Health consequences of pipe versus cigarette smoking

Aage Tverdal and Kjell Bjartveit

*Tob Control* published online October 15, 2010
doi: 10.1136/tc.2010.036780

Updated information and services can be found at:
http://tobaccocontrol.bmj.com/content/early/2010/10/15/tc.2010.036780.full.html

These include:

**References**
This article cites 15 articles, 8 of which can be accessed free at:
http://tobaccocontrol.bmj.com/content/early/2010/10/15/tc.2010.036780.full.html#ref-list-1

**P<P**
Published online October 15, 2010 in advance of the print journal.

**Email alerting service**
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

**Notes**

Advance online articles have been peer reviewed and accepted for publication but have not yet appeared in the paper journal (edited, typeset versions may be posted when available prior to final publication). Advance online articles are citable and establish publication priority; they are indexed by PubMed from initial publication. Citations to Advance online articles must include the digital object identifier (DOIs) and date of initial publication.

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://journals.bmj.com/cgi/ep
Health consequences of pipe versus cigarette smoking

Aage Tverdal,1 Kjell Bjartveit2

ABSTRACT

Objectives To estimate the risk of dying from all causes and from specified smoking-related diseases in men who were exclusive daily pipe smokers at two consecutive examinations, and in men who switched from smoking cigarettes only to pipe only.

Design A prospective cohort study.

Setting Three counties in Norway.


Outcomes Absolute mortality and relative risks adjusted for confounding variables, of dying from all causes and ischaemic heart disease, stroke, cardiovascular disease, lung cancer and other smoking-related cancer.

Results Altogether, the men were observed for 403 327 years, and during the observation period, 4933 deaths occurred. With sustained never smokers as reference, the sustained smokers of a pipe only had adjusted relative risk (95% CI), of dying from any cause that was 1.99 (1.73 to 2.27). At comparable tobacco consumption, no significant difference in risk between pipe and cigarette smokers appeared. As to survival, no difference was found between sustained smokers of a pipe only and of cigarettes only. Men who switched from cigarettes only to pipe only had a risk which was not significantly different from the risk in sustained smokers of cigarettes only.

Conclusions Between pipe and cigarette smokers, no or only minor differences were found in mortality from any cause and the specified smoking-related diseases. Pipe smoking is not safer than cigarette smoking.

INTRODUCTION

What are the health consequences of smoking a pipe, compared to smoking cigarettes? Is there a change in risk by switching from smoking cigarettes to smoking a pipe?

The first US Surgeon General report on smoking and health issued in 1964 marginalised any risk increase in people smoking a pipe. Based upon results from seven prospective studies the report concluded ‘The death rates for pipe smokers are little if at all higher than for non-smokers, even for men who smoke 10 or more pipefuls a day and for men who have smoked pipes more than 30 years’.1 The 1979 US Surgeon General report still concludes: ‘Overall mortality ratios for pipe-only smokers as a group are only slightly higher than for non-smokers’.2 The 1982 US Surgeon Report dealt with cancer, and now the conclusions are less categorical: ‘Cigar and pipe smoking are also causal factors for lung cancer’. As for oral and laryngeal cancer this report concludes that cigar and pipe smokers experience a risk similar to that of a cigarette smoker.3 For lung cancer, the 1989 US Surgeon General Report repeats this conclusion, and adds: ‘The lower risk of lung cancer among pipe and cigar smokers compared with cigarette smokers is due to the lesser amount of tobacco smoked and the lower degree of inhalation’.4

Results from several cohort studies in the UK, Sweden, Denmark, Norway and the USA have given more details on pipe smokers’ risk, both with regard to total death and of dying from major smoking-related diseases.5–11 Among pipe smokers, they all find increased risk of death from lung cancer, some also of coronary heart disease,6 9 11 others not.5

In a cohort study from the UK, it was found that smokers who switched from cigarettes to pipes or cigars halved their combined risk of dying of lung cancer, ischaemic heart disease or chronic obstructive lung disease, compared with continuing smokers, but their risk was still about 50% higher than that of lifelong non-smokers. This study did not give separate follow-up results for pipe smokers only. The authors concluded that cigarette smokers who have difficulty in giving up smoking altogether would be better off changing to cigars or pipes.12

Except for the British Doctors’ Study, the prospective cohort analyses referred to above have been based on one survey only. People may change smoking behaviour during the observation period and, thus, have an impact upon the outcome of the study. Moreover, confounding variables may have influenced the results.

