

Final Project: An Evaluation of the World Happiness Report

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11/4/2020

INTRODUCTION

CodeStone chose to explore the data from the World Happiness Reports of 2018 and 2019, published by the Sustainable Development Network. According to the WHR, this data is derived from the Gallup World Poll, systematic telephone surveys and in person interviews in over 160 countries whose surveys claim to represent 80%+ of the population [1]. The calls are made via random phone number generation and randomly selecting households [2]. The data sets from each year include 312 cases, each representing the data for a particular country. The original variables in the data set included the overall rank according to happiness score, country name, happiness score, and then 6 variables that were used to calculate the happiness score in the WHR's analysis. These are GDP per capita, social support, healthy life expectancy, freedom to make life choices, generosity, and perceptions of corruption, all of which are expanded upon below. Additionally, we added variables for year as well as region to further our analysis.

Variable Sources and Definitions

Happiness Score: Happiness score is a self-reported measure of overall current life satisfaction. This was measured by asking respondents, "Please imagine a ladder, with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?" The average of these values represents respective countries and regions [3][4].

GDP per capita: PPP (purchasing power parity) is a rate of conversion which attempts to equalize the purchasing power across all different currencies. The World Happiness Report sources its GDP per capita in PPP values from the 2017 and 2018 World Development Indicators respectively. This value is logged. [3][4].

Social Support: Social support is a self-reported measure of whether or not the respondent feels they can be helped. Specifically, respondents were asked, "If you were in trouble, do you have relatives or friends you can count on to help you whenever you need them, or not?" and responded with 0 or 1 (no or yes). The average for each respective country or region creates this value [3][4].

Life Expectancy: Life expectancy data was extrapolated from the WHO's health observation data up to 2016. Where missing, life expectancy data for certain countries was found using research and government tools [3][4].

Perceptions of Corruption: Perception of Corruption is a self-reported measure of whether or not respondents feel there is active corruption within government and business. Specifically, respondents were asked, "Is corruption widespread throughout the government or not?" and "Is corruption widespread within businesses or not?" and responded to both with 0 or 1 (no or yes). The average for each respective country or region creates this value [3][4]. Note: A higher value for this measure represents a lower perception of corruption.

Generally, we want to explore the following question: what factors contribute to the differences in happiness scores between countries in North America and Australia versus Western Europe? Both regions are relatively comparable in terms of financial and political structures, but Western Europe contains the Nordic countries which consistently score highest in the World Happiness reports. With this, questions are raised as to what contributes to such happiness in this region of the world.

```
## Rows: 312
## Columns: 11
## $ Overall_rank      <dbl> 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,...
## $ Country           <chr> "Finland", "Norway", "Denmark", "Icela...
## $ Score              <dbl> 7.632, 7.594, 7.555, 7.495, 7.487, 7.4...
## $ GDP_per_capita     <dbl> 1.305, 1.456, 1.351, 1.343, 1.420, 1.3...
## $ Social_support     <dbl> 1.592, 1.582, 1.590, 1.644, 1.549, 1.4...
## $ Healthy_life_expectancy <dbl> 0.874, 0.861, 0.868, 0.914, 0.927, 0.8...
## $ Freedom_to_make_life_choices <dbl> 0.681, 0.686, 0.683, 0.677, 0.660, 0.6...
## $ Generosity         <dbl> 0.202, 0.286, 0.284, 0.353, 0.256, 0.3...
## $ Perceptions_of_corruption <dbl> 0.393, 0.340, 0.408, 0.138, 0.357, 0.2...
## $ year              <chr> "2018", "2018", "2018", "2018", "2018"...
## $ Region            <chr> "Western Europe", "Western Europe", "W..."
```

Chi-square test

Description of chi square test for methodology



##

```
## Pearson's Chi-squared test with simulated p-value (based on 2000
## replicates)
##
## data: worldhappiness$Score and worldhappiness$Region
## X-squared = 2562.2, df = NA, p-value = 0.1124
```

Summary Statistics

Description of summary statistics for methodology

```
## WE_mean_happiness median_score SD
## 1 6.86375 7.003 0.6939077

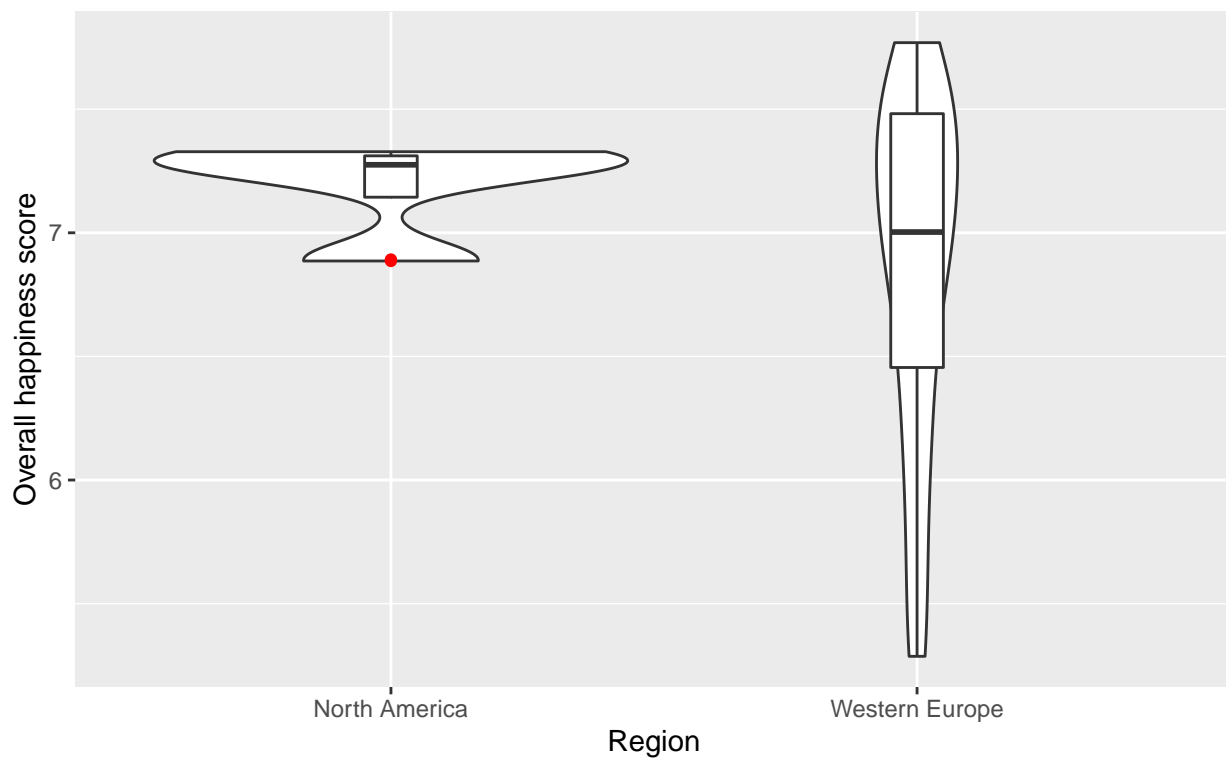
## NA_mean_happiness median_score SD
## 1 7.189375 7.275 0.1881557
```

