Lab 1: Question 3

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Importance and Context

The question of interest for this report is: **Are people who believe that science is important for making government decisions about COVID-19 more likely to disapprove of the way their governor is handling the pandemic?**

In Political Science, to design better policies and recommendations, we need to consider how common scientific knowledge can influence political decisions and motivations in citizens of democratic countries. It is known that certain sociodemographic groups influenced by religion, beliefs, and other ways of life are reluctant to accept science in decision-making. They believe that it will not make a difference because it is falsely manipulated by a group that does not align with their core values and beliefs. In the past year, these groups may have played a role in spreading COVID-19 since they opposed recommendations such as wearing masks, washing their hands often, and even vaccinating. Also, they are against business closures and social distancing, to the extreme case where some of them believe that the Chinese government sent COVID-19 to harm The United States' economic power.

On the other hand, people who believe in science care about the scientific process that is moved around evidence. They follow what specialists and professionals in specific areas recommend. People who believe in science are more likely to agree with authorities to contain COVID-19 wearing masks and practicing social distancing. For this reason, we are interested in knowing how belief in science in decision-making affects the approval of government handling on COVID-19 on a state level.

Description of Data

We will use data from the 2020 American National Election Studies (ANES) to address this question. This is an observational dataset based on a sample of respondents drawn from the YouGov platform. We selected two variables from this dataset and cleaned the responses such that we have valid answers to perform the statistical test that corresponds and explains our analysis.

From the 1,381 variables with this dataset, we focused on two variables: (1) PRE: SUMMARY: Approve or disapprove R's governor handling COVID-19 and (2) POST: How important should science be for decisions about COVID-19. For question one, 8,218 respondents out of 8,280 correctly answer the question. For question two, 7,383 respondents correctly answer the question. Knowing this, we will perform our analysis on a sample of size 7,337.

To organize the answer to our main question, we divided the dataset into two groups: people who believe science is important for COVID decisions and people who don't believe science is important for COVID decisions. We did this based on question (2). People who believe in science correspond to the respondents who consider that science is extremely important and very important for decisions about COVID-19. People who don't believe in science correspond to respondents that consider that science is moderately, a little, and not at science all important for decisions about COVID-19. Graph 1 can help us see the distribution of the answers in our dataset and divide respondents in this sample. Data is reported on a 5-point Likert scale that ranges from 1 ("not at all") to 5 ("extremely"), and the same question is asked to each respondent.

