

Health Consequences of Giving up Smoking in a Prospective Population Study of Middle-Aged Swedish Men

The Study of Men Born in 1913

Agneta Hjalmarsson and Kurt Svärdsudd

*From the University of Göteborg, the Section of Preventive Cardiology at Sahlgrenska Hospital
and at Östra Hospital, Gothenburg, Sweden*

ABSTRACT. The effect when persons quit smoking was studied in a prospective study of 855 50-year-old men randomly selected from the general population of Gothenburg, Sweden. These men have been followed since 1963. For this report, data from the first ten years of follow-up were used. The survivors from this period were divided into three groups: those who had never smoked, those who were smokers at the first examination but not since (ex-smokers), and those who were smokers at all three examinations. Compared to ex-smokers, the smokers had a steeper decrease of bronchial peak flow, more days of sick leave, more complaints and poorer self-assessed life situation score. After adjusting for possible confounding factors and differences in morbidity prevalence between the groups at the start of the study, the smokers still had a more unfavorable health course than the ex-smokers.

Key words: smoking, health, population study.

Acta Med Scand 210:93, 1981.

Since the 50s, evidence for negative health consequences of smoking has rapidly accumulated. The association between cigarette smoking and increased morbidity and mortality from ischemic heart disease, cancer of the respiratory tract, chronic bronchitis and peripheral vascular disease is by now well known. The effects of cessation of smoking on other health indices are, however, less well known. The purpose of this study was to analyze the consequences of quitting smoking on various health indices in a random sample of middle-aged Swedish men.

STUDY POPULATION

All inhabitants of Sweden have a national registration number that includes date of birth, sex and other vital

statistics. These numbers are stored in a population register with names and addresses. The population from which the sample for this study was drawn consisted of all men born in 1913 and living in the city of Gothenburg, Sweden. A random sample consisting of one third of this population was drawn from the population register in 1963, using the date of birth as the sampling criterion. Of the 973 men in the sample, 855 agreed to be examined (7) and have been followed at re-examinations in 1967 and 1973. Mortality and some other end-points have been registered continuously.

METHODS

During the examinations in 1963, 1967 and 1973, the smoking habits were recorded and graded as never smoked (non-smokers), stopped smoking more than one month ago (ex-smokers), and presently smoking (smokers). The sample was divided into three groups according to the smoking habits. Group 1: 118 men who declared themselves as non-smokers in 1963, 1967 and 1973, group 2: 22 men who were smokers in 1963 but ex-smokers in 1967 and 1973, group 3: 250 men who were smokers on all three occasions. The other 465 men, i.e. those who died during the first ten years of follow-up and those who changed their smoking habits in ways other than mentioned above, were analyzed separately. The intention of the study was to contrast the ex-smokers as a reference group.

Airway function was measured as Wright's peak flow in 1963 and 1973. Based on their profession, the men were given a social class code 1 (blue collar workers), 2 (white collar workers), or 3 (professionals).

Information on marital status and employment, including data on disability pensions and other pensions, was collected by interview. Information on alcohol intemperance was obtained from the local Temperance Board. Data on sick leave from 1955 until 1973 were obtained from the Social Insurance Office. These data were coded as number of days and number of periods of sick leave 1955-63 and 1964-73.

In 1973 the participants were asked questions about the presence or absence of 30 specified symptoms like joint

Correspondence to: Kurt Svärdsudd, M.D., Section of Preventive Cardiology, Department of Medicine, Östra Hospital, S-41685 Gothenburg, Sweden.

Acta Med Scand 210

TIMN 261227

Table I. Social class, marital status and registration for alcohol intemperance in 1963 and retirement from work 1963-73

	Non-smokers (n=118)	Ex-smokers (n=22)	Smokers (n=250)	p<
Social class (mean score)	1.77	1.73	1.64	n.s.
Married (%)	82	86	89	n.s.
Retired (%)	12.9	4.5	16.5	n.s.
Registered by Temperance Board (%)	8.5	9.1	24.8	0.0001

problems, fatigue, lightheadedness, unusual loss of hair, impairment of vision, impairment of hearing, and so on. The aim was not to collect data on the separate items but to estimate a "complaint level" as a measure of well-being. The number of affirmative answers was used as an estimate of this level.

An effort was also made to measure changes in the overall life situation of these men. In 1973 they were asked to assess their work situation, domestic situation, financial situation, housing situation, health, hearing, sight, memory, level of physical fitness, appetite, temperament, energy, patience, self-confidence and sleep, as experienced in 1963 and 1973, using a code ranging from "excellent, could not be better" (=1), to "very bad" (=7). The change in the sum of codes from 1963 to 1973 was used as a measure of change in life situation.

