

The British Doctors' Study (1951-2001)

From 1951 to 2001, researchers at the University of Oxford in Oxford, England, conducted the British Doctors' Study, a study that examined the smoking habits, disease rates, and mortality rates of physicians in Britain. Two epidemiologists, scientists who study occurrence and distribution of disease, Richard Doll and Austin Bradford Hill, initiated the study, and statistician Richard Peto joined the team in 1971. The objective of the study was to assess the risks associated with tobacco use, and its relationship to lung cancer. The researchers tracked 34,439 male doctors practicing in Britain, and recorded smoking habits, development of diseases including lung cancer, other cancers, respiratory diseases, cardiovascular diseases, and mortality rates. The researchers published updated results every ten years. In 1980, Doll and other researchers concluded a related study on the smoking habits and disease rates of female doctors practicing in Britain. The results of both studies provided evidence that individuals who smoked tobacco were more likely to develop chronic respiratory illnesses, including lung cancer, and cardiovascular diseases.

In the late 1940s, Doll and Hill at the University of Oxford compared smoking rates among hospital patients with lung cancer and those without. The results, documented in the paper "Smoking and Carcinoma of the Lung: Preliminary Report," indicated that a relationship existed between tobacco smoking and lung disease. Throughout the first half of the twentieth century, physicians had observed rising rates of lung cancer, particularly among adult men. In their 1950 article Doll and Hill suggested the possibility of a direct correlation between how much an individual smoked and how likely he or she was to develop lung cancer. Hill and Doll's hypothesis ran contrary to the belief of most medical experts at the time, who attributed the increase in lung cancer rates to improvements in diagnostic medicine and an increase in air pollution.

Between 1950 and 1951, Doll and Hill presented their preliminary research on smoking and lung cancer to the Medical Research Council (MRC), a public agency responsible for funding and organizing medical research in Great Britain. In 1951, the MRC Statistical Research Unit, based in Oxford, England, authorized Doll and Hill to study the smoking habits and relevant medical records of all consenting registered British physicians for an indefinite period. The researchers chose physicians as the sample population because they were required to keep their name and information updated on the medical register to practice medicine and thus would be easy to track. In addition, Doll and Hill assumed that doctors, with their scientific backgrounds, would be able to self-report their smoking habits accurately.

In October 1951, Doll and Hill mailed a questionnaire to all doctors registered to practice medicine in Great Britain. The short questionnaire included demographic information, smoking status, and follow up questions including amount of tobacco consumed, and age at which one started smoking, for those that classified themselves as smokers. Doll and Hill mailed 59,600 questionnaires and received responses from 41,024 doctors, 34,866 males and 6,158 females. After receiving the responses, the researchers broke down the responses by gender, as they assumed that the physiological differences between men and women could affect the study results. Therefore, the female physicians were followed through a separate smaller study and for a shorter period of time, only twenty-two years. Doll and Hill explained that females were excluded from the larger study for several reasons, lung cancer was relatively uncommon in women, there were more male doctors than female doctors, and more men smoked than women. Thus, due to the larger sample size and appreciable risk, and to minimize error from physiology differences, the researchers selected an all-male primary study group.

Next, the researchers separated the doctors into further categories. The doctors were grouped

by their ages at the beginning of the study: thirty-four years and younger, thirty-five to forty-four, forty-five to fifty-four, fifty-five to sixty-four, sixty-five to seventy-four, seventy-five to eighty-four, and eighty-five and older. Doll and Hill also grouped the doctors by their estimated daily tobacco consumption, using five categories: none, 1 to 14 grams, 15 to 24 grams, and 25 or more grams. The researchers also separated the doctors by their method of smoking: cigarettes, pipes, or both.

