*Introduction*. Using the 2012 BRFSS nationwide health related survey of adults of age 18 or older, we will attempt to answer three questions. The first question is 1) Do married women tend to be heavier (as measured by BMI) than never married women? To investigate this question, we must first look at some summary statistics for married and never married females. For our analysis, we will be comparing the average (mean) BMI of a random sample of married women with the average (mean) BMI of a random sample of never married women.

BMI of Married and Never Married Females

Summary Statistics for Female BMI					
Groups	Median	Mean	SD	N	Range
BMI - Married Females	26	27.2	5.72	528	15.6:51.5
BMI - Never Married Females	25.6	26.9	6.4	129	15.6:51.5
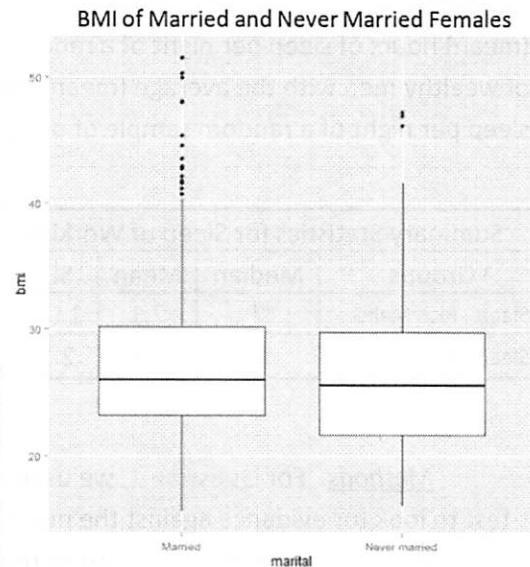
For our second question, we will ask 2) Do married men tend to be heavier (as measured by BMI) than never married men? We are essentially asking the same question of men that we asked in our first question about women. To investigate this question, we must first look at some summary statistics for married men and never married men. For our analysis, we will be comparing the average (mean) BMI of a random sample of married men with the average (mean) BMI of a random sample of never married men.
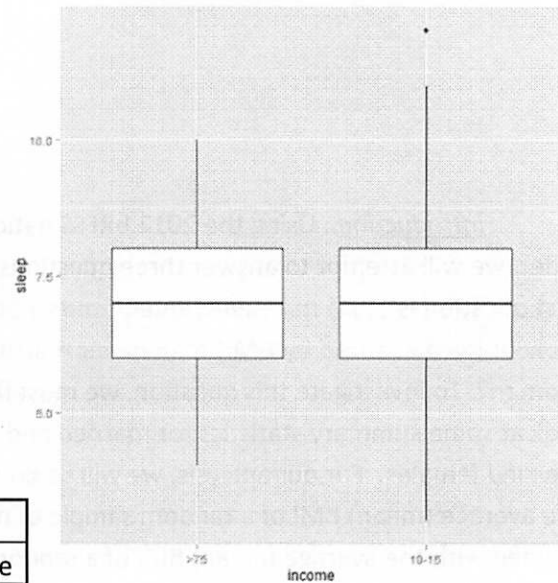
BMI of Married and Never Married Males

Summary Statistics for Male BMI					
Groups	Median	Mean	SD	N	Range
BMI - Married Males	27.7	28.1	4.9	426	2.6:56.4
BMI - Never Married Males	25.1	26	4.8	147	16.3:44.1
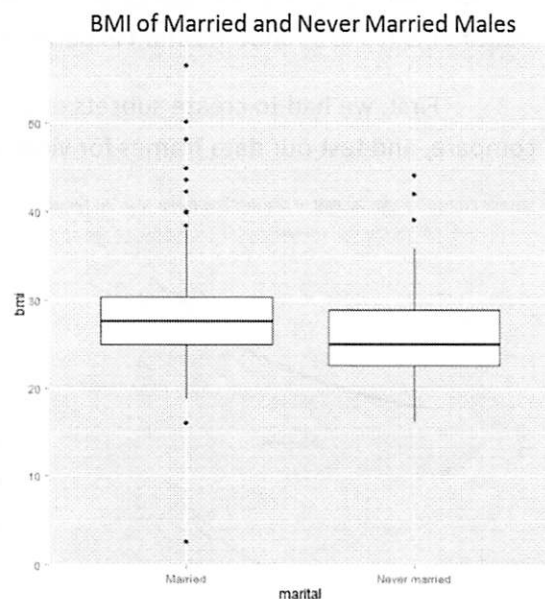
For our third question, we will ask 2) Do wealthy working men get more sleep than poor working men? We define a wealthy working man as a male that makes more than $75,000 per year. We define a poor working man as a male that makes between $10,000 and $15,000 per year. To investigate this question, we must first look at some summary statistics for poor and rich working men. For our analysis, we will be comparing the average (mean) hours of sleep per night of a random sample of wealthy men with the average (mean) hours of sleep per night of a random sample of poor men.