In the present study we have tried, at least partly, to respond to these objections. The study is based upon smoking habits registered at two surveys, years apart. The aim is to determine the risk in sustained smokers of a pipe, compared with sustained never smokers and sustained cigarette smokers. We also examine the risk in participants who between the surveys changed their mode of smoking, in particular they who switched from smoking cigarettes to smoking a pipe. The report includes a population of 16952 men, aged 20—49 years, and living in three Norwegian counties. They were surveyed in the mid-1970s for cardiovascular disease risk factors and were screened again during the next 3—13 years at least once. These men have been followed throughout 2007 for deaths from serious smoking-related diseases and from all causes, and risk calculated after adjustment for a series of confounders registered at baseline. The mean observation period is 24 years, maximum 30 years, counting from the time of the last screening.
METHODS
The study population and data collection have been described earlier\(^\text{13-15}\) and will be repeated in the following sections.

Initial screening
Between 1974 and 1978, screening examinations for cardiovascular disease were undertaken in three Norwegian counties with a mainly rural settlement (Finmark, Sogn og Fjordane, Oppland). All male and female residents, aged 35–49 years, were invited, and a 10% random sample of residents aged 20–34. The attendance was 88%.\(^\text{16}\)

An identical protocol was used in the screening programme in the three counties. It included a questionnaire related to well-known risk factors of cardiovascular disease. Height, weight and blood pressure were measured, and a non-fasting blood sample was drawn and serum analysed at the same laboratory for total cholesterol, triglycerides and glucose.\(^\text{16}\) Details on the first screening were published earlier.\(^\text{17}\)

Extensive reports on this study population with relevance to smoking and mortality after 13 and 26 years of observation have been published previously.\(^\text{9,18}\) Three other reports have been issued, concentrating on health consequences in people smoking 1–4 cigarettes per day, in heavy smokers who reduced their daily consumption by more than 50% and in sustained ex-smokers.\(^\text{13-15}\)

Second and third screening
In one county, Finnmark, two new screenings were conducted after 5 and 13 years. In the two other counties (75% of the total study population), the re-screenings were carried out 5 and 10 years after the initial screening.\(^\text{19-21}\)

At the second screening, all those invited to the initial screening were re-invited, and, in addition, a 9% random sample of people aged 20–34 years who were not invited to the first examination. The attendance was 88%.\(^\text{22}\)

At the third screening, some modifications were made of the eligibility to the study, partly due to capacity constraints. Referring to the age at the initial screening, the following were invited to the third screening: All people aged 30–44 years and all people under 30 years who were invited to the second screening. In two of the counties, a 10% random sample of people aged 45–49 years were invited; in the third county, all people in this age group were invited. The attendance was 84%.\(^\text{20,23,24}\)

All elements of the outlined screening programme, except for glucose testing, were kept unchanged throughout the screenings; in particular that part of the questionnaire covering smoking habits.

The study population
As only 18 women reported smoking a pipe at either one or both examinations, this presentation is restricted to male participants.

Further, in order to avoid influence of earlier smoking upon health, 6801 men who at the first examination were non-smokers, but reported to have smoked cigarettes daily previously, were excluded, as were 254 men who smoked cigars at either one or both examinations. Also excluded were 250 never-smoking men at both examinations, but even so they reported to have smoked for a mean of 8.6 years. In all likelihood, these men had been smoking a pipe earlier in life, but were not smoking any kind of tobacco when attending the examinations (see later under Methods, Categories of participants).

Of the remaining men, 23,058 attended two or three screenings, and of these, 22,697 had a satisfactory completion of the questions on smoking.

