

Jumping into Statistics: Introduction to Study Design and Statistical Analysis for Medical Research Using JMP Pro Statistical Software

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Meet the Instructors



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Course Objectives

- Review fundamentals of study design and research methodology
- Understand how to choose best statistical test for your research question
- Practice basic statistical analysis use JMP Pro Software

Course Topics

- Asking a Good Research Question
- Life Cycle of Research and Scientific Method
- Study Design
- Data types and Database Construction
- Descriptive Statistics
- Data Visualization
- Population and Sample, Probability, Statistical Inference
- How to Chose Correct Statistical Method and Run Some Analyses
 - T-tests, ANOVA, Non-Parametric
 - Chi-square, odds ratio, relative risk
 - Regression and Correlation
 - Survival Analysis
 - Test Diagnostics (e.g. sensitivity, specificity, etc.)
- Comparing Statistical Modeling and Machine Learning

Study Design: Sample Size and Power Calculations

2/10/2021

What is statistical power?

- Ability of a study to detect differences or effects if they exist.
- What influences power?
 - Effect size (e.g. differences, correlation)
 - Sample Variation (e.g. SD)
 - Sample size
- In study planning, we aim to determine sample size needed in order adequately power a study

Understanding Errors

Your Statistical Decision	True state of null hypothesis	
	H ₀ True (example: the drug doesn't work)	H ₀ False (example: the drug works)
Reject H ₀ (ex: you conclude that the drug works)	<i>Type I error (α)</i> <i>False positive</i> Incorrectly rejecting null	<i>Correct</i>
Do not reject H ₀ (ex: you conclude that there is insufficient evidence that the drug works)	<i>Correct</i>	<i>Type II Error (β)</i> <i>False Negative</i> Incorrectly accepting null

For most research, α is set to **0.05**...i.e. willing to accept, at most, a **5%** chance of obtaining a false positive

That's why we look for $p < 0.05$ in statistical testing

Determining statistical power

- Power = $1 - \beta$ (Type II error rate)
 - Probability of rejecting null when it is actually false
 - i.e. statistically significant result when an effect exists
 - Typical Threshold = 80%
- Note: Type I and Type II error are inversely related

Determining statistical power

- What information do we need for sample size determination?
 - **Power threshold (80%)**
 - **Smallest effect size of interest**
 - Mean difference
 - Proportion difference/Event rate difference
 - Correlation
 - Odds Ratio
 - **Type I error (alpha = 0.05)**
 - **Variability**
 - SD
 - Baseline proportions, event rates in controls
- Best if these values are informed by previous work!

Power Programs

- JMP Pro (but it is limited)
- G*Power
 - More options (correlations, regression, odds ratio, repeated measures)
 - <https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower.html>
- GLIMMPSE
 - Mixed Models
 - <https://glimmpse.samplesizeshop.org/>
- Power and Sample Size
 - <http://powerandsamplesize.com/>
- Open Epi
 - Note: has not been updated in a while, but links and programs still work
 - https://www.openepi.com/Menu/OE_Menu.htm
- For more complex designs, should seek consult from a statistician

Demo!

Questions?

JMP Pro!

<https://software.ufl.edu/>

The screenshot shows a web browser window with the URL `software.ufl.edu/software-listings/sas-jmp.html`. The browser's address bar and tabs are visible at the top. Below the browser is the University of Florida website header, which includes a navigation menu with items like NEWS, CALENDAR, OFFICES & SERVICES, DIRECTORY, GIVING, UF HEALTH, and UF IFAS. A 'Welcome' message is also present. The main content area features a sub-header with 'SOFTWARE LISTINGS', 'LIAISON DASHBOARD', and 'CONTACT US'. Below this is a secondary navigation menu with 'ABOUT', 'DETAILS', 'DOWNLOAD', 'SUPPORT', and 'ASK A QUESTION'. The 'DOWNLOAD' menu item is highlighted. The main text under 'Software' states: 'SAS JMP distributes license keys for the past 3 versions of SAS JMP and SAS JMP Pro. This gives the departments the latitude to schedule their upgrades according to its needs. Select the link below to obtain SAS JMP OR SAS JMP Pro license keys for versions: v13.2, v14.2, and v15.0.' A bulleted list contains the link 'SAS JMP License keys'. Below this, it says 'SAS JMP 15.0 and SAS JMP Pro 15.0 installation files and license keys are distributed together in one installation archive (depot)'. A second bulleted list contains the link 'SAS JMP Installation files'.

software.ufl.edu/software-listings/sas-jmp.html

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ABOUT DETAILS **DOWNLOAD** SUPPORT ASK A QUESTION

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