

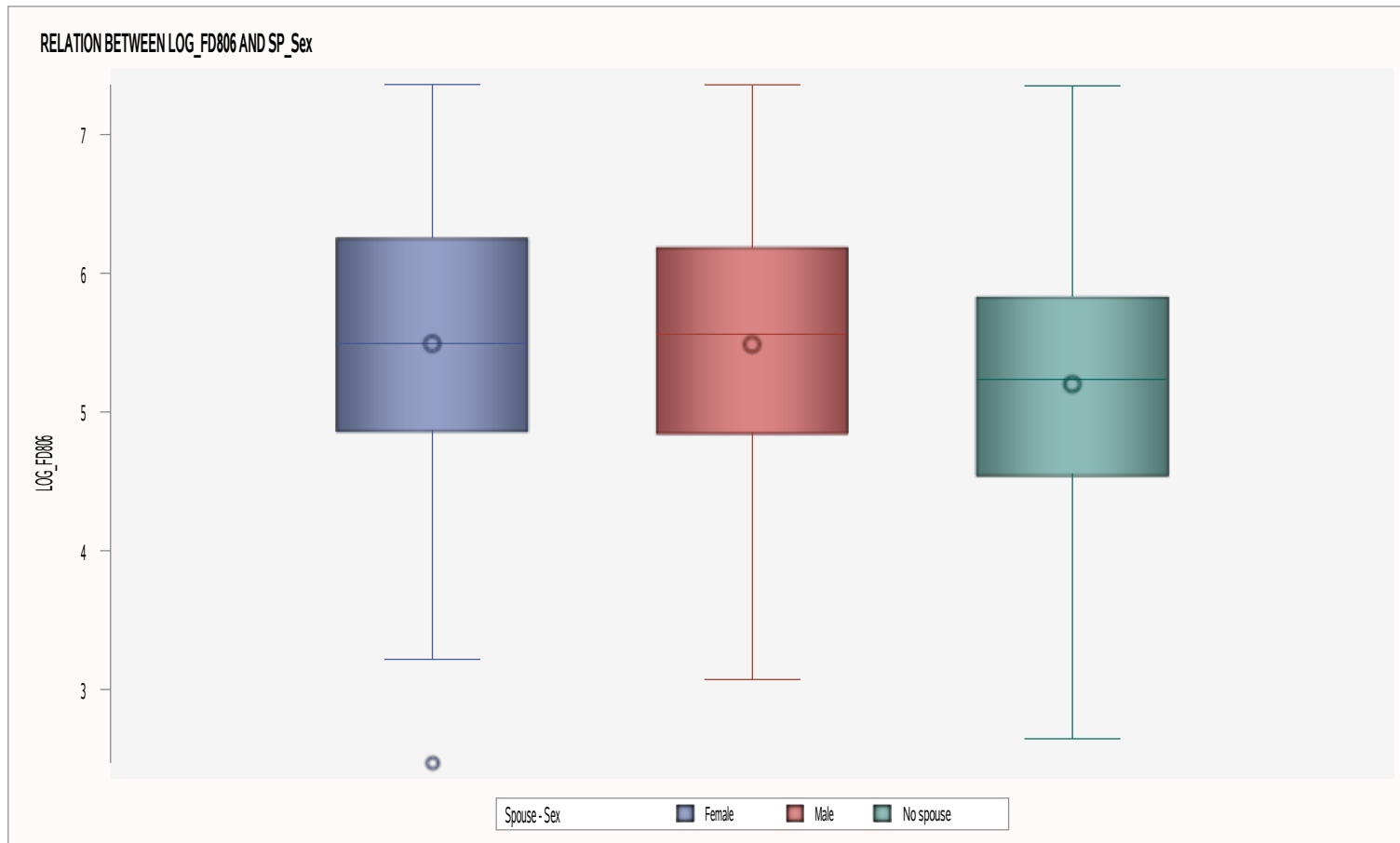
# BIVARIATE ANALYSIS OF SP\_Sex AND LOG\_FD806 FOR ANA.MODEL2

## RELATION BETWEEN LOG\_FD806 AND SP\_Sex

11:42 Saturday, November 20, 2021 1

### The MEANS Procedure

Analysis Variable : LOG_FD806														
Spouse - Sex	N Obs	N	N Miss	Minimum	Lower Quartile	Median	Mean	Upper Quartile	Maximum	Quartile Range	Coeff of Variation	Lower 95% CL for Mean	Upper 95% CL for Mean	Skewness
Female	2493849	2493849	0	2.47	4.86	5.49	5.49	6.25	7.36	1.40	17.02	5.49	5.49	-0.22
Male	2727046	2727046	0	3.07	4.84	5.56	5.48	6.18	7.36	1.34	16.80	5.48	5.48	-0.19
No spouse	2907981	2907981	0	2.64	4.54	5.24	5.20	5.83	7.35	1.29	18.07	5.20	5.20	-0.06



One-way ANOVA Assumptions
In order to run a one-way ANOVA the following assumptions must be met:
1.The response of interest is continuous and normally distributed for each treatment group:
Normality test: PROC UNIVARIATE NORMAL and QQPlot for each group.
2.Treatment groups are independent of one another. Experimental units only receive one treatment,and they do not overlap.
3.There are no major outliers.
4.A check for unequal variances will help determine which version of a one-way ANOVA is most appropriate
(Levene's test, Null hypothesis: variances are equal between groups):
A .If variances are equal, then the assumptions of a standard one-way ANOVA are met.
B. If variances are unequal, then a Welch's one-way ANOVA is appropriate.

