Mortality among male and female smokers in Sweden: a 33 year follow up

S Nilsson, J M Carstensen, G Pershagen

Abstract

***Study objective*—It is still unclear if men and women are equally susceptible to the hazards of tobacco smoking. The objective of this study was to examine smoking related mortality among men and women.**

***Design*—In 1963 a questionnaire concerning tobacco smoking habits was sent out to a random sample from the 1960 Swedish census population. Date and cause of death have been collected for the deceased in the cohort through 1996.**

***Setting*—Sweden.**

***Participants*—The survey included a total of 27 841 men and 28 089 women, aged 18–69 years. The response rate was 93.1% among the men and 95.4% among the women.**

***Main results*—After adjustment for age and place of residence positive associations were found between cigarette smoking and mortality from ischaemic heart disease, aortic aneurysm, bronchitis and emphysema, cancer of the lung, upper aerodigestive sites, bladder, pancreas in both men and women, but not from cerebrovascular disease. When the effect of amount of the cigarette consumption was considered, female smokers displayed, for example, slightly higher relative death rates from ischaemic heart disease. However, no statistically significant gender differential in relative mortality rates was observed for any of the studied diseases.**

***Conclusions*—Women and men in this Swedish cohort seem equally susceptible to the hazards of smoking, when the gender differential in smoking characteristics is accounted for. Although the cohort under study is large, there were few female smokers in the high consuming categories and the relative risk estimates are therefore accompanied by wide confidence intervals in these categories.**

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Department of Health and Society, Tema Institute, Linköping University, Linköping, Sweden
S Nilsson
J M Carstensen

Division of Environmental Epidemiology, Institute of Environmental Medicine, Karolinska Institute, Stockholm, Sweden
G Pershagen

Correspondence to:
Dr Nilsson
(stani@tema.liu.se)

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Table 1 The cohort under study according to sex and smoking characteristics in 1963

	Women		*Men*	
	Number	*%*	*Number*	*%*
Total number included in the study	25086		16458	
Age (y)				
18–29	4036	16.1	2861	17.4
30–39	3120	12.4	2051	12.5
40–49	3538	14.1	2397	14.6
50–59	8253	32.9	5421	32.9
60–69	6139	24.5	3724	22.6
Residence				
Major towns	6593	26.3	4012	24.4
Other towns	9227	36.8	5609	34.1
Rural districts	9266	36.9	6839	41.6
Smoking status				
Never smokers	19 355	72.2	8156	49.6
Former smokers	1155	4.6	3794	23.1
Current cigarette smokers	4576	18.2	4508	27.4
Number of daily cigarettes*				
1–7	2515	55.0	1650	36.6
8–15	1650	36.1	1652	36.7
16–25	390	8.5	1042	23.1
More than 25	21	0.5	164	3.6
Inhalation*				
Non-inhalers	448	9.8	285	6.3
Inhalers	4128	90.2	4223	93.7
Age when started smoking*				
<25	3076	67.2	4072	90.3
⩾25	1500	32.8	436	9.7

*Among current cigarette smokers.

Historically female smokers have been at a lower mortality risk than male smokers.[1–5] It has been argued that these results are reflections of the fact that women have been smoking less heavily and for a shorter period of time than men.[5 6] Over the past couple of decades the number of women who smoke have increased dramatically. Accordingly, more recent studies with longer follow up have presented mortality rates of women more similar to those of men and some studies have even suggested that women may be more sensitive to some of the adverse health effects of smoking.[7–10]

Studies with a representative selection of national populations are scarce. Furthermore, additional studies of the long term effects of smoking among women have been recommended to further examine possible differences in susceptibility and aetiology between men and women.[10] The objective of this study was to contribute to this knowledge by comparing the relations between smoking and selected smoking related diseases among men and women in a large prospective cohort created from a random sample of the 1960 Swedish census population.

