



Stories of Science: Up in Smoke: Finding what causes Lung Cancer

The story about how the link was found between a popular pastime and a deadly disease.

Smoking was viewed very differently in the 1940's and 50's to today. At that time it was acceptable for cigarettes to be smoked at home, in the car or at work; even doctors were used to promote the smoking of cigarettes! However, at the end of the Second World War, Britain had the highest incidence of lung cancer and nobody could work out why.

Richard Doll

Richard Doll, along with another Doctor, Austin Bradford-Hill were tasked with looking into why lung cancer rates were so high. As epidemiologists they studied which people in the population got certain diseases and tried to figure out why. They conducted a case-control study between 1948 and 1952 in London hospitals.

TABLE IV.—Proportion of Smokers and Non-smokers in Lung-carcinoma Patients and in Control Patients with Diseases Other Than Cancer

Disease Group	No. of Non-smokers	No. of Smokers	Probability Test
Males:			
Lung-carcinoma patients (649)	2 (0.3%)	647	P (exact method) = 0.0000064
Control patients with diseases other than cancer (649) ...	27 (4.2%)	622	
Females:			
Lung-carcinoma patients (60)	19 (31.7%)	41	$\chi^2 = 5.76; n = 1$ 0.01 < P < 0.02
Control patients with diseases other than cancer (60) ...	32 (53.3%)	28	

Table from XXX (19XX)



According to a recent Nationwide survey:
MORE DOCTORS SMOKE CAMELS THAN ANY OTHER CIGARETTE

Smoking Advertisement from 1949

A case-control study takes cases (those with the disease) and matches them with patients who do not have the disease but are otherwise similar (the controls). Doll and Bradford-Hill interviewed both cases and controls about their smoking habits. They interviewed both men and women, but due to the disproportionate ratio of men to women (25 to 2) only men were included in the final study. By doing this, Doll and Bradford Hill showed that the levels of lung cancer amongst smokers was much higher than in non-smokers. Doll himself stopped smoking in 1949! The findings from this study are shown (left).

Correlation or Causation?

Although Doll and Bradford-Hill knew there was a link between smoking and lung cancer (correlation) they could not prove that it caused cancer (causation). When Doll and Bradford-Hill published their results, it was greeted with apathy and disbelief; the British tobacco industry had close ties to the government and smoking was a popular habit that the government did not want to interfere with.

Doll and Bradford-Hill followed this up with a cohort study of British doctors. A cohort study follows individuals and looks at their lifestyle and risk factors to determine if they develop a disease. The Doll and Bradford-Hill study ran until 2004 and showed that half of all smokers died from smoking-related diseases. It also generated extraordinary results in terms of identifying the range of conditions caused by smoking. This has been a seminal study and since 1970 the United Kingdom has had biggest reduction in smoking-related diseases in the world.



What does this picture show?



Comprehension and Reflection Questions

1. Why was smoking socially acceptable in the 1940's and 1950's?

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2. What does an epidemiologist do?

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3. What factors should the cases and controls be matched on?

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4. Explain what might be a problem with interviewing people about their smoking habits?

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5. Give a reason why there were more men than women who were smokers in the initial study.

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6. What reasons were there that people did not believe Doll and Bradford-Hill?

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7. What is meant by the words 'correlation' and 'causation'?

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8. Discuss the differences between a case-control study and a cohort study? Which do you think is best?

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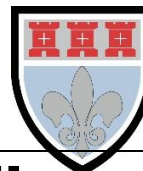
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9. Write a definition for a 'risk factor'? Can you think of other risk factors for cancer?

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Extension Activities

Ideas for things to do next:

Many case-control studies and cohort studies have been done since Doll and Bradford-Hill. Choose two of these from Google and see if they showed a correlation and how they proved a link.

Several statistical tests can be used to show correlations in epidemiological studies. Research these and write a paragraph about how they are used and what they show.

Further Reading

Ideas for things to read next:

Doll R, Hill AB. Smoking and Carcinoma of the Lung. British Medical Journal. 1950;2(4682):739-748.

Doll R, Peto R, Boreham J, Sutherland I. Mortality from cancer in relation to smoking: 50 years observations on British doctors. British Journal of Cancer. 2005;92(3):426-429. doi:10.1038/sj.bjc.6602359.

Weinberg R. One Renegade Cell: The Origin of Cancer (1999) Basic Books. New York