November 23, 2020

MAA MATHEMATICAL ASSOCIATION OF AMERICA | PROGRAMS StatPREP

NEWSLETTER

BUILDING COMMUNITY THROUGH DISCUSSION BOARDS: FLU SHOTS

BY AMBIKA SILVA

As we come into fall, the leaves are changing, the temperature drops, and flu season is upon us. The flu shot's effectiveness can vary year to year because flu viruses mutate constantly and the vaccine wears off over time. This means you can't get vaccinated once and expect to be covered for years, as you can with other diseases. The vaccine must be changed each year and according to https://www.webmd.com/lung/news/20200902/how-effective-is-the-flu-vaccine on average, it's been 40% effective. For this discussion board, students will read the following article: https://statisticsbyjim.com/hypothesis-testing/flu-shots-effectiveness . The article given uses a different number for the effectiveness as it's focusing on one year in particular, but it has great vocabulary for our introductory statistics students to read about.

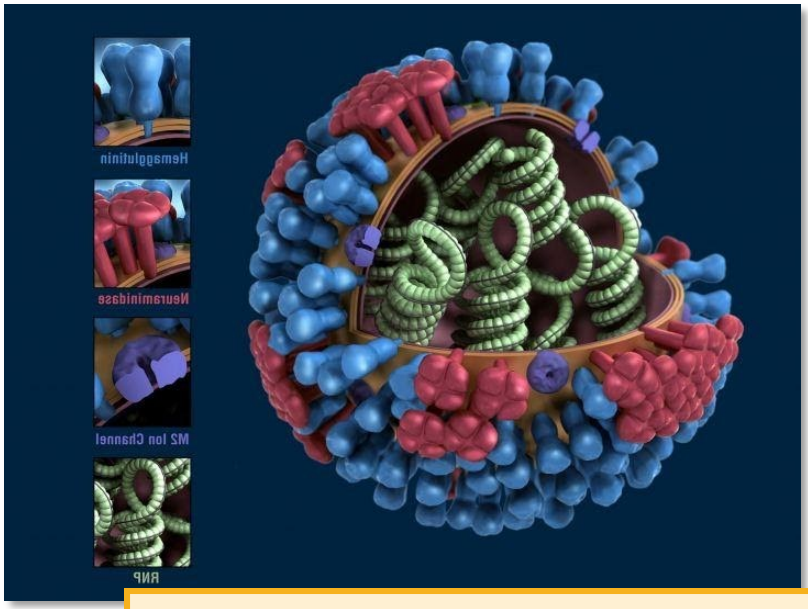

Photo taken from: https://pixnio.com/science/microscopy-images/influenza/3-dimensional-model-of-influenza-virus

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Support for this MAA Program is provided by NSF DUE-1626337

Sample Prompt and Student Responses

Read the following article: https://statisticsbyjim.com/hypothesis-testing/flu-shots-effectiveness

Answer the following questions in complete sentences, then respond to at least two classmates. You must have a minimum of 15 sentences total for your first post.

1. The article looked at peer-reviewed articles, what does this mean? Why do you think this is important to note? (You may have to do additional internet searches on this.)
2. What is the author's opinion of RCTs?
3. What kind of hypothesis tests did they run? What were the results?
4. Describe the difference between Relative Risk versus Absolute Risk.
5. Find three quotes, results, or statistics that resonated with you.

Student sample responses can vary wildly, and a few are given here to demonstrate the type of first responses students may give:

Student #1 initial post (unedited):

1. Peer review articles are articles that have been reviewed by numerous scholars to check the quality of research before publication. In this article, the author looked at peer reviewed articles that have been checked by numerous doctors to make sure all points have correct information. It is important to note peer reviewed articles because it helps put credibility in the claim and arguments a research may have.
2. The author's opinion towards RCT'S are that they are more expensive to conduct than observational studies, but they provide the tremendous benefit of identifying causal relationships rather than merely correlation. This makes sense because correlation does not directly imply causation.
3. The researchers ran a Two Population Proportion Hypothesis Test. The results showed that the flu shots were about 68% effective for the Monto Study. In addition, the researchers found out that flu shots were 69% effective compared to the control group in the Beran Study.
4. Relative Risk in the comparison in which two risks is compared over time. Absolute Risk is the actual chance of something actually happening. In this article, the author claim the vaccine effectiveness as the Relative Risk because they compared the vaccines among two groups. Furthermore, the absolute risk identified in the article is finding the actual risk of getting the flu after taking the vaccine.