Methods

This study is based on the Swedish 1963 smoking habit survey, earlier described in detail.[2 11] Briefly, the smoking habit survey is based on a age stratified sample of 55 930 people (27 841 men and 28 089 women), aged 18–69 years, selected randomly from a register of the 1960 Swedish census population. Through three questionnaires and additional follow up telephone interviews a total response rate of 94.2% (95.4% for women and 93.1% for men) was achieved. The survey consisted of, for example, questions about present and former (previous nine years) consumption of different types of tobacco, duration of smoking,

*Table 2 Number of deaths, relative death rates (RR), and 95% confidence intervals (CI) for women and men by never, former, and current smokers for selected causes of death (ICD 8) with never smokers as reference group**

		Never	Former			Current		
Cause of death (ICD 8)	*Gender*	*Deaths*	*Deaths*	*RR*	*95% CI*	*Deaths*	*RR*	*95% CI*
Cancer of the upper aerodigestive sites (140–150, 161)	*Women*	49	2	1.16	0.28,4.83	11	1.95	0.97,3.90
	Men	18	17	1.77	0.91,3.46	33	3.24	1.79,5.84
Cancer of the liver and biliary passages (155–156)	*Women*	161	7	0.98	0.46,2.11	22	0.90	0.57,1.44
	Men	36	19	1.00	0.57,1.75	40	2.29	1.44,3.64
Cancer of the pancreas (157)	*Women*	147	9	1.52	0.77,3.01	34	1.72	1.16,2.55
	Men	39	30	1.48	0.92,2.40	55	2.95	1.93,4.52
Cancer of the trachea, bronchus and lung (162)	*Women*	103	5	0.97	0.39,2.40	91	4.87	3.58,6.62
	Men	36	30	1.47	0.91,2.40	177	9.40	6.53,13.6
Cancer of the bladder (188)	*Women*	57	2	1.02	0.24,4.21	9	1.39	0.67,2.92
	Men	24	29	2.17	1.26,3.74	25	2.18	1.23,3.86
Ichaemic heart disease (410–414)	*Women*	3220	115	1.16	0.96,1.40	491	1.58	1.43,1.75
	Men	1632	931	1.06	0.97,1.15	999	1.43	1.32,1.55
All cerebrovascular disease (430–438)	*Women*	1541	41	0.85	0.62,1.16	155	1.03	0.87,1.23
	Men	489	287	1.09	0.94,1.26	197	0.99	0.83,1.17
Aortic aneurysm (441)	*Women*	62	1	0.42	0.06,3.02	27	3.43	2.11,5.59
	Men	32	27	1.57	0.94,2.63	47	3.30	2.08,5.23
Bronchitis and emphysema (490–492)	*Women*	57	4	1.56	0.56,4.34	59	7.16	4.83,10.6
	Men	31	34	1.92	1.18,3.14	90	6.83	4.49,10.4
Peptic ulcer (531–534)	*Women*	67	4	1.97	0.71,5.46	15	2.26	1.25,4.08
	Men	32	20	1.06	0.61,1.87	32	2.14	1.29,3.54
Cirrhosis of the liver (571)	*Women*	43	3	1.25	0.38,4.09	29	1.27	0.63,2.55
	Men	27	19	1.27	0.70,2.30	9	1.63	0.95,2.78
Accidents, suicide and violence (E800–E999)	*Women*	416	21	1.46	0.93,2.29	73	1.48	1.13,1.95
	Men	390	65	0.71	0.53,0.94	132	1.41	1.12,1.77
All cause mortality	*Women*	10 778	365	0.96	0.87,1.07	1673	1.37	1.30,1.45
	Men	4454	2528	1.05	1.00,1.11	2673	1.38	1.32,1.45

*All rates are standardised by age and place of residence.

age when taking up the habit, manner of smoking, and quantity. The questions about quantity smoked were answered by fixed response alternatives, 1–3, 4–7, 8–15, 16–25 and more than 25 cigarettes smoked per day, respectively. In the analysis the categories 1–3 and 4–7 were merged because of because of small numbers.

