INVESTIGATION 1.1.1 POPCORN PRODUCTION AND LUNG DISEASE

In May 2000, eight people who had worked at the same microwave-popcorn production plant reported to the Missouri Department of Health with fixed obstructive lung disease. These workers had become ill between 1993 and 2000 while employed at the plant. On the basis of these cases, in November 2000 researchers began conducting medical examinations and environmental surveys of workers employed at the plant to assess their occupational exposures to certain compounds (Kreiss et al., 2002). As part of the study, current employees at the plant underwent spirometric testing. This measures FVC—forced vital capacity—the volume of air that can be maximally, forcefully exhaled. On this test, 31 employees had abnormal results, including 21 with airway obstruction.

Researchers were curious as to whether the baseline rate was high among microwave-popcorn workers. We could compare these workers to the general population (Chapter 3) and we can also compare these workers to others within the same plant who had different levels of exposure. The plant itself was broken into several areas, such as the flavor-mixing room, a quality-control room for popping sample product, and packaging rooms. Some of the areas, such as the bag-printing area and the outdoors, were separate from the popcorn production area. Air and dust samples in each job area were measured to determine the exposure to diacetyl, a marker of organic chemical exposure. The cumulative exposure for participants was determined by taking into account how long they spent at different jobs within the plant and the average exposure in that job area. Employees were then classified into two groups: a "low-exposure group" and a "high-exposure group."

These researchers were interested in whether the employees in the high-exposure group had a higher "risk" of developing lung problems than those in the low-exposure group. If we morbidly define a "success" to be "having airway obstruction," this is the same as comparing the "proportion of successes" in the two groups. Of the 21 participants with airway obstruction, 6 were from the low-exposure group and 15 were from the high-exposure group.

INVESTIGATION 1.2.1 SMOKING AND LUNG CANCER

After World War II, evidence began mounting that there was a link between cigarette smoking and pulmonary carcinoma (lung cancer). In the 1950s, two now classic articles were published on the subject. One of these studies was conducted in the United States by Wynder and Graham ("Tobacco Smoking as a Possible Etiologic Factor in Bronchiogenic Cancer," *Journal of the American Medical Association*, 143(4)). They found records from a large number (684) of patients with proven bronchiogenic carcinoma (a specific form of lung cancer) in hospitals in California, Colorado, Missouri, New Jersey, New York, Ohio, Pennsylvania, and Utah. They personally interviewed 634 of the subjects to identify their smoking habits, occupation, exposure to dust and fumes, alcohol intake, education, and cause of death of parents and siblings. Thirty-three subjects completed mailed questionnaires and information for the other 17 was obtained from family members or close acquaintances. Of those in the study, the researchers focused on 605 male patients with the same form of lung cancer. Another 1332 hospital patients with similar age and economic distribution (including 780 males) without lung cancer were interviewed by these researchers in St. Louis and by other researchers in Boston, Cleveland, and Hines, Illinois.

The following two-way table replicates the counts for the 605 male patients with the same form of cancer and for the "control group" of 780 males.

Amount of Cigarette Smoking for More than 20 Years by Males*

	None (less than 1 per day)	Light (1–9 per day)	Moderately heavy (10–15 per day)	Heavy (16–20 per day)	Excessive (21–34 per day)	Chain (35+ per day)
Lung cancer patients (n = 605)	8	14	61	213	187	122
Controls (n = 780)	114	90	148	278	90	60

*Pipe and cigar smoking were included by counting 1 cigar as 5 cigarettes and 1 pipeful as 2½ cigarettes.

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INVESTIGATION 1.2.2 SMOKING AND LUNG CANCER (CONT.)

Another landmark study investigating the link between lung cancer and smoking was conducted by Hammond and Horn (1958). Starting in 1952, they used 22,000 American Cancer Society volunteers as interviewers. Each interviewer was to ask 10 healthy white men between the ages of 50 and 69 to complete a questionnaire on smoking habits. Each year during the 44-month follow-up, the interviewer reported whether or not the man had died, and if so, how. They ended up tracking 187,783 men in nine states (California, Illinois, Iowa, Michigan, Minnesota, New Jersey, New York, Pennsylvania, and Wisconsin), over 44 months. Almost 188,000 were followed up by the volunteers through October 1955, during which time about 11,870 of the men had died, 448 from lung cancer. The following table (reproduced from the Hammond and Horn article) classifies the men as "having a history of regular cigarette smoking" or not and whether or not they died from lung cancer. Note that nonsmokers are grouped with occasional smokers, including pipe- and cigar-only smokers.

	Regular smoker	Not regular smoker	Total
Lung cancer death	397	51	448
Alive or other cause of death	78,557	108,778	187,335
	78,954	108,829	187,783

1.5.2 Relieving Back Pain

A study published in the journal *Neurology* (May 22, 2001) examined whether the drug botulinum toxin A is helpful for reducing pain among patients who suffer from chronic low back pain. The 31 subjects who participated in the study were randomly assigned to one of two treatment groups: 16 received a placebo of normal saline and the other 15 received the drug itself. The subjects' pain levels were evaluated at the beginning of the study and again after eight weeks. The researchers found that 2 of the 16 subjects who received the saline experienced a substantial reduction in pain, compared to 9 of the 15 subjects who received the actual drug.