Statistics for Social Research II

Derrick Snow

Omega Graduate School

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Professor

Dr. Taladay

**Assignment #3: Instructor Assignment - Practical Statistics**

Answer the following questions in an essay format, with 1-2 fully developed paragraphs for each question. Include citations/references from your Developmental Reading log.

What is normality? Why is it relevant to parametric (generalizable to the target population) versus nonparametric (applicable only to the sample) statistics in social science research?

What is a histogram? What is a box and whisker plot? How are they useful for understanding the normality of a given sample?

Describe the following statistical procedures:

\* Quasi-Experimental: t-Tests (Independent and Dependent) - Parametric

\* Quasi-Experimental: Mann Whitney U and Wilcoxon - Nonparametric

\* Correlational: Pearson’s r - Parametric

\* Correlational: Spearman’s Rank – Non-Parametric

Navitage to OGS’s Practical Statistics for Social Research (PSSR) tool. Click on “Example Datasets” and load the “Independent t-Test: Ethical Decision-Making” dataset.

Scroll to “Step Three: Run Statistical Procedures” and click “t-Test”.

Copy and paste the output's contents into your assignment document. Read it carefully and expand on it based on your understanding. Answer the following questions:

\* What might be good problem and purpose statements for this dataset?

\* What might be good research questions related to the hypotheses generated by the PSSR software?

\* What does the output tell you about the comparison of the two groups?

\* How was the p-value used to test the hypotheses?

\* Repeat steps 10-12 for the “Correlational: Life Satisfaction Index” dataset. Note that this is a correlational design with two continuous variables. What does the scatterplot tell you about the relationship between the two variables?

\* Repeat steps 10-12 for both datasets, but use the nonparametric equivalents of the statistical tests (Mann \* \* \* Whitney U and Spearman’s Rank, respectively). How did the results change?

For each dataset, click on “Assumptions” under “Step Two: Run Descriptives and Assumptions.” Based on the output of each dataset, should you use parametric or nonparametric procedures? Are the datasets normally distributed? Note that this is a judgment call on behalf of the researcher and not a black-and-white decision.

Finally, navigate to OGS’s Practical Statistics for Social Research (PSSR) tool. Click on “Example Datasets” and load the “Example: Perfect Correlation” dataset. Scroll to “Step Three: Run Statistical Procedures” and click “Linear Regression”. What does the scatterplot graph show you about the relationship between the X and Y variables?

Summarize what you learned from conducting these statistical tests.

Include a title page, well-developed introduction and conclusion paragraphs, a references page, and in-text APA-formatted citations to support your responses.

What is normality? Why is it relevant to parametric (generalizable to the target population) versus nonparametric (applicable only to the sample) statistics in social science research?

Normality is an assumption about the shape of the data, whether it fits the approximate normal or Gaussian distribution. Normality is a statistical feature that has been noticed to be a common occurrence of data distribution (hence ‘normal’) in phenomena in the world. Based on this, many statistical procedures were developed, and this mathematical distribution could be assumed given a random sampling of a given population that if the population is normally distributed then the random sample would also take the normal distribution. Because of this, our findings in our sample can be inferred into the larger population. Parameters are values that describe information about the larger population and statistics are values that describe information about the sample. Thus, parametric statistics refers to the population and the normal distribution (Shepherd-Banigan et al., 2014), and nonparametric does not refer to the population and normal distribution it only refers to the sample.

What is a histogram? What is a box and whisker plot? How are they useful for understanding the normality of a given sample?

A histogram is a type of graph used to display the shape of data in grouped in bins in a column chart and may display the overall shape of the data using a bell curve, it also may display a vertical line where the mean is and values of mean and standard deviation. A box and whisker plot is a type of graph that looks like boxes and whiskers, displaying the distribution of the data with min and max, quartiles, and median. Both graphs inform us of the shape of the data and allows us to see the shape of the data visually and if it follows the normal distribution (Min, 2022), ( López-Gálvez et al., 2021); these visuals are not only helpful for the researcher but also for the audience of the research in publications.

