

1. Exposure of workers to asbestos at construction sites and shipyards is considered dangerous. The workers at a construction site are concerned that asbestos might be present in the air, and so an inspector has been called. The inspector will select a random sample of locations at the site and will measure the asbestos level at those locations. If the data collected by the inspector provide convincing evidence that mean level of asbestos at the site is below the permissible exposure limit of 0.1 fibers per cubic centimeter (f/cc) then work at the site will be allowed to continue. Otherwise, work will stop until precautions have been put into place.
 - (a) The results of the inspection will be analyzed by means of a hypothesis test. State the null and alternative hypotheses that would be used for the test, and define the parameter of interest.
 - (b) In the context of this situation, describe Type I and Type II errors and describe the consequences for the workers of each type of error.
2. A company that manufactures exercise equipment for use in the home is considering a new marketing approach in which people who attend public gyms are specifically targeted. It has been though for several years that roughly 60% of people who attend public gyms have exercise equipment at home. In order to gather some data to investigate the truth of this, the company sends an employee, Amy, to a downtown gym in the city in which the company is based.

Amy speaks to 83 of the gym's members as they leave the building, and asks each person whether he/she has exercise equipment at home. Of these 83 people, 42 reply that they have exercise equipment at home, and the remaining 41 reply that they do not.

We can assume that the 83 people in Amy's sample form a random sample of the gym's members, and that the gym has a large number of members.

- (a) Do the data provide convincing evidence that fewer than 60% of the gym's members have exercise equipment at home?

The company sends a second employee, Leonard, to a more exclusive suburban gym. Using the same method as Amy, Leonard finds that in a sample of 10 of the suburban gym's members, 2 respond that they have exercise equipment at home, and the remaining 8 respond that they do not. We can assume that the 10 people in Leonard's sample form a random sample of the suburban gym's members, and that the gym has a large number of members.

- (b) Would it be reasonable to use the same statistical procedure from part (a) to determine if the data provide convincing evidence that fewer than 60% of the gym's members have exercise equipment at home? Explain.

- (c) Suppose that exactly 60% of the suburban gym's members have exercise equipment at home. What is the probability that, in a random sample of 10 of the gym's members, 2 or fewer will have exercise equipment at home?
- (d) Does your answer to (c), along with the result of Leonard's survey, lead you to suspect that fewer than 60% of the suburban gym's members have exercise equipment at home? Explain your reasoning.
3. An experiment was designed to determine whether, in a test of physical endurance, the presence of other participants improved performance. The 32 students in a high school class were randomly assigned to two groups: Group 1 and Group 2. Each student was asked to hold a weight at arm's length in his or her dominant hand for as long as possible. The time (in seconds) for which each student was able to continue to hold the weight in this way was noted. (The same weight was used for each student, and care was taken to ensure that the students' arms were straight, and held in a horizontal position to the side of the body.) Each student in Group 1 performed the task with only the time recorder present. When students in Group 2 performed the task, the other students in Group 2 remained in the room and were allowed to give encouragement to the person performing the task.

The following results were obtained.

Group 1	180	128	135	207	120	207	159	187	183	83	53	154	72	128	105	227
Group 2	278	126	258	280	225	216	166	138	177	162	301	199	76	390	145	384

Does the data provide strong evidence that the presence of other participants appear to bring about a higher mean time for this task? Give appropriate statistical evidence to support your conclusion.