SMOKING AND LUNG CANCER

Jean-François Boivin

September 20th 2010
Mortality in relation to smoking: 50 years’ observations on male British doctors

Richard Doll, Richard Peto, Jillian Boreham, Isabelle Sutherland
Abstract

Objective To compare the hazards of cigarette smoking in men who formed their habits at different periods, and the extent of the reduction in risk when cigarette smoking is stopped at different ages.
THE MORTALITY OF DOCTORS IN RELATION
TO THEIR SMOKING HABITS
A PRELIMINARY REPORT

BY

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AND

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Professor of Medical Statistics, London School of Hygiene and Tropical Medicine; Honorary Director of the Statistical Research Unit of the Medical Research Council
Figure 6.3. Age-adjusted annual mortality rates from selected causes of cancer in males, aged 50–74, Scotland, 1911–1986. (From MacFarlane GJ, Boyle P. Scottish Mortality Data, 1911–1985. Mimeographed. Personal communication, 1987.)
Introduction

During the 19th century much tobacco was smoked in pipes or as cigars and little was smoked as cigarettes, but during the first few decades of the 20th century the consumption of manufactured cigarettes increased greatly.¹ This led eventually to a rapid increase in male lung cancer, particularly in the United Kingdom.
Throughout the first half of the 20th century the hazards of smoking had remained largely unsuspected.\(^1\) Around the middle of the century, however, several case-control studies of lung cancer were published in Western Europe\(^2\)\(^{-}\)\(^6\) and North America,\(^7\)\(^{-}\)\(^10\) leading to the conclusion in 1950 that smoking was “a cause, and an important cause” of the disease.\(^5\)
(Aus der Medizinischen Universitäts-Poliklinik, Köln-Bürgerhospital. — Direktor: Prof. Dr. G. Wüllenweber.)

Tabakmißbrauch und Lungenkarzinom *.

Von
Franz Hermann Müller.

Mit 2 Textabbildungen.
(Eingegangen am 24. Dezember 1938.)
THE NAZI WAR ON CANCER

ROBERT N. PROCTOR
Fig. 6.1. The Nazi party barred smoking in many public spaces, including party offices and waiting rooms (Diensträume). Note the negroid head on the cigar; Nazi antitobacco activists tried to characterize smoking as the vice of degenerate Africans. Source: Auf der Wacht 58 (1941): 24.
Unser Führer Adolf Hitler

trinkt keinen Alkohol und raucht auch nicht. Ohne andere im geringsten in dieser Richtung zu beeinflussen, hölt er sich eisern an das selbstauferlegte Lebensgefühl. Seine Arbeitsleistung ist ungeheuer.

(Reichsjugendführer Baldur von Schirach im Buch: "Hitler, wie ihn keiner kennt."

Fig. 6.10. "Our Führer Adolf Hitler drinks no alcohol and does not smoke. . . . His performance at work is incredible." From Auf der Wacht 54 (1937): 18.
<table>
<thead>
<tr>
<th>Extrem Raucher (täglicher Verbrauch von 10—15 Zigarren, mehr als 35 Zigaretten, mehr als 50 g Pfeifentabak)</th>
<th>Lungenkrebskranke</th>
<th>Gesunde</th>
<th>von 86 Lungenkrebskranken</th>
<th>von 86 Gesunden</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>4</td>
<td>29,07</td>
<td>4,65</td>
<td></td>
</tr>
<tr>
<td>Sehr starke Raucher (7—9 Zigarren, 26—35 Zigaretten, 36—50 g Pfeifentabak)</td>
<td>18</td>
<td>5</td>
<td>20,93</td>
<td>5,81</td>
</tr>
<tr>
<td>Starke Raucher (4—6 Zigarren, 16 bis 25 Zigaretten, 21—35 g Pfeifentabak)</td>
<td>13</td>
<td>22</td>
<td>15,12</td>
<td>25,58</td>
</tr>
<tr>
<td>Mäßige Raucher (1—3 Zigarren, 1 bis 15 Zigaretten, 1—20 g Pfeifentabak)</td>
<td>27</td>
<td>41</td>
<td>31,39</td>
<td>47,68</td>
</tr>
<tr>
<td>Nichtraucher</td>
<td>3</td>
<td>14</td>
<td>3,49</td>
<td>16,28</td>
</tr>
<tr>
<td>Zusammen</td>
<td>86</td>
<td>86</td>
<td>100,00</td>
<td>100,00</td>
</tr>
</tbody>
</table>
**Design** Prospective study that has continued from 1951 to 2001.