Over the next fifty years, Doll and Hill proceeded to track the disease rate, mortality rate, and self-reported smoking habits of the doctors. With access to the physicians' relevant medical histories up to and after the start of the study, the researchers collected data on lung cancer, cancers outside of the lungs, non-cancer respiratory diseases and general illness, coronary thrombosis, later called myocardial infarction, commonly known as heart attack, cardiovascular diseases other than coronary thrombosis, and all other diseases. Doll and Hill sent follow-up questionnaires to the physicians in 1957, 1966, 1971, 1978, 1991, and 2001. Although Doll and Hill collected relatively complete data on health and smoking habits, the team could not track everything about the doctors' lives, meaning that there may have been other factors that influenced the health of research subjects. However, the large sample size was used to compensate for those unknown variables, and enabled researchers to analyze significant trends and form generalizable conclusions.

In 1954, Doll and Hill published their preliminary findings in "The Mortality of Doctors in Relation to their Smoking Habits: A Preliminary Report" in the *British Medical Journal*. The preliminary report excluded participants under the age of thirty-five, an exclusion that Doll and Hill justified by stating that they could not gain useful data from the age group at the time due to the scarcity of lung cancer cases in younger patients. In the report, the researchers outlined the methods of their study and presented early findings that suggested strong correlations between frequency of tobacco use and lung cancer, other respiratory diseases, coronary thrombosis, and general mortality. They also established loose correlations between general tobacco use and non-lung cancers, cardiovascular diseases other than coronary thrombosis, and unrelated diseases.

In a secondary follow-up report in 1956, "Lung Cancer and Other Causes of Death in Relation to Smoking," Doll and Hill reported a strong correlation between smoking and lung and cardiovascular diseases. In their second report, they included the doctors younger than thirty-five at the start of the study. The data presented by the researchers suggested that smoking increased the frequency of lung cancer occurrence across all age groups. The researchers also found that smoking increased the likelihood that doctors would be diagnosed with other respiratory diseases and coronary thrombosis. Rates of non-lung cancers and death was highest in the heaviest smoking category, but the correlation between smoking and disease was weaker. Furthermore, living participants in the eighty-five-and-older category in the 1956 report were more likely to be light smokers or nonsmokers in comparison to other age groups. The results suggested that nonsmokers and light smokers were more likely than heavy smokers to reach the older age brackets before dying. The report also included strong evidence that cigarette smokers faced a disproportionately higher risk of lung disease than pipe smokers.

Doll, Hill, and Peto concluded their study in 2001, at which point the youngest surviving participants had reached their late seventies and the majority of total participants were dead. Over the fifty-year span of their study, the researchers published follow-up results on the subjects' health and smoking status after the first, second, fourth, and fifth decades from the study's onset. Those results strengthened the correlations found in the earlier studies, reinforcing the scientific and public perceptions of tobacco use as causative to respiratory and cardiovascular illness.

From 1951 to 1973, while studying the male physicians, Hill and Doll also studied the group of responding female doctors practicing in Britain. In "Mortality in Relation to Smoking: 22 Years' Observations on Female British Doctors," the authors discussed all the disease types included in the study on men, in addition to the occurrences of breast and ovarian cancer. Their study of female physicians was also unique in that it surveyed whether the participants described themselves as inhalers of cigarette smoke, and explicitly commented on the differences in habits of women who reported to have begun smoking before and after World War I. Inhaling tobacco smoke deeply into the lungs increases the absorption of nicotine, an addictive and stimulatory chemical, and the practice was more commonly found in women who had developed or would later develop lung cancer. Doll and Hill provided evidence that, like men, women smokers experienced an increased

risk of lung and cardiovascular disease. Heart disease, lung cancer, and chronic obstructive lung disease strongly correlated with smoking, although the excess risks of increased smoking frequency were found to be lower in women than in men who smoked equivalently. Ovarian cancer risk was significantly elevated in heavy-smoking women, while breast cancer appeared uncorrelated.

Doll, Hill and Peto's reports have accrued over 17,000 literature citations as of 2017. The study provided a formative basis for public anti-tobacco policy, including tobacco tax increases, advertising campaigns, and the funding of research for smoking cessation drugs.

Sources

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