Information on mortality was obtained from the Cause of Death Registry of the Swedish Central Bureau of Statistics, which collects and codes all death certificates in Sweden. By using the 10 digit civic registration number, unique to every person living in Sweden, record linkages have been possible between the smoking habit survey and the Cause of Death Registry. All deaths through 1996 have been collected. In the analysis the first five years of follow up (up to 1968) were excluded to reduce the risk of inverted causality—that is, that the individual changes the smoking habit because of the lethal disease. Since 1987 underlying and contributing causes of death in the Cause of Death Registry have been coded according to the 9th revision of the international Classification of Diseases (ICD) and between 1969 and 1987 according to the 8th revision. In the analysis all classifications have been translated to the 8th revision according to a translation list constructed by the Central Bureau of Statistics.[12] The analysis of the cause specific mortality has been restricted to the underlying cause of death.

Cox proportional hazards regression model[13] was used to calculate cause specific relative mortality rates for different groups defined by smoking habits (that is, amount smoked). Using a stratified Cox model the rates were standardised both by age in 1963 in seven age groups (18–29, 30–39, 40–49, 50–54, 55–59, 60–64, 65–69 years), and place of residence in three categories: major towns (Stockholm, Gothenburg, Malmö), other towns, and rural districts. This stratified model is less restricted as it permits a different (non-proportional) baseline hazards function in each of the subgroups defined.[13] Dose-response tests were calculated for trends in the rates where never smokers, smokers of 1–7, 8–15, 16–25, and more than 25 cigarettes per day were coded as 1, 2, 3, 4, and 5 respectively (former smokers are not included). Smokers of cigarettes only are included in this study because less than 1% of the women smoked other tobacco products compared with 36% of the men. The male smokers of other tobacco products, mostly pipe smokers, have previously been analysed as a separate group.[14] The reference group consists of those who reported that they had never smoked any tobacco products regularly. Finally, when non-codable answers were excluded, a total of 16 458 men and 25 086 women were included in the analysis and a total of 877 635 person years were accumulated (547 889 among the women and 329 736 among the men). The women started smoking at a later age than the men in the cohort, with an average age of debut of 22.9 and 18.6 years respectively. Furthermore, 10% of the female and 6% of the male smokers were non-inhalers. A further description of the cohort under study is given in table 1.

As the female smokers have started smoking at an older age than the male smokers have, we divided the cohort according to age at smoking debut. We divided the cohort into those who started smoking before 25 years of age and those who were 25 years or older and analysed the groups separately.

We have chosen to present the relative death rates for selected causes of death considered to be closely related to smoking previously[3–5 15–17] or otherwise viewed as interesting, for example, alcohol related.

Results

Increased relative risks, with 95% confidence intervals (CI) not covering unity, among all current smokers (with never smokers as reference)

(table 2) as well as significant dose-response trends with amount smoked (table 3) were seen for ischaemic heart disease, aortic aneurysm, bronchitis and emphysema, peptic ulcer, cancer of the trachea, bronchus and lung, accidents, suicide and violence, and all causes of death for both male and female smokers. In addition both male and female current smokers displayed significantly increased risks of cancer of the pancreas (table 2), and the male smokers also showed a significant dose-response relation with number of cigarettes smoked per day (table 3). Furthermore male current smokers displayed significantly increased risks of cancer of the upper aerodigestive sites, liver and biliary passages, and bladder (table 2). Male smokers also displayed a significantly positive dose-response relation with number of cigarettes smoked for cancer of the upper aerodigestive sites, cancer of the liver and cirrhosis of the liver (table 3). Notably no statistically significantly increased relative risk of all cerebrovascular disease or any specific cerebrovascular diagnosis was observed at any level of exposure for either men or women.

No major differences were found between male and female smokers in the relative risks of any of the studied diseases other than tumour diseases, where the male current smokers displayed consistently higher relative risk estimates than the female current smokers did (table 2). There were, however, no significant differences in relative death rates between male and female smokers at different levels of exposure (table 3).

When analysing the follow up period in two parts there was a tendency towards lower relative mortality from ischaemic heart disease and all cause mortality in the later part of the follow up period, 1982–96, than the earlier, 1969–82, for male smokers (table 4). There were no significant differences in relative death rates between male and female smokers, at any level of exposure, in either of the two periods of follow up.

After dividing the cohort according to age at smoking debut it was shown that younger age at debut seems to increase the risks of all cause mortality among both male and female smokers. The relative death rates of ischaemic heart disease and all cause mortality were somewhat higher in female smokers. However, the confidence intervals are wide and the differences were not significant (table 5).

