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Changes in cigarette smoking among adults in 35 populations in the mid-1980s

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Abstract
***Objective*—To examine changes in the prevalence of cigarette smoking in 35 study populations of the World Health Organisation's MONICA Project.**
***Design*—Data from two independent, community-based surveys conducted, on average, five years apart.**
***Setting*—Geographically defined populations in 21 countries mainly in eastern and western Europe.**
***Subjects*—Randomly selected men and women aged 25–64 years. Numbers of participants in each study population ranged from 586 to 2817 in each survey.**
***Main outcome measures*—Changes in proportions of current smokers, ex-smokers, and never-smokers by age and sex using data collected by standardised methods.**
***Results*—Among men, smoking prevalence decreased in most populations, by three to four percentage points over five years. In Beijing, however, it increased in all age groups—overall by 11 percentage points. Among women there were increases in smoking in about half the populations. The increases were mainly in the age group 35–54 years and often in those populations where smoking prevalence among women has been relatively low.**
***Conclusions*—Smoking initiation by middle-aged women in parts of southern and eastern Europe and among men of all ages in Beijing is a matter of concern. The various public health measures that have helped to reduce smoking among men in developed countries should be vigorously extended to these other groups now at growing risk of smoking-related disease.**

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Keywords: cigarette smoking, prevalence, World Health Organisation MONICA Project

Introduction

The role of cigarette smoking as a risk factor for several cancers and cardiovascular disease is well established. During the 1970s preventive measures were formally recommended by the World Health Organisation (WHO) and were initiated in many countries. Since then the overall trends in cigarette smoking among men in western countries have been downwards. The prevalence of smoking has been increasing, however, among women in many western countries, and among men (and sometimes women) in eastern Europe and in most developing countries.[1]

During the 1980s, tobacco control activities intensified in many countries and there was a growing public awareness of the adverse effects of smoking on health.[2] Thus it is of interest to know whether the previously reported trends in cigarette smoking continued during the mid-1980s and which populations changed their smoking behaviour most. The WHO MONICA Project provides an opportunity for investigating some of these issues using data collected in a standardised way.

The WHO MONICA Project is a multinational study to *moni*tor trends and determinants of *ca*rdiovascular disease. It involves collaborating centres in 21 countries over a 10-year period starting in the early 1980s. The project consists of population-based surveys of cardiovascular risk factors, surveillance of all suspected coronary events (and, optionally, strokes), and monitoring of acute coronary care in geographically defined communities.[3 4]

This paper examines changes in cigarette smoking in the study populations between the first risk factor survey and another conducted, on average, five years later. The following main questions are addressed.

- What changes have occurred in prevalence of smoking in the populations between the two surveys?
- Have the changes been similar for men and women and in different age groups or birth cohorts?
- Are the magnitudes of change related to the levels of prevalence of smoking among the differing populations?
- Within populations, are the magnitudes of changes related to educational level?

Methods

The study populations for the WHO MONICA Project lie predominantly in Europe, where they are widely distributed geographically and cover a range of social, economic, and political conditions. There are also a few centres in North America, Asia, and

Table 1 Sampling and survey characteristics for study populations in the WHO MONICA Project

