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ORIGINAL ARTICLE

The longitudinal age and birth cohort trends of smoking in Sweden: a 24-year follow-up study

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Abstract
Objectives The aim of this study is to analyse longitudinally, the annual effects of age group and birth cohort on smoking in the Swedish population during a 24-year period and to analyse the smoking trends for different levels of education.
Methods A random sample of adult, non-institutionalized persons aged 16–71 years was interviewed every 8 years by professional interviewers. In addition to three time-related variables—year of interview, age at the time of the interview, and year of birth—we included the following explanatory variables in the analyses: sex, educational level, and urbanization.
Results We found significant decreases in smoking prevalence in all studied subgroups. The adjusted odds ratios for age were 0.89 (95 % CI 0.88–0.90) and 0.92 (95 % CI 0.91–0.93) for men and women, respectively. The decreases in smoking over time were significant in all levels of education, except for in women with low educational level.
Conclusions In Sweden, the prevalence of smoking has decreased in most age groups and cohorts, and in persons in most levels of education, albeit less so in women with low educational level.

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Keywords Smoking · Longitudinal studies · Cohort effect · Mixed models · Statistical models

Introduction

Smoking is a major risk factor for both heart disease and lung cancer (Carnethon et al. 2006; Lee et al. 2012). A recent report on the global burden of disease estimated that 6.3 million deaths and 6.3 % (5.5–7.0 %) of disability-adjusted life years (DALYs) in 2010 were attributable to tobacco smoking (Lim et al. 2012). The estimated total cost of smoking in Sweden in 2007 was USD 1.6 billion (or USD 181 per person) (Bolin et al. 2011). Direct costs, including health care costs, accounted for one-third of the total costs. Cigarette smoking continues to be a leading cause of preventable death.

In a study from the United Kingdom, the proportion of deaths attributable to smoking in 2005 was estimated to be 27 % in men and 11 % in women (Allender et al. 2009). In a similar study from the US, it was estimated that 20 % of all deaths among men and 15 % of all deaths among women in 2004 were attributable to smoking (a total of 420,000 deaths) (van Meijgaard and Fielding 2012).

The prevalence of smoking in the EU in 2009 was 29 % (European Commission 2010). Within the EU, the proportion of smokers was highest in southern Europe (40 % in Greece and 39 % in Bulgaria), and lowest in northern European countries (16 % in Sweden and 21 % in Finland). In longitudinal studies in Denmark and UK, the prevalence of cigarette smoking was found to have decreased (Frank et al. 2004; Osler et al. 1998). There are, however, differences between men and women. The decrease was smallest in women and among the least educated, and the increasing prevalence of heavy smoking

in women is a cause for concern. In the United States, there have been large, persistent increases in the risks of smoking-related deaths among women over the past 50 years and the risks for women now equal those for men (Thun et al. 2013). Moreover, the prevalence of smoking varies according to age, socioeconomic status (Fernandez et al. 2003), and education (Huisman et al. 2005b). Although decreases in smoking prevalence have been reported, the trends may vary between different countries, population groups and according to demographic and socioeconomic factors. In this study, we will disentangle the smoking trends in Sweden in different birth cohorts and age groups over a 24-year period.

The first aim of this study is to analyse, longitudinally, the annual effects of age group and birth cohort on smoking in the Swedish population during a 24-year period, for each sex separately and based on four assessments on the same individuals at intervals of 8 years. The second aim is to analyse whether any observed effects remain after adjustment for possible confounders, such as education and urbanization, and whether potential effects are modified by certain individual characteristics. The third aim is to analyse the smoking trends in different levels of education over the 24-year period.

Methods

The Swedish annual level of living survey

The Swedish Annual Level of Living Survey (SALLS) is a nationally representative, simple cross-sectional random sample of adult, non-institutionalized persons aged 16–84 years, taken from the Swedish Total Population Register. It represents the entire population of Sweden, and was used as the source of data in this study (Statistics Sweden 1996). Professional interviewers from Statistics Sweden conducted face-to-face interviews, usually at the respondents' homes (Statistics Sweden 1996). The data are not publicly available and the use and analysis of the data need permission from Statistics Sweden (a government agency that produces statistics).

A sample of 3,148 men and 3,390 women aged 16–71 at study start were randomly drawn from the Swedish Total Population Register and were followed from 1980/1981 to 2004/2005.

