

# Age of smoking initiation: Implications for quitting

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## Abstract

### Objectives

The effect of an early age of smoking initiation on cigarette consumption and on the probability of quitting is analyzed for people aged 21 to 39.

### Data source

The data are from Statistics Canada's 1994/95 National Population Health Survey. The findings in this article are based on 3,449 randomly selected respondents aged 21 to 39 who were or had ever been daily smokers.

### Analytical techniques

Logistic regression was used to analyze the association between age of smoking initiation and heavy cigarette consumption (more than 20 a day). Survival analysis techniques were used to study the relationship between age of smoking initiation and smoking cessation for men and women. Cox proportional hazard models were used to control for potential confounding factors such as education, household income, depression, chronic stress, self-esteem, and amount smoked.

### Main results

Among 21- to 39-year-olds, smoking initiation during early adolescence was associated with greater daily cigarette consumption and a lower cumulative probability of quitting.

### Key words

tobacco use, adolescent behaviour, age of onset, depression, psychological stress

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Cigarette smoking has long been recognized as a major public health problem and the single most preventable cause of death.<sup>1-8</sup> Quitting, however, confers almost immediate health benefits.<sup>9,10</sup> Therefore, the factors associated with starting to smoke and stopping have important public-health implications.

Past research has shown that the earlier individuals begin daily smoking, the more cigarettes they are likely to smoke, and the less likely they are to quit.<sup>11-13</sup> Using data from the 1994/95 National Population Health Survey (NPHS), this article, too, shows an association between age of starting to smoke and smoking dependence among 21- to 39-year-olds, where smoking dependence is measured by the number of cigarettes smoked per day and by the probability of smoking cessation (see *Methods* and *Limitations*). This analysis adjusts for several potential confounding factors: education, household income, and the presence of depression, chronic stress and low self-esteem.

## Methods

### Data source

This analysis is based on the household component of Statistics Canada's 1994/95 National Population Health Survey (NPHS) for the 10 provinces. An institutional component of the survey, which covered long-term residents of hospitals and residential care facilities, was excluded from the analysis, as were data for the Yukon and the Northwest Territories.

The 1994/95 NPHS non-institutional sample for the provinces consisted of 27,263 households, of which 88.7% agreed to participate. After the application of a screening rule, 20,725 households remained in scope.

One knowledgeable person in every participating household provided general socio-demographic and health information about each household member. In total, data pertaining to 58,439 individuals were collected. In addition, one randomly selected person in each of the 20,725 participating households was chosen to provide in-depth information about their own health. In 18,342 of these households, the selected person was aged 12 or older. Their response rate to these in-depth health questions was 96.1%, or 17,626 respondents. In the remaining 2,383 participating households, the randomly selected respondent was younger than age 12. (In-depth health information was collected for these individuals as part of the 1994/95 National Longitudinal Survey of Children and Youth). A more detailed description of the survey design, sample, and interview procedures is available in published reports.<sup>14</sup>

To reduce bias caused by incomplete information for younger age groups, selection due to smoking-related mortality, and recall errors for older age groups, only respondents aged 21 to 39 are examined here. Limiting the analysis to this relatively small age group may also have reduced differences between birth cohorts in smoking behaviour, in societal attitudes about the acceptability of smoking, and in the types of cigarettes smoked.<sup>13,15</sup> The sample size was 3,449 respondents (Appendix, Table A).

Respondents were asked to report their current smoking status: *At the present time, do you smoke cigarettes daily, occasionally, or not at all?* Those who indicated that they smoked cigarettes daily were asked at what age they had started. Current daily smokers were also asked how many cigarettes they smoked a day.

Respondents who were not current daily smokers were asked: *Have you ever smoked cigarettes at all?* Those who answered "yes" were asked: *Have you ever smoked cigarettes daily?* If they had, they were asked: *At what age did you begin to smoke cigarettes daily?* and *How many cigarettes did you usually smoke each day?*

Former daily smokers were asked: *At what age did you stop smoking (cigarettes) daily?* Their age at the onset of daily smoking and their age at the time they quit were used to estimate the duration of daily smoking in years. Since there is a high recidivism rate in the first year of quitting, smoking cessation was defined as having quit for at least a year.<sup>13,15,16</sup>

Smokers who smoked more than 20 cigarettes a day were considered to be heavy smokers. The analysis of heavy smoking is restricted to current daily smokers, while the analysis of smoking cessation pertains to current and former daily smokers.