Population	Place	Sampling scheme*	First survey: Survey period†	First survey: Number of respondents‡	First survey: Response rate (%) A/B§	Middle survey: Survey period†	Middle survey: Number of respondents‡	Middle survey: Response rate (%) A/B§
AUS-NEW	Newcastle, Australia	1s	5/83–12/83	2454	68/82	6/88–11/89	1342	64/71
AUS-PER	Perth, Australia	2s	5/83–11/83	1292	81/84	6/89–12/89	604	74/81
CHN-BEI	Beijing, China	2s	8/84–11/85	1247	89/90	9/88–10/89	1,217	78/79
CZE-CZE	Czech Republic	1s	3/85–11/85	1938	85/85	3/88–11/88	2,105	86/86
DEN-GLO	Glostrup, Denmark	1s	11/82–2/84	2817	79/80	8/86–4/87	1146	77/88
FIN-KUO	Kuopio Province, Finland	1s	1/82–4/82	1952	85/85	1/87–4/87	1234	85/85
FIN-NKA	North Karelia, Finland	1s	1/82–4/82	2342	80/80	1/87–4/87	2362	84/84
FIN-TUL	Turku/Loimaa, Finland	1s	1/82–4/82	2464	86/86	1/87–4/87	1165	81/81
FRA-TOU	Toulouse, France	4s	5/85–2/87	678	63/73	10/88–5/91	586	59/65
GER-AUR	Augsburg (rural), Germany	2s	10/84–5/85	1703	82/85	10/89–6/90	1660	79/81
GER-AUU	Augsburg(urban),Germany	1s	10/84–5/85	1388	76/80	10/89–6/90	1365	74/77
GER-BER	Berlin-Lichtenberg, Germany	1s	4/84–6/85	1093	75/NA	2/88–6/88	1110	76/76
GER-COT	Cottbus County, Germany	1s	10/84–7/86	1003	77/NA	5/89–5/90	752	74/NA
GER-HAC	Halle County, Germany	1s	11/83–7/84	1675	88/NA	10/88–7/89	1622	88/89
GER-KMS	Karl-Marx-Stadt County, Germany	1s	NA/82–12/85	1739	91/NA	1/88–12/89	1715	79/81
HUN-PEC	Pecs, Hungary	2s	1/82–2/83	1228	NA/NA	2/87–6/88	2215	87/NA
ICE-ICE	Iceland	1s	6/83–11/83	1341	76/NA	9/88–10/89	1330	74/75
ITA-BRI	Area Brianza, Italy	2s	4/86–3/87	1268	71/71	5/89–7/90	1246	70/70
ITA-FRI	Friuli, Italy	1s	12/85–9/86	1458	81/84	3/89–12/89	1399	79/83
LTU-KAU	Kaunas, Lithuania	1s	1/83–3/85	1463	69/NA	12/86–6/87	1762	66/69
POL-TAR	Tarnobrzeg Voivodship, Poland	1s	6/83–11/84	2678	76/77	5/87–11/88	1288	73/73
POL-WAR	Warsaw, Poland	1s	12/83–1/85	2624	74/74	1/88–1/89	1418	76/78
RUS-MOC	Moscow (control), Russia	1s	2/84–2/86	1415	78/NA	3/88–10/89	1202	74/74
RUS-MOI	Moscow (intervention), Russia	2s	1/84–12/85	1175	70/70	2/88–2/89	1210	72/72
RUS-NOC	Novosibirsk (control), Russia	1s	11/85–1/86	1178	71/NA	12/88–4/89	1249	73/NA
RUS-NOI	Novosibirsk (intervention), Russia	1s	5/85–1/86	1267	73/NA	5/88–12/88	1266	74/NA
SPA-CAT	Catalonia, Spain	2s	4/86–7/88	1980	76/79	10/90–5/92	2106	69/73
SWE-GOT	Gothenburg, Sweden	1s	2/85–11/86	1038	73/73	2/90–5/91	1243	72/73
SWE-NSW	Northern Sweden	1s	1/86–4/86	1252	84/86	1/90–4/90	1213	83/83
SWI-TIC	Ticino, Switzerland	2s	11/85–5/86	1550	79/83	10/88–4/89	1454	74/76
SWI-VAF	Vaud/Fribourg, Switzerland	2s	10/84–6/85	1197	62/69	11/88–6/89	1283	64/71
UNK-BEL	Belfast, United Kingdom	1s	10/83–9/84	1854	57/71	9/86–12/87	1823	58/65
UNK-GLA	Glasgow, United Kingdom	2s	2/86–7/86	984	51/65	1/92–9/92	1184	57/69
USA-STA	Stanford, California, United States	1sh	5/79–4/80	942	67/67	4/85–6/86	1027	58/58¶
YUG-NOS	Novi Sad, Yugoslavia	1s	9/84–12/84	1182	82/NA	9/88–5/89	1197	83/86

*Sampling scheme: 1s = single-stage probability sample; 2s = two-stage probability sample; 4s = four-stage probability sample; 1sh = single-stage household sample.
†Survey period: month/year.
‡For age group 35–64 years.
§A = response rate with subjects who could not be contacted treated as non-respondents; B = response rate if these subjects are treated as ineligible.
¶For age group 25–64 years.
NA = data not available.

Australasia. Rates of mortality and incidence of coronary disease vary markedly among the MONICA populations. Brief descriptions of the populations were given in a previous report documenting rates of coronary events.[5] The first surveys of risk factors were conducted in the early 1980s with the earliest starting in 1979 and the latest concluding in 1988. The middle surveys were carried out in the late 1980s with the earliest beginning in 1985 and the last completed in 1992. (Final surveys were conducted a decade after the first ones.) The same methodology was used for both surveys for each population.