Violin Plot Visualizations

Description of visualizations for methodology.

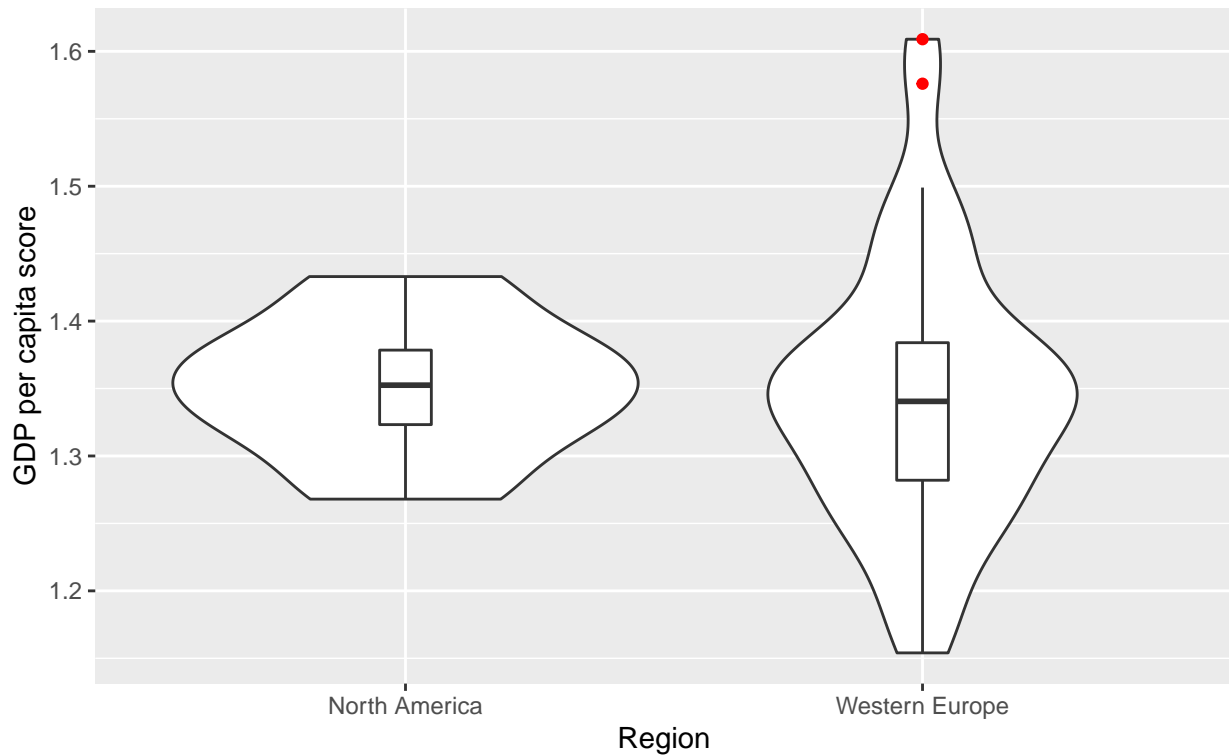
Distributions of overall happiness scores by region

Red points denoting outliers



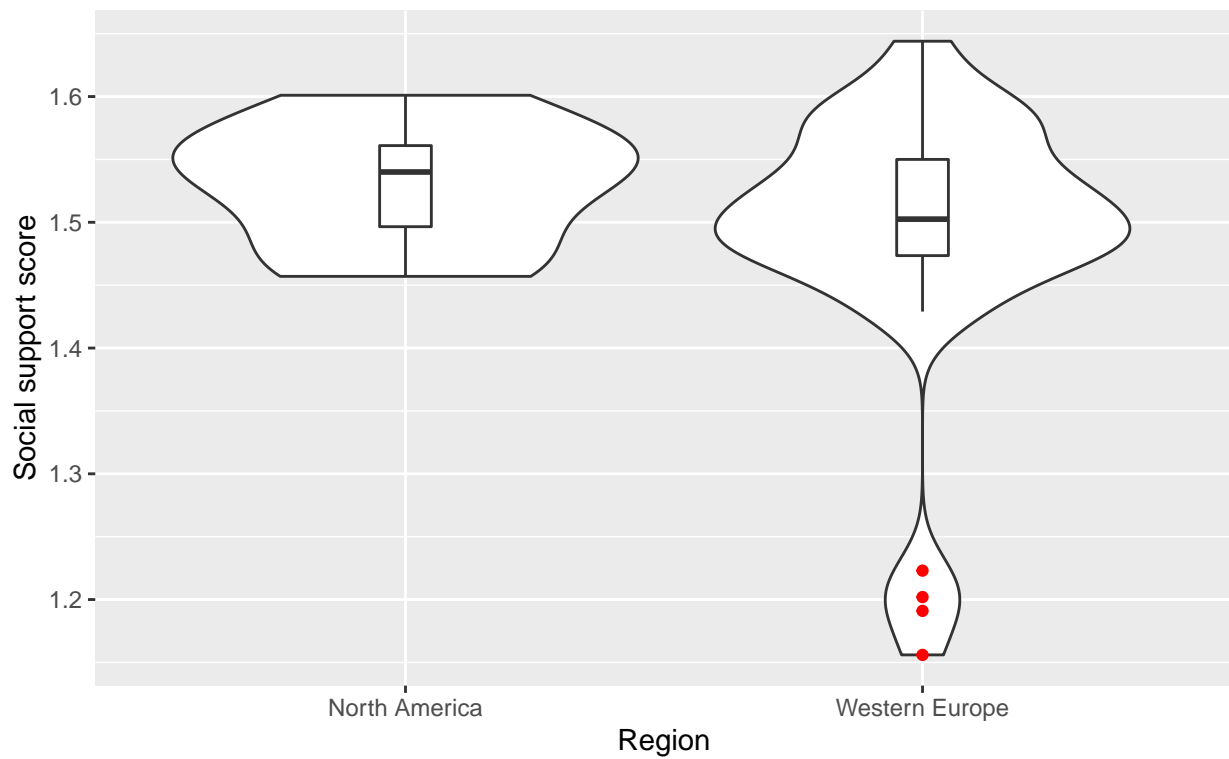
Distributions of GDP per capita scores by region