For this analysis, respondents' completed education was divided into three categories: less than high school graduation, high school

graduation or some postsecondary studies, and college or university graduation.

Respondents' household income was divided into quintiles, based on household size. The two lowest quintiles were combined to form the group considered to have inadequate income.

The NPHS collected information on psychological as well as physical health. Three psychological variables were included in this analysis: chronic stress, self-esteem, and depression (see *Psychological variables*).

### Analytical techniques

Logistic regression was used to estimate the probability of smoking more than 20 cigarettes a day as a function of the age of starting to smoke, adjusting for other potentially confounding factors. The LOGISTIC procedure of SAS was used in the analysis.<sup>17</sup> To obtain unbiased estimates of the logistic regression coefficients and less biased standard errors, the sample was weighted using sample survey weights re-scaled to average 1.

To assess the association between age at smoking initiation and stopping, the product-limit (Kaplan-Meier) life table method was used to estimate the probability of smoking cessation as a function of the time since the onset of daily smoking. Quitting was treated as a once-in-a-lifetime event, analogous to mortality. The data analyses were performed with the LIFETEST procedure in SAS.<sup>17</sup> The survival function  $S(t)$  was calculated as the proportion of respondents in the cohort who had not quit smoking after having smoked for  $t$  years. The complement of the survival function,  $1-S(t)$ , is the cumulative probability of smoking cessation at time  $t$ . Respondents who still smoked at the time of the survey or who had quit daily smoking for less than one year were considered censored; that is, they remained in the analysis as an unknown outcome, in statistical terms, a censored observation.

Cox proportional hazard models were used to model the hazard of smoking cessation as a function of age at smoking initiation. Additional variables in the model include education, household income, major depressive episode, chronic stress, low self-esteem, and number of cigarettes smoked per day.<sup>18</sup> Because of differences in male and female smoking behaviour, separate models were fitted for men and women. The data analyses were performed with the PHREG procedure in SAS.<sup>17</sup>

For the Cox proportional regression analysis, re-scaling the sample weight to average 1 is not possible using the PHREG procedure in SAS.<sup>17</sup> This is because the procedure excludes any observations with a weight less than 1.

The standard errors obtained using the original sample weights are usually too small. Therefore, to obtain less biased estimates of the standard error of the regression coefficient, the standard error obtained by fitting the model using the original weights was multiplied by an inflation factor. The inflation factor was defined as the square root of the ratio of the estimated population size to the sample size. These adjusted standard errors were used to calculate confidence intervals.<sup>19</sup> This adjustment procedure does not take into account other aspects of the survey design. Consequently, the results should be interpreted with caution.

## Majority began in teens

Most smokers begin daily smoking in their teens. In 1994/95, 16% of 21- to 39-year-olds who had ever smoked daily reported that they had started to do so at age 13 or younger; 55% reported ages 14 to 17; and 15%, ages 18 or 19. Just 14% had started daily smoking at age 20 or older.

## Heavy smoking

Starting to smoke at an early age was associated with heavy smoking in later life, that is, more than 20 cigarettes a day (Table 1). The odds of being a heavy smoker were significantly greater for those who began in early adolescence, compared with those who started at age 20 or older.

Table 1  
Odds ratios for heavy smoking,<sup>†</sup> current daily smokers aged 21 to 39, provinces, 1994/95

Independent variable	Odds ratio	95% confidence interval
<b>Age at onset</b>		
13 or younger	2.47*	1.65, 3.70
14-17	2.33*	1.63, 3.32
18-19	1.13	.73, 1.75
20-39 <sup>‡</sup>	1.00	...
<b>Sex</b>		
Men	1.98*	1.62, 2.41
Women <sup>‡</sup>	1.00	...
<b>Education</b>		
Less than high school graduation	1.53*	1.16, 2.02
High school graduation/some postsecondary	1.06	.84, 1.35
College or university graduation <sup>‡</sup>	1.00	...
<b>Major depressive episode<sup>§</sup></b>		
Yes	1.30	.93, 1.80
No <sup>‡</sup>	1.00	...
<b>High chronic stress</b>		
Yes	1.28*	1.04, 1.58
No <sup>‡</sup>	1.00	...
<b>Low self-esteem</b>		
Yes	.86	.65, 1.15
No <sup>‡</sup>	1.00	...