Describe the following statistical procedures:

Quasi-Experimental: t-Tests (Independent and Dependent) – Parametric and Quasi-Experimental: Mann Whitney U and Wilcoxon – Nonparametric

Quasi-experimental research designs are similar to an actual experiment but do not have a random assignment of participants, such as a pharmaceutical research random assignment. Quasi-experiments are common in social research (Sheskin,2011). Using a random sample with a large enough sample size and if the data from that sample is approximately normal distribution, then parametric is appropriate. The inferential statistic used to test the difference between the means of two groups is the t-test; this statistic tests whether or not there is a statistically significant difference between the two groups, such as seasonal and migrant farm workers and office workers' health test scores (López-Gálvez et al., 2021). There is a t-test for independent samples, where two different groups of a sample are means-tested against each other to see if there is a significant difference between the two groups, then there is a t-test for paired sample where the means are tested for a significant difference at two different times, pre-intervention and post intervention. If the sample size is smaller or if the data does not fit the normality assumptions than nonparametric test are used such as Mann Whitney U and Wilcoxon, (Terrell, 202) for example “The data were not normally distributed, and we therefore employed the nonparametric Mann–Whitney U test to compare pesticide exposure between samples collected during the nonspray season and the spray season (Curl et al., 2021, p. 541).

Correlational: Pearson’s r - Parametric and Correlational: Spearman’s Rank – Non-Parametric

Correlational studies examine the relationship between two different variables to measure the direction of the relationship, positive or negative, and the strength of the association (Sheskin,2011). Correlation does not mean causation, but merely an association, where the researcher hopes to find a relationship between variables and perhaps one variable could be impacted by an intervention and then could impact the other variable of interest, such for example, Pearson’s product correlation coefficient was used to examine the relationship between fluid intake and hydration status among farmworkers (Mizelle et al., 2022). Where if the research finds that there is a strong association between water intake and hydration then an education model on the importance of drinking water while farmwork which would hope to increase drinking water and thus have an increase in worker hydration. As like the t-test, there are certain assumptions that need to be met largely around normality in order to use the parametric correlation statistical procedure of Pearson’s r (correlation coefficient) which ranges from -1 to +1 where a r close to 0 means there is no association between the variables and r close to -1 means there is a strong negative correlation between variable where one goes up the other variable goes down, a r close to +1 means there is a strong positive association where both variables go in the same direction. When the assumptions of normality are not met then a researcher would use the statistical procedure of Spearman Rank correlation coefficient for nonparametric statistics. Spearman Rank is very similar to Pearson’s r where the statistics measures the association between two variables from -1 to +1, for example, “We evaluated several predictors of the chronic inhalation risks estimated in this report, using Spearman rank correlation coefficients. The California ranking for potential pesticide toxic air contaminants (Table 1) was not significantly correlated with the child chronic risk ranking (r = 0.22, p = 0.43).” (Lee et al., 2002, p. 1180)

Navitage to OGS’s Practical Statistics for Social Research (PSSR) tool. Click on “Example Datasets” and load the “Independent t-Test: Ethical Decision-Making” dataset.

Scroll to “Step Three: Run Statistical Procedures” and click “t-Test”.

Copy and paste the output's contents into your assignment document.

**Results of t-Test Procedure**

**Table 1**

*T-Test Statistics*

|  |  |
| --- | --- |
| Measure | Value |
| Group 1 (Religious Participants) Mean | 9.1625 |
| Group 2 (Non-Religious Participants) Mean | 4.3630 |
| Degrees of Freedom | 34.0000 |
| t-Statistic | 3.8475 |
| p-Value | 0.00050021 |

**Hypotheses**

H0: No statistically significant difference exists in the mean scores of the Ethical Decision-Making Scale (EDMS) between Religious Participants and Non-Religious Participants.

Ha: A statistically significant difference exists in the mean scores of the Ethical Decision-Making Scale (EDMS) between Religious Participants and Non-Religious Participants.

A two-tailed Student's t-Test was applied to independent samples assuming equal variances to test the null hypothesis that the difference in means the Ethical Decision-Making Scale (EDMS) between Religious Participants and Non-Religious Participants were not equal to zero. The means for the groups Religious Participants and Non-Religious Participants were 9.1625 and 4.3630 respectively. With 34.0000 degrees of freedom, the t-statistic was 3.8475.

The p-value of 0.00050021 suggests a statistically significant difference between the groups' means at a 0.05 alpha level. The null hypothesis was rejected.

**Post-Hoc Procedures**

**Table 2**

*T-Test Post Hoc Statistics*

|  |  |
| --- | --- |
| Statistic | Value |
| Bonferroni Correction Alpha | 0.050000 |
| Cohen's d (effect size) | 1.290490 |
| Power | 0.0000 |

**Attribution**

Statistical procedures were conducted using [PSSR (Practical Statistics for Social Research)](https://stats.ogs.edu/), statistical analysis software developed by Joshua D. Reichard for [Omega Graduate School](https://ogs.edu/) based on the [jStat](https://jstat.github.io/) library.

