

Religiosity and formal education

Introduction:

In this report, we try to answer the question whether there is a connection between someone's highest level of formal education and their religiosity (as measured by how often they attend religious services). It has often been stated that having a higher formal education correlates with lower church attendance. Using the GSS (General Social Survey) data, we can assert the correctness of this affirmation.

Data:

The General Social Survey (GSS) is a sociological survey used to collect data on demographic characteristics and attitudes of residents of the United States. The survey is conducted face-to-face with an in-person interview by the National Opinion Research Center at the University of Chicago, of adults (18+) in randomly selected households. The survey was conducted every year from 1972 to 1994 (except in 1979, 1981, and 1992). Since 1994, it has been conducted every other year. The survey takes about 90 minutes to administer. (Source: Wikipedia)

The cases in this study are adult (18+) residents of the United States. Two variables are of interest in this study, namely degree - respondents highest degree - a categorical variable (less than high school, high school, junior college, bachelor, graduate) and "attend" - how often does the respondent attend religious services, also a categorical variable, with values such as never, once a year, once a week, etc

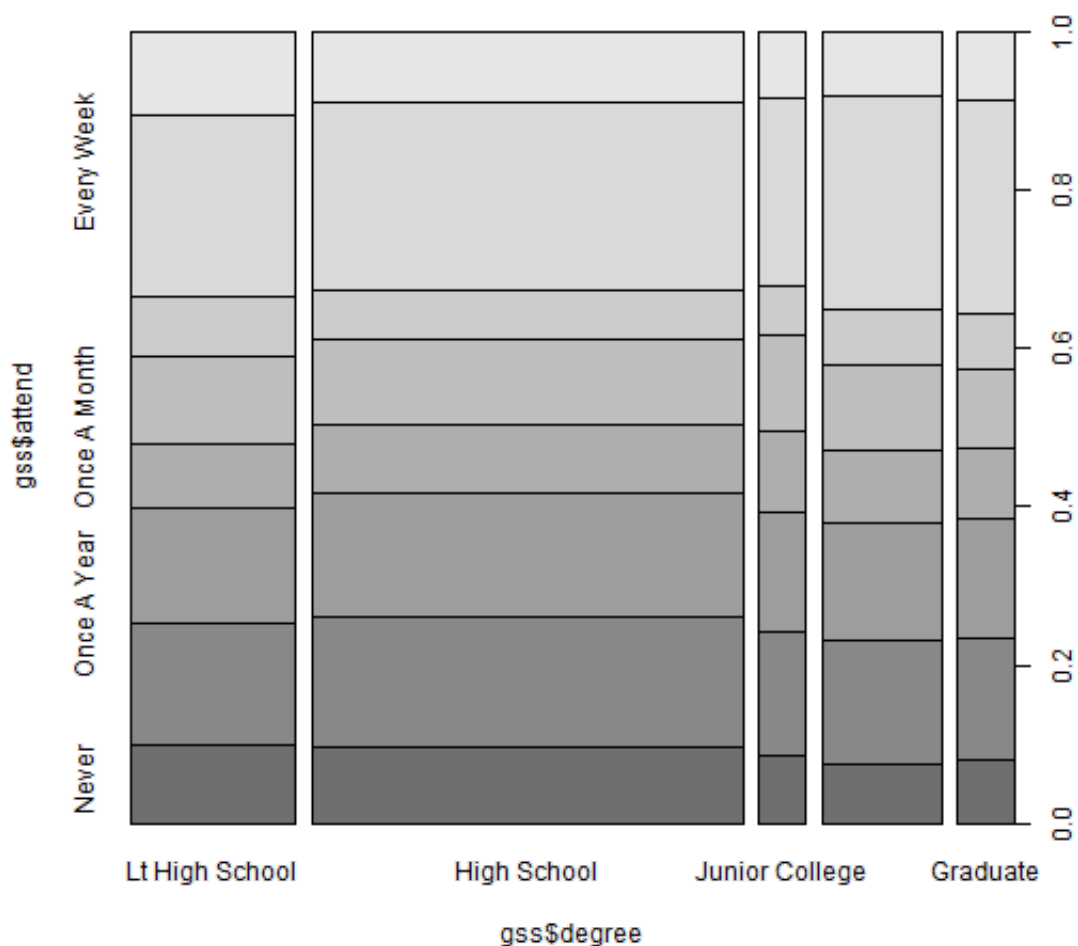
The GSS study is an observational study. The collection of the data did not directly interfere with the way the data arose. People were randomly selected for surveying, but there was no control group. Results of the survey were recorded, but not compared against a control group.