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BUILDING COMMUNITY Continued...

Student #1 initial post (unedited) continued:

5. "In fact, without flu shots, you still have a low probability of getting the flu in any one flu season."

   "The difference between the groups (1.9%) is not what we hear about in the media, they report the vaccine effectiveness, which is the relative reduction in the risk for the vaccinated group."

   "Without vaccinations, you have a 41% chance of getting the flu at least twice in 20 years com pared to 5% with annual vaccinations".

Student #2 sample response (unedited):

The article looked at peer-reviewed articles, what does this mean? Why do you think this important to note? (You may have to do additional searches on this.)

- Peer-reviewed articles are sent through a process of editing in order to check for accuracy and validity. This way, they can be considered scholarly and can be an accurate place for others to obtain information.

What is the author's opinion of RCTs?

- The author states that randomized controlled trials are more expensive to conduct than observational studies. However, he believes they have a huge benefit. There is benefit in showing cause and effect relationships rather than simply seeing how things are correlated.

What kind of hypothesis tests did they run? What were the results?

- They ran a 2 Proportions test to determine if the difference between the proportion of sick people in each group was statistically significant. They found that the difference between the two groups was statistically significant. They also found that there was a 66.9% vaccination effectiveness for the flu shot compared to the control group.

Describe the difference between Relative Risk versus Absolute Risk

- Absolute risk is more helpful because it provides more information. In this case, knowing the absolute risk of catching the flu after vaccination compared to no vaccination is more important than knowing the relative risk. Relative risk only provides some information, and could possibly skip some important info.

Find three quotes, results, or statistics that resonated with you.

- "The assumptions are that the average infection rate for the...unvaccinated is 7.0% annually [and] vaccinates is 1.9% annually."
- "When you model long-term outcomes of being vaccinated against the flu regularly, it supports my hypothesis that flu vaccinations will save you from at least one week of misery, and probably more! Regular flu shots both lengthen your expected time until first catching the flu and reduce the number of times you can expect the flu virus to make you sick within a 20-year timeframe."
- "Flu shots contain vaccine for three or four strains of the influenza virus that scientists predict will be the most common strains in a flu season."

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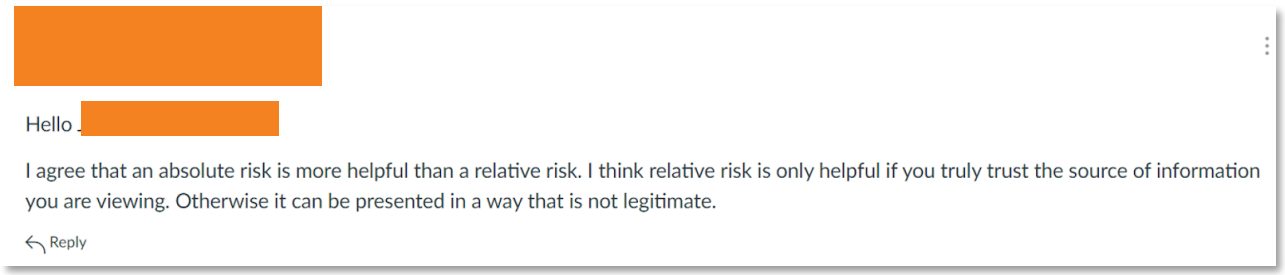
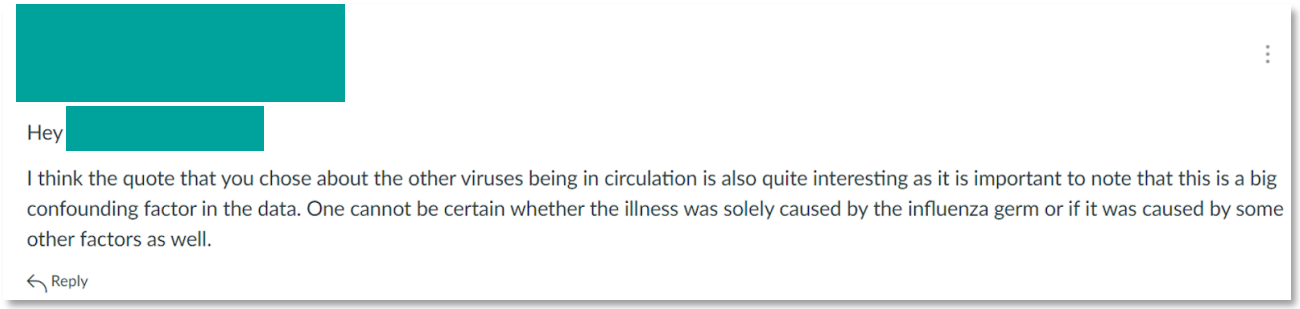
BUILDING COMMUNITY Continued...

