**Math 58B: Power Analysis / Sample Size Determination**

**The Islands Activity[[1]](#footnote-1)**

**Due: Tuesday, April 4, 2023**



|  |
| --- |
| The goal of the power analysis assignment is to estimate how many observations are needed for an Islands project to reach significance. |

Some reminders:

Logging on: Go to the Islands (<https://theislands.umn.edu/login.php>). If you have forgotten your password, click on ‘Need to set or reset your password?’, enter your 5C email address (most likely of the form aaaa20xx@mymail.pomona.edu), and the Islands will resend your password to you. Let me know if you cannot access the Islands.

Note: The Visitor Center on the Islands (click on the square just south of Arcadia) is a great source for information about the Islands.

Don’t forget about the **Academy**. What is there? Are there any studies that seem interesting? Is the response variable quantitative or categorical? How many explanatory variables are there? Are they each quantitative or categorical? How many observational units total were collected in the study?

**FINAL REPORTS / OUTCOMES**

3/28/23: **Pilot Study** -- research question, methods section, preliminary data

4/4/23: **Power Analysis** – calculation of sample size from the pilot data

4/18/23: **Preliminary Data Analysis** -- data summaries / visualizations, first draft of analysis, including regression

5/2/23: **Complete Draft** – including multiple regression

5/4 + 12/22: **Presentation** -- 2 slides, 5 min presentation (either during our final time or during reading days)

5/12/23: **Final** (edited) **Project**

**TO TURN IN: a power analysis**

* Using the data from the pilot study, calculate three different sample sizes, each which gives a power of 0.7. The difference between the three calculations is the effect size (the suggested difference between 1 and 2 in HA). Include your work / calculations
* Provide a reflection on which of the three effect size suggestions is most realistic (given what you see in your pilot data)
* Provide a justification for the number of observations you plan to collect (also, tell the reader how many observations you plan to collect). Your justification will be based partially on the power analysis. But it may also be based on logistical constraints. It might also be based on extended research questions (e.g., the power analysis focuses on a comparison of 2 groups, but if you have 4 groups, you may decide to double the number of observations -- you wouldn’t need 2x, the calculation is more nuanced than that, but we won’t cover the 4 group power analysis calculation).
* Given the number of observations you plan to collect, estimate the actual power (e.g., if time limitations mean that your sample size is much smaller than your original power indicated, your actual power will be much lower than 0.7).
* Be clear to indicate whether the pilot data is included in the full dataset (justify your decision).
* The analysis should be reproducible (that is, I should be able to run your markdown file!), including a link to a Google sheet with the data collection.
* Please make both the analysis and the justification (to the points above) clear for the reader. You don’t have to print out all of the output, but you should include all of the code.

As before, each individual student should turn in the project to Canvas. Each member of the group will all turn in an identical assignment.

For this assignment, **turn in an .Rmd file and a .pdf**. Having a single .Rmd file will be complicated for collaboration, but a single document will synthesize your group effort. Make sure that everyone is contributing to both the writing and to the computational analysis. It is important to do the work in the markdown file so that the R code can be integrated with the narrative.

**PRELIMINARIES**

* Do all of your work through \*one\* person’s login to the Islands (that is, share the login information!). Make sure the person’s password is not a password they use for any other accounts.
* Data collection should take place on a shared Google Sheet. Everyone should participate in the data collection process. [Keep data tidy: each row is a person; each column is a variable.]
* Everyone should participate in the writing process and the computing.
* The response variable must be quantitative.
* The explanatory variable of interest must be categorical (binary is great, but 3-4 levels is also okay).
* You will also collect demographic information on the Islanders you measure. Ideally, at least one of the demographic variables will be numeric.
* **Note: Multiple islanders can be completing tasks at the same time, but each islander can only complete one task at a time.**

**ROLES**

Each individual will have two roles in the project. They will have an organizational role (to facilitate the group dynamics) as well as a technical role (to facilitate the project). See the bottom of this handout for more details. The roles can change over the life of the project but should be clearly designated for each assignment / step in the process.