Hours of Sleep per Night of Rich and Poor Men

| Summary Statistics for Sleep of Working Males (hrs)					
Groups	Median	Mean	SD	N	Range
Sleep - Rich Males	7	7.1	1.06	135	4:10
Sleep - Poor Males	7	7.4	2.1	47	3:12

Methods. For Question 1, we used a two-sample t-test to look for evidence against the null hypothesis: H_o = The BMI of married women is equal to the BMI of never married women. We used a two-sample t-test because we do not have paired data as in a paired t-test (we are not recording two BMI scores on the same women), and none of our subjects were assigned to treatments (as in a randomization experiment).

First, we had to create subsets of data to compare, and test our data frames for violations of the assumptions for a two

Equal Variance Analysis for BMI of Married and Never Married Females

Normal Probability plot for BMI of Married and Never Married Females
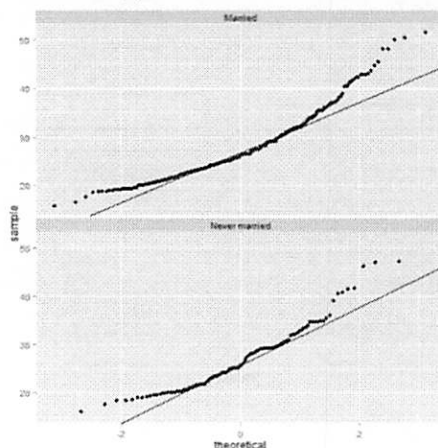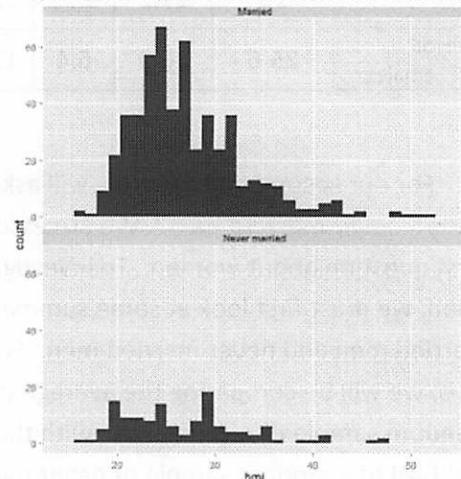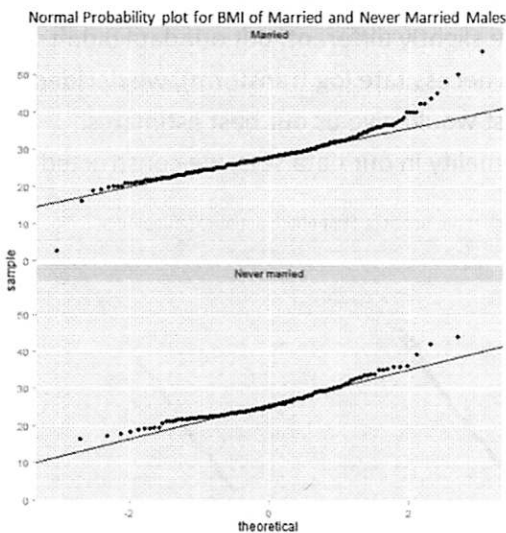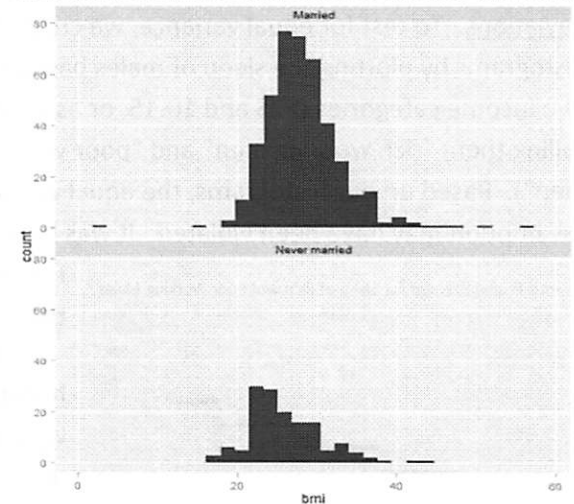