**Data source:** 1994/95 National Population Health Survey

**Note:** The analyses were based on 2,088 respondents who provided information for all variables.

<sup>†</sup> More than 20 cigarettes a day

<sup>‡</sup> Identifies reference category, for which the odds ratio is always 1.00.

<sup>§</sup> In 12 months before NPHS interview. Despite the positive association between major depressive episode and self-esteem, the results of the analysis are similar to those presented here when either of these variables is deleted from the model.

... Figures not applicable

\*  $p < 0.05$

A number of other factors were linked with heavy smoking. The odds were greater for men than for women. Educational attainment was also important, as people with less than high school graduation had higher odds of being heavy smokers than did those with college or university graduation.

By contrast, while chronic stress was significantly related to heavy smoking, depression during the last year and low-self esteem were not.

## Quitting

Daily smoking in early adolescence was also strongly associated with a lower probability of quitting. For example, just 18% of smokers who started at age 13 or younger had stopped within ten years, compared with 42% of those who started at age 20 or older (Table 2). These results are similar to findings of a local survey in the United States.<sup>13</sup>

Delaying the onset of daily smoking increased the cumulative probability of quitting for both sexes, although there were some differences. Among men who had started daily smoking when they were

Table 2  
Cumulative probability of having quit smoking, by age of onset and duration of daily smoking, population aged 21 to 39 who ever smoked daily, provinces, 1994/95

Duration of daily smoking (years) <sup>†</sup>	Age of onset of daily smoking			
	13 or younger	14-17	18-19	20-39
Probability of having quit				
1	.01	.02	.02	.06
2	.03	.04	.05	.10
3	.04	.07	.08	.13
4	.06	.10	.10	.16
5	.06	.13	.13	.21
6	.07	.15	.18	.24
7	.09	.17	.20	.28
8	.12	.19	.23	.31
9	.14	.21	.26	.35
10	.18	.22	.28	.42
11	.20	.26	.33	.45
12	.22	.28	.38	.49
13	.25	.30	.40	.51
14	.26	.33	.42	.52
15	.28	.35	.44	.54
16	.29	.37	.45	.55
17	.31	.38	.46	.58

**Data source:** 1994/95 National Population Health Survey

<sup>†</sup> For those who quit smoking, duration refers to period from age of onset to age of quitting.

## Psychological variables

The NPHS measures a *major depressive episode (MDE)* with a subset of questions from the Composite International Diagnostic Interview.<sup>20,21</sup> These questions cover a cluster of symptoms for a depressive episode, which are listed in the Diagnostic and Statistical Manual of Mental Disorder (DSM-III-R).<sup>22</sup> Respondents who reported that during the previous 12 months they had experienced a period of at least two weeks when they had felt sad, blue or depressed, or had lost interest in most things that usually give them pleasure, answered a series of questions about that period:

1. During that time, how long did these feelings usually last? (All day long; Most of the day; About half the day; Less than half the day)
2. How often did you feel this way during those two weeks? (Every day; Almost every day; Less often)
3. During those two weeks did you lose interest in most things? (Yes; No)
4. Did you feel tired out or low on energy most of the time? (Yes; No)
5. Did you gain weight, lose weight, or stay about the same? (Gained weight; Lost weight; Stayed about the same; Was on a diet)
6. About how much did you gain/lose?
7. Did you have more trouble falling asleep than you usually do? (Yes; No)
8. How often did that happen? (Every night; Nearly every night; Less often)
9. Did you have a lot more trouble concentrating than usual? (Yes; No)
10. At these times, people sometimes feel down on themselves, no good, or worthless. Did you feel this way? (Yes; No)
11. Did you think a lot about death—either your own, someone else's, or death in general? (Yes; No)

A value of 1 was assigned to any “yes” answer to the “yes/no” questions. For the question on weight, a score of 1 was assigned if the change was at least 10 pounds (4.5 kilograms). For the question on sleep, a score of 1 was assigned if respondents had trouble falling

asleep every night or nearly every night. Responses were scored, and the results were transformed into a probability estimate of a diagnosis of MDE. For this article, if the estimate was 0.9 or more, that is, 90% likelihood of a positive diagnosis of MDE, the respondent was considered to have experienced depression. To obtain a probability of 0.9, respondents had to score 5 or more.

