Biostatistics

Busy Day Tool Kit Preceptor Instructions

Learner level: IPPE and APPE Students

Estimated time to complete: May take several hours/days and can be done intermittently while completing other assigned projects.

Preceptor Instructions: Provide an example of a well-designed and poorly designed study. Referring to these articles, ask the student to use this module to describe all data and statistical test discussed in article.

- Were the tests used appropriate? Why?
- Ask the student to design their own study. What type of data would you have? Which tests would you pick? Why?

Arrange a time to review the results with the student.

Student Instructions: Find articles (or use the articles provided) of a well-designed and poorly designed study. Use this module to describe all data and statistical test discussed in article. Develop responses to the following: Were the tests used appropriate? Why? Finally, design your own study. What type of data would you have? Which tests would you pick? Why? Meet with your preceptor to review the completed drug information request.

Biostatistics

Type of data
- Discrete Variables
  - Nominal (sex, race)
  - Ordinal (NYHA scale)
- Continuous Variables
  - Interval (degrees F)
    - Zero is arbitrary
  - Ratio (HR, BP)
    - Has an absolute zero

Descriptive Statistics
- Mean - average
- Median - midpoint
- Mode – most common value
- Standard Deviation – measure of the variability about the mean
- Range – difference between the smallest and largest value

Choosing Appropriate Statistical Tests
- Type of data
- Distribution of data
- # of groups
- Study design
- Confounders
- Parametric vs. Nonparametric

Parametric vs. Nonparametric
- Parametric
  - Normal distribution
  - Continuous data
- Non parametric
  - Not normally distributed
  - Discrete data

Parametric Tests
- Student t-test
- ANOVA
- ANCOVA
- Pearson Correlation
- Linear Regression

Nonparametric Tests
- Wilcoxon Rank Sum Test
- Mann-Whitney U Test

Nominal Data
- Chi-square test
- Fisher Exact Test
- McNemar
- Mantel-Haenszel

Decision Errors
- Type 1 error (α)- concluding that there is a difference when one does not exist
- Type 2 error (β)- concluding no difference exists when one truly does

Power
The probability of making a correct decision when the null hypothesis is false

Correlation and Regression
- Correlation
  - Examines the strength of the association between 2 variables
  - Not prediction
- Regression
  - Examines the ability of one or more variables to predict another variable

References
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2. Gaddis ML, Gaddis GM. Introduction to biostatistics. Part 2, descriptive statistics. Ann Emerg Med 1990;19:309-15.
3. Gaddis ML, Gaddis GM. Introduction to biostatistics. Part 3, sensitivity, specificity, predictive value, and hypothesis testing. Ann Emerg Med 1990;19:591-7.
4. Gaddis ML, Gaddis GM. Introduction to biostatistics. Part 4, statistical inference techniques in hypothesis testing. Ann Emerg Med 1990;19:820-5.
5. Gaddis ML, Gaddis GM. Introduction to biostatistics. Part 5, statistical inference techniques for hypothesis testing with nonparametric data. Ann Emerg Med 1990;19:1054-9.
6. Gaddis ML, Gaddis GM. Introduction to biostatistics. Part 6, correlation and regression. Ann Emerg Med 1990;19:1462-8.