**Reference**

Reichard, J. (2024). *Practical Statistics for Social Research (PSSR)*. Omega Graduate School. <https://stats.ogs.edu/>

Read it carefully and expand on it based on your understanding. Answer the following questions:

What might be good problem and purpose statements for this dataset?

# Problem Statement

The problem is ethical decision-making among people.

# Purpose Statement

The purpose of this survey study will be to test the theory of the ethical decision-making model

that considers differences in ethical decisions among religious people and non-religious people. The independent variable will be defined as Religious/Non-Religious classification. The dependent variable will be defined as Ethical Decision-Making Scale (EDMS).

What might be good research questions related to the hypotheses generated by the PSSR software?

# Research Questions

RQ1: Do religious people have a higher Ethical Decision-Making score compared to non-religious people?

What does the output tell you about the comparison of the two groups?

The religious participants' mean Ethical Decision-Making score was 9.2, compared to 4.4 for the non-religious participants. Thus, religious participants had a higher ethical decision-making score than non-religious participants. The question is whether or not the difference between the two groups is statistically significant (a real difference).

How was the p-value used to test the hypotheses?

The p-value is used to identify if the difference between Religious Participants and Non-Religious Participants is statistically significant based on an alpha of .05, and given the p-value of 0.00050021 is less than .05 we reject the null hypothesis that there is no difference in the Ethical Decision-Making Scale between the two groups and accept the alternative hypothesis that there is a statistically significant difference between the two groups.

Repeat steps 10-12 for the “Correlational: Life Satisfaction Index” dataset. Note that this is a correlational design with two continuous variables. What does the scatterplot tell you about the relationship between the two variables?

A graph with black dots and white text

Description automatically generated

The scatterplot informs us that there is a moderately weak positive association between Hours of Weekly Religious Involvement and Life Satisfaction Index. The Pearson’ r of .365 reflects this moderate weak association as well.

Repeat steps 10-12 for both datasets, but use the nonparametric equivalents of the statistical tests (Mann Whitney U and Spearman’s Rank, respectively). How did the results change?

For each dataset, click on “Assumptions” under “Step Two: Run Descriptives and Assumptions.” Based on the output of each dataset, should you use parametric or nonparametric procedures? Are the datasets normally distributed? Note that this is a judgment call on behalf of the researcher and not a black-and-white decision.

The results for the t-test and Mann-Whitney U did not change much from the parametric to the nonparametric statistics, I was not sure given the smaller sample size. The assumption tests indicate an approximately normal distribution, which is good. I may use the nonparametric statistics for this research, given the smaller sample size, I may not be able to generalize to the larger population.

For the Pearson’s r and Spearman Rank both show a moderately weak relationship between Hours of Weekly Religious Involvement and Life Satisfaction Index; the smaller sample size leads me to lean toward the nonparametric statistics, and then looking at the assumption output the data does not meet the normality assumptions thus the way to go for this research is the nonparametric statistics.

**Results of Mann-Whitney U Procedure**

**Table 4**

*Mann Whitney U Statistics*

|  |  |
| --- | --- |
| Measure | Value |
| Group 1 (Religious Participants) Mean | 9.1625 |
| Group 2 (Non-Religious Participants) Mean | 4.3630 |
| Mann Whitney U | 52.0000 |
| Z-Score | -3.4383 |
| p-value | 0.00058547 |

**Hypotheses**

H0: No statistically significant difference exists in the distributions of the Ethical Decision-Making Scale (EDMS) between Religious Participants and Non-Religious Participants.

Ha: A statistically significant difference exists in the distributions of the Ethical Decision-Making Scale (EDMS) between Religious Participants and Non-Religious Participants.

A two-tailed Mann-Whitney U procedure was applied to the samples assuming equal variances to test the null hypothesis that the difference in means the Ethical Decision-Making Scale (EDMS) between Religious Participants and Non-Religious Participants were not equal to zero. The means for the groups Religious Participants and Non-Religious Participants were 9.1625 and 4.3630 respectively.

The p-value of 0.00058547 suggests a statistically significant difference between the groups' distributions at a 0.05 alpha level. The null hypothesis was rejected.

**Post-Hoc Procedures**

**Table 5**

*Mann-Whitney U Post Hoc Statistics*

|  |  |
| --- | --- |
| Statistic | Value |
| Bonferroni Correction Alpha | 0.050000 |
| Cohen's d (effect size) | 1.290490 |
| Power | 0.0000 |

**Attribution**

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**Assumptions Tests**

Assumptions tests were conducted on the samples Religious Participants and Non-Religious Participants to test for normality and equal variances.