Independent samples were selected for each survey, as the WHO MONICA Project is designed as a longitudinal study of populations, not individuals. The duration of the surveys varied among the study populations. In most populations single-stage sampling was used with stratification by age and sex. In 11 populations the sampling had two or more stages—for example, in the first stage, villages were selected, and in the second stage individuals from the chosen villages were sampled. In one population the household was the unit of sampling. The samples were all approximately self-weighting so that within strata defined by sex and 10-year age group, each person in the study population had approximately the same probability of being selected. Therefore the data were analysed as though they were collected by simple random sampling within each stratum.

Response rates for the surveys were calculated in two ways, using different denominators. For populations where the sampling frame was inaccurate and migration was common, there were subjects selected for the sample who could not be contacted and for whom it was not even possible to determine if they lived in the study area. Response rates were calculated firstly regarding these people as non-respondents and hence in the denominator (definition A) and secondly regarding them as ineligible and so not in the denominator (definition B). If no information was available on the size of this group, the second response rate was not calculated. The true response rate lies between the two rates reported. Basic information on the populations, sampling schemes, survey periods, and response rates is shown in table 1.

Information on smoking was obtained using standardised methods during risk factor surveys which included physical measurements and taking blood samples. Data were obtained either by self-completed questionnaires which were usually completed at the time of the physical examination and then checked by the research staff, or by face-to-face interview. A current cigarette smoker was defined as a person who reported smoking cigarettes regularly at the time of the survey. An ex-smoker was

Table 2a Prevalence of cigarette smoking among men estimated for 1986, by 10-year age group and age-standardised prevalence for ages 35–64

Population	*Estimated age-specific prevalence in 1986 by age group (%)*				*Estimated age-standardised prevalence in 1986 (%) (SE)*
	25–34	*35–44*	*45–54*	*55–64*	
USA-STA	27	23	23	13	20.5 (2.3)
SWE-NSW	21	23	24	22	23.2 (1.7)
ICE-ICE	34	29	23	16	23.8 (1.2)
FIN-NKA	31	31	26	22	26.9 (1.1)
AUS-PER	35	28	29	25	27.6 (1.6)
FIN-TUL	41	35	28	20	28.6 (1.6)
GER-AUR	41	33	27	26	29.2 (1.3)
AUS-NEW	NA	30	31	27	29.9 (1.2)
GER-COT	40	34	28	28	30.4 (1.7)
GER-BER	43	37	30	25	31.4 (1.5)
FIN-KUO	37	35	33	26	31.8 (1.6)
SWE-GOT	28	33	32	29	31.8 (1.9)
SWI-VAF	40	35	33	30	32.8 (1.4)
UNK-BEL	35	34	37	31	34.5 (1.3)
GER-KMS	52	39	32	32	34.7 (1.2)
ITA-FRI	45	38	34	30	34.8 (1.8)
GER-AUU	45	40	34	28	34.9 (1.4)
FRA-TOU	NA	37	35	34	35.6 (1.7)
GER-HAC	55	42	36	28	36.2 (1.2)
SWI-TIC	NA	42	35	33	37.1 (1.5)
LTU-KAU	NA	44	32	35	37.5 (1.3)
RUS-MOI	NA	44	39	37	40.2 (1.5)
DEN-GLO	52	43	42	36	40.9 (1.9)
CZE-CZE	54	53	41	31	43.0 (1.2)
ITA-BRI	50	48	41	39	43.2 (2.0)
RUS-MOC	NA	51	46	34	44.8 (1.3)
YUG-NOS	66	58	45	37	48.0 (1.4)
SPA-CAT	60	55	44	45	48.5 (2.0)
HUN-PEC	57	56	49	40	49.8 (1.2)
UNK-GLA	40	53	54	48	52.1 (2.3)
CHN-BEI	68	61	52	42	52.9 (1.5)
RUS-NOI	65	57	55	42	52.9 (1.5)
POL-WAR	NA	65	55	47	56.6 (1.2)
POL-TAR	NA	62	60	50	57.9 (1.4)
RUS-NOC	67	65	64	46	59.7 (1.6)

SE = standard error.
NA = data not available.

anyone who reported having smoked cigarettes regularly in the past but was not a current smoker at the time of the survey. A never-smoker was a person who reported not being a current smoker and who had never smoked cigarettes regularly in the past. Occasional smokers (those who usually smoked less than one cigarette per day) were excluded. The proportions of occasional smokers were below 5% in most populations. Smoking of pipes or cigars was not taken into consideration.

