Cigarette smoking has been officially recognized as a health hazard for many decades, but despite numerous studies and reports indicating the ill effects of pipe and cigar smoking, there has remained a widespread belief that they are less hazardous to health than cigarette smoking. There is also uncertainty as to the level of risk to health associated with primary and secondary pipe/cigar smoking.

After 20 years follow-up, the British Doctors study reported that primary pipe/cigar smokers had experienced mortality rates which were similar to men who did not smoke at all, although in the latter half of follow-up smoking-related risks were increased. In their 40 years follow-up, primary and secondary pipe/cigar smokers combined showed the same total mortality rates as ex-smokers. In a study of professional and business men in London, secondary pipe/cigar smokers had higher risk of smoking-related mortality than primary pipe/cigar smokers but a lower risk than continuing cigarette smokers, and it was suggested that it was better for cigarette smokers to switch to pipe/cigars than to continue smoking cigarettes. Earlier reports from the British Regional Heart Study (BRHS) showed no increase in risk of coronary heart disease (CHD) events in primary pipe/cigar smokers, although an increased risk of stroke was suggested after 13 years follow-up. These studies have conveyed the impression that pipe/cigar smoking, while not harmless, is less hazardous than smoking cigarettes and yet several recent reports...
from the US and Europe suggest that cigar smoking in particular may result in as much smoking-related disease as cigarette smoking.8–10 This study seeks to quantify the effects of primary and secondary pipe and cigar smoking on major cardiovascular events, cancer incidence, and all-cause mortality in middle-aged British men after 22 years follow-up.

Design and Methods

The BRHS is a prospective study of cardiovascular disease (CVD) comprising 7735 men aged 40–59 years selected from age-sex registers of one general practice in each of 24 towns in England, Wales, and Scotland. The criteria for selecting the town, the general practice, and the subjects as well as the methods of data collection, have been reported.11 There was a 78% response rate and the cohort was representative in socioeconomic terms of middle-aged men in Great Britain.12 In 1978–1989 research nurses administered to each man a standard questionnaire including questions on smoking habits, alcohol intake, physical activity, and medical history. Details of classification methods for smoking status, social class (longest held occupation), physical activity, and body mass index (BMI) have been reported.11,13 Social class was defined using the Registrar General’s Classification and was related to the longest held occupation. Three Non-manual categories (I, II, III non-manual) and three Manual categories (III manual, IV, V) were defined, plus an Armed Forces category.12 Physical measurements were made and non-fasting blood samples obtained. Weight and height were measured at screening and BMI calculated as weight/height². Obesity is defined as BMI >30 kg/m² as recommended by WHO.14 Heavy drinking was defined as those drinking >6 alcoholic drinks daily or most days in the week (1 drink = 10 g alcohol). The men were asked to indicate their usual pattern of physical activity (exercise) and a score was derived for each man based on frequency and type (intensity) of the physical activity.13 The men were grouped into six broad categories based on their total score: inactive, occasional, light, moderate, moderately- and high. The majority of these men were regular (daily or most days in the week) pipe smokers (73.4%). Some 25.4% were regular cigar smokers, 5.4% were regular pipe and cigar smokers, and 5.4% were occasional pipe and cigar smokers. (There is clearly overlap in categories.) Five years later, 74% of pipe/cigar smokers were still smoking pipe/cigars and 25% had stopped smoking.

Recall of doctor diagnosis

The men were asked whether a doctor had ever told them that they had CHD (i.e. angina, myocardial infarction, heart attack, coronary thrombosis), stroke, diabetes, and a number of other disorders. All men with recall of a doctor diagnosis of CHD, stroke or diabetes (n = 554) and diagnosed cancer (excluding skin cancer) prior to or in the same calendar year of screening (n = 45) and men with missing data on smoking (n = 15) were excluded, leaving 7121 men for analysis.

Smoking

The 7121 men were classified into seven groups on the basis of their smoking status at screening:

(1) Never smokers (n = 1541). Those who had never smoked cigarettes and did not currently smoke a pipe or cigars. Five years later, 98% were still not smoking.

(2) Ex-cigarette smokers (n = 1905). Those who previously smoked cigarettes and did not currently smoke pipe or cigars. Five years later, 93% were still not smoking.

(3) Primary pipe/cigar smokers (n = 184). Those who had never smoked cigarettes and currently smoked a pipe or cigars. The majority of these men were regular (daily or most days in the week) pipe smokers (73.4%). Some 25.4% were regular cigar smokers, 5.4% were regular pipe and cigar smokers, and 5.4% were occasional pipe and cigar smokers. (There is clearly overlap in categories.) Five years later, 74% of pipe/cigar smokers were still smoking pipe/cigars and 25% had stopped smoking.