**Religious Participants**

**Skewness and Kurtosis**

**Table 15**

|  |  |
| --- | --- |
| Measure | Value |
| Skewness | 0.1708 |
| Excess Kurtosis | -3.9003 |

This sample had negative excess kurtosis. The distribution had lighter tails than a normal distribution. This indicates fewer extreme values (outliers) than expected in a normal distribution. Distributions with negative excess kurtosis are known as platykurtic.

The distribution was skewed to the right; the right tail (larger values) was longer or fatter than the left tail (smaller values). This indicates that the bulk of the data were concentrated on the left side of the distribution. Most observations tended to be below the mean, with a few large values pulling the mean to the right of the median.

The sample visually appeareed to be close to a normal distribution.

**Normality Tests**

The Kolmogorov-Smirnov statistic was applied to compare the distribution with a theoretical distribution function, assumed to be normal. The maximum absolute difference is the KS statistic. This statistic can be used to assess the normality of the data.

**Table 16**

|  |  |
| --- | --- |
| Statistic | Value |
| KS Statistic | 0.1974 |

A value closer to 0 suggested that the data may follow a normal distribution.

A simplified version of the Shapiro-Wilke statistic was applied to calculate a correlation coefficient between the data's standardized values and the expected quantiles of a normal distribution.

**Table 17**

|  |  |
| --- | --- |
| Statistic | Value |
| SW Statistic | 0.9842 |

A value closer to 1 suggests that the data may follow a normal distribution.

**Non-Religious Participants**

**Skewness and Kurtosis**

**Table 18**

|  |  |
| --- | --- |
| Measure | Value |
| Skewness | 1.5084 |
| Excess Kurtosis | -0.8446 |

This sample had negative excess kurtosis. The distribution had lighter tails than a normal distribution. This indicates fewer extreme values (outliers) than expected in a normal distribution. Distributions with negative excess kurtosis are known as platykurtic.

The distribution was skewed to the right; the right tail (larger values) was longer or fatter than the left tail (smaller values). This indicates that the bulk of the data were concentrated on the left side of the distribution. Most observations tended to be below the mean, with a few large values pulling the mean to the right of the median.

The sample did not visually appear to be normally distributed.

**Normality Tests**

The Kolmogorov-Smirnov statistic was applied to compare the distribution with a theoretical distribution function, assumed to be normal. The maximum absolute difference is the KS statistic. This statistic can be used to assess the normality of the data.

**Table 19**

|  |  |
| --- | --- |
| Statistic | Value |
| KS Statistic | 0.2148 |

A value closer to 0 suggested that the data may follow a normal distribution.

A simplified version of the Shapiro-Wilke statistic was applied to calculate a correlation coefficient between the data's standardized values and the expected quantiles of a normal distribution.

**Table 20**

|  |  |
| --- | --- |
| Statistic | Value |
| SW Statistic | 0.9087 |

A value closer to 1 suggests that the data may follow a normal distribution.

**Tests for Equal Variances**

**Table 21**

|  |  |
| --- | --- |
| Normality Statistic | Result |
| Levene's F-Statistic | 0.773252 |
| Levene's p-Value | 0.385386 |
| F-Test p-Value | 0.449884 |
| F-Test F-Statistic | 0.930416 |

Levene's Test for equal variances was not statistically significant at the (p < 0.050) alpha level.

The F-Test for equal variances was not statistically significant at the (p < 0.050) alpha level.

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**Results of Spearman's Rank Procedure**

**Table 6**

|  |  |
| --- | --- |
| Measure | Value |
| Group 1 (Hours of Weekly Religious Involvement) Mean | 1.7579 |
| Group 2 (Life Satisfaction Index (LSI)) Mean | 8.9342 |
| Spearman's Rank (ρ) | 0.3996 |
| p-Value | 0.0912 |

**Hypotheses**

H0: No statistically significant relationship exists between Hours of Weekly Religious Involvement and Life Satisfaction Index (LSI).

Ha: A statistically significant relationship exists between Hours of Weekly Religious Involvement and Life Satisfaction Index (LSI).

**Findings**

**Table 7**

|  |  |
| --- | --- |
| Measure | Value |
| Group 1 (Hours of Weekly Religious Involvement) Mean | 1.7579 |
| Group 2 (Life Satisfaction Index (LSI)) Mean | 8.9342 |
| Spearman's Rank (ρ) | 0.3996 |
| p-Value | 0.0912 |

The probability that the relationship between Hours of Weekly Religious Involvement and Life Satisfaction Index (LSI) was not statistically significant at a 95% confidence level (p = 0.09121576). The null hypothesis could not be rejected.