sample t-test. Our assumptions are that subjects were sampled at random from a population with normal distribution and equal standard deviations. To test for equal variance, we created histograms by plotting the BMI of females based on two marital categories (married and never married). Based on our histograms, the equal variance assumption appeared to be valid for our data set. We then moved on to test for normality in our data sets. To test for normality, we constructed a normal probability plot

using the same data sets we used for our equal variance tests. All of our observations did not fall exactly on the regression line, and therefore we may have a slightly non-normal data set. However, because we have equal variance and large sample sizes, we can appeal to the Central Limit Theorem for robustness of our analysis.

For Question 2, we used a two-sample t-test to look for evidence against the null hypothesis: H_o = The BMI of married men is equal to the BMI of never married men. We used a two-sample t-test because we do not have paired data as in a paired t-test (we are not recording two BMI scores on the same men), and none of our subjects were assigned to treatments (as in a randomization experiment).

Equal Variance Analysis for BMI of Married and Never Married Males

First, we had to create subsets of data to compare, and test our data frames for violations of the assumptions for a two sample t-test. Our assumptions are that subjects were <u>sampled at random</u> from a population with <u>normal distribution</u>

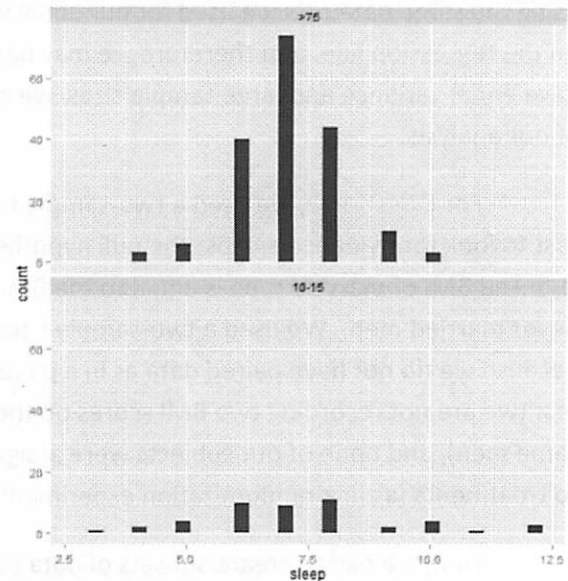Normal Probability plot for BMI of Married and Never Married Males

and <u>equal standard deviations</u>. To test for equal variance, we created histograms by plotting the BMI of males based on two marital categories (married and never married). Based on our histograms, the equal variance assumption may have been violated. It was hard to tell by the initial histograms. After running several simulations from our data, we were satisfied that the equal variance assumption had not been violated. We then moved on to test for normality in our data sets. To test for normality, we constructed a normal probability plot using the same data sets we used for our equal variance tests. All of our observations did not fall exactly on the regression line, and therefore we may have a slightly non-normal data set. However, because we have equal variance and large sample sizes, we can appeal to the Central Limit Theorem for robustness of our analysis.

For Question 3, we used a Welch's two-sample t-test to look for evidence against the null hypothesis: H_o = The number of hours of sleep that working wealthy men (>\$75/year) get per night is equal to the number of hours working poor men (\$10-15/year) get per night. We used the Welch's two-sample t-test because we do not have paired data as in a paired t-test (we are not recording two sleep scores on the same men), and none of our subjects were assigned to treatments (as in a randomization experiment).