Excluding the non-inhalers did not change the results in any substantial way (table 6). Though women and men display a different pattern of inhalation, self described degree of inhalation proved to have little impact on the relative risk estimates of the studied diseases and an even smaller effect on the male/female risk ratios.

*Table 3 Number of death, relative death rates (RR), and 95% confidence intervals (CI) for female and male smokers by amount smoked for selected causes of death with never smokers as reference group**

	Number of cigarettes smoked per day												
	1–7			*8–15*			*16–25*			*>25*			*Test for trend †*
	Number	*RR*	*CI*	*Number*	*RR*	*CI*	*Number*	*RR*	*CI*	*Number*	*RR*	*CI*	
Cancer of the upper aerodigestive sites													
Women	6	1.72	0.72,4.10	5	2.90	0.36,23.5	0	—	—	0	—	—	0.13
Men	9	2.38	1.06,5.32	8	2.24	0.96,5.24	15	6.84	3.33,14.1	1	2.48	0.32,19.0	<0.0001
Cancer of the liver and biliary passages													
Women	13	0.93	0.52,1.65	8	0.97	0.47,2.01	1	0.52	0.07,3.73	0	—	—	0.57
Men	9	1.26	0.61,2.63	14	2.40	1.27,4.55	14	4.25	2.21,8.20	3	5.09	1.52,17.0	<0.0001
Cancer of the pancreas													
Women	24	2.05	1.31,3.20	7	1.06	0.49,2.31	3	1.96	0.61,6.25	0	—	—	0.081
Men	18	2.35	1.34,4.12	18	2.87	1.61,5.10	15	4.07	2.18,7.60	4	6.44	2.25,18.5	<0.0001
Cancer of the trachea, bronchus and lung													
Women	29	2.77	1.81,4.24	44	7.31	4.98,10.7	16	10.6	6.09,18.4	2	23.6	5.70,97.3	<0.0001
Men	23	3.15	1.86,5.33	68	10.8	7.14,16.4	71	20.6	13.5,31.4	15	25.8	13.9,48.1	<0.0001
Cancer of the bladder													
Women	2	0.52	0.13,2.16	4	2.05	0.72,5.87	2	4.18	0.98,17.9	1	41.6	5.31, 327	0.028
Men	7	1.43	0.61,3.32	12	3.11	1.53,6.33	6	2.71	1.08,6.80	0	—	—	0.0093
Ischaemic heart disease													
Women	289	1.47	1.30,1.66	153	1.69	1.43,2.00	46	2.24	1.67,3.01	3	2.06	0.66,6.39	<0.0001
Men	393	1.24	1.11,1.38	354	1.52	1.35,1.71	210	1.70	1.46,1.97	42	2.01	1.48,2.74	<0.0001
All cerebrovascular disease													
Women	94	0.99	0.80,1.22	55	1.26	0.95,1.65	6	0.59	0.26,1.31	0	—	—	0.82
Men	86	0.92	0.73,1.16	69	1.05	0.81,1.36	34	1.00	0.70,1.42	8	1.43	0.71,2.90	0.71
Aortic aneurysm													
Women	12	2.54	1.34,4.80	15	6.14	3.35,11.3	0	—	—	0	—	—	<0.0001
Men	16	2.58	1.41,4.71	20	4.20	2.36,7.46	10	3.76	1.80,7.86	1	2.15	0.29,16.0	<0.0001
Bronchitis and emphysema													
Women	18	3.80	2.20,6.57	31	11.8	7.36,18.9	10	16.1	7.98,32.6	0	—	—	<0.0001
Men	19	3.30	1.86,5.85	36	8.46	5.15,13.9	32	15.9	9.34,30.0	3	8.39	2.52,28.0	<0.0001
Peptic ulcer													
Women	10	2.39	1.21,4.74	4	2.00	0.71,5.64	1	2.27	0.31,16.8	0	—	—	0.050
Men	12	1.80	0.92,3.50	10	1.98	0.96,4.12	8	3.20	1.42,7.20	2	3.64	0.85,15.6	0.0017
Cirrhosis of the liver													
Women	4	0.83	0.29,2.36	6	1.98	0.81,4.83	1	1.42	0.19,10.6	0	—	—	0.31
Men	5	0.84	0.32,2.18	10	1.55	0.74,3.24	11	2.51	1.22,5.16	3	4.00	1.19,13.5	0.0046
Accidents, suicide and violence													
Women	35	1.24	0.86,1.77	27	1.65	1.10,2.49	11	2.76	1.49,5.10	0	—	—	0.0008
Men	44	1.19	0.85,1.65	53	1.58	1.16,2.16	30	1.52	1.02,2.26	5	1.65	0.67,4.03	0.0019
All cause mortality													
Women	926	1.24	1.15,1.32	583	1.56	1.43,1.70	153	1.73	1.47,2.04	11	1.90	1.05,3.43	<0.0001
Men	993	1.15	1.08,1.24	944	1.46	1.36,1.56	627	1.81	1.66,1.97	109	1.84	1.52,2.23	<0.0001