Red points denoting outliers



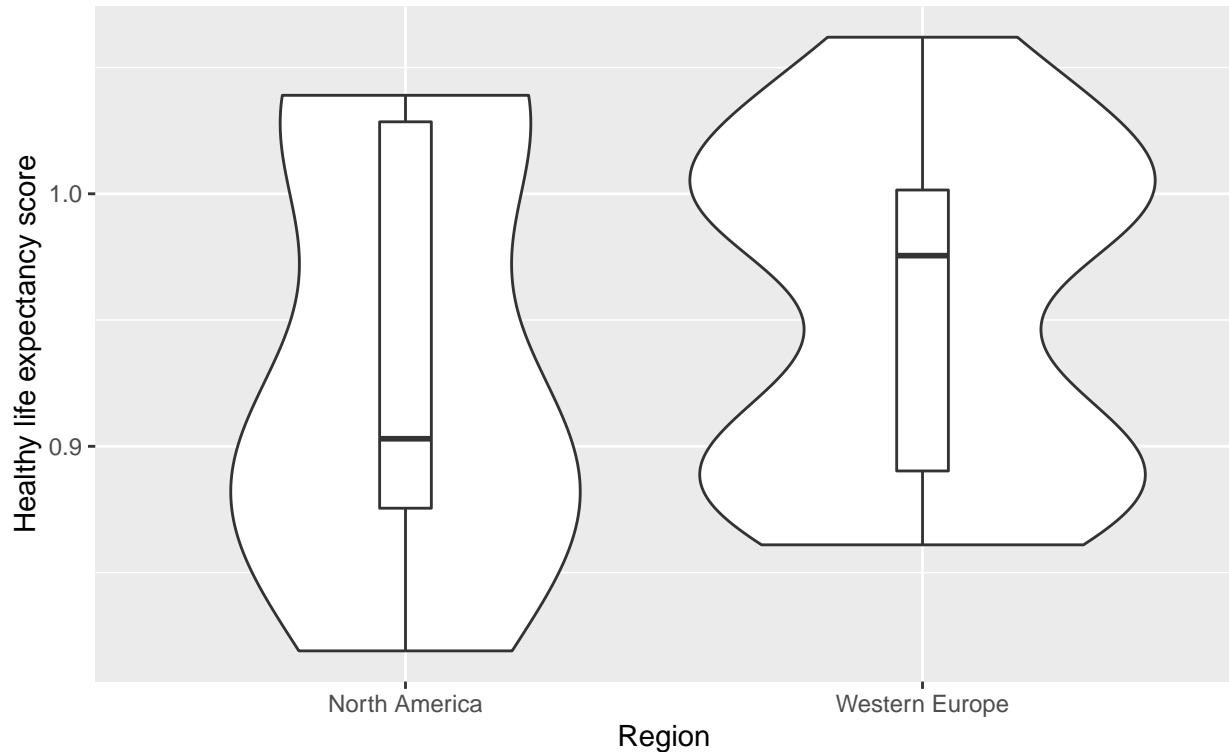
Distributions of social support scores by region

Red points denoting outliers



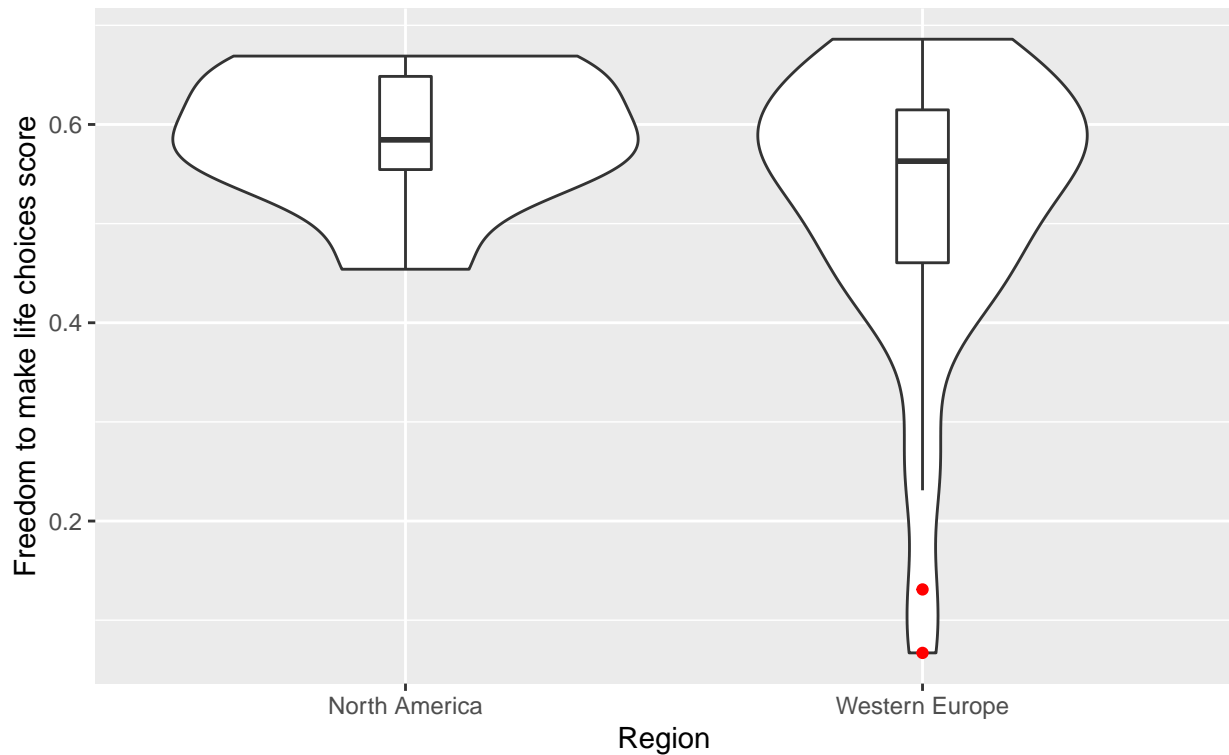
Distributions of healthy life expectancy scores by region

