# IHP 330 Module Two WorksheetMeasuring Disease

A causal relationship between cigarette smoking and lung cancer was first suspected in the 1920s on the basis of clinical observations. To test this apparent association, numerous epidemiologic studies were undertaken between 1930 and 1960. Two studies were conducted by Richard Doll and Austin Bradford Hill in Great Britain. The first was a case-control study begun in 1947 comparing the smoking habits of lung cancer patients with the smoking habits of other patients. The second was a cohort study begun in 1951 recording causes of death among British physicians in relation to smoking habits. This case study deals first with the case-control study, then with the cohort study.

Data for the case-control study were obtained from hospitalized patients in London and vicinity over a four-year period (April 1948 – February 1952). Initially, 20 hospitals, and later more, were asked to notify the investigators of all patients admitted with a new diagnosis of lung cancer. These patients were then interviewed concerning smoking habits, as were controls selected from patients with other disorders (primarily nonmalignant) who were hospitalized in the same hospitals at the same time. Data for the cohort study were obtained from the population of all physicians listed in the *British Medical Register* who resided in England and Wales as of October 1951. Information about present and past smoking habits was obtained by questionnaire. Information about lung cancer came from death certificates and other mortality data recorded during ensuing years.

Over 1700 patients with lung cancer, all under age 75 were eligible for the case-control study. About 15% of these persons were not interviewed because of death, discharge, severity of illness, or inability to speak English. An additional group of patients were interviewed by later excluded when initial lung cancer diagnosed proved mistaken. The final study group included 1,465 cases (1,357 males and 108 females). The following table shows the relationship between cigarette smoking and lung cancer among male cases and controls:

Table 1

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cases | Controls |  |
| Cigarette Smoker | 1,350 | 1,296 |  |
| Nonsmoker | 7 | 61 |  |
| Total | 1,357 | 1,357 |  |

1. Accurately calculate the proportion of cases that smoked. Be sure to show your calculations.
2. Accurately calculate the proportion of controls that smoked. Be sure to show your calculations.
3. Accurately calculate the odds ratio, with the correct equation. What do you infer from the odds ratio about the relationship between smoking and lung cancer?

Table 2 shows the frequency distribution of male cases and controls by average number of cigarettes smoked per day.

Table 2: Daily cigarette consumption

|  |  |  |  |
| --- | --- | --- | --- |
| Daily Number of Cigarettes | Number of Cases | Number of Controls | Odds Ratio |
| 0 | 7 | 61 | Referent |
| 1–14 | 565 | 706 |  |
| 15–24 | 445 | 408 |  |
| 25+ | 340 | 182 |  |
| All smokers | 1350 | 1296 |  |
| Total | 1357 | 1357 |  |

1. Accurately calculate the odds ratios by category of daily cigarette consumption, comparing each category to nonsmokers. Be sure to show your calculations.

**Group smoking 0 cigarettes per day**

**Group smoking 1-14 cigarettes per day**

**Group smoking 15-24 cigarettes per day**

**Group smoking 25 or more cigarettes per day**

**All Smokers**

Interpret these results and describe the trends or patterns you see in the data.

Part 2: The Cohort Study

Data for the cohort study were obtained from the population of all physicians listed in the British Medical Register who resided in England and Wales as of October 1951. Questionnaires were mailed in October 1951 to 59,600 physicians. The questionnaire asked the physicians to classify themselves into one of three categories: 1) current smoker, 2) ex-smoker, or 3) nonsmoker. Smokers and ex-smokers were asked the amount they smoked, their method of smoking, the age they started to smoke, and, if they had stopped smoking, how long it had been since they last smoked. Nonsmokers were defined as persons who had never consistently smoked as much as one cigarette day for as long as one year. Physicians were also asked whether or not they had a diagnosis of lung cancer. Usable responses to the questionnaires were received from 40,637 (68%) physicians, of whom 34,445 were males and 6,192 were females. The next section of this case study is limited to the analysis of male physician respondents, 35 years of age or older.

The occurrence of lung cancer in physicians responding to the questionnaire was documented over a 10-year period (November 1951 through October 1961) from death certificates filed with the Registrar General of the United Kingdom and from lists of physician deaths provided by the British Medical Association. All certificates indicating that the decedent was a physician were abstracted. For each death attributed to lung cancer, medical records were reviewed to confirm the diagnosis.

Diagnoses of lung cancer were based on the best evidence available; about 70% were from biopsy, autopsy, or sputum cytology (combined with bronchoscopy or X-ray evidence); 29% were from cytology, bronchoscopy, or X-ray alone; and only 1% were from just case history, physical examination, or death certificate. In total, there were 355 cases of lung cancer during this 10-year time period, with 255 newly diagnosed cases of lung cancer.

Of 4,597 deaths in the cohort over the 10-year period, 157 were reported to have been caused by lung cancer; in 4 of the 157 cases this diagnosis could not be documented, leaving 153 confirmed deaths from lung cancer.

The following table shows numbers of lung cancer deaths by daily number of cigarettes smoked at the time of the 1951 questionnaire (for male physicians who were nonsmokers and current smokers only). Person-years of observation ("person-years at risk") are given for each smoking category. The number of cigarettes smoked was available for 136 of the persons who died from lung cancer.

Table 3: Number and rate (per 100,000 person-years) of lung cancer deaths by number of cigarettes smoked per day, Doll and Hill physician cohort study, Great Britain, 1951–1961.

|  |  |  |  |
| --- | --- | --- | --- |
| Daily number of cigarettes smoked | Deaths from lung cancer | Person-years at risk | Mortality rate per 1,000 person-years |
| 0 | 3 | 42,800 | 0.07 |
| 1–14 | 22 | 38,600 |  |
| 15–24 | 54 | 38,900 |  |
| 25+ | 57 | 25,100 |  |
| All smokers | 133 | 102,600 |  |
| Total | 136 | 145,400 |  |

1. Accurately calculate the lung cancer mortality rates for each smoking category. Be sure to show your calculations.
2. Describe the trends or patterns you see in the data about mortality, and explain what the trends or patterns mean.
3. Accurately calculate the incidence for lung cancer during the 10 year time period. Be sure to show your calculations.
4. Accurately calculate the prevalence for lung cancer during this 10 year time period. Be sure to show your calculations.