(4) Secondary pipe/cigar smokers (n = 546). Former cigarette smokers who currently smoked pipe or cigars; 52.4% were regular pipe smokers, 44.4% were regular cigar smokers, 2.9% were regular pipe and cigar smokers, and 0.2% were occasional pipe and cigar smokers. Five years later, 72% were still smoking pipe/cigars or cigarettes, 28% were not smoking.

(5–8) Current cigarette smokers at three levels; Light: 1–19 (n = 1069), Moderate: 20 (n = 784), and Heavy: ≥21 (n = 1092) cigarettes per day, irrespective of whether they have ever smoked pipe or cigars. Five years later, 78% were smoking cigarettes or pipe/cigars and 22% had stopped smoking.

Follow-up

All men have been followed up for all-cause mortality and cardiovascular morbidity from screening in January 1978–July 1980 to December 2000, a mean follow-up period of 21.8 years (range 20–22.5 years); follow-up has been achieved for 99% of the cohort.15 Major CHD events include sudden cardiac death and myocardial infarction (fatal and non-fatal). Major stroke events refer to fatal and non-fatal events.15 Evidence regarding non-fatal heart attacks and stroke was obtained by reports from GPs, by biennial reviews of patients’ notes and from questionnaires on events refer to fatal and non-fatal events.15 Information on death was collected through the established ‘tagging’ procedures provided by the National Health Service registers. Cancer morbidity is based on follow-up until December 1997, a mean of 18.8 years. Cancer cases were ascertained by death certificates, the cancer registry, and by questionnaires on recall of doctor diagnoses sent to survivors in 1992, 1996, and in 1998.17 The shortened follow-up period for cancer cases was due to the time lag in Cancer Registry notifications.

Smoking-related cancers included cancer of the lip, tongue, oral cavity and larynx (ICD 140, 141, 143–149), oesophagus (ICD 150), pancreas (ICD 157), respiratory tract (ICD 160–163), bladder (ICD 188), and kidney (ICD 189).

Statistical methods

The Cox proportional hazards model was used to obtain the hazard ratios (relative risks [RR]) for the smoking groups adjusted for age and potential confounders.18 Smoking was fitted as a categorical variable. In the adjustment, physical activity, social class, alcohol intake, and anti-hypertensive treatment were fitted as categorical variables. Age, BMI, systolic blood pressure,
Results

During the mean follow-up period of 21.8 years (to December 2000) there were 1994 deaths from all causes, 1133 major CHD events (fatal = 633, non-fatal = 500), and 440 major stroke events (fatal = 132, non-fatal = 308) in the 7121 men with no diagnosed CHD, stroke, diabetes, or cancer at screening. During the 18.8 years mean follow-up to December 1997 there were 919 cases of malignant neoplasms (excluding skin cancers).

Table 1 shows the baseline characteristics for the smoking groups. Primary pipe and cigar smokers showed personal and biological characteristics similar to those who had never smoked cigarettes or pipe/cigars and they had the lowest percentages of manual workers and obesity and the lowest levels of mean systolic blood pressure and serum total cholesterol (Table 1). Secondary pipe/cigar smokers had characteristics similar to those of light cigarette smokers but with a lower percentage of manual workers.

Primary and secondary pipe/cigar smokers were consuming more tobacco at screening than light cigarette smokers (combined pipe/cigar mean usage 13.9 g/day) with larger amounts smoked by moderate and heavy smokers. The lifetime duration of smoking was slightly less in primary than secondary pipe/cigar smokers, the latter having the same duration of smoking as all the cigarette smoking categories.

Major cardiovascular events

With never smokers as the baseline, primary pipe and cigar smokers showed increased age-adjusted risk (non-significant) of major CHD and stroke events (Table 2). Because of their favourable personal and biological characteristics, full adjustment increased their RR and the differences became significant for major CHD events and marginally significant for stroke. Secondary pipe/cigar smokers had significantly increased risk of both CHD and stroke events after adjustment. Ex-cigarette smokers (who did not currently smoke pipe/cigars) showed similar risk of major CHD and stroke events to never smokers after full adjustment (Table 2). Combined primary and secondary pipe/cigar smokers showed RR of major CHD and stroke events significantly greater than non-smokers and similar to light cigarette smokers (RR = 1.69, 95% CI: 1.32, 2.14 and RR = 1.62, 95% CI: 1.08, 2.41, respectively). The highest risks for both CHD events and stroke were seen in heavy current smokers.