In order to avoid questions on reverse causality that might occur if people changed smoking habits owing to illness, the study was restricted to men who at the last examination did not report a history of myocardial infarction, angina pectoris, stroke, diabetes, atherosclerosis of legs, treatment for hypertension, use of glycérine trinitrate and symptoms indicative of angina pectoris or atherosclerosis obliterans, totalling 20,049 men. We focus on the seven smoking categories defined below, which means that 2484 men who quit smoking between the two surveys, and 633 men who reported not to have smoked a pipe only did not enter the analysis. Hence, we are left with 16,952 men. For each man who underwent two or more examinations, paired results were selected according to the following priority, on the basis of attendance at:

- first and second screening (n=14,350)
- second and third screening (n=2130)
- first and third screening (n=452).

The follow-up period started from the last of the two examinations available.

Questions about smoking behaviour
In a special box in the questionnaire, the smokers of a pipe reported the actual packs of tobacco (50 g) smoked per week, also noting down quarters or thirds of a pack. In another box, the cigarette smokers reported the actual number of cigarettes smoked per day, allowing citing a range, such as 10–15 cigarettes.

People who stated that they did not smoke cigarettes at present were asked if they had smoked cigarettes daily before, and if they were smoking cigars daily. All present or previous smokers were asked about how many years altogether they had been smoking daily.

At the examination site, the nurses carefully checked through the questionnaire with the participants. Factory made and hand-rolled cigarettes had to be counted together. The nurses were instructed that one pack of tobacco for hand rolling (50 g) equalled 50 cigarettes. For those who gave a range of consumption, we used the highest figure.

Categories of participants
In this report we have applied the following categories:

Main categories
- ‘Sustainers’: Men whose smoking behaviour did not change from the first to the second examination.
- ‘Switchers’: Men who were smoking daily at both examinations, but had switched their mode of smoking from the first to the second examination.

Subcategories
- Never smoked: Men who at both examinations were not smoking daily, and had never smoked cigarettes daily before
- Pipe only: Men who were smoking a pipe daily, and not smoking cigarettes daily
- Cigarettes only: Men who were smoking cigarettes daily, and not smoking a pipe daily
- Mixed: Men who were smoking both a pipe and cigarettes daily.

Regrettably, we do not have information on men, who, before the first examination, may have smoked a pipe daily, but had
stopped doing so. Likewise, we lack information on occasional, but not daily, smoking.

Endpoints
We carried out a mortality follow-up by linking our records with the National Causes of Death Register, using the 11-digit personal identification number as record linkage. Each person accrued person-years from the day of the last examination until date of death, date of emigration or 31 December 2007.

In addition to deaths from all causes, we studied deaths from the following:

> Stroke: ICD-8 and ICD-9: 430–438; ICD-10: I60–I69
> Lung cancer: ICD-8 and ICD-9: 161–162; ICD-10: C33–C34
> Other smoking-related cancer: Types of cancer that the International Agency for Research on Cancer has classed as liable to be caused by smoking, and later applied by Doll et al.25 26 Thus, the following types of cancer were included:
> – lip, oral cavity and pharynx: ICD-8 and ICD-9: 140–149; ICD-10: C00-C14
> – nose and nasal sinuses: ICD-8 and ICD-9: 160; ICD-10: C30-C31
> – oesophagus: ICD-8 and ICD-9: 150; ICD-10: C15
> – stomach: ICD-8 and ICD-9: 151; ICD-10: C16
> – liver: ICD-8: 155, 197.8; ICD-9: 155; ICD-10: C22
> – kidney and renal pelvis: ICD-8 and ICD-9: 189.0-1; ICD-10: C64-C65

Statistical methods
Age adjustments were made by the indirect method based on 5-year age intervals. Hazard ratios were estimated by the Cox proportional hazards model including potential confounders as covariates (see footnote, table 1). All covariates were entered as continuous linear variables, except for body mass index.

Age adjustments were made by the indirect method based on the cut-offs 20, 25, 30 and 35 kg/m². Height was included among the covariates – family history of coronary heart disease recorded at the last examination.