*All rates are standardised for age and place of residence.
†Test for linear trend between smokers of 1–7, 8–15, 16–25, and >25 cigarettes per day in 1963.

*Table 4 Number of deaths, relative death rates (RR), and 95% confidence intervals (CI) presented by two periods of follow up, 1969–82 and 1983–96, for selected causes of death. Female and male smokers are displayed separately by amount smoked. Never smokers constitute the reference group**

		Number of cigarettes smoked per day											
		1–7			8–15			16–25			>25		
Period of follow up		Number	RR	CI	Number	RR	CI	Number	RR	CI	Number	RR	CI
Cancer of the trachea, bronchus and lung													
1969–82	Women	10	2.56	1.27,5.13	14	6.79	3.59,12.8	4	7.78	2.71,22.4	1	31.6	4.20, 237
	Men	13	3.14	1.56,6.36	35	10.4	5.90,18.5	32	19.6	10.8,35.5	11	40.5	18.9,86.7
1983–96	Women	19	2.90	1.69,4.99	30	7.59	4.68,12.3	12	12.0	6.25,23.2	1	18.7	2.53, 138
	Men	10	3.16	1.43,6.97	33	11.3	6.18,20.8	39	21.8	12.0,39.7	4	12.8	4.19,39.1
Ischaemic heart disease													
1969–82	Women	116	1.61	1.33,1.95	59	1.88	1.44,2.46	11	1.72	0.95,3.15	0	—	—
	Men	199	1.18	1.01,1.38	191	1.57	1.34,1.85	108	1.79	1.45,2.20	23	2.24	1.48,3.40
1983–96	Women	173	1.38	1.17,1.61	94	1.58	1.28,1.96	35	2.46	1.75,3.45	3	2.97	0.95,9.26
	Men	194	1.30	1.11,1.53	163	1.46	1.23,1.74	102	1.61	1.30,1.99	19	1.79	1.13,2.83
All cause mortality													
1969–82	Women	326	1.23	1.10,1.38	193	1.49	1.28,1.72	51	1.75	1.32,2.32	5	2.66	1.11,6.41
	Men	487	1.19	1.08,1.31	482	1.56	1.41,1.73	307	1.96	1.73,2.22	51	1.92	1.45,2.54
1983–96	Women	600	1.24	1.14,1.35	390	1.59	1.43,1.77	102	1.72	1.41,2.10	6	1.53	0.69,3.42
	Men	506	1.13	1.02,1.10	462	1.36	1.23,1.51	320	1.69	1.50,1.90	58	1.77	1.36,2.31

*All rates are standardised for age and place of residence.

*Table 5 Number of deaths, relative death rates (RR), and 95% confidence intervals (CI) presented by age of smoking debut, <25 years and ⩾25 years, for selected causes of death. Female and male smokers are displayed separately by amount smoked. Never smokers constitute the reference group**