Trends in smoking prevalence within age groups reflect both the effects of quitting and of never starting to smoke—both important targets for prevention. In populations where adoption of smoking occurs mainly at ages younger than those in the WHO MONICA Project, birth cohort-specific trends should reflect patterns of quitting smoking. In other populations, where smoking may start later in life, age-specific trends rather than birth cohort-specific trends may be more readily interpreted. For these reasons patterns of smoking were examined by both age group and birth cohort.

The age of a subject was calculated as the age at the last birthday on or before the date of participation in the survey. This was then categorised as 25–34, 35–44, 45–54, or 55–64 years. Some centres did not include the youngest age group (25–34 years) in their surveys. Any subject whose age was outside the range 25–64 years was excluded. Five-year birth cohorts were defined by the years of birth corresponding most closely to the five-year age groups 25–29, 30–34, and so on, at the middle of the first survey in each population.

Age-specific average changes over five years in smoking prevalence were estimated by fitting simple linear regression models separately for each sex and 10-year age group in each population. The models were of the form

$$y = a+b(t-\bar{t}) \qquad \text{(equation 1)}$$

where y is the prevalence in each calendar year (obtained from either survey), t is the calendar year, and $\bar{t}$ is the mean value of t. Then the coefficient a is the prevalence at the mid-point of the two surveys and the coefficient b is the average annual change. This parameterisation is chosen so that the estimators for a and b are uncorrelated.[6] The average change over five years was estimated by $b\times5$ and its standard error was calculated as five times the standard error of b. For some populations the surveys were less than five years apart so the five-year averages are extrapolations from the data. To enable comparisons to be made of smoking prevalence among populations for the same period, equation 1 was also used to estimate the prevalence in 1986.

Age-standardised changes for the age group 35–64 years were calculated from the estimates of average changes for the 10-year age groups by direct standardisation using the world standard population weights of 12/31, 11/31, and 8/31 for the age groups 35–44, 45–54, and 55–64 years, respectively.[7] Birth cohort-specific changes in smoking prevalence for each sex were calculated similarly.

To examine the relationship between magnitude of change and average prevalence of smoking, Pearson correlation coefficients were calculated between the estimates of a and the estimates of b (obtained from equation 1) for all populations.

Level of education was divided into three, approximately equal categories defined by years of schooling within each five-year birth cohort and sex group in each population. This approach was adopted to take into account the rapid changes in educational level that have occurred in many of the populations. Cut-points between whole years of schooling were chosen so that the proportions in the two extreme categories, those with least and most years of schooling, were as close as possible to a third. Because of clumping of the distributions of years of schooling, however, these cut-points were changed if necessary to ensure that each of the two extreme categories had at least 15% of the participants.

To compare the changes in smoking prevalence between subgroups defined by level of education, a two-stage procedure was used. First the changes (b in equation 1) were estimated for each five-year birth cohort/sex/population/education category. Then a model was fitted with the change in smoking

Table 2b Prevalence of cigarette smoking among women estimated for 1986, by 10-year age groups and age-standardised prevalences for ages 35–64

Population	*Estimated age-specific prevalence in 1986 by age group (%)*				*Estimated age-standardised prevalence in 1986* (%) (SE)*
	25–34	*35–44*	*45–54*	*55–64*	
RUS-NOI	5	4	2	2	2.6 (0.5)
RUS-NOC	5	5	2	4	3.6 (0.6)
LTU-KAU	NA	5	3	4	3.9 (0.5)
SPA-CAT	32	11	3	1	5.7 (1.2)
FIN-KUO	21	17	10	3	10.7 (1.0)
FIN-NKA	19	15	11	5	10.9 (0.7)
RUS-MOI	NA	17	7	8	11.2 (0.9)
GER-COT	27	14	10	9	11.2 (1.1)
GER-KMS	24	13	12	9	11.4 (0.8)
RUS-MOC	NA	20	10	6	12.8 (1.1)
GER-AUR	25	18	13	7	13.0 (1.0)
GER-HAC	35	18	13	11	14.4 (0.8)
CHN-BEI	1	8	16	24	14.8 (1.0)
POL-TAR	NA	28	10	2	15.2 (0.9)
FIN-TUL	25	25	11	12	16.9 (1.3)
ITA-BRI	31	24	19	13	19.3 (1.6)
AUS-NEW	NA	22	20	14	19.4 (1.0)
GER-AUU	35	28	19	12	20.9 (1.2)
USA-STA	21	20	25	17	21.0 (2.0)
CZE-CZE	35	34	17	10	21.6 (1.0)
SWI-VAF	34	32	17	14	21.9 (1.3)
AUS-PER	22	19	28	19	22.0 (1.4)
GER-BER	30	26	21	21	22.8 (1.3)
SWI-TIC	NA	28	25	17	23.9 (1.4)
HUN-PEC	48	35	23	11	24.6 (1.0)
ITA-FRI	29	31	22	21	25.2 (1.6)
YUG-NOS	48	37	22	14	25.6 (1.3)
SWE-NSW	30	34	24	17	26.3 (1.8)
UNK-BEL	35	33	27	29	30.1 (1.2)
SWE-GOT	41	38	34	27	33.7 (1.7)
ICE-ICE	43	43	31	29	35.3 (1.3)
POL-WAR	NA	48	30	26	36.0 (1.1)
DEN-GLO	50	37	47	38	40.8 (1.9)
UNK-GLA	51	54	52	41	49.7 (2.3)