Table 1  Personal and biological characteristics at screening of 7121 middle-aged men from 24 British towns

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Ex-cigarette smoker</th>
<th>Primary pipe/cigar</th>
<th>Secondary pipe/cigar</th>
<th>Cigarettes 1–19/day</th>
<th>Cigarettes 20/day</th>
<th>Cigarettes 21+/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of men</td>
<td>1541</td>
<td>1905</td>
<td>184</td>
<td>546</td>
<td>1069</td>
<td>784</td>
<td>1092</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>48.6</td>
<td>50.7</td>
<td>49.9</td>
<td>50.4</td>
<td>50.5</td>
<td>50.4</td>
<td>49.7</td>
</tr>
<tr>
<td>Smoking (years)</td>
<td>0</td>
<td>19.3</td>
<td>26.7</td>
<td>31.7(^{a})</td>
<td>32.5</td>
<td>33.0</td>
<td>33.2</td>
</tr>
<tr>
<td>Tobacco usage (g/day)</td>
<td>0</td>
<td>0</td>
<td>11.5</td>
<td>14.7</td>
<td>14.7</td>
<td>14.7</td>
<td>14.7</td>
</tr>
<tr>
<td>% Manual</td>
<td>45.3</td>
<td>54.8</td>
<td>34.2</td>
<td>50.9</td>
<td>67.0</td>
<td>66.8</td>
<td>66.9</td>
</tr>
<tr>
<td>% 'Active'</td>
<td>48.0</td>
<td>40.0</td>
<td>44.7</td>
<td>41.8</td>
<td>38.1</td>
<td>30.0</td>
<td>25.4</td>
</tr>
<tr>
<td>% Heavy drinkers</td>
<td>5.3</td>
<td>9.4</td>
<td>6.0</td>
<td>11.0</td>
<td>10.7</td>
<td>13.0</td>
<td>21.0</td>
</tr>
<tr>
<td>% Obese</td>
<td>8.8</td>
<td>9.8</td>
<td>7.5</td>
<td>5.8</td>
<td>5.6</td>
<td>7.5</td>
<td>7.5</td>
</tr>
<tr>
<td>BMI(^{b}) (kg/m(^2))</td>
<td>25.65</td>
<td>26.26</td>
<td>25.27</td>
<td>25.49</td>
<td>25.00</td>
<td>24.92</td>
<td>24.93</td>
</tr>
<tr>
<td>SBP(^{c}) (mmHg)</td>
<td>143.4</td>
<td>147.4</td>
<td>142.7</td>
<td>144.3</td>
<td>144.3</td>
<td>144.9</td>
<td>145.0</td>
</tr>
<tr>
<td>Cholesterol (mmol/l)</td>
<td>6.25</td>
<td>6.34</td>
<td>6.20</td>
<td>6.25</td>
<td>6.26</td>
<td>6.23</td>
<td>6.30</td>
</tr>
<tr>
<td>% Anti-hypertensives</td>
<td>3.6</td>
<td>4.1</td>
<td>2.7</td>
<td>2.9</td>
<td>2.5</td>
<td>3.1</td>
<td>2.7</td>
</tr>
</tbody>
</table>

\(^{a}\) Cigarette smoking 21.3 years plus pipe smoking 10.4 years.

\(^{b}\) Body mass index.

\(^{c}\) Systolic blood pressure.

Table 2  Major cardiovascular disease events (age-adjusted rates\(^{a}\) and relative risks [RR]\(^{b}\)) in 7121 men with no diagnosed coronary heart disease (CHD), stroke, diabetes, or cancer at screening, according to smoking status