RESULTS
Table 2 shows baseline characteristics of these men at the start of follow-up. In some of the categories, information on duration of smoking was missing for a negligible number of participants.

Men who smoked a pipe only were the oldest and had the longest duration of smoking. Subtracting mean duration of smoking from mean age gives the same mean age of smoking debut as the smokers of cigarettes only. Smokers of a pipe only had lower daily tobacco consumption than cigarette smokers.

Never smokers have the lowest mean values for systolic blood pressure and serum lipids, and the highest mean value for physical activity during leisure and for body mass index. Smokers of a pipe, both ‘sustainers’ and those who had switched to pipe smoking, have higher blood pressure values than sustained cigarette smokers.

Sustained never smokers have lower frequency of disability pension and, except for men who switched from mixed to exclusive pipe smoking, the lowest frequency of sick leave. As to family history of coronary heart disease there was some variation, but with no specific pattern.

Table 3 shows the number of men and number of person years distributed by category. The highest number of men is found among sustained never smokers and sustained smokers of cigarettes only. At the first examination, 912 men smoked a pipe exclusively. Of these, 665 (75%) were still exclusively pipe smokers at the second examination.

For all groups of smokers, age-adjusted mortality was distinctly higher than in never smokers. Among the ‘sustainers’, cigarette smokers had higher rates than pipe and mixed smokers. Between the ‘switchers’ no clear pattern appeared.

Table 1 Adjusted relative risk* (95% CI) of death from all causes, ischaemic heart disease, stroke, cardiovascular disease, lung cancer and other smoking-related cancer, by smoking category, with sustained never smokers as reference†

<table>
<thead>
<tr>
<th>Deaths from</th>
<th>‘Sustainers’</th>
<th>‘Switchers’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never smoked</td>
<td>Pipe only</td>
</tr>
<tr>
<td>Men (n = 16 932 aged 20–49 years)</td>
<td>1.00</td>
<td>1.99 (1.73 to 2.27)</td>
</tr>
<tr>
<td>All causes</td>
<td>1.00</td>
<td>3.07 (2.35 to 4.00)</td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
<td>1.00</td>
<td>1.54 (0.84 to 2.82)</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.00</td>
<td>2.49 (1.99 to 3.10)</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>1.00</td>
<td>10.32 (5.55 to 19.18)</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>1.00</td>
<td>1.47 (0.99 to 2.18)</td>
</tr>
</tbody>
</table>

*Adjusted for age, systolic blood pressure, total serum cholesterol, serum triglycerides, physical activity during leisure, body mass index (kg/m²), height, disability pension, sickness leave and family history of coronary heart disease recorded at the last examination.
†Participants not reporting cardiovascular disease, diabetes or treatment for hypertension, or symptoms of angina pectoris or atherosclerosis obliterans at the last examination.
Table 1 displays adjusted relative risks of deaths (95% CI) from all causes and from the specified smoking-related diseases, with sustained never smokers as reference. The relative risks are adjusted for a series of confounders (see footnote in table 1).

Among the ‘sustainers’, the highest risks were found in men smoking cigarettes only, both for deaths from all causes and from the specified diseases. Between pipe only and mixed smokers, the risk differences were small and inconsistent, as were risks between the ‘switchers’. For all causes, the risks were twice as high in all categories of smokers as in never smokers. For lung cancer, the relative risks were between 10 and 20 times higher in smokers than in never smokers.

Table 2 Background characteristics at the last examination of the participants*, by category of smoking