To measure *chronic stress*, NPHS respondents were asked whether 11 statements were true or false.<sup>20</sup> A score of 1 was assigned to each “true” response. High chronic stress was defined as a total score of 4 or more. The statements were:

1. You are trying to take on too many things at once.
2. There is too much pressure on you to be like other people.
3. Too much is expected of you by others.
4. You don't have enough money to buy the things you need.
5. Your work around the home is not appreciated.
6. Your friends are a bad influence.
7. You would like to move but you cannot.
8. Your neighbourhood or community is too noisy or too justifiably polluted.
9. You have a parent, a child, or a partner who is in very bad health and may die.
10. Someone in your family has an alcohol or drug problem.
11. People are too critical of you and what you do.

*Self-esteem* measures the “positiveness” with which individuals regard themselves.<sup>23</sup> On a five-point scale from “strongly disagree” (score 0) to “strongly agree” (score 4), NPHS respondents replied to six statements. A score of less than 18 was chosen to indicate low self-esteem.

1. You feel that you have a number of good qualities.
2. You feel that you are a person of worth at least equal to others.
3. You are able to do things as well as most other people.
4. You take a positive attitude toward yourself.
5. On the whole, you are satisfied with yourself.
6. All in all, you are inclined to feel you're a failure (scoring reversed).

younger than 20, the probability of quitting was relatively low and varied little by age of initiation (Chart 1). Among women, the probability of quitting was lowest for those who had started smoking at age 13 or younger. For women who had started ages 18 or 19, the probability of quitting was about the same as that for women who had started at age 20 or older.

Even among those who smoked fewer than 20 cigarettes a day, a younger age of onset was associated with a lower probability of quitting (data not shown).

The relationship between the age of starting to smoke and quitting persisted after controlling for some potential confounding factors such as education, income, and psychological state (Table 3). For women, the probability of quitting was significantly higher among those who had started at successively older ages, compared with the group who started daily smoking at age 13 or younger. But for men, the association was significant only for those who started at age 20 or older.

When the study population was divided into two age groups (21 to 29, 30 to 39), the effect of age of onset on smoking cessation still held (data not shown).

### Limitations

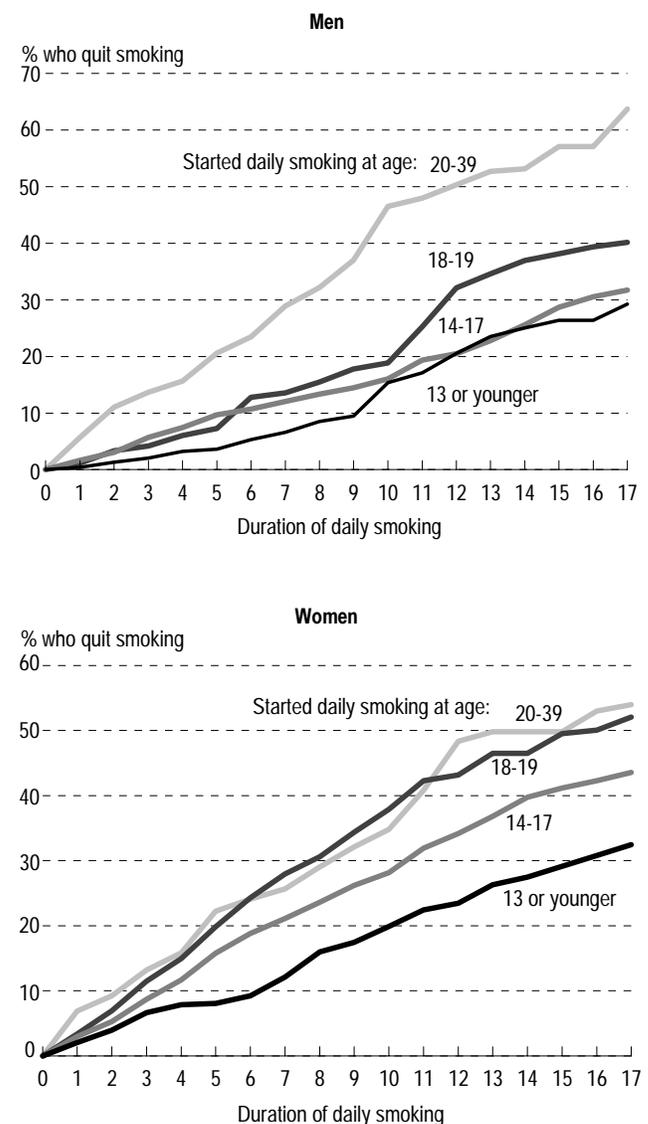
Except for age at smoking initiation, the variables used in the model refer to the characteristics of respondents when they were interviewed. These characteristics, especially psychological status, may have been different when respondents started and stopped smoking. Particularly for people who no longer smoke, these measures may not reflect psychological health at the time of cigarette use.