In this study, we used the data from the 1980/1981, 1988/1989, 1996/1997 and 2004/2005 sample, including all who took part at least once. A new sample of the age group 16–23 years was included, at each of the three last occasions. All analyses in all tables were based on the same sample sizes shown in Tables 1 and 2 by sex and assessment period. This study covered ages between 16 and 71 years. The response rates varied between 86 % (1980/1981) and 75 % (2004/2005).

Outcome variable

The outcome variable smoking comprised two levels: (0) non-smokers, comprising never smokers, occasional smokers and former smokers (regardless of when they quit); and (1) daily smokers.

Explanatory variables

We analysed three time-related variables: year of interview, age at the time of the interview, and year of birth. We chose to also include the following explanatory variables for which previous studies have suggested an association with smoking: sex, educational level (Huisman et al. 2005a; Cavelaars et al. 2000), and urbanization (Idris et al. 2007).

Assessment period comprised four categories: 1980/1981, 1988/1989, 1996/1997, 2004/2005, including all who took part at least once.

Age at the time of interview, to measure time trends, was categorized into the following groups: 16–23, 24–31, 32–39, 40–47, 48–55, 56–63, and 64-71 years, reflecting the 8-year intervals between assessments.

Birth Cohort (based on year of birth), to measure the cohort effect, comprised groups born in 1910–1917, 1918–1925, 1926–1933, 1934–1941, 1942–1949, 1950–1957, 1958–1965, 1966–1973, 1974–1981, and 1982–1989. In Tables 3 and 4, birth cohort is centred at 1950 (Cohortc).

Sex Separate analyses were undertaken for men and women.

Educational level was categorized as: (1) low (compulsory school or less, $\leq$9 years); (2) intermediate (practical high school, i.e. vocational school, 10–11 years); and (3) high (theoretical high school and/or college, $\geq$12 years).

Urbanization Residence in: (1) any of the three largest cities in Sweden; (2) medium-sized towns (population >90,000); and (3) small towns (population 27,000–90,000) and rural areas.

Statistical analysis

In the analysis, descriptive statistics were used to present the distributions of the explanatory variables (Table 1), as well as prevalence rates of smoking according to the explanatory variables (Table 2). The trend test (nptrend in STATA) used in Table 2 is a nonparametric test for trend across ordered groups (Cuzick 1985), and is an extension of the Wilcoxon rank-sum test.

A mixed logistic model with random intercepts on repeated measurements was applied to test the change in prevalence of smoking over time for age groups and

Table 1 Distribution (%) of the different variables according to sex and assessment period (longitudinal samples of the Swedish population from 1980/1981, 1988/1989, 1996/1997, and 2004/2005) in individuals aged 16–71 years

Variable	Men				Women			
	1980/81	1988/89	1996/97	2004/05	1980/81	1988/89	1996/97	2004/05
n	2,728	2,688	2,570	2,177	2,770	2,666	2,634	2,211
Age (years)								
16–23	16.3	16.3	12.8	12.7	16.2	16.0	12.0	13.1
23–31	17.6	15.5	16.5	13.1	15.9	15.8	16.5	13.0
32–39	19.6	16.1	16.5	16.6	17.0	15.8	16.6	16.2
40–47	13.2	18.1	16.1	15.2	12.3	16.8	16.1	16.1
48–55	10.6	12.4	17.9	14.5	12.9	11.1	16.5	15.3
56–63	12.4	9.5	11.3	17.1	13.0	12.2	11.0	15.4
64–71	10.3	12.1	8.9	10.8	12.7	12.3	11.3	10.9
Educational level								
Low	42.8	32.9	25.5	20.8	48.7	34.6	25.5	19.2
Intermediate	26.4	31.3	30.9	26.8	31.1	36.0	33.6	26.8
High	30.8	35.8	43.6	52.4	20.2	29.4	40.9	54.0
Urbanization[a]								
Large cities	30.8	31.0	31.2	34.3	30.5	30.0	31.4	33.5
Medium-sized towns	31.5	33.8	36.5	36.0	32.6	34.7	37.4	36.1
Small towns	37.7	35.2	32.3	29.7	36.9	35.3	31.2	30.4

