

1. Consider the Body Mass Index (BMI) in a population of 60 year old males in a nursing home. Suppose that the BMI follows a normal distribution with mean 29 and standard deviation 6. Suppose that we take 21 members of this population and are interested in the average BMI of the group.

(Example from http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/BS704_Probability/BS704_Probability8.html)

- (a) What is the probability that the average BMIs for a random group of 21 60 year old males from this population would be at least 32?
- (b) The director of a nursing home has 21 60 year old males that are currently living in her home. She would like to implement group exercise classes for these residents if the average BMI for her group is in the top 2% of average BMIs for samples of this size. What BMI would be the cutoff above which intervention is warranted?
- (c) Based on your work in the previous part, should she be concerned if the average BMI for her group is 32?
- (d) What is the probability that a randomly selected group of 21 60 year old males from this population would have an average BMI of at most 30?

2. A study of the effects of pollution on sea urchins (“Effects of Chronic Nitrate Exposure on Gonad Growth in Green Sea Urchin *Strongylocentrotus Droebachiensis*”, *Aquaculture*, Vol. 242, No. 1-4, pp. 357-363) found that the weights of adult green sea urchins are normally distributed with mean 52.0 g and standard deviation 17.2 g. Answer the following questions using this information.
- (a) What is the probability that ten randomly selected adult green sea urchins would have an average weight that is 60 g or less?
 - (b) Suppose we use the old cutoff which said that adult green sea urchins under 35.0 g are considered to be very sensitive to pollution. What is the probability that a group of 5 randomly chosen adult green sea urchins would have an average which falls below this cutoff?
 - (c) Suppose that you were looking at a population of adult green sea urchins in an area and selected five random adult green sea urchins. If your sample averages 35 g, would you consider this result surprising?
 - (d) Suppose that a biologist suggests that we should treat groups differently, rather than simply comparing to the individual cutoff of 35.0 g. He suggests that for groups of twenty random adult green sea urchins, the standard should be that pollution is suspected if the average for the group is in the smallest 20% of the distribution of sample averages. What cutoff should be used to accomplish this?