Statistical methods

Differences in mean values and frequencies between groups were estimated by a non-parametric test for partial correlation. The smoking habit groups were arbitrarily given the values 0 (non-smokers), 1 (ex-smokers) or 2 (smokers) to make the test equivalent to a trend test. In this way differences between ex-smokers and smokers were accepted only if they were part of a trend from non-smokers to smokers. The same test was used for multivariate analyses. In these instances the population was stratified according to the confounding variable(s). The analyses of interest were then performed in each stratum. The results from the different strata were pooled using a special technique described by Mantel (4).

Table II. Average level of a number of health indices

	Non-smokers	Ex-smokers	Smokers	p<
Peak flow 1973 (ml)	492	476	436	0.0001
Sick leave 1955-63				
Days	91	96	114	0.01
Periods	3.9	3.5	5.5	0.005
Sick leave 1964-73				
Days	145	232	287	0.001
Periods	7.8	7.5	9.8	n.s.
Complaint score	3.8	4.9	5.6	0.0001
Life situation 1963	29	32	30	n.s.
Life situation 1973	34	35	37	0.05

RESULTS

Social background

The smokers tended to have a lower social class score and higher frequencies of retirement and registration for alcohol intemperance than the ex-smokers and non-smokers. The percentage of married men was somewhat higher in group 3 than in groups 1 and 2. Only the difference in registration for alcohol intemperance was statistically significant (Table I).

Health indices

There was a significant difference in peak expiratory flow rate between the three groups (Table II). Non-smokers had a higher peak flow than ex-smokers, who in turn had higher values than smokers. However, smokers had had the lowest peak flow at the start of the study. The differences found during the follow-up might therefore reflect differences at the start of the study. After adjusting for these differences in prevalence at the start of the study, the differences at the end of the study were still significant, indicating that smokers had the fastest decline in peak flow during the follow-up period.

Smokers had the largest and non-smokers the low-

est number
low-up per
ences in the
differences
period before
initial differ
analyzed at
The result
a more uni
smokers an

Smokers
smokers, v
smokers. T
situation se
were weak
were still s
the groups

Multivariate

Since the
what differ
health cou
due to soc
Thus, the
confoundin
social bac
only regist
some exte
this respec
the three
leave, con
during th
analysis,
tors—alco
prevalence
account, a
more day
more neg
ex-smoker
period.

Possible i

It is well
stop smok
To make
precise, o
a stable c
period aft
in this st
original c
have cau

est numbers of days of sick leave during the follow-up period. There were no significant differences in the number of periods. There were similar differences between the groups in the nine-year period before the study started. To allow for these initial differences, the sick leave data were re-analyzed and the initial differences were controlled. The result was the same as before, i.e. smokers had a more unfavorable course of sick leave than ex-smokers and non-smokers.

Smokers had a higher complaint score than ex-smokers, who in turn had higher scores than non-smokers. There were similar differences in the life situation score in 1963 and 1973, although the trends were weaker. The differences between the groups were still significant when the differences between the groups at the start of the study were allowed for.

Multivariate analysis

Since the men in the three groups had a somewhat different social background, the differences in health course between the groups might rather be due to social background than to smoking habits. Thus, the social background may be regarded as a confounding factor. However, an analysis of the social background variables (Table I) showed that only registration for alcohol intemperance and to some extent social class required consideration in this respect. Thereafter a multivariate analysis of the three groups and their relation to days of sick leave, complaint score and change of life situation during the follow-up was performed. In this analysis, the importance of the confounding factors—alcohol intemperance, social class and initial prevalence of the health indices—was taken into account. As shown in Table III, smokers still had more days of sick leave, more complaints and more negative changes in life situation than the ex-smokers and non-smokers during the follow-up period.

DISCUSSION

Possible biases

It is well known that relatively few of those who stop smoking remain ex-smokers over long periods. To make the classification of smoking habits more precise, only individuals who reported no change or a stable change in habits over a sufficiently long period after the baseline examination were included in this study. A considerable proportion of the original cohort was thereby excluded, which may have caused a selection bias. In order to estimate

Table III. Significance level of the relation between area health indices and the study groups in multivariate analysis

The importance of social class, registration for alcohol intemperance and the start level of the three health measures are taken into account

+ = Positive trend from non-smokers to ex-smokers to smokers

	Correlation to groups of smoking habits	
	Direction	$p <$
Days of sick leave 1964-73	+	0.01
Complaint score 1973	+	0.001
Worsened life situation 1963-73	+	0.05

the size of this possible bias, a comparison was made between those included in and those excluded from the study. The majority of the men excluded from the study were smokers at the time of two of the three examinations. They had a higher mortality, a higher incidence of myocardial infarction and had more frequently retired from work than those included. In all other respects considered, the differences were small but consistent in such a way that the men excluded had more features in common with the smokers than with the ex-smokers. The exclusion of these men therefore probably caused a moderate overestimation of the differences between smokers and ex-smokers.