[a] Residence in: (1) any of the three largest cities in Sweden; (2) medium-sized towns (population >90,000); and (3) small towns (population 27,000–90,000) and rural areas

cohorts. First, we checked non-linearity by including age-squared and cohort-squared and found that both were significant. Therefore, we included also age-squared and cohort-squared in the models. There was no interaction between age and cohort. The unadjusted model included age, age-squared, cohort, and cohort-squared. A second model was also adjusted for all the explanatory variables (Tables 3, 4). In Table 3, age is centred at 42 years (age-centred) and cohort at the year 1950 (cohort-centred). The effect of time period does not need to be estimated for a longitudinal panel study, as age and time express the same effect. The results are presented as odds ratios (ORs) with 95 % confidence intervals (95 % CIs), and as annual rate of change according to age and birth cohort and separately according to sex (Tables 3, 4). Adjusted probabilities (%) of smoking and birth cohort trends (change per birth year), as well as age trends (change per year), based on the adjusted model in Tables 3 and 4 (adjusted for education and urbanization) are shown in Tables 5 (men) and 6 (women). The change over time was estimated by a variance-weighted least square regression (vwls in Stata) for each age group and each cohort, respectively, with adjusted probability for smoking as the dependent variable and time in years as the independent variable (Tables 5, 6).

The STATA software package was used for the statistical analyses (StataCorp 2009).

Ethics

This study was approved by the ethical committee in Stockholm (approval no. 12/2000). There is no demand on written consent in this survey, but the included individuals had the possibility to deny participation. They were also informed about the use of the data, which are reported only in large groups.

Results

The distribution of the different explanatory variables for longitudinal samples of the Swedish population from 1980/1981, 1988/1989, 1996/1997 and 2004/2005 are presented separately according to sex and assessment period in Table 1. For each of the three last assessment periods, new individuals aged 16–23 years were added. Educational attainment and urbanization tended to increase over time in both men and women.

In Table 2, the prevalence rates of smoking for subjects in the different explanatory variable groups are presented separately according to sex and assessment period. The results show that the prevalence of smoking decreased from 34.1 to 13.6 % in men, and from 31.8 to 18.7 % in women, between 1980/1981 and 2004/2005.

Table 2 Prevalence of smoking (%) in the different explanatory variable groups, presented separately according to sex and assessment period (longitudinal samples of the Swedish population from 1980/1981, 1988/1989, 1996/1997 and 2004/2005), in individuals 16–71 years

Variable	Men				Women			
	1980/81	1988/89	1996/97	2004/05	1980/81	1988/89	1996/97	2004/05
n	2,728	2,688	2,570	2,177	2,770	2,666	2,634	2,211
Overall %	34.1	26.9	18.2	13.6	31.8	28.7	24.2	18.7
Age (years)								
16–23	25.0[G]	18.0[H]	11.5[I]	9.0[J]	37.9[G]	23.9[H]	20.5[I]	12.4[J]
24–31	38.3[F]	27.4[G]	13.9[H]	10.9[I]	37.9[F]	34.9[G]	21.79H	15.7[I]
32–39	42.4[E]	33.6[F]	18.6[G]	9.1[H]	39.0[E]	32.6[F]	26.5[G]	18.9[H]
40–47	36.8[D]	33.5[E]	22.0[F]	15.1[G]	31.9[D]	36.2[E]	27.8[F]	21.4[G]
48–55	33.1[C]	28.2[D]	24.9[E]	18.7[F]	30.0[C]	27.5[D]	30.6[E]	21.2[F]
56–63	31.2[B]	24.8[C]	18.2[D]	18.8[E]	21.4[B]	24.3[C]	22.4[D]	23.8[E]
64–71	26.8[A]	19.4[B]	15.0[C]	11.5[D]	13.6[A]	17.4[B]	15.8[C]	15.0[D]
Educational level								
Low	36.1	29.6	22.6	18.4[a]	29.6	29.1	28.9	23.6[a]
Intermediate	36.9	28.7	20.7	17.5[b]	36.7	35.4	31.0	27.4[b]
High	29.0	22.8	14.0	9.6[c]	26.0	20.2	15.7	12.8[c]
Urbanization[K]								
Large cities	38.1	28.4	19.4	13.1	33.0	30.6	24.9	17.7
Medium-sized towns	33.4	28.6	21.1	15.6	31.8	27.2	23.1	18.5
Small towns	31.5	23.9	13.9	11.6	28.9	28.7	24.9	20.1

Test of trend within education for men and women: [a] low, $p < 0.0001$ and 0.053; [b] intermediate, $p < 0.0001$ and $p < 0.0001$; [c] high, $p < 0.0001$ and $p < 0.0001$

