Statistics

A set of procedures for describing, synthesizing, analyzing, and interpreting quantitative data

Procedures and techniques should be clearly defined and described

Scoring

♦ Standardized tests – follow manual

♦ Self-developed instruments
  – Describe in detail procedures for scoring items
  – Follow procedures carefully
  – Have independent scorer
  – Pilot test procedures
  – If machine scored – check answer sheets for stray marks

Tabulation and Coding

- ◆ Organizing data to facilitate examination and analysis

- ◆ Dependent on design of study and type of data collected

- ◆ Turn to page 434 – 6 for explanation of procedures

Types of Descriptive Data

◆ Graphing data

◆ Measures of central tendency

◆ Measures of variability

◆ Measures of relative position

◆ Measures of relationship

Graphing Data

- Table 12.2 and figure 12.1 page 438
- Most common method is the construction of a frequency polygon
- Gives a pictorial representation of the data

Measures of Central Tendency

♦ Represents the typical of average score obtained by the group

♦ Three most frequently reported
  – Mode
  – Median
  – Mean

Mode

- The score attained by the most participants
- Describes nominal data
- Not determined by calculation
- Limited value
- Problems
  - Set of scores may have two (or more) modes (bimodal)
  - It is unstable – different random samples often have different modes

Median

- The midpoint score – the core which 50% of participants scored higher and lower

- Describes ordinal data

- No calculation except for finding midpoint score

- Does not have to be an actual score

- Two different sets of scores may have same median

Mean

- The average of all the scores
- Most frequently used measure of central tendency
- Used for interval or ratio scores

Measures of Variability

- ◆ Measures spread of scores
- ◆ Three types
  - – Range – nominal data
  - – Quartile – ordinal data
  - – Standard deviation – ratio data

Range

- The difference between the highest and lowest score
- If the range is small, scores are close together
- Not a stable measurement of variability

Quartile

- Half the difference between the upper and lower quartile
- To calculate
  - Subtract the lower quartile from the upper
  - Divide the result by 2
- More stable measure than Range
- Appropriate when median is appropriate

Variance

♦ The amount of spread among scores

♦ Square root of variance is called standard deviation

♦ To calculate

– Find mean

– Calculate difference between each score and mean

– Square each difference and add

– Divide difference by number of scores

– Result is the variance of scores

Standard Deviation

♦ Square root of variance

♦ Used with ration data

♦ Counterpart of mean

♦ Most stable measure of variability

♦ Symbol for mean $\overline{x}$

♦ Standard deviation SD 99%

♦ A formula $\overline{x} \pm 3SD = 99\%$ of scores

♦ Turn to pages 442 – 3 for an explanation

The Normal Curve

♦ When variables are normally distributed
  – 50% of scores are over mean 50% are below
  – The mean, median and mode are the same value
  – Most scores are near the mean
  – The further from the mean the fewer number of participants who attained the score
  – Same number of scores are between the mean and plus one standard deviation (SD) as minus one SD

♦ Turn to figure 12.2 page 445

Skewed Distributions

♦ Distribution does not form a normal curve

♦ Distribution is not symmetrical

♦ Values of mean, median, and mode are not the same

♦ More extreme scores at one end

♦ More scores at lower end

– Negatively skewed

– Most participants did well

Measures of Relative Position

- ◆ Indicate where a score is in relationship to all other scores

- ◆ Allows comparison of one participants score to all others in study (norm referenced measure)

- ◆ Allows comparison of one participant on two or more different tests

- ◆ Two types
  - – Percentile ranks
  - – Standard scores

Percentile Ranks

♦ Indicates the percentage of scores that fall <u>at</u> or <u>below</u> a given score

♦ A score in the 80th percentile means 80% of scores are lower

♦ Appropriate ordinal scale

♦ Mainly used for internal data

♦ Not used often in research studies

♦ Most often used by public schools to report individual's results on standardized tests

Standard Scores

♦ Derived score

♦ Expresses how far a given raw score is from reference point (usually mean) in terms of standard deviation units

♦ Appropriate for interval or ratio scale of measurement

♦ Three common types
  – z scores
  – t scores
  – stanines

z Score

- Most common basic standard score
- Allow scores from different tests or subtests to be compared
- Use Table A.3 in Appendix
- Problem is involvement of negative numbers and decimals

t Scores

♦ Same as z scores but expressed in a different form

♦ Multiply z scores by 10 and add 50

♦ Transformed z scores have a mean $(\overline{x})$ of 50 and standard deviation (SD) of 10

Stanines

- Standard scores that divide distribution into nine parts
- Stanines frequently reported in norms tables for standardized tests
- Reported by schools
- Useful or frequently used for:
  - Basis for grouping
  - Selection of students for special programs

Measures of Relationships

♦ Used in correlation studies to calculate correlation coefficient

♦ Two most used types

  – The spearman *rho*

  – The Pearson *r*

The Spearman *rho*

- ◆ Used for rank data – appropriate for ordinal scale

- ◆ Used when median and quartile deviation are used

- ◆ Produces coefficient between + 1.00 and -1.00

The Pearson *r*

♦ Used when variables are interval or ration

♦ Most stable measure of correlation

♦ Most often used

♦ Assumes linear relationship

Calculation for Interval Data

Turn to page 453 – 463 for details in calculating scores

Researchers Responsibility

- Must have an understanding of the types of statistical methods available

- Must evaluate and choose the best statistical method for analyzing the data

- Must be able to describe and interpret the statistical analysis of the data

- Must have an understanding of how statistical data id calculated

When in Doubt

- Review research

- Decide what type of data will be reported; nominal, ordinal, or interval (ratio)

- Review statistical methods for type of data

- Request assistance from
  - A computer package
  - A statistician