* Group Dynamic Roles: Project Manager, Task Manager, Facilitator
* Project Roles: Director of Research, Director of Computation, Reporter

**RESEARCH QUESTION**

Remind the reader of the research question (in the form of a sentence or two describing: the population, the treatment or exposure, the comparison, and the outcome measurement.)

Develop a research question that is both interesting and feasible for an Island project. Check out the PICO structure which helps implement evidence-based practice in medicine[[2]](#footnote-2). Keep in mind that your question could be either experimental or observational in nature.

**GROUP PROJECT ROLES:**

**Norms for the Class and Projects**

1. No one individual is as smart as the entire group.
2. Everyone has something to offer.
3. Everyone has a responsibility to help others in their group.
4. Everyone has a responsibility to understand the full project and to ask for help if they need it.

**Roles for the Projects**

Each individual will have (at least) 2 roles; one role to help foster the group dynamics and the other role to divvy up the responsibilities involved in completing the project.

**Group Dynamic Roles:**

* *Project Manager:* Makes sure that the group is organized and has a clear plan for completing the project. This includes scheduling meetings and having a plan for what needs to be done before the next meeting.
* *Task Manager:* Makes sure that everyone knows what they are expected to do before the next meeting and makes sure that they do it. This might involve calling or emailing each person between meetings to discuss what they have/haven’t done. If someone can’t do the work that needs to be done, the task manager is responsible for calling another meeting if needed.
* *Facilitator:* Makes sure that every member of the group is participating and being listened to and heard. This might involve asking questions of a member that’s been silent and stopping others when someone’s comment is being overlooked.

**Project Roles:** In each case,the person assuming the role is responsible for that aspect of the project. **It doesn’t mean that they will do all that part of the project by themselves**; it means that they are responsible for **dividing** that work up among the members of the group and ensuring that it is done and recorded correctly.

* *Director of Research:* Is responsible for the literature searches / background research. The Director of Research identifies what needs to be searched for in the literature / the Academy, divvies up the background work to be performed among the group members, and coordinates changes in the searches based on information gathered and changes in direction. They are also responsible for making sure that the citations in the project are complete and accurate.
* *Director of Computation:* Is responsible for the computer programs involved in the project. The Director of Computation is responsible for designing the code so that different people can write different parts of the code. The programmer is responsible for making sure that any code written by different people can be integrated.
* *Reporter:* Is responsible for the written report. This involves taking notes during the complete process in order to keep a record of what has been done. The reporter may also gather everyone’s individual notes and put them together. The reporter is also responsible for editing the final report and making sure that the various pieces (that may have been written by different people) fit well together.

**Things to think about:**

1. If other members of a group think that one member isn’t pulling their weight, then you can come and talk to me about it. We will figure out what to do!
2. (Generally) All members of the group get the same grade for the project.
3. Grade on projects (I will send out a rubric for grading toward the end of the semester, but generally the grade will be based on the following):
* Grade for technical depth and sophistication.
* Grade for quality of write-up (organization, clarity, grammatical correctness, appropriate use of graphs, tables, formulae).
* Grade for quality of oral presentation (organization, clarity, appropriate use of graphs, tables formulae, ability to answer questions).
* Grade for quality of group work and distribution of labor.
1. Attendance: you should keep track of who is or isn’t showing up to group project meetings. Students should keep a record of all the times that they worked on the project and the work that they did. Group members should be spending roughly the same amount of time on the project.
1. Thanks to Laura Le and Ann Brearley at UMN for sharing resources. Much of the assignment is taken directly from their excellent resources. [↑](#footnote-ref-1)
2. Description: <https://guides.mclibrary.duke.edu/ebm/pico>; Sample PICO questions: <https://libraryguides.nau.edu/c.php?g=665927&p=4682772> [↑](#footnote-ref-2)