Within the discussions, students will respond to each other:





What do I want them to discuss or understand afterwards?

For this discussion, I want to give them something relevant to both what they are learning at the time as well as something relevant for the time frame it's given. At the time it's given during the fall semester, they have just learned about hypothesis tests. I also want to allow them to remind themselves of RCTs and why they are important, which they did on a previous exam. Finally, it's really wonderful to introduce them to the notion of peer reviewed articles as they may not have used this term in the past as this is an introductory course, and it will be something they may encounter in other courses as they continue their academic journey.

Join the Discussion!

Do you have thoughts on using this as a discussion post? Join the conversation online at MAA Connect, https://connect.maa.org/home.

MAA CONNECT

Need Help Joining?

Getting Started Guide Getting Started Video StatPREP October Webinar

inZight

BY DONNA LALONDE

"Requires only access to the internet" is the technology tool version of the phrase "batteries included" because no installation is required for the use of the tool. inZight, which was originally developed for high school students in New Zealand to allow them to explore data quickly and easily, has a "batteries included" version. The project is led by Professor Chris Wild who is a faculty member in the Department of Statistics at the University of Auckland. Since its initial implementation, substantial capabilities have been added including multivariate visualization capabilities, maps, time series, and multivariable regression analysis. In addition to the desktop version, there is also an online version - inZight Lite available. The development team have created "getting started" videos - https://www.stat.auckland.ac.nz/~wild/iNZightLite/IntroMovie.html and there is also excellent help available for most of the modules.

Students may import their own data but there are also sample data sets available. To use one of the available examples, students simply select the data category from a dropdown menu. For example, if "Future-Learn category is selected, students will be able to select from the datasets provided in this category. One example in this category is NHANES 1000. This dataset provides students with access to 1000 rows of data representing 41 variables. Once selected the dataset is available for students to explore using the inZight capabilities. Students may also download plots that they create so would be able to integrate the plots into a report or presentation.

Please share on the StatPREP community if you use inZight, and, of course, let us know how we can help!

Stay Tuned!