Graph 1– Post: How Important Should Science be for Decisions about COVID–19

n=8,280 / 7,383 valid responses
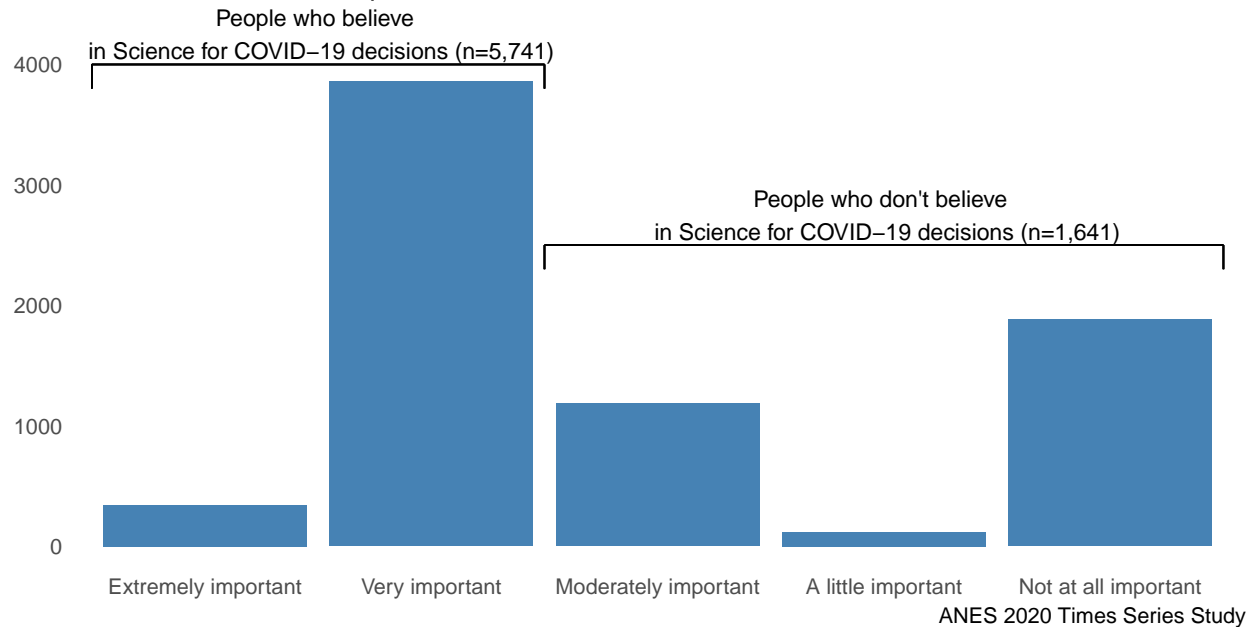
We made this transformation because we wanted to divide the data into people who believe science is important for COVID decisions and people who don't believe science is important for COVID decisions. People that consider that it is moderately important are on the middle ground, but we decide to include them in the group of people who don't believe in science since COVID-19 is a pandemic that involves a scientifical description and a scientifical solution such as clinical trials, vaccines, pills, and other medical recommendations.

After we break the sample into two groups, we examined the approval on how the governors' handling of COVID differs between people who believe in science and people who don't believe in science. As we can see from graph 2, 33% of people who disapprove strongly how its governor is handling the pandemic correspond to the group of people who don't believe in science. On the other hand, 16% of people who approve strongly the measurements taken by their governor are people who don't believe in science. Clearly, we can see a shift in this distribution as we approach the disapproval spectrum.

Graph 2– Approve or disapprove Governor Handling COVID–19 by People who Believe in S
in COVID Response

n=8,280 / 7,337 valid responses

ANES 2020 Times Series Study
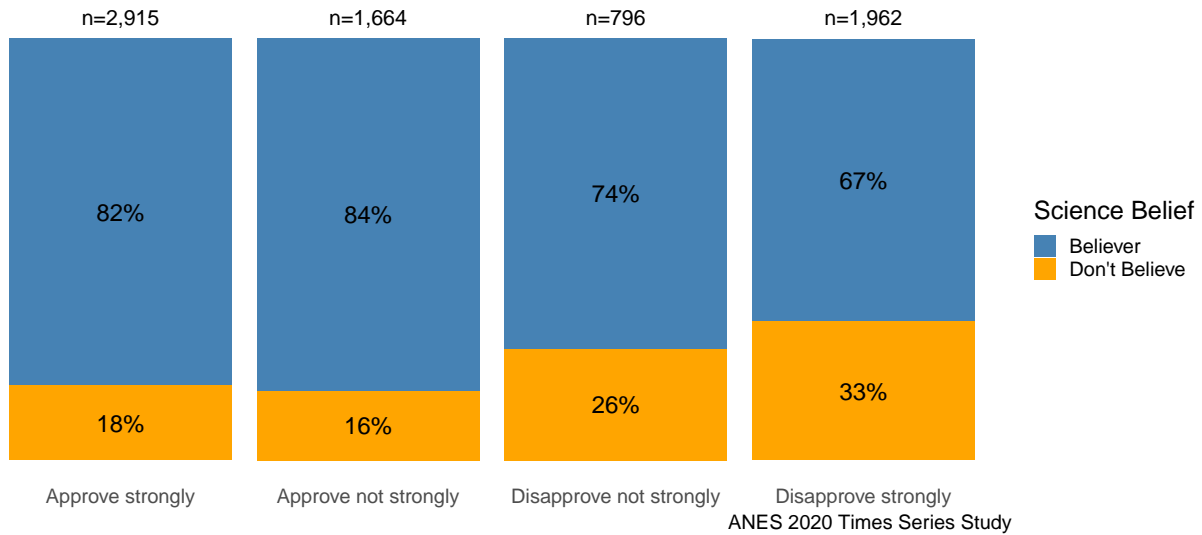
Given this information we formulate the following hypothesis to determine if there is a statistical difference on the approval rates between people who believe and science and people who don't:

