

A sampling distribution for the sample mean

From the population distribution of y , we can take repeated samples of size n and calculate a sample mean from each sample:

Sample 1, \bar{y}_1

Sample 2, \bar{y}_2

...

Sample N , \bar{y}_N

Which yields a sampling distribution of the sample mean (\bar{y}).

The Central Limit Theorem

If random samples of size n are drawn from a population with finite mean μ and standard deviation σ , then (for large enough values of n) the sampling distribution of the sample mean is approximately normal with mean μ and standard deviation σ/\sqrt{n} .

Interval estimates

A confidence interval for a parameter typically takes the form:

Statistic plus or minus (multiplier) (s.e. of statistic)

For example, the confidence interval for the population mean from a normal population, when the population standard deviation is unknown is:

$$\bar{y} \pm t_{(a/2, n-1)} \frac{s}{\sqrt{n}}$$

Remember to use the correct interpretation! See Ott (edition 7) page 236 Figure 5.3.

Steps in a Hypothesis test:

1. Specify the null and alternative hypotheses.
2. Specify the significance level.
3. Specify the test statistic.
4. Collect data.
5. Calculate a P value for the test statistic. Remember that $P(Y \geq 10 | \pi = .01)$ is NOT the same as $P(\pi = .01)$.
6. Make decision regarding the hypothesis by comparing the P value to the significance level. If P is less than the significance level, reject the null hypothesis.

Possible errors in a hypothesis test (See Ott (edition 7) page 244, Table 5.3)
The relationship between α , β , and H_a (See Ott page 251, Figure 5.10)

Other important topics:

1. Do the assumptions of the statistical procedure appear to be valid?
2. What is the scope of inference to be drawn from these data?
 - a. Was it an experiment or an observational study?
 - b. To what populations can these results be generalized?

A binomial experiment consists of:

1. A series of independent trials
2. There are two possible outcomes for each trial, which can be called Success or Failure.
3. The probability of Success is equal for each trial.

A study of a new cancer treatment

To compare the effect of a new cancer treatment to the current treatment, a list of all patients in a region of the country is made, and then potential subjects are selected from this list by random sampling. The assignment of a treatment to patients in the study is done by the physician. The survival time of each patient is recorded. Comments?

A study of a new indigestion treatment

Volunteers are recruited to participate in a study to compare the performance of a new anti-indigestion drug to a currently-used drug. Each subject is assigned to one of the two drugs by means of a random number table. The number of minutes until indigestion relief is recorded for each subject. Comments?

Scope of inference

Any conclusion about a treatment having a causal effect on a response requires that random assignment of treatments to subjects must have been performed. Otherwise confounding cannot be ruled out.

Any generalization to a larger group than those in the study requires that the subjects be randomly sampled from the larger group.