**Setting** United Kingdom.

**Participants** 34,439 male British doctors. Information about their smoking habits was obtained in 1951, and periodically thereafter; cause-specific mortality was monitored for 50 years.
The decision that this study would be conducted among doctors was taken partly because it was thought that doctors might take the trouble to describe their own smoking habits accurately, but principally because their subsequent mortality would be relatively easy to follow, as they had to keep their names on the medical register if they were to continue to practise. Moreover, as most doctors would themselves have access to good medical care, the medical causes of any deaths among them should be reasonably accurately certified.
Main outcome measures Overall mortality by smoking habit, considering separately men born in different periods.
Table 1: Causes of mortality by smoking habit, standardised indirectly for age and study year, for all 34,439 men born in the 19th or 20th century (1851-1930) and observed 1951-2001

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>No of deaths 1951-2001</th>
<th>Lifelong smokers</th>
<th>Current smokers (no other smoking habit previously reported)</th>
<th>Other smokers</th>
<th>Standardised tests for trend (x^2 on 1 df)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Non-smokers</td>
<td>Former</td>
<td>Current</td>
<td>Current (cigarettes/day)</td>
</tr>
<tr>
<td>Cancer of lung</td>
<td>1052</td>
<td>0.17</td>
<td>0.88</td>
<td>2.49</td>
<td>1.31</td>
</tr>
<tr>
<td>Cancers of mouth, pharynx, larynx, oesophagus</td>
<td>340</td>
<td>0.09</td>
<td>0.26</td>
<td>0.60</td>
<td>0.36</td>
</tr>
<tr>
<td>All other neoplasms</td>
<td>3893</td>
<td>3.34</td>
<td>3.72</td>
<td>4.69</td>
<td>4.21</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>640</td>
<td>0.11</td>
<td>0.64</td>
<td>1.56</td>
<td>1.04</td>
</tr>
<tr>
<td>Other respiratory disease</td>
<td>1701</td>
<td>1.27</td>
<td>1.70</td>
<td>2.39</td>
<td>1.76</td>
</tr>
<tr>
<td>Ischaemic heart disease</td>
<td>7623</td>
<td>6.19</td>
<td>7.61</td>
<td>10.01</td>
<td>9.10</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>3307</td>
<td>2.75</td>
<td>3.18</td>
<td>4.32</td>
<td>3.76</td>
</tr>
<tr>
<td>Other vascular (including respiratory heart) disease</td>
<td>3052</td>
<td>2.28</td>
<td>2.83</td>
<td>4.15</td>
<td>3.37</td>
</tr>
<tr>
<td>Other medical conditions</td>
<td>2560</td>
<td>2.26</td>
<td>2.47</td>
<td>3.49</td>
<td>2.94</td>
</tr>
<tr>
<td>External causes</td>
<td>891</td>
<td>0.71</td>
<td>0.75</td>
<td>1.13</td>
<td>1.08</td>
</tr>
<tr>
<td>Cause unknown</td>
<td>277</td>
<td>0.17</td>
<td>0.28</td>
<td>0.52</td>
<td>0.39</td>
</tr>
<tr>
<td>All cause (No of deaths)</td>
<td>34,439</td>
<td>19.38</td>
<td>24.15</td>
<td>35.40</td>
<td>29.34</td>
</tr>
</tbody>
</table>

*Values of x^2 on one degree of freedom for trend between three or four groups: values >15 correspond to p<0.0001.
†N/X/C compares three groups: lifelong non-smokers, former cigarette smokers, and current cigarette smokers. Amount compares four groups: never smoked regularly, and current cigarette smokers consuming 1-14, 15-24 or ≥25 cigarettes/day when last asked.
Table 1 Cause specific mortality by smoking habit, standardised indirectly for age and study year, for all 34,439 men born in 19th or 20th century (1851-1930) and observed 1951-2001

Age standardised mortality rate per 1000 men/year

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>No of deaths 1951-2001</th>
<th>Lifelong non-smokers</th>
<th>Former</th>
<th>Current</th>
<th>Current (cigarettes/day)</th>
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<tr>
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<td>0.68</td>
<td>2.49</td>
<td>1.31  2.33  4.17</td>
</tr>
</tbody>
</table>

Relative risk = 2.49 / 0.17 = 14.6
Table 1  Cause specific mortality by smoking habit, standardised indirectly for age and study year, for all 34439 men born in 19th or 20th century (1851-1930) and observed 1951-2001

