6 (0.3–1.0)</td>
<td>1. -</td>
<td>0.9 (0.4–1.7)</td>
<td>1.8 (1.1–3.0)</td>
</tr>
<tr>
<td>Psychiatric medication, 1969 (n = 651)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Percent (n)</td>
<td>11.4% (30)</td>
<td>10.0% (19)</td>
<td>8.3% (8)</td>
<td>27.7% (28)</td>
</tr>
<tr>
<td>PR (95% CI)</td>
<td>1.1 (0.7–2.0)</td>
<td>1. -</td>
<td>0.8 (0.4–1.8)</td>
<td>2.8 (1.6–4.7)</td>
</tr>
<tr>
<td>Low emotional control, 1969 (n = 650)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Percent (n)</td>
<td>24.7% (65)</td>
<td>31.4% (59)</td>
<td>24.7% (24)</td>
<td>45.1% (46)</td>
</tr>
<tr>
<td>PR (95% CI)</td>
<td>0.8 (0.6–1.1)</td>
<td>1. -</td>
<td>0.8 (0.5–1.2)</td>
<td>1.4 (1.1–1.9)</td>
</tr>
<tr>
<td>Parental divorce, 1969 (n = 643)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Percent (n)</td>
<td>6.5% (17)</td>
<td>11.8% (22)</td>
<td>4.2% (4)</td>
<td>20.2% (20)</td>
</tr>
<tr>
<td>PR (95% CI)</td>
<td>0.6 (0.3–1.0)</td>
<td>1. -</td>
<td>0.4 (0.1–1.0)</td>
<td>1.7 (1.0–3.0)</td>
</tr>
<tr>
<td>Risky use of alcohol, 1969</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent (n)</td>
<td>3.5% (9)</td>
<td>15.1% (28)</td>
<td>17.2% (16)</td>
<td>27.8% (27)</td>
</tr>
<tr>
<td>PR (95% CI)</td>
<td>0.2 (0.1–0.5)</td>
<td>1. -</td>
<td>1.1 (0.7–2.0)</td>
<td>1.8 (1.2–3.0)</td>
</tr>
<tr>
<td>Contact with police and child welfare, 1969 (n = 652)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Percent (n)</td>
<td>14.7% (39)</td>
<td>28.3% (53)</td>
<td>34.7% (34)</td>
<td>45.5% (46)</td>
</tr>
<tr>
<td>PR (95% CI)</td>
<td>0.5 (0.4–0.7)</td>
<td>1. -</td>
<td>1.2 (0.9–1.7)</td>
<td>1.6 (1.2–2.2)</td>
</tr>
<tr>
<td>Drug use, 1969 (n = 622)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Percent (n)</td>
<td>4.0% (10)</td>
<td>14.0% (25)</td>
<td>8.3% (8)</td>
<td>19.0% (18)</td>
</tr>
<tr>
<td>PR (95% CI)</td>
<td>0.3 (0.1–0.6)</td>
<td>1. -</td>
<td>0.6 (0.3–1.3)</td>
<td>1.4 (0.8–2.4)</td>
</tr>
</tbody>
</table>

*Prevalence ratio, with 95% confidence interval. Reference: quitters

### Table 3 Prevalence (%) and prevalence ratios (PR) for indicators of mental wellbeing in categories of lifetime smoking behaviour

| Level of smoking | Many studies have reported that heavy smokers have lower quit rates than light smokers.4,7,21 This pattern was confirmed by our results. The detailed psychiatric history taken at conscription enabled us to add to this observation by showing that a higher level of smoking at time of conscription was associated with mental health problems at that time as well as with smoking persistence during the follow-up period.

Because of the rather small size of our sub-cohort, we had to divide smokers into ‘heavy’ and ‘light’ at a cut-point of 10 cigarettes/day. In many studies 10–20 cigarettes/day is considered ‘moderate’ smoking, and the term ‘heavy’ is used for greater than 20 or even 30 cigarettes/day. Thus, when comparing our findings to others, it may be more appropriate to consider our higher smoking group as corresponding to ‘moderate and heavy’ smoking.

Persistent smokers of 10 or fewer cigarettes/day were not very different from quitters with respect to their mental health indicators at age 18. Individuals smoking only occasionally may not be addicted to nicotine, and this subgroup may also have different personality traits and experiences protecting them from mental health problems.6,22
The causal question
The prospective nature of our data was helpful in distinguishing between the two alternative explanations for the observation that quitters have better mental wellbeing than continuing smokers. As noted in the introduction, it has been argued that either:

(i) those with high mental well-being are more successful at smoking cessation, or
(ii) improved mental well-being results from smoking cessation.

In these data, we are confident that our measures of mental well-being long preceded a decision to quit smoking, and so the first explanation is supported by our data, while the second is not. It remains possible that there is also an improvement in mental well-being that results from smoking cessation. Due to lack of follow-up data on mental health we were not able to investigate the possible impact of the second explanation. However, we believe that the most parsimonious interpretation is that it is more difficult for those with poor mental well-being than for those with high mental well-being in late adolescence to quit smoking later in life.

Conclusion
The results of this study lend support to a causal explanation in which those with good mental health in late adolescence were more successful at later smoking cessation and those with poor mental health in late adolescence more often persisted in smoking. The results do not support (but cannot be used directly to disprove) the hypothesis that smoking cessation promotes increased mental health.

Acknowledgement
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Conflict of interest: None declared.

Key points
- Several studies have reported an association between smoking and psychiatric illness.
- Those who stop smoking report better mental health than persistent smokers.
- It is not clear if the better mental health reported by former smokers results from smoking cessation or if those with better mental health are more successful at smoking cessation.
- This study shows that those with better mental health were more successful at smoking cessation.

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