Inferential Statistics and *t* - tests

ScWk 242 – Session 9 Slides

Inferential Statistics

- **Inferential statistics** are used to test hypotheses about the relationship between the independent and the dependent variables.
- Inferential statistics allow you to test your hypothesis
- When you get a statistically significant result using inferential statistics, you can say that it is unlikely (in social sciences this is 5%) that the relationship between variables is due to chance.

Cautions about Statistics

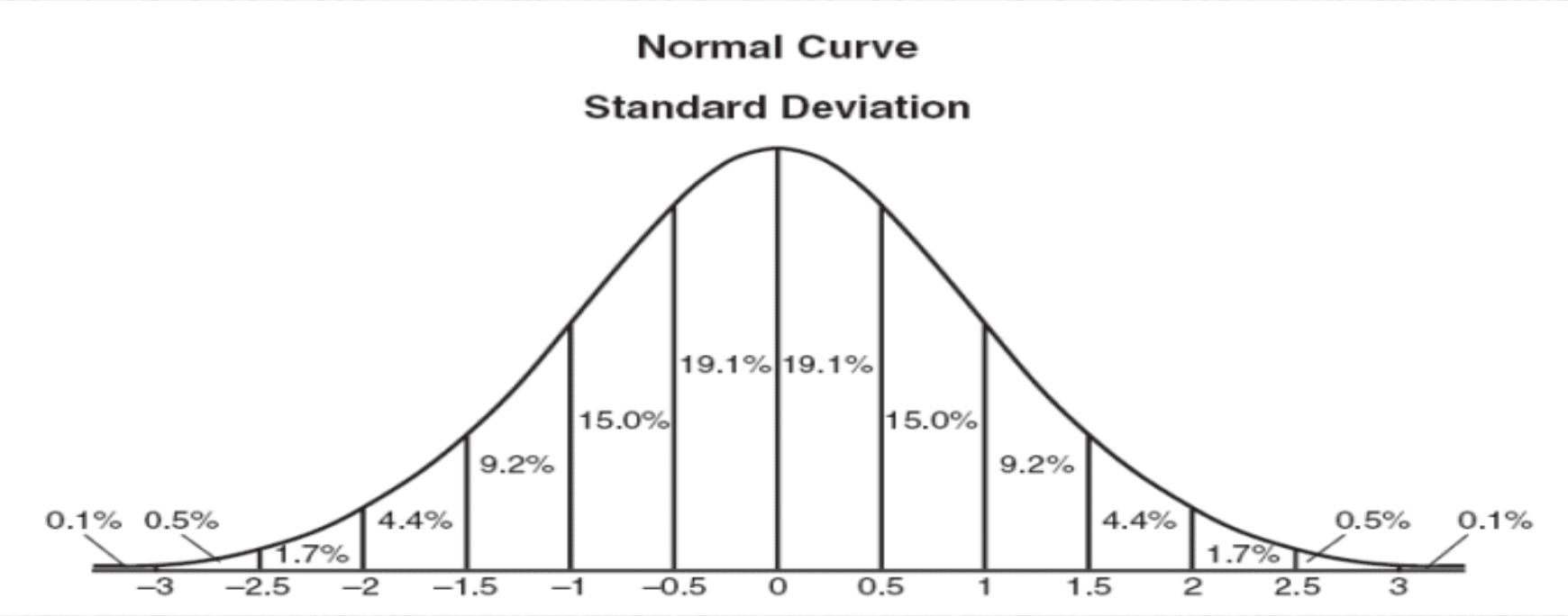
- ***Statistics NEVER prove anything*, instead, they indicate a relationship within *a given probability of error.***
- **An association does not necessarily indicate a sure cause effect relationship.**
- **Statistics can always be wrong, however, there are things that researchers can do to improve the likelihood that the statistical analysis is correctly identifying a relationship between variables.**

Probability Theory

- **Probability theory:** Allows us to calculate the exact *probability* that chance was the real reason for the relationship.
- Probability theory allows us to produce test statistics (using mathematical formulas)
- A test statistic is a number that is used to decide whether to accept or reject the null hypothesis.
- The most common statistical tests include:
  - Chi-square
  - T-test
  - ANOVA
  - Correlation
  - Linear Regression