Red points denoting outliers



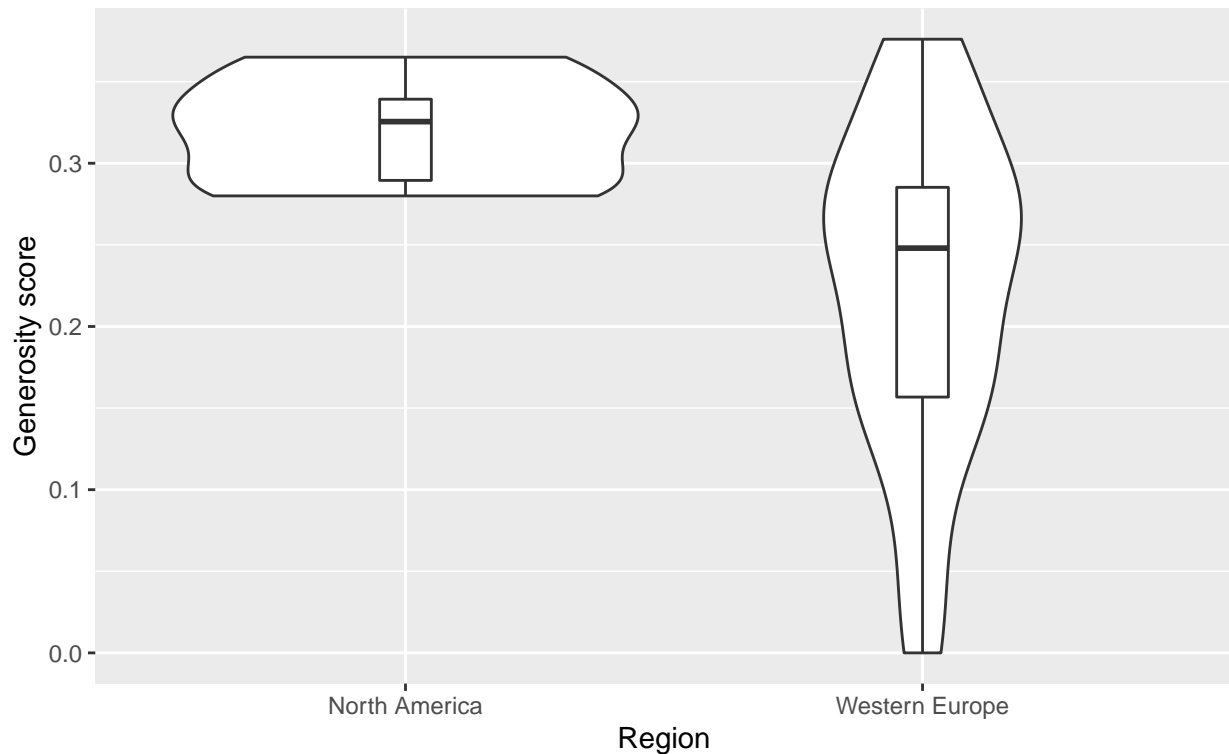
Distributions of freedom to make life choices scores by region

Red points denoting outliers



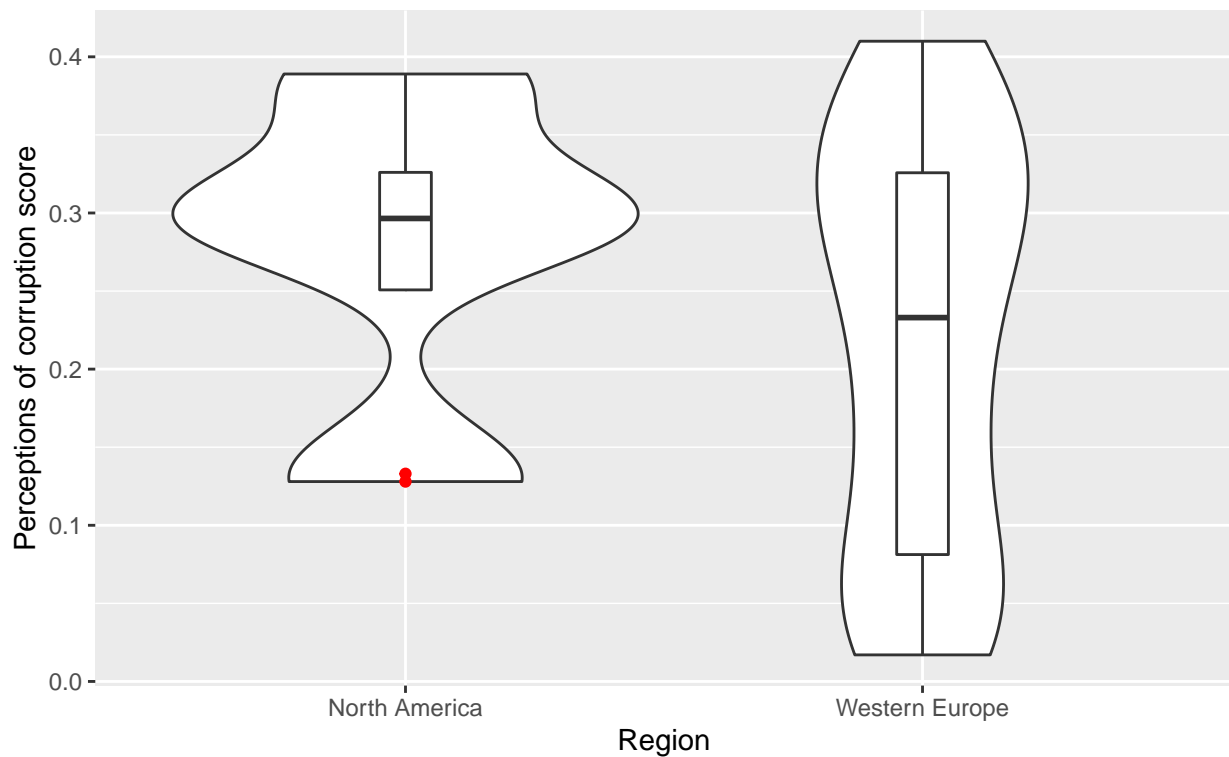
Distributions of generosity scores by region