		Number of cigarettes smoked per day											
		1–7			8–15			16–25			>25		
Age of smoking debut		Number	RR	CI	Number	RR	CI	Number	RR	CI	Number	RR	CI
Cancer of the trachea, bronchus and lung													
<25	Women	15	3.44	1.94,6.09	36	11.8	7.60,18.3	15	18.0	10.0,32.3	0	—	—
	Men	22	3.65	2.14,6.22	68	12.2	8.04,18.5	68	21.7	14.2,33.2	15	31.2	16.8,58.0
⩾25	Women	14	2.54	1.44,4.48	8	3.27	1.57,6.81	1	1.71	0.24,12.4	2	36.3	8.59,17.7
	Men	1	0.88	0.12,6.48	0	—	—	3	12.3	3.68,41.2	0	—	—
Ischaemic heart disease													
<25	Women	95	1.55	1.26,1.90	56	1.53	1.17,2.01	21	2.24	1.45,3.46	1	3.69	0.55,24.9
	Men	331	1.28	1.13,1.44	314	1.53	1.36,1.74	189	1.67	1.43,1.96	38	2.13	1.54,2.94
⩾25	Women	194	1.44	1.24,1.66	97	1.81	1.48,2.23	25	2.28	1.54,3.39	2	1.71	0.43,6.86
	Men	62	1.06	0.83,1.37	40	1.45	1.06,1.98	21	2.11	1.37,3.26	4	1.35	0.50,3.62
All cause mortality													
<25	Women	343	1.27	1.14,1.42	293	1.66	1.48,1.88	93	2.01	1.64,2.48	5	3.37	1.42,7.99
	Men	828	1.18	1.09,1.27	848	1.49	1.38,1.60	581	1.83	1.67,2.00	101	2.00	1.64,2.45
⩾25	Women	586	1.23	1.13,1.34	290	1.48	1.32,1.67	60	1.45	1.12,1.87	6	1.43	0.64,3.19
	Men	165	1.05	0.90,1.23	96	1.27	1.04,1.56	46	1.68	1.26,2.25	8	0.92	0.46,1.84

*All rates are standardised for age and place of residence.

*Table 6 Number of deaths, relative death rates (RR), and 95% confidence intervals (CI) for female and male smokers, excluding non-inhalers, by amount smoked for selected causes of death with never smokers as reference group**

	Number of cigarettes smoked per day											
	1–7			8–15			16–25			>25		
	Number	RR	CI	Number	RR	CI	Number	RR	CI	Number	RR	CI
Cancer of the trachea, bronchus and lung												
Women	26	3.23	2.06,5.06	41	7.70	5.17,11.5	16	11.5	6.62,20.1	1	12.5	1.71,90.9
Men	17	2.69	1.51,4.80	67	11.4	7.50,17.3	68	20.9	13.7,32.0	15	29.9	14.4,50.1
Ischaemic heart disease												
Women	209	1.49	1.29,1.72	135	1.73	1.45,2.06	40	2.13	1.55,2.92	2	1.75	0.43,7.01
Men	339	1.24	1.10,1.39	332	1.51	1.34,1.70	200	1.68	1.45,1.96	39	1.92	1.39,2.65
All cause mortality												
Women	697	1.27	1.17,1.37	528	1.59	1.45,1.74	141	1.73	1.46,2.04	8	1.67	0.84,3.35
Men	856	1.15	1.07,1.24	896	1.46	1.36,1.57	600	1.81	1.66,1.97	106	1.84	1.52,2.24

*All rates are standardised for age and place of residence.

Discussion

Swedish men began smoking to a larger extent around the second world war and women 20 years later. The proportion of daily smokers among men in Sweden peaked in the 1960s, when nearly half of the male population were daily smokers, and the rates then decreased to remain stable for the past 15–20 years.[11 18] At the same time the rates for women have been steadily increasing, particularly in the younger age groups. This has resulted in a larger proportion of daily smokers among women than men in the younger age categories. Today women and men in Sweden, overall, smoke to the same extent and the proportion of daily smokers is between 20 and 25%.[19]

It should be noted that smoking is not the sole risk factor of the diseases in this study. Potential confounders apart from those explicitly assessed and accounted for (place of residence and age) are, for example, diet, stress, physical activity, alcohol consumption, socioeconomic status and occupational exposures. The socioeconomic gradient in smoking does not differ between men and women in this cohort.[11]

Alcohol consumption has been associated with increased risks of, for example, cancer of

the upper digestive tract,[20] cerebrovascular disease and ischaemic heart disease.[21] Differences in alcohol consumption between different groups may, in Sweden, to some extent be indicated by the incidence of the largely alcohol related diseases cancer of the liver[20] and cirrhosis of the liver.[22] The relative risks of accidents, suicide and violence was significantly increased among both men and women and also these causes of death may be associated with certain lifestyles. The relative risks of both cirrhosis and cancer of the liver is clearly higher among the men than the women in this study and this could partly be a result of a higher alcohol consumption than expected among the men in the sample. It is therefore possible that the effects of smoking are somewhat less pronounced for certain causes than indicated in this study, especially for men.