From NPHS data, the exact age when an individual became a daily smoker cannot be precisely determined. The progression from experimental to regular smoking can take several years and can involve shifts between experimentation, quitting, occasional smoking, and daily smoking. For some people, smoking cessation may involve a series of relapses before they finally quit. Moreover, these data are based on the respondents' recall, and so are subject to error. However, the use of a relatively narrow age group for analysis—21 to 39—may have controlled for some of the bias.

## Education, depression and stress associated with quitting

For both male and female smokers, education was also significantly associated with quitting. Compared with smokers who had not completed high school, those who had graduated from a postsecondary institution had a greater likelihood of having quit. Among women, the probability of quitting was also significantly elevated among high school graduates.

Chart 1  
Cumulative probability of having quit smoking, by sex and age of onset and duration<sup>†</sup> of daily smoking, population aged 21 to 39 who ever smoked daily, provinces, 1994/95



Data source: 1994/95 National Population Health Survey

<sup>†</sup> For those who quit smoking, duration refers to period from age of onset to age of quitting.

Earlier research has shown that people who have at some time experienced depression are more likely to smoke.<sup>16,24-28</sup> In turn, attempts to quit may lead to the development of depressive symptoms among some smokers.<sup>25</sup> Two psychological variables—depression and chronic stress—were also significantly associated with a lower likelihood of quitting, but only among female smokers. That is, women who reported having had a major depressive episode in the past year and those who scored high

on chronic stress were less likely to have quit. And while the association between quitting and self-esteem was not statistically significant, this may be because of the strong relationship between depression and self-esteem.

Some other factors were also associated with quitting smoking for one sex, but not for the other in the multivariate analysis. For example, the relationship between household income and quitting was significant only for women. Women residing in households in the two highest income quintiles were more likely to have quit than were those in the lowest quintile. On the other hand, the amount that an individual smoked significantly reduced the likelihood of quitting only among men; heavy smoking by women did not significantly reduce their chances of quitting. This may be because women tend to smoke lower tar/nicotine cigarettes.<sup>29,30</sup>

Table 3  
Hazard ratio for having quit smoking, men and women aged 21 to 39 who ever smoked daily, provinces, 1994/95

	Men		Women	
	Hazard ratio	95% confidence interval	Hazard ratio	95% confidence interval
<b>Age at onset</b>				
13 or younger†	1.00	...	1.00	...
14-17	1.04	.80, 1.36	1.28*	1.03, 1.59
18-19	1.25	.90, 1.73	1.48*	1.12, 1.95
20-39	2.49*	1.80, 3.44	1.55*	1.14, 2.09
<b>Education</b>				
Less than high school†	1.00	...	1.00	...
High school graduation/ some postsecondary	1.19	.91, 1.57	1.63*	1.27, 2.09
College/university graduation	1.56*	1.18, 2.07	2.14*	1.65, 2.77
<b>Household income</b>				
Quintiles 1,2 (inadequate)†	1.00	...	1.00	...
Quintile 3	1.16	.87, 1.56	1.07	.84, 1.35
Quintile 4	1.17	.88, 1.56	1.30*	1.04, 1.62
Quintile 5 (high)	1.34	.96, 1.87	1.73*	1.32, 2.25
<b>Major depressive episode‡</b>				
Yes	.52	.27, 1.00	.51*	.36, .72
No†	1.00	...	1.00	...
<b>High chronic stress</b>				
Yes	.80	.64, 1.00	.65*	.55, .78
No†	1.00	...	1.00	...
<b>Low self-esteem</b>				
Yes	.95	.68, 1.32	.90	.71, 1.16
No†	1.00	...	1.00	...
<b>Smoked more than 20 cigarettes daily</b>				
Yes	.62*	.51, .76	.85	.70, 1.02
No†	1.00	...	1.00	...