<table>
<thead>
<tr>
<th></th>
<th>‘Sustainers’</th>
<th>‘Switchers’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never smoked</td>
<td>Pipe only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cigarettes only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No of men (n=16 932)</td>
<td>6275</td>
<td>665</td>
</tr>
<tr>
<td>Age (years)</td>
<td>43.6 (7.3)</td>
<td>48.5 (4.3)</td>
</tr>
<tr>
<td>Tobacco consumption (g/day)</td>
<td>0.0</td>
<td>9.1 (3.8)</td>
</tr>
<tr>
<td>Duration of smoking (years)</td>
<td>–</td>
<td>29.0 (6.6)</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>135.4 (15.1)</td>
<td>138.0 (17.1)</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>85.2 (10.5)</td>
<td>86.0 (9.4)</td>
</tr>
<tr>
<td>Total serum cholesterol (mmol/l)</td>
<td>5.98 (1.11)</td>
<td>6.27 (1.01)</td>
</tr>
<tr>
<td>Serum triglycerides (mmol/l)</td>
<td>1.96 (1.15)</td>
<td>2.21 (1.37)</td>
</tr>
<tr>
<td>Physical activity during leisure</td>
<td>2.32 (0.75)</td>
<td>2.17 (0.67)</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>25.3 (2.8)</td>
<td>24.7 (3.0)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>176.3 (6.8)</td>
<td>175.6 (6.2)</td>
</tr>
<tr>
<td>Disability pension (%)</td>
<td>3.3 (1.0)</td>
<td>3.7 (1.9)</td>
</tr>
<tr>
<td>Sick leave (%)</td>
<td>2.4 (1.5)</td>
<td>5.1 (2.2)</td>
</tr>
<tr>
<td>Family history of CHD (%)</td>
<td>25.6 (4.4)</td>
<td>25.3 (4.3)</td>
</tr>
</tbody>
</table>

*Values are mean (SD) or % (SD).

Participants not reporting cardiovascular disease, diabetes or treatment for hypertension, or symptoms of angina pectoris or atherosclerosis obliterans at the last examination.

Physical activity during leisure was graded 1-4, with 4 denoting the heaviest activity.

One or more of parents or siblings reported to have had a heart infarction or angina pectoris (CHD, coronary heart disease).

Table 3 Number of participants and person years. Deaths from all causes, ischaemic heart disease, stroke, cardiovascular disease, lung cancer or other smoking-related cancer, number and per 100 000 person years, age adjusted. By category of smoking*

<table>
<thead>
<tr>
<th></th>
<th>‘Sustainers’</th>
<th>‘Switchers’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never smoked</td>
<td>Pipe only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cigarettes only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of men (n=16 932)</td>
<td>6275</td>
<td>665</td>
</tr>
<tr>
<td>Number of person years</td>
<td>156 274</td>
<td>152 511</td>
</tr>
<tr>
<td>Deaths from:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All causes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>970</td>
<td>279</td>
</tr>
<tr>
<td>Ischaemic heart disease deaths</td>
<td>639</td>
<td>1306</td>
</tr>
<tr>
<td>Stroke</td>
<td>179</td>
<td>81</td>
</tr>
<tr>
<td>Cardiovascular disease deaths</td>
<td>79</td>
<td>370</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>59</td>
<td>13</td>
</tr>
<tr>
<td>Other smoking-related cancer deaths</td>
<td>39</td>
<td>57</td>
</tr>
<tr>
<td>Deaths</td>
<td>301</td>
<td>112</td>
</tr>
<tr>
<td>Ischaemic heart disease deaths</td>
<td>128</td>
<td>509</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td>Other smoking-related cancer deaths</td>
<td>4</td>
<td>121</td>
</tr>
<tr>
<td>Deaths</td>
<td>138</td>
<td>31</td>
</tr>
<tr>
<td>Deaths</td>
<td>59</td>
<td>136</td>
</tr>
</tbody>
</table>

*Participants not reporting cardiovascular disease, diabetes or treatment for hypertension, or symptoms of angina pectoris or atherosclerosis obliterans at the last examination.
For all causes, the risk in sustained smokers of cigarettes only was significantly higher than in sustained smokers of a pipe only (p=0.002). For the specified smoking-related diseases, there was no significant difference between sustained smokers of a pipe only and sustained smokers of cigarettes only, except for lung cancer, where sustained smokers of cigarettes only had a significantly higher mortality (p=0.019). For all causes and the specific causes, the risks among the sustained smokers did not differ systematically from the risks in the ‘switchers’. The only exception was stroke, where the risks in all groups of ‘switchers’ were consistently higher than among the sustained smokers.