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>No of deaths 1951-2001</th>
<th>Lifelong non-smokers</th>
<th>Former</th>
<th>Current</th>
<th>1-14</th>
<th>15-24</th>
<th>≥25</th>
</tr>
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<td>0.17</td>
<td>0.68</td>
<td>2.49</td>
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<td>2.33</td>
<td>4.17</td>
</tr>
</tbody>
</table>

Age standardised mortality rate per 1000 men/year

1.31 / 0.17 = 7.7  
2.33 / 0.17 = 13.7  
4.17 / 0.17 = 24.5
Table 1 Cause specific mortality by smoking habit, standardised indirectly for age and study year, for all 34,439 men born in 19th or 20th century (1851-1930) and observed 1951-2001

Age standardised mortality rate per 1000 men/year

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<td>0.68</td>
<td>2.49</td>
<td>1.31 15-24 2.33 25 4.17</td>
</tr>
</tbody>
</table>

Risk difference = 2.49 – 0.17 = 2.3 per 1000 men / year
Table 1 Cause specific mortality by smoking habit, standardised indirectly for age and study year, for all 34,439 men born in 19th or 20th century (1851-1930) and observed 1951-2001

Age standardised mortality rate per 1000 men/year

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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1-14: 1.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15-24: 2.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>≥25: 4.17</td>
</tr>
</tbody>
</table>

Risk difference = 1.31 - 0.17 = 1.14 per 1000 men / year

= 2.33 - 0.17 = 2.16 per 1000 men / year

= 4.17 - 0.17 = 4.00 per 1000 men / year
Biases

Confounding
Measurement
Losses to follow-up

Generalizability
Table 2 Characteristics in 19/8 of smokers, ex-smokers, and smokers born in 20th century (aged 48/8 at 19/8 survey). Means and prevalences are standardised to age distribution of all 12 669 respondents to 19/8 questionnaire

<table>
<thead>
<tr>
<th>Means of some vascular risk factors</th>
<th>Current smoker (n=3866)</th>
<th>Ex-smoker for &lt;10 years (n=1787)</th>
<th>Ex-smoker for ≥10 years (n=4074)</th>
<th>Never smoker (n=2942)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol consumption (units/week)</td>
<td>19.0</td>
<td>18.1</td>
<td>14.8</td>
<td>8.3</td>
</tr>
<tr>
<td>Body mass index*</td>
<td>24.5</td>
<td>24.7</td>
<td>24.3</td>
<td>24.1</td>
</tr>
<tr>
<td>Blood pressure, systolic (mm Hg)</td>
<td>136.9</td>
<td>137.6</td>
<td>137.2</td>
<td>135.6</td>
</tr>
<tr>
<td>Blood pressure diastolic (mm Hg)</td>
<td>83.1</td>
<td>84.3</td>
<td>83.5</td>
<td>83.1</td>
</tr>
</tbody>
</table>

Prevalences (%) of various replies

| Quit for vascular disease          | NA                     | 12.2                             | 3.9                              | NA                    |
| Quit for respiratory disease      | NA                     | 14.0                             | 8.3                              | NA                    |
| Any vascular disease              | 18.6                   | 20.2                             | 20.8                             | 16.7                  |
| Short of breath hurry†             | 17.2                   | 20.2                             | 13.8                             | 9.1                   |
| Phlegm in winter†                  | 26.6                   | 12.4                             | 8.6                              | 6.5                   |

NA=not applicable.

*Body mass index = weight (kg)/(height(m))²
†Are you short of breath when hurrying; and, do you usually bring up phlegm from your chest during the winter?
From the 59,600 individuals approached initially, 40,637 replies were received that were sufficiently complete to be used – 34,445 from men and 6,192 from women. From a one-in-ten random sample of the register, it was estimated that this represented answers from 69% of the men and 60% of the women alive at the time of the inquiry. The degree of self-selection in those who replied was assessed in terms of the overall mortality using this one-in-ten sample. The standardized death rate of those who replied to the first questionnaire was only 63% of the death rate for all doctors in the second year of the inquiry, and 85% in the third year. In the fourth to tenth years the proportion varied about an average of 93%, and there was no evidence of any regular change with the further passage of years. Evidently the effect of selection did not entirely wear off, but after the third year it had become slight. One factor in this favourable mortality was the presence among those who replied of a relatively large number of nonsmokers and a relatively small number of heavy cigarette smokers, demonstrated by a small inquiry undertaken in 1961. Two small samples were drawn of (1) those who had replied in 1951 and (2) those who had not. Eliminating those who had died between 1951 and 1961, there were 267 previous ‘answerers’ and 213 previous ‘nonanswerers’. They were asked about their smoking habits in 1961, and 261 (98%) of the answerers and 179 (84%) of the nonanswerers responded. Comparison of these two groups shows 21% (answerers) and 6% (nonanswerers) nonsmokers and 15% (answerers) and 28% (nonanswerers) as moderate or heavy cigarette smokers (15 or more daily).
Information about the death of doctors was obtained at first directly from the Registrars-General of the United Kingdom, who provided particulars of every death identified as referring to a medical practitioner. Later, lists of deaths were obtained from the General Medical Council, and these were complemented by reference to the records of the British Medical Association and other sources at home and abroad. Some deaths came to light in response to the questionnaires. Others were discovered in the course of following up doctors who had not replied to or who had not been sent subsequent questionnaires. Of the 34 440 men studied, 10 072 were known to have died before 1 November 1971, 24 265 were known to have been alive at that date, and 103 (0.3%) were not yet traced.