Red points denoting outliers



Distributions of perceptions of corruption scores by region

Red points denoting outliers



Simulation based hypothesis testing

Next, we conducted simulation-based hypothesis tests for each of the variables contributing to overall happiness score to evaluate whether there Western Europe has a statistically significantly higher mean score for a particular variable between the two regions.

Each of the simulation-based hypothesis tests used to evaluate the variables contributing to overall happiness score will be evaluated at the $\alpha = 0.05$ level.

Generally, our null hypothesis states that the mean score for a particular variable in Western Europe is less than or equal to the mean score for that same variable in North America Our alternative hypothesis therefore is that the mean score for a particular variable in Western Europe is greater than that of the mean score for that variable in North America.

$$H_0: \mu_{WE} \leq \mu_{NA}$$

$$H_A: \mu_{WE} > \mu_{NA}$$

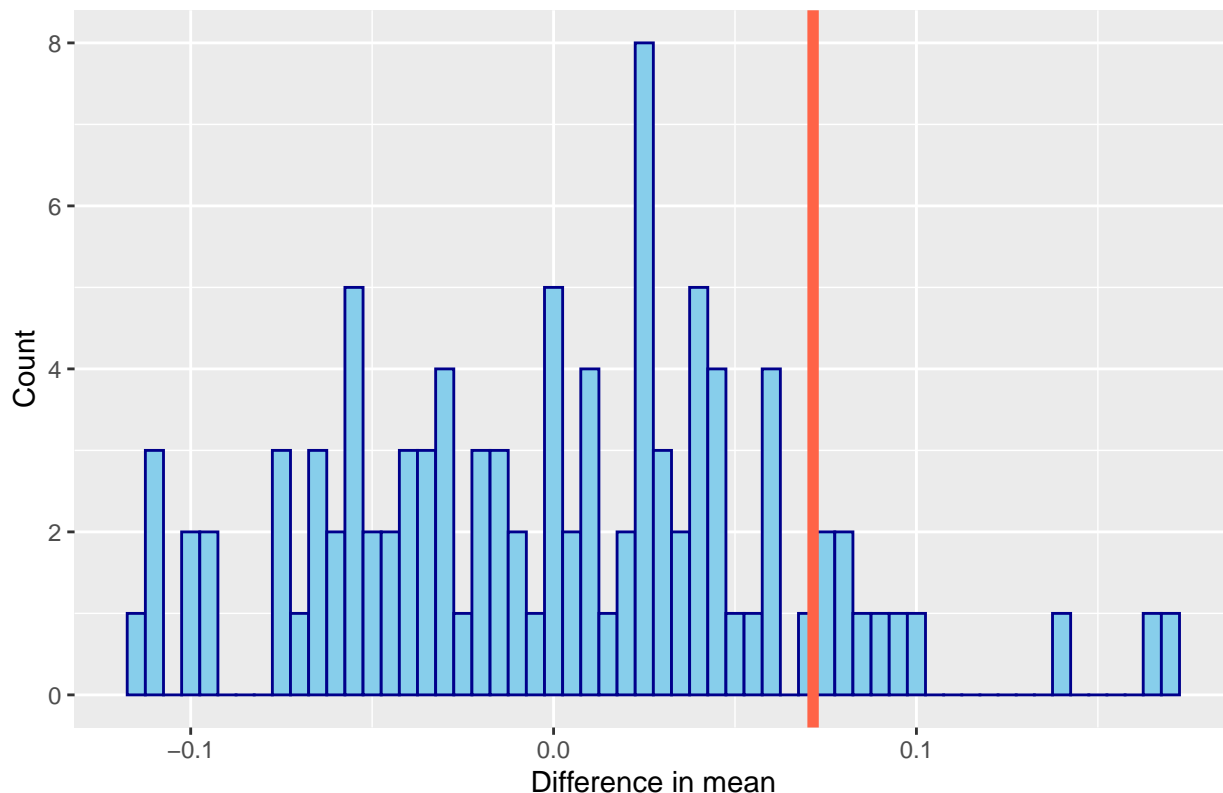
GDP per capita

```
## WE_GDP
## 1 1.34385

## NA_ANZ_GDP
## 1 1.351125

## p_val
## 1 0.11
```