The population of interest is the adult population of the United States. As the study is done on a representative random sample, the findings from the analysis can be generalized to the entire adult population of the US. Potential sources of bias at the collection of the data might include - non-response bias, if a non-random subsection of the respondents chose not to answer the survey, and convenience bias, if people who were easy to sample were more likely to be included in the sample.

Since the study is an observational study and not an experiment, causal links cannot be determined, just correlations (associations). To be able to determine causality, an experiment, a control group and a "treatment" is needed (for example, a double blind, placebo controlled experiment), which is not the case in this study.

Exploratory data analysis:

```
plot(gss$attend ~ gss$degree)
```



```
by(gss$attend, gss$degree, summary)
```

```
## gss$degree: Lt High School
##      Never      Lt Once A Year      Once A Year Sevr1
Times A Yr
##              0              938              1432
1371
##      Once A Month      2-3X A Month      Nrly Every Week
Every week
##              765              1018              710
2155
## More Thn Once wk      NA's
##              990              2443
## -----
## gss$degree: High School
##      Never      Lt Once A Year      Once A Year Sevr1
Times A Yr
```

##	0	2335	4000
3818			
##	Once A Month	2-3X A Month	Nrly Every week
Every week			
##	2082	2586	1550
5702			
##	More Thn Once wk	NA's	
##	2206	5008	
##	-----		
##	gss\$degree: Junior college		
##	Never	Lt Once A Year	Once A Year Sevr1
Times A Yr			
##	0	223	408
396			
##	Once A Month	2-3X A Month	Nrly Every week
Every week			
##	263	316	168
618			
##	More Thn Once wk	NA's	
##	218	460	
##	-----		
##	gss\$degree: Bachelor		
##	Never	Lt Once A Year	Once A Year Sevr1
Times A Yr			
##	0	517	1054
1006			
##	Once A Month	2-3X A Month	Nrly Every week
Every week			
##	609	730	479
1819			
##	More Thn Once wk	NA's	
##	560	1228	
##	-----		
##	gss\$degree: Graduate		
##	Never	Lt Once A Year	Once A Year Sevr1
Times A Yr			
##	0	263	490
490			
##	Once A Month	2-3X A Month	Nrly Every week
Every week			
##	281	324	226
868			
##	More Thn Once wk	NA's	
##	283	645	

A plot showing the proportion of religious services attendance across each educational degree shows that the proportions are somewhat similar - suggesting that there might be differences between attendance as formal degree changes, however, more precise measuments need to be performed in order to draw appropriate conclusions.

Inference:

The null hypothesis is that there are no differences in the proportions of attendance as formal education degree changes. In other words, religious service attendance is independent of the formal educational degree obtained. The alternative hypothesis is that the two variables are dependent of each other, there is a correspondence (however, causality still cannot be determined). We are going to choose a 5% significance level, and apply the chi-squared test of independence.

Conditions for the chi-square test:

- Independence - sampled observations must be independent - fulfilled by the data collection method, according to GSS guidelines (random sample)
- Number of cases is less than 10% of the population - GSS surveys about 55,000 respondents
- Sample size - each cell has at least 5 expected cases (in fact, in our particular case we have way more than that in each cell)

In the chi-square test, we are going to determine how different the expected values are from the observed values. If these differences are large, we can conclude that these deviations are unlikely to occur due to chance alone and therefore it might provide evidence for the alternative hypothesis.