Many of the 103 untraced doctors were not British, and 67 (65%) were known to have gone abroad. It was felt unlikely that more than about a dozen deaths relevant to the study could have been missed.
By the mid-1920s smoking had become commonplace in the United States and cigarette tobacco was the most popular form of tobacco consumption. At the same time women had just won the right to vote, widows were succeeding their husbands as governors of such states as Texas and Wyoming, and more were attending college and entering the workforce. While women seemed to be making great strides in certain areas, socially they still were not able to achieve the same equality as their male counterparts. Women were only permitted to smoke in the privacy of their own homes. Public opinion and certain legislation at the time did not permit women to smoke in public, and in 1922 a woman from New York City was arrested for lighting a cigarette on the street.

George Washington Hill, president of the American Tobacco Company and an eccentric businessman, recognized that an important part of his market was not being tapped into. Hill believed that cigarette sales would soar if he could entice more women to smoke in public.
In 1928 Hill hired Bernays to expand the sales of his Lucky Strike cigarettes. Recognizing that women were still riding high on the suffrage movement, Bernays used this as the basis for his new campaign. He consulted Dr. A.A. Brill, a psychoanalyst, to find the psychological basis for women's smoking. Dr. Brill determined that cigarettes which were usually equated with men, represented torches of freedom for women. The event caused a national stir and stories appeared in newspapers throughout the country. Though not doing away with the taboo completely, Bernays's efforts had a lasting effect on women smoking.
PROPAGANDA

By

EDWARD L. BERNAYS

Copyright 1928
Reissued in 1972

KENNIKAT PRESS
Port Washington, N. Y./London
‘The conscious and intelligent manipulation of the organized habits and opinions of the masses is an important element in democratic society.’

EL Bernays (1928)
1929 Easter Parade (New York)

**Torches of freedom:**
Dozens of women lighted cigarettes
Press forewarned
Arranged by Bernays for a tobacco company
FIGURE 1. Annual adult per capita cigarette consumption and major smoking and health events — United States, 1900–1998

- 1st World Conference on Smoking and Health
- 1st Surgeon General’s Report
- Broadcast Ad Ban
- End of WW II
- 1st Great American Smokeout
- Nicotine Medications Available Over the Counter
- Fairness Doctrine Messages on TV And Radio
- Master Settlement Agreement
- Nonsmokers’ Rights Movement Begins
- Surgeon General’s Report on Environmental Tobacco Smoke
- Federal Cigarette Tax Doubles
- 1st Smoking Cancer Concern
- Great Depression
- 1900–1998

Year

Number
Bring on the duelling Top-10s:

Second Opinion

ANDRÉ PICARD

Every day in the media there are reports on the latest health research findings. Many of these articles, implicitly or explicitly, offer advice on how to improve your health: Walk more to prevent dementia; eat more tomatoes to stave off prostate cancer; get regular mammograms to reduce the risk of breast cancer; and so on.

Based on this kind of research, it’s easy enough to put together a Letterman-like Top 10 Tips for Better Living.

It would read something like this:

1. Don’t smoke.
2. Eat a balanced diet.
3. Be physically active.
4. Limit your stress.
5. If you drink alcohol, do so in moderation.
6. Cover up in the sun.
7. Practise safer sex.
8. Get a regular check-up, including screening for common diseases.
10. Learn first aid and CPR.

All these measures relate to lifestyle — adapting to your social environment. But we have long known that there are more important factors in determining your health, including genetics and the environment in which you live.