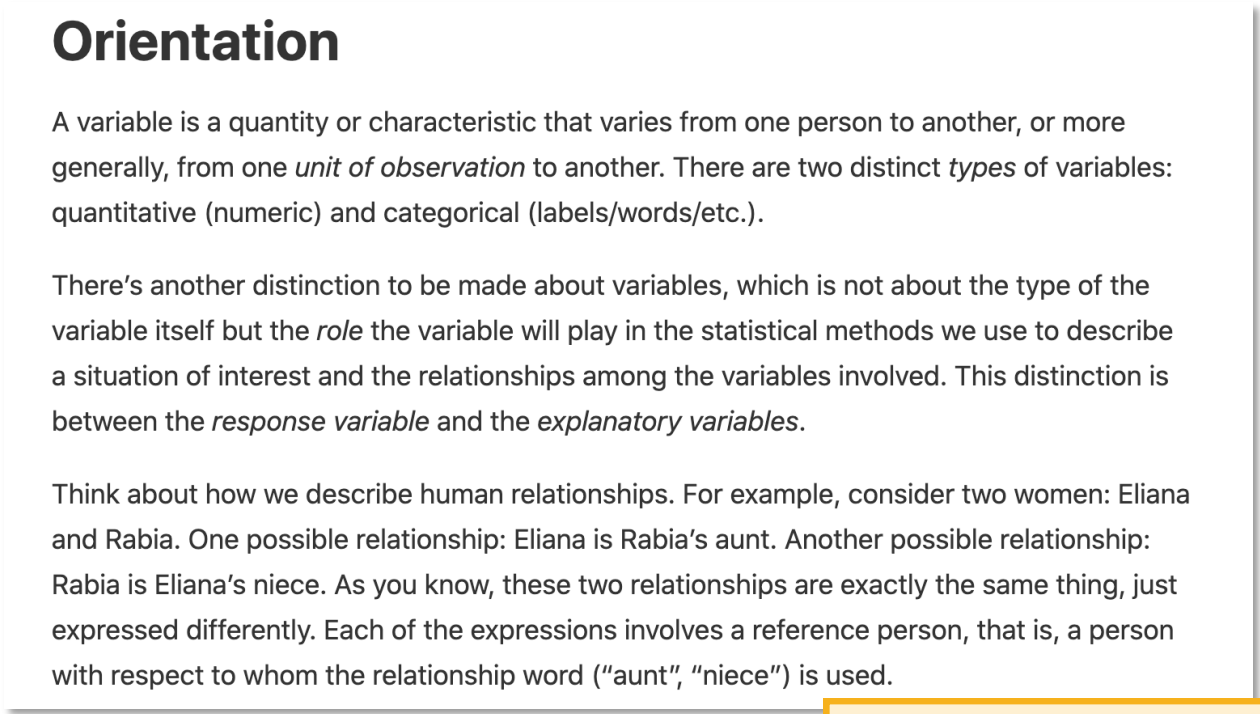
More information on Workshops and Activities for 2021 coming soon!

LITTLE APP ACTIVITY: RESPONSE AND EXPLANATORY VARIABLES

BY KATHRYN KOZAK

If students don't understand the difference between quantitative and categorical variables, then they have a hard time figuring out how to analyse the data. Students need to be introduced to the concepts of these variables early on in the semester, and get a solid understanding of the differences. To aid in helping students learn these concepts, there is an activity that can be used in your class. This activity is one to use at the start of a course to make sure students understand the different types of variables.

The activity starts out with an orientation to response and explanatory variables. Most textbooks do not spend much time discussing explanatory and response variables, but they are important concepts. An understanding of these concepts helps students grasp how to use data to answer questions.



Orientation

A variable is a quantity or characteristic that varies from one person to another, or more generally, from one *unit of observation* to another. There are two distinct *types* of variables: quantitative (numeric) and categorical (labels/words/etc.).

There's another distinction to be made about variables, which is not about the type of the variable itself but the *role* the variable will play in the statistical methods we use to describe a situation of interest and the relationships among the variables involved. This distinction is between the *response variable* and the *explanatory variables*.

Think about how we describe human relationships. For example, consider two women: Eliana and Rabia. One possible relationship: Eliana is Rabia's aunt. Another possible relationship: Rabia is Eliana's niece. As you know, these two relationships are exactly the same thing, just expressed differently. Each of the expressions involves a reference person, that is, a person with respect to whom the relationship word ("aunt", "niece") is used.

Figure 1: excerpts from the activity

After the orientation, the activity starts with an explanation of what type of analysis may be used for different types of response and explanatory variables. Then the students are directed to open up the Little App on Regression.

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ACTIVITY FOR LITTLE APPS Continued...