Data source: 1994/95 National Population Health Survey

Note: The analyses were based on 1,415 male respondents and 1,808 female respondents who provided information for all variables.

† Identifies reference category, for which the hazard ratio is always 1.00.

‡ In 12 months before NPHS interview

... Figures not applicable

\*  $p < 0.05$

## Implications

The 1994/95 National Population Health Survey found that the majority of smokers start in adolescence, and this affects the amount that they smoke and their chances of quitting in later life. Other research has shown similar results.<sup>12,13,15</sup> Thus, while preventing smoking initiation altogether is most desirable, delaying it by even a few years might have both individual and public-health benefits.

A central question is why such a delay makes a difference in the ability to quit. It might be that physical dependence on nicotine is greater if the person starts smoking at a younger age. An early age of smoking initiation could also mean that the psychological and/or social factors that contribute to dependency are stronger.

This issue has taken on added importance in light of a recent increase in teenage smoking. In 1990, 21% of 15- to 19-year-olds were smokers, but by 1994/95, the percentage had risen to 28%.<sup>31</sup> At the same time, smoking declined among most other age groups.

The age of smoking initiation may be an indicator for factors that were not accounted for in this analysis. Smoking at an early age may reflect family influences.<sup>32</sup> Studies have shown that the prevalence of smoking among children, their overall level of

cigarette consumption, and the tar/nicotine levels of cigarettes smoked by children are directly associated with the smoking practices of adults in the household.<sup>33,34</sup> Adult behaviour may communicate messages to children about the health risks and motivations associated with smoking.

As well, persistence in smoking over time may indicate greater social support for smoking, not only at home, but also at work. Smoking at an early age may be a marker for lower socioeconomic status. These smokers, in turn, may be selected into occupational groups with few constraints on workplace smoking.<sup>35</sup>

Prevention of smoking among adolescents and encouraging those who do smoke to quit are major objectives of programs to control tobacco use in Canada.<sup>36</sup> There is growing recognition that no single anti-smoking effort is likely to be successful, and multi-faceted approaches have been adopted.<sup>37,38</sup> For instance, the availability of cigarettes has been reduced by banning the sale of tobacco products from vending machines and restricting sales to persons over age 19. Restrictions on the advertising of cigarettes, taxation increases, and community smoking by-laws transmit a message that smoking is not desirable.<sup>39</sup> The NPHS data also suggest that the inclusion of information about the management of stress and depression may be important in smoking prevention programs.

One of the principles behind current efforts to reduce adolescent smoking is that prevention must be focused on strategic points in the smoking continuum. The NPHS data indicate that early adolescence is one of those points and that a delay of even a few years in the initiation of smoking could have a positive influence in later life.

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## Appendix

Table A  
Distribution of selected characteristics of population aged 21 to 39 who ever smoked daily, provinces, 1994/95

	Sample size	Weighted % distribution
<b>Total</b>	<b>3,449</b>	<b>100.0</b>
<b>Age at onset</b>		
13 or younger	575	16.4
14-17	1,889	54.7
18-19	511	15.2
20-39	460	13.5
Not stated or unknown	14	0.3
<b>Sex</b>		
Male	1,574	49.3
Female	1,875	50.7
<b>Education</b>		
Less than high school graduation	729	19.2
High school graduation/some postsecondary	1,718	49.9
College or university graduation	1,000	30.9
Not stated or unknown	2	0.1
<b>Household income</b>		
Quintiles 1, 2 (inadequate)	813	19.8
Quintile 3	1,043	29.3
Quintile 4	1,198	35.6
Quintile 5 (high)	302	12.1
Not stated or unknown	93	3.2
<b>Major depressive episode</b>		
Yes	320	7.5
No	3,008	88.0
Not stated or unknown	121	4.5
<b>High chronic stress</b>		
Yes	1,104	30.9
No	2,232	64.7
Not stated or unknown	113	4.3
<b>Low self-esteem</b>		
Yes	490	12.8
No	2,843	82.9
Not stated or unknown	116	4.4
<b>Smoke more than 20 cigarettes daily</b>		
Yes	942	27.1
No	2,502	72.6
Not stated or unknown	5	0.3

**Data source:** 1994/95 National Population Health Survey  
**Note:** Because of rounding, percentages may not add to 100%.