Cohort: [A] 1910–1917; [B] 1918–1925; [C] 1926–1933; [D] 1934–1941; [E] 1942–1949; [F] 1950–1957; [G] 1958–1965; [H] 1966–1973; [I] 1974–1981; [J] 1982–1989

[K] Residence in: (1) any of the three largest cities in Sweden; (2) medium-sized towns (population >90,000); and (3) small towns (population 27,000–90,000) and rural areas

Table 3 Odds ratios (ORs) with 95 % confidence intervals (95 % CIs) for smoking in men aged 16–71 years, calculated using mixed models with random intercepts

Variable	Category	Unadjusted model		Adjusted model	
		OR	95 % CI	OR	95 % CI
Fixed effects					
Rate of change					
Age-centred	Centred at 42 years	0.886	0.874–0.897	0.890	0.878–0.901
Age-squared		0.998	0.997–0.999	0.998	0.997–0.999
Cohort-centred	Centred at 1950	0.866	0.853–0.880	0.872	0.858–0.885
Cohort-squared		0.998	0.997–0.999	0.998	0.997–0.999
Educational level	Low			1	
	Intermediate			0.93	0.68–1.27
	High			0.44	0.31–0.62
Urbanization[a]	Large cities			1	
	Medium-sized towns			0.85	0.58–1.22
	Small towns			0.48	0.32–0.70
Variance components	Variance	SE	Variance	SE	
Var (cons)	19.8	1.71	18.4	1.59	

[a] Residence in: (1) any of the three largest cities in Sweden; (2) medium-sized towns (population >90,000); and (3) small towns (population 27,000–90,000) and rural areas

Table 4 Odds ratios (ORs) with 95 % confidence intervals (95 % CIs) for smoking in women aged 16–71 years, calculated using mixed models with random intercepts

Variable	Category	Unadjusted model		Adjusted model	
		OR	95 % CI	OR	95 % CI
Fixed effects					
Rate of change					
Age-centred	Centred at 42 years	0.911	0.899–0.922	0.918	0.907–0.930
Age-squared		0.998	0.997–0.999	0.998	0.997–0.999
Cohort-centred	Centred at 1950	0.928	0.916–0.941	0.940	0.927–0.953
Cohort-squared		0.997	0.996–0.998	0.998	0.997–0.999
Educational level	Low			1	
	Intermediate			1.37	0.98–1.82
	High			0.38	0.26–0.54
Urbanization[a]	Large cities			1	
	Medium-sized towns			0.66	0.46–0.96
	Small towns			0.63	0.43–0.92
Variance components	Variance	SE	Variance	SE	
Var (cons)	23.6	2.0	21.5	1.84	

[a] Residence in: (1) any of the three largest cities in Sweden; (2) medium-sized towns (population >90,000); and (3) small towns (population 27,000–90,000) and rural areas

For both men and women, higher education was associated with lower prevalence of smoking. There was no clear association between smoking and urbanization.

Smoking decreased over time in men and women with all levels of education, and these decreases were significant except for in women with low educational level. The decrease in smoking prevalence was higher among highly educated women than among women with low and intermediate levels of education.

Two mixed models with random intercepts (one without adjustment and one adjusted for all the explanatory variables) were applied to estimate the effects of age and cohort on the prevalence of smoking over time. Two models for each sex are presented in Tables 3, 4. The rate of change is shown as the OR for smoking by age and cohort. For men, the OR for smoking by age (centred at 42 years) was 0.887 (95 % CI 0.876–0.899) per year above 42 years, reflecting a decrease in smoking prevalence with increasing age. The OR for smoking by cohort (centred at birth year 1950) was 0.867 (95 % CI 0.854–0.881) for each birth year later than 1950, reflecting a decrease in smoking prevalence among those born in later years, i.e. the younger birth cohorts. Decreases in smoking according to age and cohort were seen in men and women (Tables 3, 4). The adjusted model showed significant ORs for age and cohort, similar to those in the first model. Education and urbanization were associated with the outcome variable, with statistically significant differences for high versus low categories. The variance components in the two models were also close to each other, albeit they were significantly reduced, for both men and women.