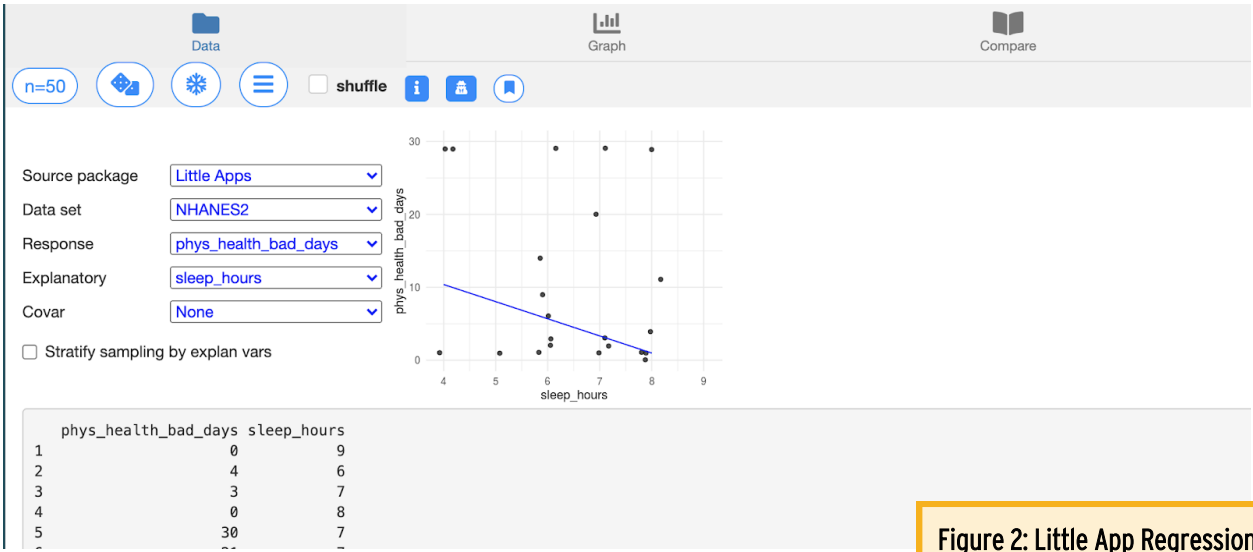


Figure 2: Little App Regression

The activity has the students pick the variables that they are interested in exploring. The students then choose different variables to be the response variable and the explanatory variable. After that point, the activity then asks the students to look for the type of relationship between the variables.

After looking for a relationship, the activity then examines cause and effect. The activity explains the different types of cause and effect relationships. Then the students are to look at different combinations of explanatory and response variables, and determine which type of casual relationship exists between the variables. This gives students an elementary understanding of causal relationships between variables. Lastly, the activity discusses the idea of prediction.

To aid students, the activity suggests different pairs of variables that they can work with. Students can play around with these variables and then explore with variables in which they are interested.

The activity is available in a Word version or a pdf version. Teachers can post either the Word document or the pdf version in their learning management system for students to download. Another option is to create a google doc and share the link to the doc with the students. The advantage of google docs is that the teacher can watch as the students are filling in the google doc. This way teachers can correct misconceptions while the students are working on the document. No matter how the students are given access to the activity, gaining an understanding of variable types is important for understanding statistical processes and it is worth spending class time to help with understanding this concept.

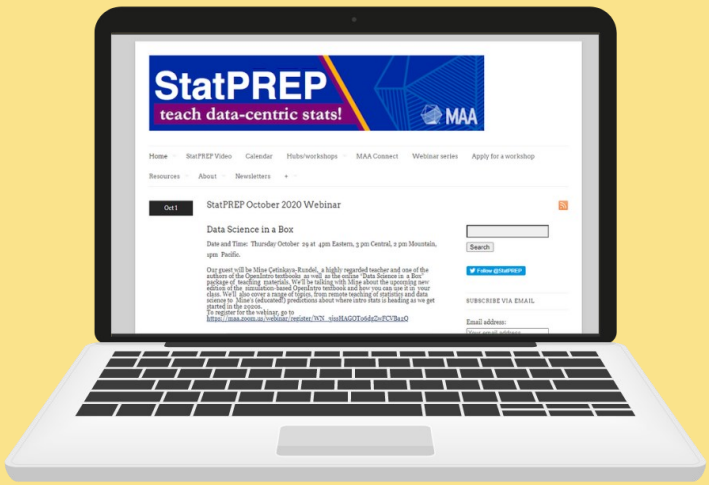
December Webinar

What's Your Data Science Future?

December 3 at 3 p.m.

Join us for a panel discussion of the recent Two Year College Data Science Summit Report, with panelists: Rob Gould, Rebecca Wong, and Danny Kaplan. Hosted by Ambika Silva.

Want More StatPREP?



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