SE = standard error.
NA = data not available.

prevalence as the response variable, and education category, population, birth cohort, and smoking prevalence at the mid-point between the surveys (*a* from equation 1) as the explanatory variables. These models were estimated for each sex separately.

Some of the MONICA collaborating centres are conducting the project in more than one population. There were 37 populations in which the first and middle surveys were carried out and data of acceptable quality were available in the MONICA Data Centre in Helsinki, Finland. Of these populations, two were excluded because it was not possible to distinguish unequivocally, from the questions used, between people who smoked regularly and those who smoked only occasionally. In addition, one centre included only men in the middle survey. Thus for most analyses there were 35 populations of men and 34 of women. For eight populations the age group 25–34 years was not included in one or both surveys. In one population it was not possible to define birth cohorts. For analyses involving level of education based on years of schooling, six populations were excluded because either the information was not collected or it failed to meet the MONICA quality control criteria.

Results

The median response rate for the first survey was 76% (range 51–91%) and for the middle survey was 74% (range 57–88%) by the more conservative definition A (table 1).

Among men the estimated age-standardised prevalence of current cigarette smoking in 1986 varied from 20.5% in Stanford (California, United States) to 59.7% in Novosibirsk (Russia) (table 2a). In most populations, smoking prevalence was highest in the youngest age group and decreased with age. Among women, smoking prevalence varied from less than 3% in Novosibirsk to almost 50% in Glasgow (United Kingdom) (table 2b). In almost all populations, prevalence among women was highest in the youngest age group and decreased with age, most dramatically from 32% in the age group 25–34 years to 1% in the oldest age group of women in Catalonia (Spain). Prevalences of smoking for birth cohorts (not shown here) exhibited patterns similar to those seen in tables 2a and 2b for age groups.

Between the two surveys, the age-standardised prevalence of current smoking decreased among men in 29 of the 35 populations although many of the changes were not statistically significantly different from zero (table 3a). The average decline in all populations over five years was three to four percentage points and this decline was similar in all age groups. The greatest declines were in Stanford and Ticino (Switzerland), whereas smoking prevalence increased significantly in all age groups of men in Beijing.

Among women, between the two surveys there were fewer overall changes in patterns of current smoking (table 3b). There were, however, large increases in smoking prevalence in urban Augsburg (Germany), Tarnobrzeg Voivodship (Poland), and Catalonia, and consistent decreases in Stanford, Belfast (United Kingdom), and Newcastle (Australia).

For men the correlations between changes in smoking prevalence and prevalence levels were mainly small and positive: 25–34 years, $r = 0.09$, 95% confidence interval (CI) = −0.30 to 0.46; 35–44 years, $r = 0.20$, 95% CI = −0.15 to 0.50; 45–54 years, $r = -0.24$, 95% CI = −0.53 to 0.10; and 55–64 years, $r = 0.25$, 95% CI = −0.09 to 0.54). The populations with lower prevalence of smoking among men showed larger decreases. For women, in contrast, the correlations were all negative as there were increases in smoking in populations with low prevalence and decreases in population with higher prevalence: 25–34 years, $r = -0.20$, 95% CI = −0.54 to 0.20; 35–44 years, $r = -0.19$, 95% CI = −0.49 to 0.16; 45–54 years, $r = -0.12$, 95% CI = −0.44 to 0.22; and 55–64 years, $r = -0.35$, 95% CI = −0.61 to −0.01.

Tables similar to tables 2 and 3 were also constructed for the proportions of ex-smokers and never-smokers by age group (not shown). The results are summarised in table 4. Among men, the usual pattern was that the prevalences of current smokers and never-smokers decreased with age and the prevalence of ex-smokers increased. One exception was Beijing, where the prevalences of current smokers decreased and never-smokers increased with age, but there were few ex-smokers.

