WHAT ARE SOME STATISTICAL METHODS FOR ASSESSING THE SIGNIFICANCE OF DIFFERENCES, CHANGES, AND TRENDS?

There are many kinds of statistics, and thus, many different ways of doing statistical analysis. The basic requirement for statistical analysis is information about what you have accomplished, or the group or population you care about, that is in the form of numbers (quantitative). At its most basic, statistical analysis is a way of arranging this numerical information (also called data) to:

- Summarize information so that it is more understandable and useful, and/or
- Make generalizations or draw conclusions from the available data to a larger group or set of circumstances

Descriptive statistics – those that help summarize information – include:

- Frequency distributions – the number and usually percent of cases (people, organizations, housing units, etc.) that fall into separate and non-overlapping categories.
    - **Discrete** is a term that is used to describe categories that separate things into different types of groups. The groups are not linked on a scale that goes from more to less of the same thing. Instead each category is its own type. Gender, country of origin and racial/ethnic groupings are discrete categories for purposes of doing statistical analysis.
    - The other kind of category is often called "continuous" or "ordinal." In this type of grouping, items are put into categories along a scale or continuum – such as age, quantity, amount, size, etc. For example, when people do statistical analyses of work to improve pre-schools, they often look at the health and development of children ages pre- birth to age 3; children ages 4-5; and children ages 6 and older. The three categories of children (ages pre-school to age 3; 3-5 and 6 or older) are categories using an ordinal scale. On the other hand, if each child were assigned a code based on how old they were in months, that would be using a continuous scale (not an ordinal one). Both are different from discrete scales – because both ordinal and continuous scales assume a continuum.
    - Frequency distributions are most useful for information that is coded into a relatively small number of categories that are discrete, rather than continuous in nature. For example, they are useful to show the percentage or number of people of color vs. whites who are approved for mortgage loans within 30 days of application; or who have graduated from parent leadership training; etc.
    - Frequency distributions can also be helpful in summarizing ordinal information if there are relatively few categories. Examples of such information could be grade in school and number of people in the family.
    - Often continuous information are collapsed into groups, for example, age groups (12 or younger, 13 to 18, 19 to 30, etc.), years of residence in a community (less than one year, 1 to 5 years, 6 to 10 years, greater than 10 years), or annual gross receipts of a business (less than

$100,000, $100,000 to $500,000, $500,000 to $1 million, more than $1 million). Then frequencies are also a useful way of summarizing this information.

- **Means** – a way of describing the distribution of data that is computed as the sum of the information for each case divided by the number of cases

    - Common examples of the use of means are average family income, average age of housing, average amount of business loans, average standardized test scores.

- **Other measures of central tendency** include the median (the value of an item of information at which half of the group is above and half is below) and the mode (the most frequent value)

    - The median is more commonly used, especially in situations where the distribution of values for an item of information is known to be skewed to one end of the distribution or the other – there are many more low values than high values, or vice versa. This is because the mean is "pulled" in the direction of the largest values, even if there are very few cases with that value.

    - A common example is median income in an economically diverse community.

        - In such communities it is generally the case that there are a few families and individuals with very high incomes and many with moderate to low incomes. The mean income in such a community would be higher than the median, and for most uses the median would give a better picture of the average income.

When you use measures of central tendency, you can also look at how much your information clusters together or is spread out. This helps you understand whether the summary statistic you are using is a good representation of the differences or variability within your information. For example, suppose you want to build leadership among community residents. if the mean age of community residents is 37 years old, do you have a group of mostly 30 year olds, with a few fifty year olds and a few twenty year olds – or do you have a group that includes people in their twenties, thirties, forties and fifties and some eighty and ninety year olds? This is very useful to know for planning purposes and when you go to evaluate whether or not you have reached the residents you were hoping to engage.

- One of the advantages of using the mean to describe information is that it is possible to calculate the **standard deviation of the mean**. This is a measure of how wide the distribution of values is around the mean (giving a sense of the range).