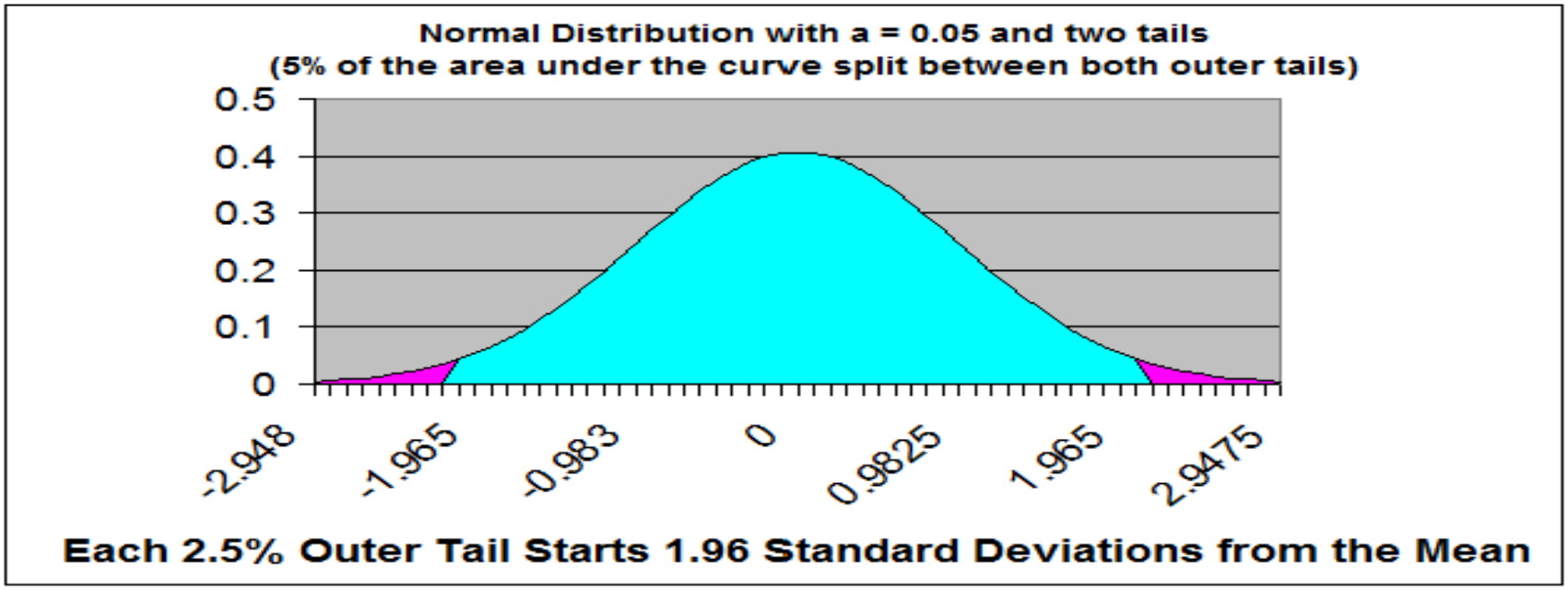
Normal Distributions

- All test statistics that use a continuous dependent variable can be plotted on the normal distribution (chi-square, for example, uses the chi-square distribution).
- A **normal distribution** is a theoretical bell shaped curve:



Significance – Rejection Regions

- If the test statistic produced by the statistical test (using a mathematical formula) falls within a specified *rejection region* on the normal distribution, then we can conclude that the relationship between the independent and dependent variables *is unlikely to be due to chance.* (rejection = rejection of the NULL hypothesis)
- The rejection region is determined by the researcher prior to conducting the statistical test and is called the *alpha level*.



Two-Tailed Significance Tests

- Two-tailed statistical tests (most common) split the rejection region between the tails of the normal distribution so that each tail contains 2.5% of the distribution for a total of 5%.
- Two-tailed tests test non-directional hypotheses
- Example:
  - It is hypothesized that there is a relationship between participation in Independent Living Programs while in foster care (the independent variable) and having been taught budgeting skills while in foster care (the dependent variable)
  - We are not specifying whether the ILP group is more or less likely to have been taught budgeting skills while in foster care
  - We are just saying that there is a difference in the dependent variable (budgeting skills) between the two groups (ILP vs. no ILP)
  - Researchers usually choose two-tailed tests to allow for the possibility that the IV affects the DV in the opposite direction as expected

One-Tailed Tests

One-tailed tests test directional hypotheses

Example:

- **It is hypothesized that youth who participated in Independent Living Programs while in foster care (the independent variable) will have a greater likelihood of having been taught budgeting skills while in foster care (the dependent variable)**
- **We are specifying the expectation that ILP youth will be more likely to have been taught budgeting skills while in foster care than non-ILP youth**
- **The possible risk with one-tailed tests of directional hypotheses is that if ILP youth have fewer budgeting skills, the test won't pick it up and we would have missed a significant finding (in an unexpected direction).**

p Values

- Each test statistic has a *p* value (a probability value) associated with it.
- When you plot a test statistic on the normal distribution, the location of the test statistic on the normal distribution is associated with a *p value*, or a probability.
- If the *p value* produced by the test statistic is within the *rejection region* on the normal distribution, then you reject the null hypothesis and conclude that there is a relationship between the independent and the dependent variables. This shows *statistical significance*.

t-test Statistic

- The t statistic allows researchers to use sample data to test hypotheses about an unknown population mean.
- The t statistic is mostly used when a researcher wants to determine whether or not a treatment intervention causes a significant change from a population or untreated mean.
- The goal for a hypothesis test is to evaluate the *significance* of the observed discrepancy between a sample mean and the population mean.
- Therefore, the t statistic requires that you use the sample data to compute an estimated standard error of M.
- A large value for t (a large ratio) indicates that the obtained difference between the data and the hypothesis is greater than would be expected if the treatment has no effect.

Significance vs. Magnitude

- **Degrees of Freedom (df) is computed by using n – 1 with larger sample sizes resulting in an increased chance of finding significance.**
- **Because the significance of a treatment effect is determined partially by the size of the effect and partially by the size of the sample, you cannot assume that a significant effect is also a large effect.**
- **Therefore, it is recommended that the measure of effect size (differences of outcomes vs. expectations) be computed along with the hypothesis test.**

Interpreting Results

Key items to include in the interpretation of results:

- **Are the findings consistent, or not, with previous research?**
- **Clinical relevance (different from statistical significance)**
- **Limitations and Potential Errors**

Happy Spring Break!