The data referred to above concern people without a history of cardiovascular disease or diabetes, or without symptoms of angina pectoris or atherosclerosis obliterans. If this group is not excluded, however, we find adjusted relative risks that are substantially the same as those presented in table 1.

Of the 10,657 daily smokers who underwent two examinations, 7,696 (72%) also met for a third one, 5–10 years after the last of the two examinations available, or 5–10 years after the follow-up period started. Table 4 shows their smoking behaviour at the third screening.

As a whole, around 10% of the smokers at the second examination had quit smoking at the third examination, and there is no significant difference between the categories. The groups who had switched between smoking categories at the second examination vary somewhat; apparently some men who had switched from cigarettes to pipe only were again smoking cigarettes only at the third examination.

Table 5 is restricted to sustained smokers of a pipe only and of cigarettes only, and never smokers, altogether 16,281 men. These two categories of smokers are divided in three subgroups by daily consumption of tobacco. The subgroups of pipe and cigarette smokers correspond fairly well with each other, as can be seen from the mean weight of tobacco consumed daily (the weight of one cigarette equals 1 g). For the groups with the highest consumption, 2% of the pipe smokers consumed 2½ packs or more per week, or 39+ g per day, whereas 27% of the cigarette smokers consumed 40 cigarettes+ per day.

For both pipe and cigarette smokers there is a dose-response relation by amount of tobacco consumed per day. Exceptions are lung cancer and other smoking-related cancer among the sustained smokers of a pipe, where there is no increasing risk by amount smoked. Between pipe and cigarette smokers with about the same daily consumption, there is no systematic difference in risk.

In both pipe and cigarette smokers with the lowest consumption, the risks are significantly higher than in never smokers. This applies to deaths from all causes and from the specified smoking-related diseases, with the exception of stroke and other smoking-related cancer in both categories of smokers, and cardiovascular disease in cigarette smokers.

Figure 1 demonstrates survival of sustained smokers of exclusive pipe or cigarettes. The data used in the figure are adjusted as outlined in the legend. A figure based upon unadjusted data, however, gives a similar picture. The survival is roughly the same in both categories of smokers with a slightly lower survival in pipe smoker after 20 years of observation. The unadjusted 25-year survival is 66% in pipe smokers and 69% in cigarette smokers, which may be compared to 87% in never smokers.

### DISCUSSION

We have found that pipe smokers have a mortality that is similar to the mortality in cigarette smokers at comparable consumption levels. This observation is made both for total mortality and for the specified smoking-related diseases, with the exception of lung cancer, where smokers of only cigarettes have the highest mortality. Switching between smoking groups did not change the risk substantially.

Of particular interest is that men with the lowest daily consumption have significantly higher risk than never smokers. For cigarette smokers, this has been demonstrated before in another study based upon partly the same population, and is confirmed by this new follow-up. The same observation is now made for pipe smokers with the lowest consumption, less than three pipefuls per day. For lung cancer, our findings correspond well with the US Cancer Prevention Study II, and with the Norwegian part of the Migrant Study, where significant risk increases were found in smokers of 1–5 pipes/day and 1–4 g/day, respectively. The US study also found a significant risk increase of coronary heart disease in the said consumption group.

The higher lung cancer mortality in cigarette smokers may, at least partly, be due to the occurrence of extreme daily consumption (40 g/day+).

Generally, our findings reveal a more serious outcome for sustained pipe smokers than has been found in most other studies so far. In fact, the risk for pipe smokers is of the same order of magnitude as for cigarette smokers.

Several explanations may account for the discrepancies with other studies. Other studies are based upon only one recording of smoking habits, or refer to the participants’ recall of previous smoking. People may change both their mode of smoking and their daily consumption. Recordings made at two different examinations, years apart, may give a more valid estimate of smoking habits. Another explanation may be that pipe smokers over time have changed their smoking technique; that in previous years they were merely puffing, but later started to inhale the smoke, imitating the technique they observed in cigarette smokers. We cannot elaborate on this theory, as our questionnaire did not include questions on inhaling. In our neighbouring country Sweden, however, a similar proportion of inhalers was found in cigarette smokers as in pipe smokers, in contrast to studies in the UK and USA, where the proportion of inhalers was found to be higher in cigarette smokers than in pipe smokers.