The environment, which academics like to call the socio-economic determinants of health, entered the mainstream in 1974, when then-minister of health and welfare Marc Lalonde issued his landmark report, New Perspectives on the Health of Canadians.

Thirty years on, that perspective is more important than ever, but still largely overlooked.

The reality is that the factors that have the greatest impact on whether we develop life-threatening diseases are out of our control as individuals.

Income is a far better predictor of heart disease than commitment to regular exercise. The neighbourhood you live in influences your cancer risk more than your diet. The job you work at will give you a much better idea of your Alzheimer risk than the amount of fish oil you consume. And your level of education will determine your longevity more accurately than screening tests.

In other words, general living conditions contribute more to long-term health status and mortality rates than lifestyle practices. Factors like education, income,
1. Don’t smoke.
2. Eat a balanced diet.
3. Be physically active.
4. Limit your stress.
5. If you drink alcohol, do so in moderation.
6. Cover up in the sun.
7. Practise safer sex.
8. Get a regular check-up, including screening for common diseases.
10. Learn first aid and CPR.
1. Don’t be poor.
2. Pick your parents well.
3. Graduate from high school or, better yet, university.
4. Don’t work at a stressful, low-paid job. Find a job where you have decision-making power and control.
5. Learn to control stress levels.
6. Be able to afford a foreign holiday and sunbathe (with SPF 30).
7. Don’t be unemployed.
8. Leave in a community where you have a sense of belonging.
9. Don’t live in a ghetto, near a major road or polluting factory.
10. Learn to make friends and keep them.
Harm reduction
Needle exchange programs to reduce the spread of AIDS

Decrease the harmfulness of drug injection

(Not necessarily the prevalence of drug injection)
Methadone to reduce the adverse consequences of heroin dependence

Substitute one dependence by another
Tobacco harm reduction
CLEARING THE SMOKE

Assessing the Science Base for Tobacco Harm Reduction

Kathleen Stratton, Padma Shetty, Robert Wallace, and Stuart Bondurant, Editors

Committee to Assess the Science Base for Tobacco Harm Reduction

Board on Health Promotion and Disease Prevention

INSTITUTE OF MEDICINE
Tobacco harm reduction

Modified tobacco
Modified cigarettes
Nicotine patches, inhalers, etc.
Nicotine antagonists
Antidepressants
Is Tobacco Research Turning Over a New Leaf?

Scientists developing reduced-harm tobacco products increasingly rely on tobacco industry funding, but some universities and grant organizations want to forbid it.

Burning issue. University of Nebraska's Stephen Rennard says bans on tobacco industry funding violate academic freedom.
Term paper

The following assignment must be completed by November 19th. Students are advised to work in groups of approximately 2-3 persons. Class presentations will be given on November 19th and 24th. A written paper summarizing the presentation is also required.

- **Preamble:** “Tobacco use is a major cause of death from cancer, cardiovascular disease, and pulmonary disease. Cigarette smoking is also a risk factor for respiratory tract and other infections, osteoporosis, reproductive disorders, adverse postoperative events and delayed wound healing, duodenal and gastric ulcers, and diabetes. In addition, smoking has a strong association with fire-related and trauma-related injuries.”(Benowitz 2010) On the other hand, smoking is also associated with some favorable health outcomes.

- **Question:** Provide an estimate of the number of deaths attributable to cigarette smoking in the world during the 20th century.

- **Comments about this assignment:** You should devote approximately 25 hours to this assignment (two hours per week on average throughout the entire course). This question could actually require hundreds of hours of work to obtain a satisfactory answer. On the other hand, quick back-of-the-envelope calculations could be completed very rapidly. You should focus on the structure of the problem and the identification of the types of data required to arrive at an estimate. Given the limited amount of time and information available to you, describe the simplifying assumptions that you have decided to make in your calculations. Your answer must be quantitative: you must provide one numerical estimate of the number of deaths (or perhaps a few plausible alternatives). Your answer should also include quantitative information that was used in arriving at your estimate. Your class presentation should last approximately 20 minutes, including time for questions. Your written text should be based on the PowerPoint presentation, following the same structure. It should correspond to approximately one page per PowerPoint slide. Your written text must be received by JF Boivin by December 3rd. Assignments received after this date will receive a maximum mark of 50%.

Students who do not wish to present their work in class may work alone. You must then provide a more substantial written text, equivalent to 50 hours of work, in lieu of the PowerPoint presentation and the group work.


Version 27 August 2010