It should be pointed out that we have not been able to adjust for any changes in smoking habits after 1963. Any gender differences in smoking cessation are probably small[23] and have only limited effects on the results. During the 1960s and 70s the proportion of female smokers increased, especially women in the younger age categories started smoking. It is therefore possible that a higher proportion of the younger women than the younger men took up smoking after the smoking habits were registered. However, in the study only 1.3% of the deaths occurred among women between 18 and 29 years old in 1963 and the potential effects on results are probably small. It is also rare to take up smoking at an older age and the possible bias is therefore negligible.[24] In 1963 smoking was socially accepted and bias attributable to underreporting is probably small. Notably only few women smoked more than 15 cigarettes per day in 1963. This gives rise to somewhat more unstable relative risk estimates in these categories and the statistical power to detect differences in dose-response gradient between men and women is therefore limited.

Consistently with previous studies clear associations between smoking and the risk of ischaemic heart disease, aortic aneurysm, peptic ulcer, bronchitis and emphysema, were observed for both men and women.[3–5 14–17] In this study men and women seem to be at equal risks for most of these smoking related hazards as similar associations were found for both genders at different levels of tobacco exposure from cigarettes. However, the female smokers consistently displayed higher relative death rates from ischaemic heart disease than the male smokers did, though not significantly. This gender difference has also previously been reported.[10] In this study no association was found between smoking and cerebrovascular disease at any level of tobacco exposure for either men or women. In some previous research cerebrovascular disease has been considered to be partly caused by smoking.[16 17 21] There are however some other studies that have failed to show any association between smoking and some forms of cerebrovascular diseases[25 26] and the relation is still a matter of debate.[27] It should be noted that cerebrovascular disease is a broad category of diseases with a complex aetiology.[5]

KEY POINTS
- Smoking increases the mortality from, for example, ischaemic heart disease, bronchitis, emphysema, and cancer at several sites in both men and women.
- There was no increased cerebrovascular mortality among either male or female smokers in this cohort.
- Swedish women and men seem equally susceptible to the hazards of smoking.
- The negative effects of smoking among Swedish women will largely appear in the future.

Statistically significant relations between cigarette smoking and cancers of the lung, upper aerodigestive sites, bladder and pancreas have consistently been observed among both men and women.[3–6 10 15 17 18] These findings are in line with the results from this study.

When all current smokers were compared with never smokers, not adjusted for amount, the male smokers generally displayed higher relative risks of cancer than the female smokers did. This gender differential was reduced when the current smokers were divided into groups by amount smoked. The fact that female current smokers are at a lower relative risk than male current smokers seems to be a result largely of the lack of female smokers in the high consuming categories. It seems as if different levels of exposure largely can explain the difference between the genders in mortality rates from tumour diseases. This is not unexpected as men took up smoking earlier than women, and men have also generally been smoking more heavily than women.[21]

It should be noted that a similar relative risk in women and men related to smoking does not mean that the habit has the same public health consequences. The baseline mortality rates are lower in women than in men, for, for example, ischaemic heart disease, which leads to lower absolute risk differences if the relative risks are equal.

In conclusion, this representative study of Swedish men and women shows that women are generally as susceptible to the negative consequences of smoking as men are. It should be noted that although the cohort is large the number of women smoking more than 16 cigarettes per day is limited. The relative risk estimates for the female smoker in the high consuming categories should therefore be interpreted with caution. As men are smoking less at the same time as there has been an increase in the number of female smokers it can be expected that male smoking related mortality will decrease at the same time as the negative effects of smoking among women will largely appear in the future.

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