Simulated null distribution of difference in GDP per capita



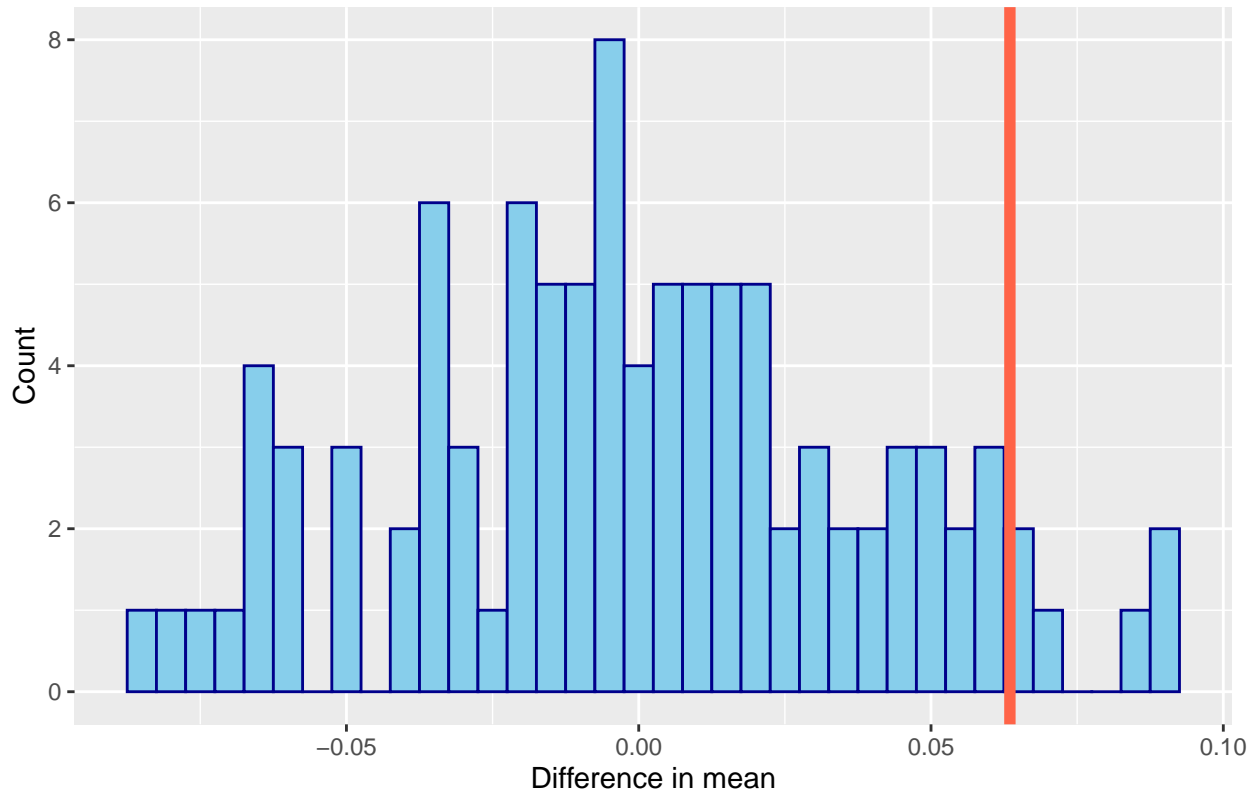
Social Support

```
## WE_Soc_Support
## 1 1.486825
```

```
## NA_ANZ_Soc_Support
## 1 1.5305

## p_val
## 1 0.06
```

Simulated null distribution of difference in social support



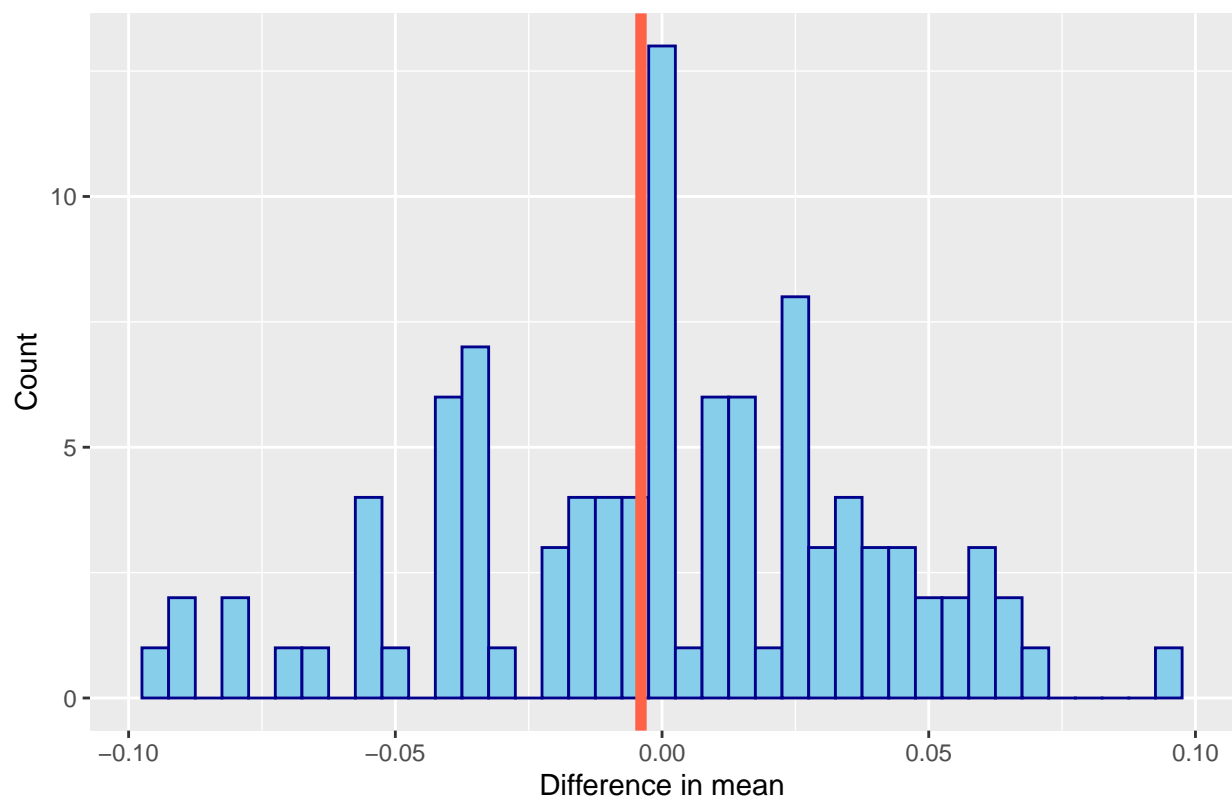
Freedom to make life choices

```
## WE_Life_Choices
## 1 0.52105

## NA_ANZ_Life_Choices
## 1 0.587

## p_val
## 1 0.6
```