**Effect Size**

The r² statistic of 0.1596 indicates a small positive effect between Hours of Weekly Religious Involvement and Life Satisfaction Index (LSI).

**Scatterplot**

0.1

3.8

15.44

1.33

**Attribution**

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**Assumptions Tests**

Assumptions tests were conducted on the samples Hours of Weekly Religious Involvement and Life Satisfaction Index (LSI) to test for normality and equal variances.

**Hours of Weekly Religious Involvement**

**Skewness and Kurtosis**

**Table 8**

|  |  |
| --- | --- |
| Measure | Value |
| Skewness | 0.1660 |
| Excess Kurtosis | -4.1681 |

This sample had negative excess kurtosis. The distribution had lighter tails than a normal distribution. This indicates fewer extreme values (outliers) than expected in a normal distribution. Distributions with negative excess kurtosis are known as platykurtic.

The distribution was skewed to the right; the right tail (larger values) was longer or fatter than the left tail (smaller values). This indicates that the bulk of the data were concentrated on the left side of the distribution. Most observations tended to be below the mean, with a few large values pulling the mean to the right of the median.

The sample did not visually appear to be normally distributed.

**Normality Tests**

The Kolmogorov-Smirnov statistic was applied to compare the distribution with a theoretical distribution function, assumed to be normal. The maximum absolute difference is the KS statistic. This statistic can be used to assess the normality of the data.

**Table 9**

|  |  |
| --- | --- |
| Statistic | Value |
| KS Statistic | 0.1827 |

A value closer to 0 suggested that the data may follow a normal distribution.

A simplified version of the Shapiro-Wilke statistic was applied to calculate a correlation coefficient between the data's standardized values and the expected quantiles of a normal distribution.

**Table 10**

|  |  |
| --- | --- |
| Statistic | Value |
| SW Statistic | 0.9709 |

A value closer to 1 suggests that the data may follow a normal distribution.

**Life Satisfaction Index (LSI)**

**Skewness and Kurtosis**

**Table 11**

|  |  |
| --- | --- |
| Measure | Value |
| Skewness | -0.0447 |
| Excess Kurtosis | -4.0622 |

This sample had negative excess kurtosis. The distribution had lighter tails than a normal distribution. This indicates fewer extreme values (outliers) than expected in a normal distribution. Distributions with negative excess kurtosis are known as platykurtic.

The distribution was skewed to the left; the left tail (smaller values) was longer or fatter than the right tail (larger values). This suggests that the bulk of the data were concentrated on the right side of the distribution. In this case, most observations were above the mean, with a few small values pulling the mean to the left of the median.

The sample did not visually appear to be normally distributed.

**Normality Tests**

The Kolmogorov-Smirnov statistic was applied to compare the distribution with a theoretical distribution function, assumed to be normal. The maximum absolute difference is the KS statistic. This statistic can be used to assess the normality of the data.

**Table 12**

|  |  |
| --- | --- |
| Statistic | Value |
| KS Statistic | 0.1727 |

A value closer to 0 suggested that the data may follow a normal distribution.

A simplified version of the Shapiro-Wilke statistic was applied to calculate a correlation coefficient between the data's standardized values and the expected quantiles of a normal distribution.

**Table 13**

|  |  |
| --- | --- |
| Statistic | Value |
| SW Statistic | 0.9852 |

A value closer to 1 suggests that the data may follow a normal distribution.

**Tests for Equal Variances**

**Table 14**

|  |  |
| --- | --- |
| Normality Statistic | Result |
| Levene's F-Statistic | 0.000025 |
| Levene's p-Value | 0.996012 |
| F-Test p-Value | 0.000002 |
| F-Test F-Statistic | 0.086793 |

Levene's Test for equal variances was not statistically significant at the (p < 0.050) alpha level.

The F-Test for equal variances was statistically significant at the (p < 0.050) alpha level.

**Attribution**

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**Reference**

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Finally, navigate to OGS’s Practical Statistics for Social Research (PSSR) tool. Click on “Example Datasets” and load the “Example: Perfect Correlation” dataset. Scroll to “Step Three: Run Statistical Procedures” and click “Linear Regression”. What does the scatterplot graph show you about the relationship between the X and Y variables?

A graph with dots and numbers

Description automatically generated

The scatterplot graph shows a perfect positive linear relationship.

Summarize what you learned from conducting these statistical tests.

Utilizing the Practical Statistics for Social Research tool with the example datasets has been a pleasant experience. It brings together the statistical models and the narrative logic in a great way for researchers to use.

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