Table 3a Five-year trends (absolute changes in percentage points) in prevalence of cigarette smoking among men, by 10-year age groups and age-standardised trends for ages 35–64

Population	Age-specific 5-year trend age groups 25–34	35–44	45–54	55–64	Age-standardised trend (35–64 years) (SE)
USA-STA	−5	−15	−9	−9	−11.2 (2.4)
SWI-TIC	NA	−16	−6	−10	−10.9 (4.0)
AUS-PER	−2	−11	−7	−8	−8.6 (2.7)
RUS-NOC	−12	−5	−14	−5	−8.4 (3.6)
AUS-NEW	NA	−3	−9	−10	−6.8 (2.0)
UNK-GLA	0	−7	−6	−6	−6.5 (2.6)
ITA-BRI	−21	−5	−4	−11	−6.4 (4.3)
FRA-TOU	NA	4	−13	−14	−6.3 (3.3)
RUS-NOI	4	2	−16	−6	−6.2 (4.8)
RUS-MOC	NA	−11	−2	−5	−6.2 (2.9)
DEN-GLO	−4	−1	−13	−4	−5.8 (3.5)
CZE-CZE	−6	−12	6	−10	−5.1 (3.7)
POL-WAR	NA	−6	−8	1	−4.9 (2.8)
ITA-FRI	−1	−10	−5	4	−4.5 (4.2)
GER-BER	−8	−12	3	−3	−4.1 (4.0)
GER-HAC	−6	−3	−6	−2	−3.8 (2.6)
GER-COT	9	−11	3	−2	−3.7 (3.5)
SPA-CAT	3	−4	0	−8	−3.6 (2.5)
FIN-KUO	−2	−2	−4	−5	−3.3 (2.5)
GER-KMS	−4	1	−7	−5	−3.2 (2.3)
FIN-NKA	−6	3	−8	−6	−3.2 (1.9)
GER-AUU	−6	−4	−2	−4	−3.1 (2.5)
ICE-ICE	−3	−5	−1	0	−2.7 (2.1)
FIN-TUL	−1	3	1	−14	−2.2 (2.4)
GER-AUR	−9	2	−1	−7	−1.6 (2.2)
RUS-MOI	NA	−4	3	−4	−1.6 (4.1)
SWE-GOT	−5	3	−5	0	−0.6 (3.0)
LTU-KAU	NA	−5	4	0	−0.4 (3.5)
HUN-PEC	−10	10	−11	−1	−0.2 (2.3)
UNK-BEL	−2	−6	9	−3	0.1 (3.8)
POL-TAR	NA	2	−5	5	0.5 (2.9)
SWI-VAF	6	4	−5	4	0.7 (3.2)
YUG-NOS	−12	2	−1	2	1.2 (3.5)
SWE-NSW	−4	4	−2	5	1.9 (3.1)
CHN-BEI	15	14	8	10	11.0 (3.6)

SE = standard error.
NA = data not available.

The average trends showed a decline in current smoking among men during the study period. Changes in the proportions of ex-smokers were generally small and inconsistent. In several populations, however, there were large (more than seven percentage points) and consistent increases in the proportions of ex-smokers in all age groups. This pattern of fewer current smokers and more ex-smokers shows clearly that smoking cessation occurred in Ticino, Newcastle, and Stanford. In contrast, in Beijing never-smoking declined by 17 percentage points whereas current smoking and, to a lesser extent ex-smoking, increased.

Among women, the prevalences of current and ex-smokers decreased and the percentages of never-smokers increased with age (table 4). Over the study period, however, there was evidence of an increase in smoking cessation among younger women. In contrast to men, the prevalence of ex-smokers in women decreased with age. The percentages of ex-smokers increased and current smokers decreased (giving credence to an actual decline in smoking) in Stanford and Newcastle and among younger women in Glostrup (Denmark). There was also evidence of increases in the adoption of smoking (demonstrated by declines in never-smoking and increases in current and ex-smoking) in most age groups in several populations: Catalonia, Augsburg (urban), North Karelia (Finland), Tarnobrzeg Voivodship, and the Swiss centres.