First, we had to create subsets of data to compare, and test our data frames for violations of the assumptions for a two sample t-test. Our assumptions, again, are that subjects were <u>sampled at random</u> from a population with <u>normal distribution</u>, but may have <u>unequal standard deviations</u>. To test for equal variance, we created histograms by plotting the sleep of males based on two income categories (>75 and 10-15, or as we are calling them "rich working men" and "poor working men"). Based on our histograms, the equal variance assumption may have been violated. It was hard to tell by the initial

Equal Variance Analysis for Sleep of Rich and Poor Working Males

histograms. After running several simulations from our data, we were still not completely satisfied that the equal variance assumption had not been violated.

The variances still appeared slightly different. Because we may have slightly different, but our data didn't appeared skewed (to necessitate log transform), we decided that the Welch's t-test would give us our best estimates. When testing for normality in our data sets, we constructed a


Normal Probability plot for Sleep of Rich and Poor Working Males
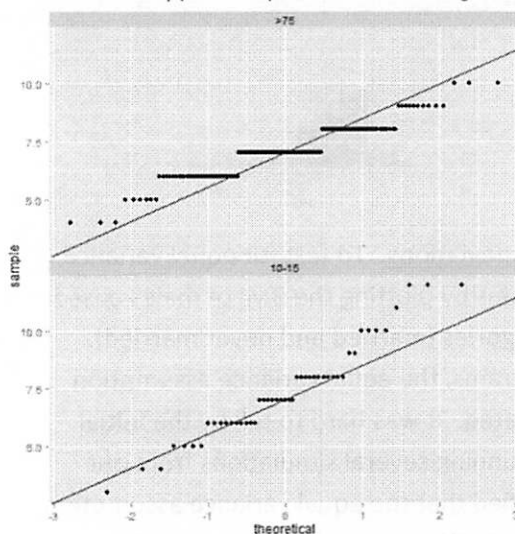
normal probability plot using the same data sets we used for our equal variance tests. All of our observations did not fall exactly on the regression line, and therefore we may have a slightly non-normal data set. We decided to construct a simulated probability plot to test for normality, and our data points fell tightly on the regression line, indicating robustness to the normaility assumption.

Simulated Probability plot for Sleep of Rich and Poor Working Males
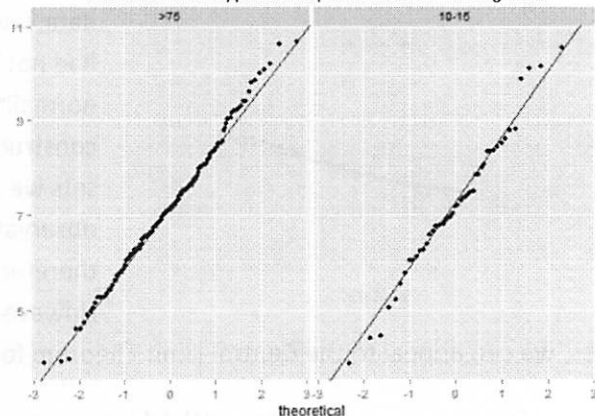
Summary. For Question 1, there is no evidence that the mean BMI of married women is different than the mean BMI of never married women in 2012 (two-sample t-test, two-sided p-value = 0.57). With 95% confidence, the population mean BMI of married women is between -0.80 and 1.46 BMI points higher than the population mean BMI of never married women in 2012.

For Question 2, there is convincing evidence that the mean BMI of married men is different than the mean BMI of never married men in 2012 (two-sample t-test, two-sided p-value = <0.001). The mean BMI of married men is estimated to be on average 2.09 BMI points higher than the mean BMI of never married men in 2012. With 95% confidence, the population mean BMI of married men is between 1.18 and 3.00 BMI points higher than the population mean BMI of never married men in 2012.

For Question 3, there is no evidence that the number of hours of sleep that working wealthy men (>75k per year) get per night was different than the number of hours of sleep that working poor men (10-15k per year) get per night in 2012 (Welch's t-test, two-sided p-value = 0.32). With 95% confidence, the population mean hours of sleep of wealthy men was between -0.95 and 0.31 hours less than the population mean hours of sleep of poor men in 2012.