Other explanations for the discrepancies between our findings and results from other studies may be that we have been able to

### Table 4 Smoking behaviour at the third examination, by category at the second examination

<table>
<thead>
<tr>
<th>Status at the third examination</th>
<th>‘Sustainers’ at the second examination</th>
<th>‘Switchers’ at the second examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pipe only</td>
<td>Cigarettes only</td>
</tr>
<tr>
<td>Number of men</td>
<td>341</td>
<td>6,967</td>
</tr>
<tr>
<td>Unchanged smoking category (%)</td>
<td>73.3</td>
<td>87.6</td>
</tr>
<tr>
<td>Changed smoking category (%)</td>
<td>13.8</td>
<td>1.3</td>
</tr>
<tr>
<td>Stopped smoking (%)</td>
<td>12.9</td>
<td>11.1</td>
</tr>
</tbody>
</table>
Table 5  Sustained smokers of a pipe and sustained smokers of cigarettes*, by amount smoked recorded at the last examination. Number of participants, person years and deaths. Adjusted relative risk† (95% CI) of death from all causes, ischaemic heart disease, stroke, cardiovascular disease, lung cancer and other smoking-related cancer, with sustained never smokers as reference

<table>
<thead>
<tr>
<th></th>
<th>Sustained smokers of a pipe only</th>
<th>Sustained smokers of cigarettes only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never smoked</td>
<td>&lt;1 pack per week (&lt;7 g per day)</td>
</tr>
<tr>
<td>Participants</td>
<td>6275</td>
<td>62</td>
</tr>
<tr>
<td>(n = 16 531)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of person years</td>
<td>156274</td>
<td>1473</td>
</tr>
<tr>
<td>Number of deaths</td>
<td>970</td>
<td>25</td>
</tr>
<tr>
<td>Mean daily tob.</td>
<td>0</td>
<td>3.79</td>
</tr>
<tr>
<td>consumption (g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative risks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths from:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All causes</td>
<td>1.00</td>
<td>1.79 (1.20 to 2.67)</td>
</tr>
<tr>
<td>Ischaemic heart</td>
<td>1.00</td>
<td>2.73 (1.34 to 5.56)</td>
</tr>
<tr>
<td>disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>1.00</td>
<td>1.13 (0.16 to 8.20)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>1.00</td>
<td>2.03 (1.08 to 3.82)</td>
</tr>
<tr>
<td>disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lung cancer</td>
<td>1.00</td>
<td>23.51 (6.35 to 87.05)</td>
</tr>
<tr>
<td>Other smoking-</td>
<td>1.00</td>
<td>1.91 (0.70 to 5.16)</td>
</tr>
<tr>
<td>related cancer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Participants not reporting cardiovascular disease, diabetes or treatment for hypertension, or symptoms of angina pectoris or atherosclerosis obliterans at the last examination.† Adjusted for age, systolic blood pressure, total serum cholesterol, serum triglycerides, physical activity during leisure, body mass index (kg/m²), height, disability pension, sickness leave and family history of coronary heart disease recorded at the last examination.

It is also worth noting the impact of age and consumption on the effect estimates. The crude mortality, as may be calculated from table 3, was higher in smokers of a pipe only than in smokers of cigarettes only. Adjustment for age reversed this picture (table 5). After stratifying on consumption, however, the adjusted relative risks were comparable between pipe and cigarette smokers. This underlines the importance of adequate adjustment for confounders.

Different results in different studies may also be due to changes in smoking habits during the follow-up. For 72% of smokers in our study population, we have recordings of smoking habits 5–10 years after follow-up started. At that time, quit rates in the smoking categories varied between 9% and 14%. Of the sustained smokers of a pipe only, 12.9% had quit. This shows that just a few people had given up smoking during the first third of the follow-up period. However, as the prevalence of pipe smoking has declined we cannot rule out the possibility that our risk estimates may be biased owing to changes in smoking habits during the remainder of the follow-up period.