Based on the data above, we can proceed to clean and group the variables. If we eliminate the NA's and group attendance into two categories (for convenience) : those who attend less than once a week, and those who attend at least once a week, we get to the following table:

	Less than once a week	At least once a week	Totals
Lt High school	6234	3145	9379
High school	16371	7908	24279
Junior college	1774	836	2610
Bachelor	4395	2379	6774
Graduate	2074	1151	3225

We now have two categorical variables, one of which has two levels, and the other one has 5 level. We are going to apply a hypothesis test only (no confidence interval), and since the expected size condition is met, no simulation is needed.

Degrees of freedom $df = 4 \times 1 = 4$, the test statistic is 26.29 , and the p value is

```
chisq.test(data.frame(c(6234, 16371, 1774, 4395, 2074),
c(3145, 7908, 836, 2379,
1151)))
```

```
##  
## Pearson's Chi-squared test  
##  
## data: data.frame(c(6234, 16371, 1774, 4395, 2074),  
c(3145, 7908, 836, 2379, 1151))  
## X-squared = 26.29, df = 4, p-value = 2.764e-05
```

```
pchisq(26.29, df = 4, lower.tail = FALSE)
```

```
## [1] 2.766e-05
```

Since no other methods are applicable we cannot compare whether the hypothesis test and the confidence interval agree.

Conclusion:

Based on the p value of 2.764e-05 we can reject the null hypothesis at the 5% significance level. Therefore, we can conclude that the data does present conclusive evidence that there is correspondence in the proportions of attendance as formal educational degree changes. At this significance level, religious service attendance does seem to depend on formal educational degree. The differences between observed and expected attendance in the sample can not be simply attributed to chance.

Other possible areas of study might include taking into account the respondent's IQ instead of formal educational degree, as IQ tends to measure native intelligence, while formal education depends on a lot of factors, such as environmental factors, family background, social status and so on. Such studies have been done in the past (see referenced Wikipedia article). Admittedly however, introducing IQ measurement into the GSS might prove very difficult and possibly impractical.

References:

Smith, Tom W., Michael Hout, and Peter V. Marsden. General Social Survey, 1972-2012 [Cumulative File]. ICPSR34802-v1. Storrs, CT: Roper Center for Public Opinion Research, University of Connecticut /Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributors], 2013-09-11. doi:10.3886/ICPSR34802.v1

Persistent URL: <http://doi.org/10.3886/ICPSR34802.v1>

Wikipedia: http://en.wikipedia.org/wiki/General_Social_Survey

Wikipedia: http://en.wikipedia.org/wiki/Religiosity_and_intelligence

Appendix:

	year	age		degree	attend
1	1972	23		Bachelor	Once A Year
2	1972	70	Lt	High School	Every week
3	1972	48		High School	Once A Month
4	1972	27		Bachelor	<NA>
5	1972	61		High School	<NA>
6	1972	26		High School	Once A Year
7	1972	28		High School	Every week
8	1972	27		Bachelor	<NA>
9	1972	21		High School	Sevr1 Times A Yr
10	1972	30		High School	More Thn Once wk
11	1972	30		High School	Every week
12	1972	56	Lt	High School	Every week
13	1972	54	Lt	High School	Every week
14	1972	49	Lt	High School	Every week
15	1972	41	Lt	High School	More Thn Once wk
16	1972	54		High School	2-3X A Month
17	1972	24		High School	Every week
18	1972	62	Lt	High School	Every week
19	1972	46		Bachelor	Every week
20	1972	21		High School	2-3X A Month
21	1972	57		High School	2-3X A Month
22	1972	58		High School	Once A Year
23	1972	21		High School	Lt Once A Year
24	1972	26		High School	<NA>
25	1972	71		Bachelor	Sevr1 Times A Yr
26	1972	53		High School	Every week
27	1972	42		High School	Once A Year
28	1972	42		High School	Once A Year
29	1972	20		High School	Sevr1 Times A Yr
30	1972	23	Lt	High School	Every week