HSCC 470
Research Methods and Data Analysis in Health Sciences

Hypothesis Testing I.
Inferential Statistics

Unit Objectives

Upon completion of this unit, the student will be able to:

– Describe the 4 levels of measurement and provide examples of each.
– Describe a probability distribution.
– Define sampling distribution
– Describe the Central Limit Theorem and discuss its implications for hypothesis testing.
– Discuss hypothesis testing
– Identify the null and alternative hypotheses of a hypothesis test
– Discuss the elements of a statistical test

Levels of Measurement

- **Nominal**
  – Set of categories that vary in some quality but not in magnitude
    - Male/female, resuscitated/not resuscitated
- **Ordinal**
  – Categories have a natural ordering, but the distances between the values do not have a precise numerical meaning
    - Strongly agree, agree, disagree, strongly disagree
- **Interval/ratio**
  – Natural ordering but also a quantitative distance between values.
    - Can compare values not only in terms of which is larger, but also in terms of how much larger

Probability Distribution

- **Probability – the proportion of times that a particular outcome would occur in the long run in repeated random sampling**
- **Probability distribution**
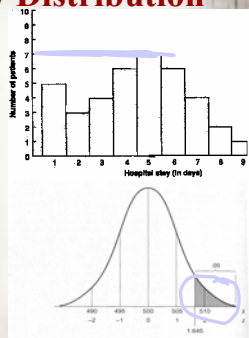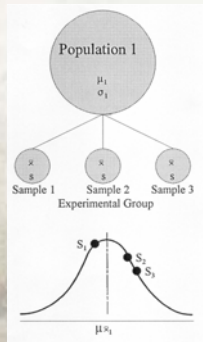 - Discrete
  - Continuous

Figure 11.2 *Sampling distribution of the mean with* $\mu = 500$, $\sigma_{\bar{x}} =$

Sampling Distribution

Probability distribution that specifies the probabilities of the possible values of a sample statistic.

Central Limit Theorem

- **Consider a random sample of *n* measurements from a population distribution having mean μ and standard deviation σ. Then, if *n* is sufficiently large, the sampling distribution of $\bar{Y}$ is approximately a normal distribution with mean μ and standard error**

$$\sigma_{\bar{Y}} = \frac{\sigma}{\sqrt{n}}$$

Central Limit Theorem continued

- **Implications**
  - As n becomes larger, the standard error becomes smaller
  - The sampling distribution approximates a normal distribution regardless of the underlying distribution of the population
  - The mean of the sampling distribution exactly equals the mean of the population distribution.

Hypothesis Testing

- **Prediction about some aspect of a variable or a collection of variables.**
- **Each hypothesis has an alternative hypothesis.**
- **The null hypothesis (H_0) is the hypothesis that is actually tested.**
- **The alternative hypothesis (H_a)is accepted when the test results in rejection of the null hypothesis. It consists of an alternative set of parameter values to those given in the null hypothesis.**

Elements of a Statistical Test

- **Assumptions**
  - Scale of measurement
  - Population distribution
  - Method of sampling
  - Sample size
- **Hypotheses**
  - Null
  - alternative
- **Test statistic**
- **P-value**
- **Conclusion**