The frequency of pipe smoking has changed considerably over time in Norway. Up to 1950 it was the dominant form of tobacco smoking; later it lost ground to cigarette smoking. Population surveys disclosed that during 1958 to 1975, the fraction of pipe smokers was halved from about 40% to about 20%. Since the mid-1970s, Statistics Norway has carried out annual surveys of representative samples of the Norwegian population aged 16–74 years, applying similar questions as in our study (Norwegian Directorate of Health, 2009). In 1975, these surveys showed that 9.7% of males aged 35–49 years smoked a pipe daily (including mixed smokers), which corresponds well with the frequency observed in our study. Further results of the national surveys are shown in figure 2, which also shows that during the last couple of years, pipe smoking in Norway is virtually non-existent. A similar trend is reported from the USA.

Strengths and weaknesses of the study
The strength of the study is the size of the population, 16 932 men, who were surveyed twice, years apart. They were examined according to standardised procedures, and observed for a mean of 24 years, more than 400 000 person-years. We have information on a series of relevant confounding variables, which have been adjusted for, and we have provided continuous survival rates up to 30 years after onset of the study. The follow-up is complete with respect to both death and emigration. By excluding former cigarette smokers and cigar smokers we have been able to concentrate on pipe smokers. We also have

---

**Figure 1**  Survival (%) of sustained smokers of a pipe only and of cigarettes only, by observation years. The survival estimates are adjusted to age—50 years, duration of smoking—20 years, consumption—1–1.99 packs/week for pipe smokers and 5–14 cigarettes per day for cigarette smokers, cf, table 5.
information on smoking habits for a large part of the study population up to 10 years after follow-up started.

One weakness is that, despite the size of the study population, the risk estimates for some endpoints become imprecise for several of the smoking categories. If we could have implied incidence, it would have been better for aetiological considerations, as mortality is the result of incidence and fatality. Incidence endpoints would also have increased the power of the study.

One possible bias could be that only 72% of the men from the last of the two examinations showed up for a third examination. This lack of attendance may partly be because only 10% in the age group 45–49 years (at the first examination) in two of the counties were invited to the third screening (cf. ‘Study population’). Also, at the first examination, all people who could not attend the screening were asked to send in a special form provided, giving the reasons for not attending. Of the non-attendees, 55% sent such an absence note, and of these 59% stated that disease, disability or temporary absence as the reason for not showing up.16 We have no reason to believe that the causes for non-attendance have changed substantially for the two last screenings.

Possible implications for policymakers

In the population, misconceptions undoubtedly prevail as to the risk of pipe smoking, possibly originating from the early milestone reports on smoking and health (see Introduction).

In health education and patient counselling it is important to communicate that there is only a negligible difference, if any, in risk between pipe and cigarette smokers, and that harm reduction in no way will be obtained by switching from smoking cigarettes to smoking a pipe.

It may be said that the findings of our study are of historical interest only, since pipe smoking has almost disappeared in many countries. In other countries, however, pipe smoking may still exist, and, in addition, people’s smoking behaviour may change quickly so that pipe smoking may come into fashion again. In Norway, such a development has been observed for the use of moist snuff (Swedish ‘snus’). Some decades ago, this form of tobacco was used only by elderly men, but has in recent years become fashionable again in younger generations.

CONCLUSION

Exclusive pipe smokers registered at two consecutive screenings, years apart, have a risk of dying from all causes and from specified smoking-related diseases that is significantly higher than in sustained never smokers. Between pipe and cigarette smokers with comparable daily tobacco consumption, there is no consistent difference in risk. Pipe smokers with the lowest consumption, less than three pipefuls per day, have a risk that is significantly higher than in never smokers. Men who switch from cigarettes only to pipe only have a risk that is not significantly different from that of sustained smokers of cigarettes only.

Acknowledgements The authors thank Rita Lindbæk, senior adviser, Norwegian Directorate of Health, Tobacco Control Department, for providing survey data on Norwegian smoking habits.

Competing interests None.

Contributors Both authors have contributed.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES