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Ex-cigarette smoker</th>
<th>Primary pipe/cigar</th>
<th>Secondary pipe/cigar</th>
<th>Cigarettes 1–19/day</th>
<th>Cigarettes 20/day</th>
<th>Cigarettes 21+/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major CHD events (n = 1133)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>160</td>
<td>260</td>
<td>27</td>
<td>95</td>
<td>199</td>
<td>161</td>
<td>231</td>
</tr>
<tr>
<td>Rate/1000 p-y(^{a})</td>
<td>5.2</td>
<td>7.1</td>
<td>7.6</td>
<td>9.3</td>
<td>10.4</td>
<td>11.8</td>
<td>12.4</td>
</tr>
<tr>
<td>Age-adj RR</td>
<td>1.00</td>
<td>1.20 (0.98, 1.46)</td>
<td>1.35 (0.90, 1.46)</td>
<td>1.60 (1.24, 2.06)</td>
<td>1.81 (1.47, 2.23)</td>
<td>2.09 (1.68, 2.61)</td>
<td>2.33 (1.90, 2.85)</td>
</tr>
<tr>
<td>Multi adj RR(^{b})</td>
<td>1.00</td>
<td>1.10 (0.91, 1.36)</td>
<td>1.59 (1.05, 2.39)</td>
<td>1.72 (1.32, 2.22)</td>
<td>1.85 (1.49, 2.30)</td>
<td>2.12 (1.69, 2.67)</td>
<td>2.30 (1.86, 2.84)</td>
</tr>
<tr>
<td>Major stroke events (n = 440)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>62</td>
<td>108</td>
<td>13</td>
<td>35</td>
<td>83</td>
<td>54</td>
<td>85</td>
</tr>
<tr>
<td>Rate/1000 p-y(^{a})</td>
<td>2.2</td>
<td>2.7</td>
<td>3.5</td>
<td>4.0</td>
<td>4.0</td>
<td>3.8</td>
<td>4.6</td>
</tr>
<tr>
<td>Age-adj RR</td>
<td>1.00</td>
<td>1.21 (0.88, 1.65)</td>
<td>1.66 (0.91, 3.01)</td>
<td>1.47 (0.97, 2.23)</td>
<td>1.89 (1.36, 2.62)</td>
<td>1.79 (1.24, 2.58)</td>
<td>2.23 (1.61, 3.10)</td>
</tr>
<tr>
<td>Multi adj RR(^{b})</td>
<td>1.00</td>
<td>1.13 (0.82, 1.56)</td>
<td>1.83 (0.98, 3.42)</td>
<td>1.55 (1.02, 2.37)</td>
<td>1.91 (1.35, 2.68)</td>
<td>1.78 (1.22, 2.61)</td>
<td>2.12 (1.50, 2.99)</td>
</tr>
</tbody>
</table>

\(^{a}\) Adjusted for age, social class, body mass index, physical activity, systolic blood pressure, serum total cholesterol, alcohol intake, and anti-hypertensive treatment.
Cancer

Current cigarette smokers showed the highest risk of total cancer with a strong dose-response effect (Table 3). Both primary and secondary pipe/cigar smokers showed higher adjusted risk of total cancer than never smokers (non-significant). Both groups showed significantly higher risk of smoking-related cancers, their risk level approaching that seen in light cigarette smokers. The increased risk was largely due to a marked increased risk in lung cancer. For combined primary and secondary pipe/cigar smokers, the RR for smoking-related cancers and lung cancer were 2.67 (95% CI: 1.70, 4.26) and 4.35 (95% CI: 2.05, 8.94) respectively. Ex-cigarette smokers showed a significant increase in smoking-related cancers, particularly affecting ‘other’ smoking-related cancers rather than lung cancer.

Table 3 Cancer risk (age-adjusted rates and relative risks [RR]) in 7121 men with no diagnosed coronary heart disease (CHD), stroke, diabetes or cancer at screening, according to smoking status

<table>
<thead>
<tr>
<th>Smoking-related (n = 460)</th>
<th>Lung cancer (n = 251)</th>
<th>Non-smoking (n = 459)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>32</td>
<td>11</td>
</tr>
<tr>
<td>Rate/1000 p-ya</td>
<td>1.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Mult adj RRb</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Total mortality

Compared to never smokers and after full adjustment, primary pipe/cigar smokers showed a marginally significant increased risk of total mortality ($P = 0.06$) but secondary pipe/cigar smokers showed a significantly increased risk of total mortality (Table 4). If primary and secondary pipe/cigar smokers are combined, as their RR for total, CVD, and non-CVD deaths are similar, they show a significantly increased risk in total mortality compared with never smokers after full adjustment (RR = 1.44, 95% CI: 1.19, 1.74). This increased risk is seen for both CVD and non-CVD causes (RR = 1.49, 95% CI: 1.13, 1.96 and RR = 1.40 (95% CI: 1.08, 1.78, respectively). Ex-cigarette smokers showed similar risk to never smokers after full adjustment. Current smokers showed the highest RR of total, CVD, and non-CVD causes with a dose-response relationship with increasing number of cigarettes smoked.