Trends in smoking behaviour by birth cohort were examined to elucidate further the patterns of change (results not shown here). In populations where smokers are quitting, decreases in prevalence of current smoking and corresponding increases in prevalence of ex-smoking are to be expected. This pattern was indeed apparent in many populations. Downward trends in prevalence of never-smoking indicate people taking up smoking for the first time. This was evident among men in Beijing and among women in the urban population of Augsburg and in Ticino. Increases in the prevalence of never-smoking within birth cohorts are logically impossible. Where such changes are seen, they suggest either changes in the representativeness of the study samples between the two surveys due to differences in response rate or demographic changes—for example, because of migration—or changes in reporting behaviour. Large increases in the reported prevalence of never-smoking within birth cohorts were apparent among men and women in some populations in East Germany, and in the Czech Republic and Gothenburg (Sweden); among men only in Warsaw, Kaunas (Lithuania), and the populations in Russia; and among women only in Novi Sad (Yugoslavia) and Friuli (Italy).

Among men but not women, there were statistically significant differences in the prevalence of smoking between groups defined by level of education, adjusted for birth cohort and population (table 5). The prevalence of smoking was highest in the groups with least education and decreased with increasing education. Between the two surveys the decreases in smoking prevalence showed only small and not statistically significant differences between educational groups in both men and women.

Discussion

Among men, the prevalence of smoking was generally high in eastern European and lowest in some northern European populations. In most populations smoking among men declined during the study period, continuing trends that had begun earlier. There was consistent evidence of reductions in the proportions of current smokers and increases in the proportions of ex-smokers. In Beijing, however, the prevalence of smoking in men increased by 11 percentage points overall. Among women, smoking increased in most populations where the prevalence was low. In populations where prevalence was high, smoking among women declined and the patterns were similar to those for men. Our results are thus consistent with the model proposed by Lopez *et al*.[8]

The strength of this study is that data were collected by methods standardised over time and among populations in countries with widely varying prevalences of smoking for men and women. Only survey results satisfying specified criteria for acceptable quality are included in the analyses presented here.

In this study the changes in smoking refer to populations, not individuals, as the data were

Table 3b Five-year trends (absolute changes in percentage points) in prevalence of cigarette smoking among women by 10-year age groups and age-standardised trends for ages 35–64 years

Population	Age-specific 5-year trend age groups: 25–34	35–44	45–54	55–64	Age-standardised trend (35–64 years) (SE)
USA-STA	−8	−15	−4	−8	−9.4 (2.2)
UNK-BEL	−11	−4	−8	−15	−8.4 (3.7)
AUS-NEW	NA	−9	−5	−7	−7.0 (1.8)
RUS-MOI	NA	−12	3	−10	−6.1 (2.5)
UNK-GLA	−4	−5	−7	−4	−5.5 (2.6)
DEN-GLO	−8	−14	1	2	−4.6 (3.6)
SWE-GOT	−14	−9	−2	0	−4.3 (2.5)
GER-KMS	4	0	−8	−5	−4.2 (1.4)
ICE-ICE	−5	−7	−1	−4	−4.0 (2.3)
CHN-BEI	1	−2	−1	−7	−3.0 (2.3)
ITA-FRI	−11	−8	4	−4	−2.8 (3.8)
YUG-NOS	2	4	−2	−7	−1.1 (3.1)
ITA-BRI	−2	3	−1	−5	−0.6 (3.4)
FIN-TUL	−2	2	−2	0	−0.1 (1.9)
GER-BER	−10	1	1	−2	0.0 (3.7)
SWE-NSW	−4	−1	−2	4	0.1 (3.2)
RUS-NOI	7	3	−2	−1	0.1 (1.5)
RUS-NOC	2	2	−1	0	0.2 (1.4)
AUS-PER	−1	−2	3	0	0.3 (2.4)
LTU-KAU	NA	2	−1	0	0.4 (1.3)
FIN-KUO	−2	6	−3	−2	0.5 (1.6)
HUN-PEC	−1	1	0	2	1.0 (1.9)
GER-COT	2	1	−1	4	1.0 (2.5)
GER-HAC	−1	6	−3	2	1.7 (1.8)
SWI-VAF	3	1	5	3	2.8 (2.9)
FIN-NKA	−4	4	3	0	2.8 (1.2)
GER-AUR	−2	4	4	−1	2.8 (1.7)
CZE-CZE	−9	1	7	2	3.5 (3.0)
RUS-MOC	NA	3	9	−3	3.7 (3.2)
SWI-TIC	NA	7	8	−1	5.2 (3.7)
POL-WAR	NA	13	7	−8	5.7 (2.8)
SPA-CAT	14	11	4	3	6.2 (1.6)
POL-TAR	NA	18	3	1	8.0 (1.9)
GER-AUU	−1	15	4	6	8.8 (2.1)

SE = standard error.
NA = data not available.