    - Specifically, the standard deviation describes how closely your information clusters around the mean. (Technically, it is the value at which a certain proportion of the cases occur relative to the mean).

    - One standard deviation on either side of the mean will include about two-thirds of all cases, and two standard deviations on either side of the mean will include about 95 percent of all cases. The smaller the standard deviation, the more closely the information clusters around the mean.

    - Thus, when you compute standard deviations along with the means, you will get a sense of how much of the information falls close to the mean and how much falls either well above or well below the mean.

- Other **measures of variability in the data** include:

- The **range** (the lowest and highest values)
- **Quartiles** (the range of values within which one-quarter of the cases fall – there are four quartiles from lowest -- with the lowest 25 percent of the cases, to the highest -- with the highest 25 percent of the cases)

- **Coefficient of variability** (the ratio of the standard deviation to the mean), which describes how similar or homogeneous a group is within itself

- **Skewness** (a measure of the degree and direction in which the bulk of the cases fall) -- a normal distribution is not skewed, that is, the distribution of cases is the same on either side of the mean. The statistic produced by this analysis, called the skewness coefficient, will have a positive value if there are more positive than negative values in the data and negative if there are more negative than positive values in the data.

- When people talk about statistical analysis, they are often talking about **measures of association.**

  - Measures of association indicate how much one characteristic of the people, groups or organizations your data are describing occurs simultaneously with other characteristics of the same people, groups or organizations. For example, poor health and poor income are often associated – they often occur together for the same people and groups.

    - One explanation is that many of the same institutional and structural factors that affect income affect health. Also, people in poor health have a harder time finding and holding employment, just as people with little money have a harder time finding and using health care.

    - Measures of association help you look at these kinds of relationships – and your analysis of racism and theory of change help you understand the "cause and effect" nature of why these associations might be occurring.

  - **Correlation statistics** are computed for characteristics with ordinal or continuous values – like age, income, years of education, size of loan, gross receipts, etc.

    - There are several specific types of correlation statistics, but the most commonly used is the Pearson correlation coefficient.

    - This coefficient ranges from +(positive) 1.0 to –(negative) 1.0. A coefficient of +1.0 indicates that the values on each of the two correlated characteristics are arrayed in exactly the same way from lowest value to highest value. A coefficient of –1.0 indicates that the values on one characteristic are arrayed in exactly the opposite direction from values on the other characteristic. A coefficient of zero means that there is no pattern between how the values of the characteristics are distributed.

  - **Cross-tabulations** are tables in which the categories of one characteristic represent the rows and the categories of the other characteristic are the columns.

    - Cross-tabulations are most helpful when there are a small number of categories in each characteristic.

  - **Inductive statistics** are those that allow the user to reasonably infer that what has been observed did not happen by chance and that the same observation would be found in repeated samples from the same underlying group or population. If an observation is statistically significant, it can be reasonably assumed that it applies to the group as a whole.

- Observations could be pre-post measures for the same entities, changes over time in group characteristics, differences between groups, and associations between characteristics.

- Inductive statistics rely on probability theory. The results are generally presented in terms of the probability that the observation is due to chance (or is no difference from zero).

- The usual threshold for statistical significance is p <= .05 – that is, the probability that the observation is due to chance (or is no different from zero) is no more than 5 times out of a hundred.

- Tests of statistical significance can be computed for differences in means over time or between groups, correlation coefficients, cross- tabulations, and other statistical measures.

- For example, you might want to test whether the average home selling price in one neighborhood is statistically different from that is another neighborhood, or whether the differences in standardized reading test scores among Hispanic, African-American, and white 4th graders are statistically greater than zero.

- **There are computer software packages that can produce both descriptive and inductive statistics**.

  - Two of the most well-known in the academic environment are SPSS and SAS. Most university social science departments and centers that deal with quantitative data will have such programs. These would also be a good source for advice and assistance on using and interpreting statistical findings.

  - Sage Publications has a series of relatively inexpensive, short reports (monographs) on a wide range of specific research techniques and statistics. (See "Research Methods & Evaluation" on http://www.sagepub.com/ for a complete list.)