Table 4 Pipe/cigar smoking and age-adjusted rates and relative risks (RR) for all cause mortality in 7121 men with no diagnosed coronary heart disease (CHD), stroke, diabetes, or cancer at screening

<table>
<thead>
<tr>
<th>Total (n = 1994)</th>
<th>Cardiovascular disease (n = 896)</th>
<th>Non-cardiovascular disease (n = 1098)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>256</td>
<td>126</td>
</tr>
<tr>
<td>Rate/1000 p-ya</td>
<td>9.2</td>
<td>4.5</td>
</tr>
<tr>
<td>Age-adj RRb</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Mult adj RRb</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

b Adjusted for age, social class, body mass index, physical activity, systolic blood pressure, serum total cholesterol, alcohol intake and anti-hypertensive treatment.
Duration of exposure
We have divided the follow-up into two successive 11-year periods for CHD events (n = 547; n = 587) and for stroke (n = 145; n = 295), and into successive 11- and 8-year periods for smoking-related cancers (n = 194; n = 266). For major CHD events, primary pipe/cigar smokers only showed a significant increase in risk in the later period of exposure (RR = 1.90, 95% CI: 1.14, 3.15). Little effect was seen in the earlier period (RR = 1.20, 95% CI: 0.60, 2.42). Other smoking categories showed no difference between the early and later periods of exposure. For stroke and for smoking-related cancers, increased risk associated with primary pipe/cigar smoking was seen in both early and late periods of follow-up and the risks were somewhat greater in the earlier period. Similar effects were seen in all other smoking categories.

Discussion
Although attention had earlier been drawn to an increased risk of myocardial infarction in men who switched from cigarettes to pipe/cigars, it is only recently that concern has increased regarding the risks associated with smoking tobacco products other than cigarettes. Research in the US and Europe has focused on cigar smoking, presumably because pipe smoking is relatively uncommon in those countries and is a decreasing rather than an increasing phenomenon, unlike cigar smoking. Most studies combine pipe and cigar smoking although it is usual to separate primary pipe/cigar smokers who have never smoked cigarettes from secondary pipe/cigar smokers who have switched from cigarettes to pipe and/or cigar. In the present study, pipe and cigar smokers are combined although in this cohort, pipe smoking was somewhat more common than cigar smoking at screening, particularly among the primary pipe/cigar smokers. In this 22-year follow-up study, both primary and secondary pipe/cigar smokers showed significantly higher risk of major CHD and stroke events than never smokers and there was little difference between the effects of primary and secondary pipe/cigar smoking after adjustment for differences in lifestyle and biological characteristics. All pipe/cigar smokers had significantly increased risk of smoking-related cancers and a significant increase in cardiovascular and non-cardiovascular mortality compared with never smokers. Overall, the pipe/cigar smokers, whether primary or secondary, experienced much the same outcomes as regular light cigarette smokers.

Changes in smoking behaviour
After 5 years follow-up, three-quarters of pipe/cigar smokers were still smoking and about one-quarter had stopped smoking. The cigarette smokers showed a similar pattern with about one-quarter having stopped smoking. It seems likely that this similarity in smoking behaviour will have continued over the 22-year follow-up period and there seems little likelihood of bias arising from differential changes in smoking patterns over time. While cessation of smoking is likely to reduce the absolute risk of events over follow-up, this would apply in similar measure to all smoking categories. The trend towards stopping or diminishing smoking is likely to underestimate the effects on outcome in all the smoking categories.

Duration of effect
The absence of effect of primary pipe/cigar smoking on CHD events observed in the earlier BRHS reports after 6.2 and 9.5 years follow-up and the small increase in risk of stroke after 12.8 years follow-up, suggest that primary pipe/cigar smoking might require longer exposure than cigarette smoking to manifest pathological effects. This appears to be true for CHD events, with a significant increase in risk in primary pipe/cigar smokers seen only in the later period of follow-up. For both stroke and for smoking-related cancers, the effect of primary pipe/cigar smoking is seen in both early and later periods. The import of this observation is that, at least for CHD, shorter term follow-up may not reveal the pathology developing in these subjects. However, for both stroke and for smoking-related cancers the ill effects are apparent and significant in the shorter period of follow-up.