Table 4 Mean prevalence (%) in each category of smoking status estimated for 1986 and mean five-year trend (in percentage points), by age group

	Age (years): 25–34	35–44	45–54	55–64
Men				
Prevalence in 1986				
current smokers	46	43	38	32
ex-smokers	16	24	27	37
never-smokers	36	32	34	30
Five-year trend				
current smokers	−3*	−3*	−4*	−4*
ex-smokers	−2	2	0	−1
never-smokers	6*	1	4*	5*
Women				
Prevalence in 1986				
current smokers	30	25	19	15
ex-smokers	13	11	9	9
never-smokers	56	63	72	76
Five-year trend				
current smokers	−2*	1	0	−2*
ex-smokers	3*	3*	1*	1
never-smokers	0	−3*	−2	2

*Significantly different from zero ($p<0.05$).

obtained on independent samples taken at different times. This multiple cross-sectional study design is appropriate for estimating changes in populations. Estimates of smoking prevalence, and changes in prevalence, all have associated standard errors. These were not taken into consideration in the calculation of correlations and as a result the strength of association may have been underestimated somewhat.[9] Only trends in cigarette smoking are discussed and not trends in other uses of tobacco, such as smoking cigars, cigarillos, or cheroots, or taking oral snuff.

In most of the study populations, smoking prevalence among men was lower among those with higher education. The declines in smoking prevalence in groups defined by level of education were very variable and there were no consistent patterns. For example, in Beijing where the prevalence of smoking is rising, increases were greater among less educated men than more educated men in each age group. Among women, there were no consistent patterns of prevalence or change in smoking in relation to education. It is possible that five years is too short a period to demonstrate different rates of change between educational groups.

It is possible that under-reporting of current smoking and over-reporting of never-smoking may have increased between the two surveys, possibly because of growing attitudes against smoking in many populations. This could account for some of the large increases in prevalence of never-smoking, as they occurred in populations with relatively high and stable response rates for the two surveys. Major demographic changes could also be the cause in some of the populations. As the strength of public opinion against smoking increases, the possibility of mis-reporting may increase so that validation of self-reported behaviour will become an important issue.

The problem of smoking among women requires special attention. In populations where few women smoke, our data show clear evidence of middle-aged women taking up smoking. This may reflect responses to intensive, targeted advertising campaigns, as well as profound societal changes in some populations. It presents a new challenge for public health. The increases in smoking among middle-aged women are additional to the increases in smoking among girls and young women reported from many countries.[10] The youngest group of women included in the WHO MONICA Project, those aged 25–34 years, showed the greatest declines in smoking prevalence. However, this group is older than the adolescents about whom concern is usually expressed and it is the age group where most pregnancies occur in many developed countries. Pregnancy could be a reason for cessation of smoking, and our results provide some evidence that women, who may have begun to smoke as teenagers or in early adulthood, give up smoking in their twenties and thirties.

In many of the populations in this study, there have been intensive programmes to control tobacco and there is evidence that these have been effective. For example, some of the largest declines were in California where there has been a long-established, multifaceted, antismoking campaign. In many populations there have been extensive health promotion campaigns. The implications for public health policy of the findings reported here are that activities aimed at changing community and individual attitudes need to be maintained or intensified to reduce cigarette smoking, especially among women and in those countries where smoking prevalence is high.[11]

Table 5 Prevalence (%) of current smoking by educational groups: mean at mid-point of the two surveys and mean five-year trend (age standardised for 35–64 years) in percentage points

	Educational group			
	Low	*Middle*	*High*	*p**
Men				
Prevalence at the mid-point of the two surveys	46	42	33	0.0001
5-year trend compared with low-education group	—	−0.3	−0.1	0.71
Women				
Prevalence at the mid-point of the two surveys	22	22	20	0.12
5-year compared with low-education group	—	0.5	0.2	0.16

*p-value obtained from regression models with terms for educational group, population, birth cohort, and, for analysis of trends, prevalence of smoking at the mid-point between the two surveys.

The International Union Against Cancer tripartite strategy provides a comprehensive approach to tobacco control, covering legislation (including, for example, taxation, restrictions on sales and promotion, and cigarette yield), education (to limit adoption and to encourage cessation of cigarette smoking), and cessation activities (using a variety of methods).[12] As such strategies are more widely adopted, significant declines in smoking may be anticipated. The WHO MONICA Project, which is monitoring smoking over a 10-year period, provides an opportunity for evaluating the effectiveness of campaigns in a large number and range of communities.

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