To find out what effect this exclusion might have had on the relationships found in this study, a new analysis was performed under the assumption that all those excluded were in reality smokers during the most part of the follow-up period. The result did not affect the conclusions.

Self-selection might be another possible bias since men who stop smoking are not a representative sample of smokers (Table I). The best way to avoid this problem would have been to perform a randomized controlled trial. However, this analysis was carried out using data at hand from a longitudinal cohort study. To avoid the self-selection bias as far as possible, factors suspected to affect both the probability of giving up smoking and the health indices measured during follow-up were taken into account. Furthermore, differences in health index prevalence, also suspected to be a confounding factor, were taken into account.

Other studies

The effects of cessation of smoking on the incidence of ischemic heart disease, lung cancer and chronic bronchitis is well documented in both cross-sectional and longitudinal observations (1, 2, 3, 6, 8). The effect on other health indices is less well known. Few studies have looked at the effect on sick leave and, to our knowledge, none has analyzed the impact of cessation of smoking on the subjective measures of well-being as we did.

As far as we know, only one randomized controlled trial on the effect of giving up smoking has been published (5). In that study, 1445 cigarette smoking, 40-59 year-old men were randomly allocated to an intervention group and to a non-intervention group and followed for approximately eight years. The conclusions were that cessation of cigarette smoking improved cough and slowed the progress of potentially disabling airway obstruction. However, no significant effect on the mortality was seen. Sick leave data in the form of mean number of days off work during the first year of the trial were also analyzed. The intervention group had less days of self-reported sick leave than the other group, but there were no differences in data provided by the employers. We obtained the sick leave data, covering ten years, independently of the participants. The longer period covered may be an explanation of the relationship found between cessation of smoking and days of sick leave.

Both the complaint score and the self-assessed life situation score are admittedly "soft" variables and were registered retrospectively. However, they were not registered in connection to questions

about smoking habits and the participants did not know that these questions were to be used as health indices in connection with smoking. These variables were introduced because we wanted to have a measure of the subjects' own opinion of their well-being. Since both measures showed the predicted trend and the same trend as the more "hard" variable sick leave, we interpret the findings as indications of a positive effect of cessation of smoking on the well-being.

REFERENCES

1. Fletcher, C., Peto, R., Tinker, C. & Speizer, F. E.: The natural history of chronic bronchitis and emphysema. Oxford University Press, London 1976.
2. Gordon, T., Kannel, W. B., Dawber, T. R. & McGee, D.: Changes associated with quitting smoking: The Framingham study. *Am Heart J* 90: 322-328, 1975.
3. Hill, A. B. & Doll, R.: Lung cancer and tobacco; B.M.J.'s questions answered. *Br Med J* 1: 1060-1063, 1956.
4. Mantel, N.: Chi-square tests with one degree of freedom. Extensions of the Mantel-Haenszel procedure. *J Am Statist Assoc* 58: 690-700, 1963.
5. Rose, G. & Hamilton, P. J. S.: A randomized controlled trial of the effect on middle-aged men of advice to stop smoking. *J Epidemiol Community Health* 32: 275-281, 1978.
6. Smoking and health. A report of the Surgeon General. U.S. Department of Health, Education and Welfare. Government Printing Office, Washington D.C. 1979.
7. Tibblin, G.: High blood pressure in men aged 50. A population study of men born in 1913. *Acta Med Scand* (Suppl) 470, 1967.
8. Wilhelmsen, L., Wedel, H. & Tibblin, G.: Multivariate analysis of risk factors for coronary heart disease. *Circulation* 48: 950-958, 1973.

ABSTRA
22-25 y
(MBPE)
controls
(HR) rea
terminated
criteria f
tatory B
diastolic
which tl
≥140 m
ic. The
cruited t
mmHg e
The ma
tween h
(+15.3
NC grou
the syst
during i
noon th
type of
values t
nounced
ingly, r
nificant
Normol
with M
respect

Key wo
pressure
Acta Me

Mild b
norma
at leas

7-81297