In Tables 5 and 6, adjusted prevalence rates, based on the models in Tables 3 and 4, are presented according to cohort and age group. Between 1980/1981 and 2004/2005, the prevalence of smoking decreased in men and women in all cohorts and age groups. These tables also show annual changes in the studied birth cohorts and age groups, estimated by applying mixed regression models (prevalence of smoking and time) for each age group and each birth cohort. The annual decrease by age group varied between 0.56 and 1.32 in men, and between 0.32 and 0.98 in women, and was highest in men aged 24–31, 32–39, and 40–47 years, and in women aged 16–23, 24–31, and 32–39 years. All annual changes were statistically significant, except those for women aged 56–63 and 64–71 years.

The annual decrease in smoking prevalence by cohort varied between 0.25 and 1.40 in men, and between 0.34 and 0.93 in women. The annual decreases were statistically significant, except that for the cohort born in 1974–1981, which was only followed for one 8-year interval. The annual changes in smoking prevalence were highest in male cohorts born in 1918–1925, 1926–1933, and 1934–1941 and in female cohorts born in 1926–1933, 1918–1925, and 1934–1941.

Table 5 Adjusted prevalence (%) of smoking in men based on the adjusted model in Table 3 and average annual change (%) in smoking prevalence (ΔSMO per year by age and cohort, test of trend) in individuals aged 16–71 years, presented according to age, cohort (birth year), and assessment period (longitudinal samples of the Swedish population from 1980/1981, 1988/1989, 1996/1997 and 2004/2005)

Variable	Age group							
Birth cohort	16–23	24–31	32–39	40–47	48–55	56–63	64–71	ΔSMO cohort
1910–17	–	–	–	–	–	–	25.9	–
1918–25	–	–	–	–	–	31.2	*20.3*	−1.37***
1926–33	–	–	–	–	34.9	*24.6*	***14.7***	−1.26***
1934–41	–	–	–	37.0	*28.7*	***19.2***	**11.3**	−1.08***
1942–49	–	–	41.5	*33.8*	***25.3***	**16.8**	–	−1.03***
1950–57	–	36.6	*31.6*	***24.4***	**18.6**	–	–	−0.76***
1958–65	27.6	*24.9*	***19.6***	**14.5**	–	–	–	−0.56***
1966–73	*18.3*	***14.1***	**10.9**	–	–	–	–	0.46***
1974–81	***12.2***	**9.7**	–	–	–	–	–	−0.25 ns
1982–89	**7.8**	–	–	–	–	–	–	–
ΔSMO age group	−0.79***	−1.10***	−1.29***	−1.00***	−0.65***	−0.59***	−0.61**	

Upright: 1980/1981, italic: 1988/1989, bolditalic: 1996/1997 and bold: 2004/2005

ns non-significant

Test for trend: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 6 Adjusted prevalence (%) of smoking in women based on the adjusted model in Table 4 and average annual change (%) in smoking prevalence (ΔSMO per year by age and cohort, test of trend) in individuals aged 16–71 years, presented according to age, cohort (birth year), and assessment period (longitudinal samples of the Swedish population from 1980/1981, 1988/1989, 1996/1997 and 2004/2005)

Variable	Age group							
Birth cohort	16–23	24–31	32–39	40–47	48–55	56–63	64–71	ΔSMO cohort
1910–1917	–	–	–	–	–	–	13.5	–
1918–1925	–	–	–	–	–	21.6	*16.9*	−0.60*
1926–1933	–	–	–	–	30.1	*23.5*	***16.6***	−0.84***
1934–1941	–	–	–	32.7	*28.3*	***22.1***	**15.5**	−0.72***
1942–1949	–	–	40.5	*34.9*	***29.3***	**23.6**	–	−0.70***
1950–1957	–	37.8	*32.9*	***27.9***	**21.4**	–	–	−0.68***
1958–1965	36.4	*33.1*	***28.3***	**22.5**	–	–	–	−0.58***
1966–1973	*25.4*	***21.9***	**18.3**	–	–	–	–	−0.44***
1974–1981	***19.7***	**15.8**	–	–	–	–	–	−0.49 ns
1982–1989	**12.1**	–	–	–	–	–	–	–
ΔSMO age group	−0.97***	−0.97***	−0.90***	−0.49***	−0.32***	+0.06 ns	+0.10 ns	

Upright: 1980/1981, italic: 1988/1989, bolditalic: 1996/1997 and bold: 2004/2005

ns non-significant

Test for trend: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Discussion

In this longitudinal study, we found significant decreases in smoking prevalence between 1980/1981 and 2004/2005 in all studied subgroups of men and women. Overall, the prevalence of smoking decreased from 34.1 to 13.6 % in men and from 31.8 to 18.7 % in women during the study period. Most age groups and birth cohorts of men and women showed significant annual decreases in smoking prevalence, except for women in the 55–63 and 64–71 years age groups. The annual decrease in smoking was highest in the age groups 24–31, 32–39, and 40–47 years in males and 16–23, 24–31, and 32–39 years in females. The annual decreases in smoking prevalence were highest in cohorts born in 1918–1925, 1926–1933, and 1934–1941.