Other studies
Early studies from Canada, the UK, and the US all showed a considerably lower risk of lung cancer for pipe and cigar smokers than for cigarette smokers, and may have helped foster the belief that pipe/cigar smoking was a lesser hazard to health in general than cigarette smoking. Since then, increasing evidence suggests that pipe or cigar smoking may result in as much smoking-related disease as cigarette smoking. A Swedish study (32% cigarettes, 27% pipe, 5% cigar) showed that pipe (only) smokers experienced similar mortality risk to cigarette smokers for smoking-related cancers, respiratory disease, and CHD with a linear relationship with the amount of tobacco smoked, whether it was cigarettes, pipe, or cigars. In British men (Whitehall study), all-cause mortality rates for secondary pipe/cigar smokers were higher than for primary pipe/cigar smokers and those who switched from cigarettes to pipe smoking had a higher mortality than those who gave up smoking completely. A case-control study from seven European centres suggested that the smoking of cigars, cigarillos, and pipe tobacco exerted a carcinogenic effect on the lungs comparable to smoking cigarettes. A similar case-control European study showed pipe and cigar smoking to be associated with cancer of the urinary bladder. In two large follow-up studies of US men who had never smoked cigarettes (Kaiser Permanente and Cancer Prevention Study II) cigar smoking was associated with increased risk of CHD and smoking-related cancers as well as bronchitis and emphysema. A 28-year study of Norwegian men and women found a dose–response relationship between lung cancer, cancer of the upper digestive and respiratory tracts and both cigarette smoking and pipe smoking in men. Our findings of increased risk of smoking-related cancers and CHD in primary and secondary pipe/cigar smokers support these earlier findings and extend the evidence to risk of stroke.

Magnitude of effect
Comparison of the magnitude of effect of primary and secondary pipe/cigar smoking, or of combined pipe/cigar smoking, has proved extremely difficult. There are marked differences between studies in the definitions used for smoking categories and in the relative proportions of pipe and cigar smokers. The studies have a wide range of duration of exposure to smoking and not all
express their results in terms of RR or make appropriate adjustments for confounding variables. However, despite these restrictions, it is evident that recent prospective studies are in general agreement that pipe and/or cigar smokers have higher risks approximating or similar to those of regular light cigarette smokers and significantly higher than those who have never smoked.

Limitations

The number of primary pipe/cigar smokers is relatively small and thus the findings for primary and secondary pipe/cigar smokers have been presented separately and combined. We cannot draw any firm conclusion as to whether the risks of primary pipe/cigar smokers differ from those of secondary pipe/cigar smokers but both appear to be at increased risk. The magnitude of effect of pipe/cigar smoking on CVD and smoking-related cancers is substantial even after adjustment for confounders. While adjustment can never entirely remove the effects of these confounders, it is unlikely that the significant effects are simply due to residual confounding by factors such as social class, as social class differences between secondary pipe/cigar smokers and never smokers were relatively small. Indeed, the primary pipe/cigar smokers are far more likely to be non-manual workers and precise measurements of social class would increase the risk further.

Public health implications

The American Cancer Society (1998) concluded that (1) smoking cigars instead of cigarettes does not reduce the risk of nicotine addiction, (2) cigar smoke contained higher concentrations of toxic and carcinogenic compounds than cigarettes and was a major source of carbon monoxide, (3) cigar smoking causes cancers of the oral cavity, larynx, lung, and oesophagus, and (4) with increasing numbers of cigars smoked, the risk of death approached that of cigarette smoking. The findings in the present study in middle-aged men who are pipe and/or cigar smokers supports these conclusions and suggests that 'cessation of all tobacco products is the best strategy for decreasing exposure to tobacco smoke'.

Conclusion

In these middle-aged British men, both primary and secondary pipe/cigar smokers experienced an increased risk of major cardiovascular events, cancer incidence, and all-cause mortality compared with never smokers, at a level similar to current light smokers. These findings supplement published data indicating that all tobacco smoking, not just cigarette smoking, should be regarded as hazardous to health.

Acknowledgement

The British Regional Heart Study is a British Heart Foundation Research Group and receives support from the Department of Health (England). The views expressed in this publication are those of the authors and not necessarily those of the Department of Health (England).

KEY MESSAGES

- Pipe/cigar smokers have significantly higher risk of coronary heart disease and stroke events than never smokers.
- Cardiovascular, non-cardiovascular, and all-cause mortality are significantly higher in pipe/cigar smokers than never smokers.
- Pipe/cigar smokers have significantly increased risk of smoking-related cancer, largely due to lung cancer.
- Pipe/cigar smoking health effects are intermediate between never smokers and light smokers; lung cancer risk is similar to light cigarette smoking.
- All forms of tobacco smoking are hazardous to health.

References

4 Wald NJ, Watt HC. Prospective study of effect of switching from cigarettes to pipes or cigars on mortality from three smoking related diseases. BMJ 1997;314:1860–63.