Simulated null distribution of difference in freedom to make life choices

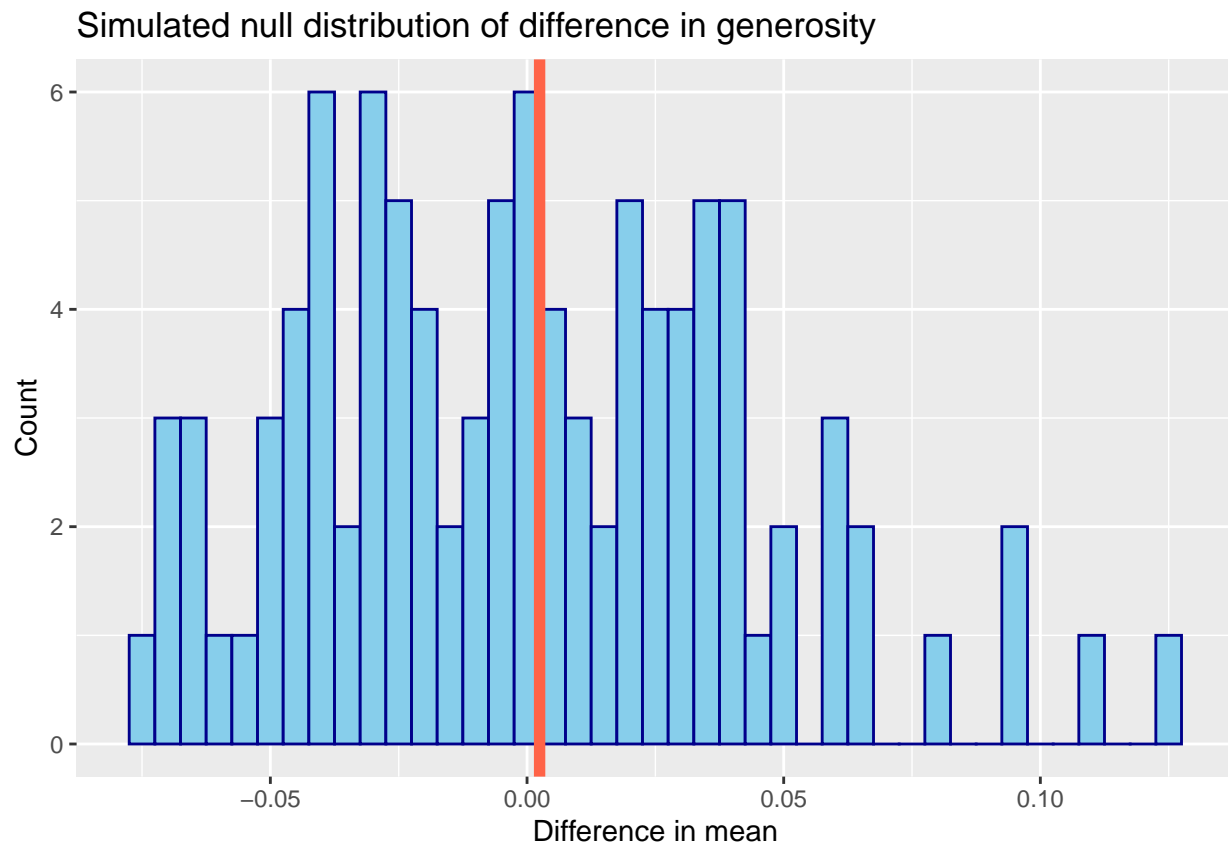


Generosity

```
## WE_Gen
## 1 0.22245

## NA_ANZ_Gen
## 1 0.320625

## p_val
## 1 0.45
```



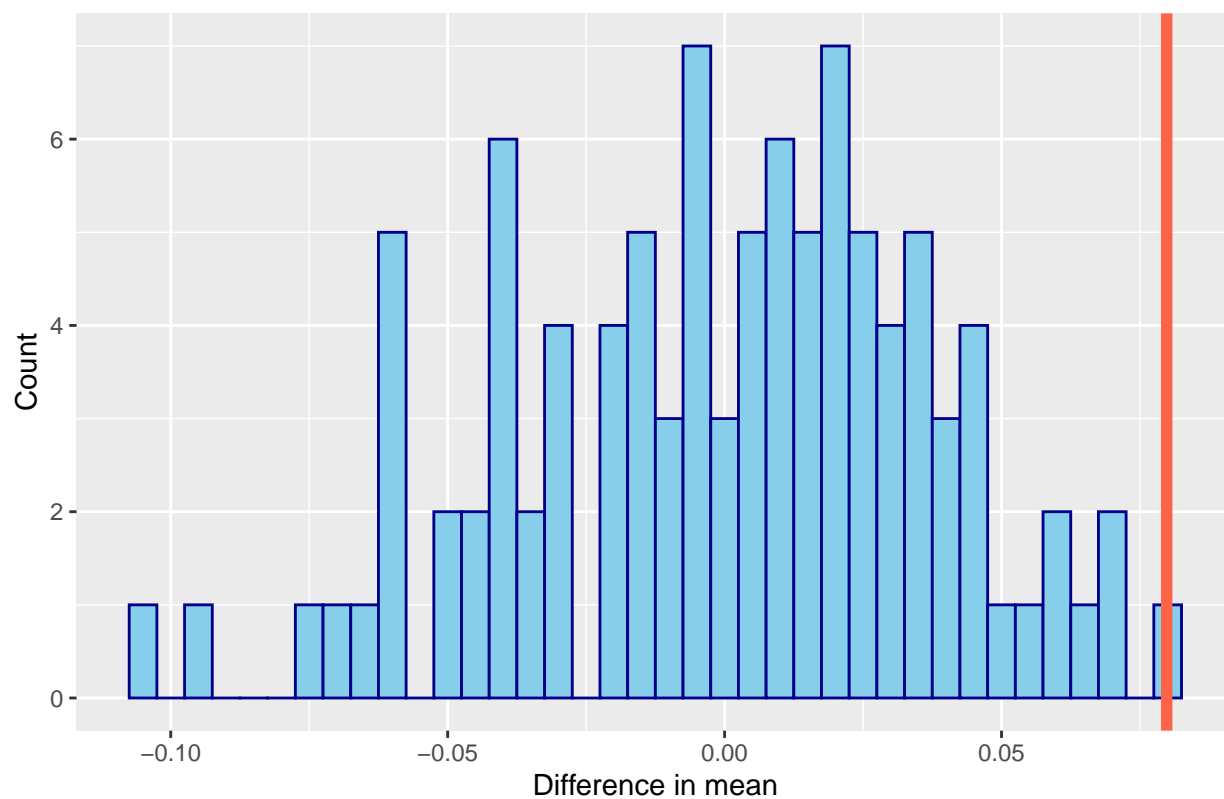
Life Expectancy

```
## WE_life_expectancy
## 1 0.954825

## RestofW_life_expectancy
## 1 0.954825

## p_val
## 1 0.01
```