$$H_0 : P\left(Rank\ of\ D > Rank\ of\ R\right) = P\left(Rank\ of\ D \leq Rank\ of\ R\right)$$
$$H_A : P\left(Rank\ of\ D > Rank\ of\ R\right) \neq P\left(Rank\ of\ D \leq Rank\ of\ R\right)$$

where D represents a random person who believe that science is important for COVID-19 decisions and R represents a random person who believe that science is not important for COVID-19 decisions.

Most appropriate test

To answer this question, we determined that the non-parametric Wilcoxon Rank Sum Test is the most appropriate test for this research question. It can be executed in R using **wilcox.test**. The main requirements for using this test are:

1. Unpaired data: the grouping variable is science believer (science believer or non science believer), and as each respondent can only be science believer or not science believer and not both, we consider this unpaired data.

2. Ordinal variable: the main variable for comparison is ordinal scale, which goes from level 1 to 5 (1 = approve strongly, 4 = disapprove strongly)

3. I.I.D. : The design of the study suggests the data was generated through an independent and identically distributed (i.i.d.) sampling process. Participants in this survey were randomly drawn from the USPS delivery sequence file. The USPS delivery sequence file contains all residential addresses in the 50 states across the U.S. and all addresses had an equal chance of being selected.

We will use p-value as the rejection criteria, with an alpha of 0.05. Thus, if the Wilcox test p-value is less than 0.05, we would reject the null hypothesis (Ho), otherwise, we will fail to reject it.

Test, results and interpretation

```
##
##   Wilcoxon rank sum test with continuity correction
##
## data:  analysis$governor_handling by analysis$science_belief
## W = 3674894, p-value < 2.2e-16
## alternative hypothesis: true location shift is not equal to 0
```

With a p-value of >0.0000 (less than 0.05) for the Wilcoxon Rank Sum test, we reject the null hypothesis. Thus, it supports that the probability that a randomly selected observation's rank of a voter who believes in science for COVID decisions being greater than the rank of a random voter who does not believe in science for COVID decisions is different from the probability of that voter's rank who believe in science for COVID decisions being less than or equal to the rank of a voter who doesn't believe in science for COVID decisions. In short, the belief that science is important for making government decisions about COVID-19 gives us information on how the voters approve their governor's handling of the pandemic.

Using the W statistic we can say that in .39 (3,674,894/9,294,252) of pairings between a Believer and Non-Believer in Science, the Believer is likely to have a higher approval of Governor's handling of COVID-19 (the .39 represent a lower rank which means a higher approval as the approval scale goes from 1=Approve Strongly to 4=Disapprove Strongly).

For practical significance, we conducted a rank-biserial correlation which measures how much reported governor's COVID-19 related decisions approval rates vary by level of belief in science. The correlation coefficient is 0.158255, which suggests a small positive effect. Even though the p-value is significant, having a low correlation coefficient indicates a relatively small relationship between believing in science for COVID decisions and approval rates to governors' decisions in COVID.

Test Limitations

The division of groups of people who believe in science and people who don't believe may be rigid and contingent to interpretation (i.e. where do you classify people in the middle?). In addition, the fact that a voter approves a Governor's handling of COVID-19 might reflect alignment in scientific view. For example, a Governor may not believe in science, but she/he may have a high approval because voters also do not believe in science. Thus, the data is missing if the Governor's actions are aligned with science or not (i.e. Did they implement a mask mandate policy or not?).