In Sweden several tobacco control measures to reduce smoking have been undertaken, e.g. restricting smoking in certain public spaces. Within the EU, Sweden is considered to have medium tobacco control activity (Thyrian et al. 2010). However, tobacco control measures do not seem to have reached all population groups to an equal extent and the potential mechanisms behind these inequalities are unclear, although some potential explanations may exist.

For example, the lack of a decrease in smoking prevalence in women in the highest age groups may be due to a later peak of the smoking prevalence in women compared to men (Bostrom 2006).

The smoking prevalence was highest in men with low and women with intermediate educational level. Our data do not allow us to examine why smoking was most common in women with intermediate educational level. This potential gender difference has not been observed in other countries (Huisman et al. 2005b). The smoking prevalence decreased most among highly educated individuals, whereas the prevalence of smoking declined less among individuals with low educational levels. This has also been shown in a European study (Giskes et al. 2005). In that study greater declines in smoking among men with a low educational level were seen in some European countries, which is similar to our results. Since it is known that smoking contributes to educational inequalities in mortality (Blakely and Wilson 2005; Mackenbach et al. 2004), people with low educational level should be targeted in efforts to reduce smoking.

The prevalence of smoking declined less among men and women in small towns than in men and women in large cities. This could possibly be an effect of educational differences between urban and rural areas. Educational inequalities have been shown to be larger than income-related inequalities in the prevalence of smoking in Northern Europe (Huisman et al. 2005b).

Limitations and strengths

This study has some important limitations. One limitation is that our outcome measures were based on self-reported smoking, which may have led to smoking prevalence being underestimated. In a review of studies comparing self-reported smoking to cotinine measurement, the prevalence based on self-report was 6 % lower than that determined by cotinine measurement (Gorber et al. 2009). However, if such underestimation exists in our study, it exists for all assessments. It is possible that the bias of underestimation caused by self-report is not the same for all assessments, since public acceptance of smoking decreased during the study period. Another limitation is that the non-response rate was 20–25 %. There are probably more smokers among the non-responders, which may have led to the underestimation of smoking prevalence. However, this bias would also be similar for all measurements and would not markedly affect the longitudinal trends. Another limitation of the study is that loss to follow-up may have resulted in selection bias. Smoking prevalence might also have decreased because more smokers than non-smokers died. The survey does not follow individuals for mortality or disease incidence. For the youngest age group, reported educational level may not reflect final educational level. Some younger individuals may not have not yet finished their education and may therefore still increase their educational level.

These limitations are balanced by the strengths of this study. Other studies that have focused on smoking trends over time have been based on repeated cross-sectional samples of different individuals or single cohort studies (Blakely and Wilson 2005; Giskes et al. 2005). In contrast, we used longitudinal data obtained through four assessments of the same individuals. Key strengths are the follow-up of smoking in individuals for a long period of time (24 years). Another strength is that the SALLS is one of the most comprehensive national surveys to date and has been conducted in Sweden for more than 30 years. SALLS represents a random sample with a longitudinal "panel" with repeated measurements, drawn from the Total Population Register, and is thus representative of the entire Swedish population. An advantage of longitudinal studies is the possibility to distinguish changes over time within individuals (age effects) from differences among individuals at baseline (cohort effects).

The surveys in the present study were mainly conducted in the respondents' homes as face-to-face interviews by well-trained interviewers. The reliability of the survey questions has been estimated by re-interviewing a sample of the participants (test–retest method). The kappa coefficients were 0.64 for self-rated health and 0.58 for physical activity (Wärneryd 1991).

Conclusions

In Sweden, the prevalence of smoking has decreased in all age groups and cohorts, and in persons with all levels of education, albeit to a lesser extent in women with low educational level. The results of the present study indicate that efforts to reduce smoking should target inequalities in smoking, and particularly smoking among women with low or intermediate educational levels.

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