Simulated null distribution of difference in life expectancy

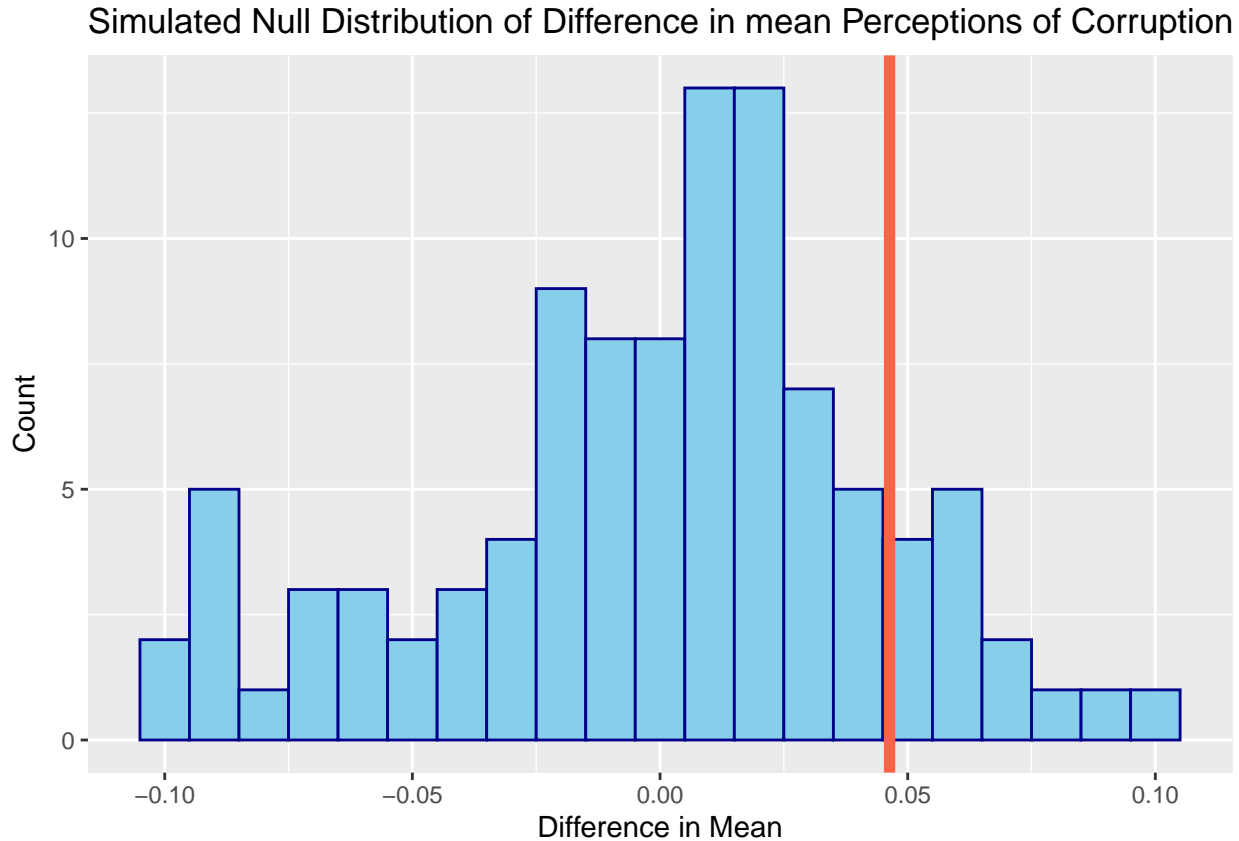


Perceptions of Corruption

```
##      WE_POC
## 1 0.217675

##      NA_POC
## 1 0.277625

##      p_val
## 1 0.14
```



RESULTS

Chi-square test

With a simulated p-value of 0.1124 which is less than our $\alpha = 0.05$, we have sufficient evidence to reject the null hypothesis in favor of the alternative hypothesis and conclude that there is an association between region of the world and happiness score.

Simulation-based hypothesis tests

GDP per capita: Since the calculated p-value of 0.11 is not significant at the $\alpha = 0.05$ level, we fail to reject the null hypothesis. Therefore, there is not statistically significant evidence to suggest that the mean GDP per capita score in Western Europe is greater than that of North America.

Social support: The calculated p-value of 0.06 is not significant at the $\alpha = 0.05$ level, so we fail to reject the null hypothesis. Therefore, there is not statistically significant evidence to suggest that the mean social support score in Western Europe is greater than that of North America.

Freedom to make life choices Since the calculated p-value of 0.06 is not significant at the $\alpha = 0.05$ level, we fail to reject the null hypothesis. Therefore, there is not statistically significant evidence to suggest that the mean freedom to make life choices score in Western Europe is greater than that of North America.

Generosity The calculated p-value of 0.45 is not significant at the $\alpha = 0.05$ level, so we fail to reject the null hypothesis. Therefore, there is not statistically significant evidence to suggest that the mean generosity score in Western Europe is greater than that of North America.

Life expectancy The calculated p-value of 0.01 is significant at the $\alpha = 0.05$ level, so we can the null hypothesis. Therefore, there is statistically significant evidence to suggest that the mean life expectancy score in Western Europe is greater than that of North America.

Perceptions of corruption Since the calculated p-value of 0.14 is not significant at the $\alpha = 0.05$ level, we fail to reject the null hypothesis. Therefore, there is not statistically significant evidence to suggest that the mean perceptions of corruption score in Western Europe is greater than that of North America.

DISCUSSION