Normal Distribution?
Null hypothesis: sample has a normal distribution
CLT :
a.If it looks normal and each group have more than 30 observations
b.If moderately skewed, each group must have more than 100 observations
*rule of thumb: If skewness is between -1 and -0.5 or between 0.5 and 1, the distribution is moderately skewed.
*if the sample size is over 2000, the Kolmogorov test should be used. If the sample size is less than 2000, the Shapiro test is better.

**The UNIVARIATE Procedure**  
**Variable: LOG\_FD806**

**Freq: WeightD**

**Spouse - Sex=Female**

Moments			
<b>N</b>	2493849	<b>Sum Weights</b>	2493849
<b>Mean</b>	5.48775798	<b>Sum Observations</b>	13685639.7
<b>Std Deviation</b>	0.93420326	<b>Variance</b>	0.87273572
<b>Skewness</b>	-0.216224	<b>Kurtosis</b>	-0.6025601

**The UNIVARIATE Procedure**  
**Variable: LOG\_FD806**

**Freq: WeightD**

**Spouse - Sex=Female**

Moments			
<b>Uncorrected SS</b>	77279948.9	<b>Corrected SS</b>	2176470.24
<b>Coeff Variation</b>	17.0234048	<b>Std Error Mean</b>	0.00059157

Basic Statistical Measures			
Location		Variability	
<b>Mean</b>	5.487758	<b>Std Deviation</b>	0.93420
<b>Median</b>	5.493761	<b>Variance</b>	0.87274
<b>Mode</b>	6.583603	<b>Range</b>	4.89010
		<b>Interquartile Range</b>	1.39589

Tests for Location: Mu0=0				
Test	Statistic		p Value	
<b>Student's t</b>	<b>t</b>	9276.596	<b>Pr &gt;  t </b>	<.0001
<b>Sign</b>	<b>M</b>	1246925	<b>Pr &gt;=  M </b>	<.0001
<b>Signed Rank</b>	<b>S</b>	1.555E12	<b>Pr &gt;=  S </b>	<.0001

Tests for Normality				
Test	Statistic		p Value	
<b>Kolmogorov-Smirnov</b>	<b>D</b>	0.049375	<b>Pr &gt; D</b>	<0.0100
<b>Cramer-von Mises</b>	<b>W-Sq</b>	1049.703	<b>Pr &gt; W-Sq</b>	<0.0050
<b>Anderson-Darling</b>	<b>A-Sq</b>	8131.745	<b>Pr &gt; A-Sq</b>	<0.0050

The UNIVARIATE Procedure  
Variable: LOG\_FD806

Freq: WeightD

Spouse - Sex=Female

Quantiles (Definition 5)	
Level	Quantile
100% Max	7.36074
99%	7.23335
95%	6.90112
90%	6.64348
75% Q3	6.25416
50% Median	5.49376
25% Q1	4.85826
10%	4.18510
5%	3.94893
1%	3.31200
0% Min	2.47064

Extreme Observations					
Lowest			Highest		
Value	Freq	Obs	Value	Freq	Obs
2.47064	3940	241	7.30971	58	426
3.21727	186	64	7.32095	5649	28
3.22764	463	605	7.33580	1566	144
3.23789	987	180	7.35014	1360	249
3.25810	2580	351	7.36074	43	416

**The UNIVARIATE Procedure**  
**Variable: LOG\_FD806**

**Freq: WeightD**

**Spouse - Sex=Male**

Moments			
<b>N</b>	2727046	<b>Sum Weights</b>	2727046
<b>Mean</b>	5.48162384	<b>Sum Observations</b>	14948640.4
<b>Std Deviation</b>	0.92083002	<b>Variance</b>	0.84792793
<b>Skewness</b>	-0.1911797	<b>Kurtosis</b>	-0.6566523
<b>Uncorrected SS</b>	84255161.2	<b>Corrected SS</b>	2312337.63
<b>Coeff Variation</b>	16.7984898	<b>Std Error Mean</b>	0.00055761

Basic Statistical Measures			
Location		Variability	
<b>Mean</b>	5.481624	<b>Std Deviation</b>	0.92083
<b>Median</b>	5.560682	<b>Variance</b>	0.84793
<b>Mode</b>	6.488141	<b>Range</b>	4.28666
		<b>Interquartile Range</b>	1.33867

Tests for Location: Mu0=0				
Test	Statistic		p Value	
<b>Student's t</b>	<b>t</b>	9830.509	<b>Pr &gt;  t </b>	<.0001
<b>Sign</b>	<b>M</b>	1363523	<b>Pr &gt;=  M </b>	<.0001
<b>Signed Rank</b>	<b>S</b>	1.859E12	<b>Pr &gt;=  S </b>	<.0001

**The UNIVARIATE Procedure**  
**Variable: LOG\_FD806**

**Freq: WeightD**

**Spouse - Sex=Male**

Tests for Normality				
Test	Statistic		p Value	
Kolmogorov-Smirnov	D	0.04949	Pr > D	<0.0100
Cramer-von Mises	W-Sq	1427.212	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq	9647.027	Pr > A-Sq	<0.0050

Quantiles (Definition 5)	
Level	Quantile
100% Max	7.35843
99%	7.29261
95%	6.90938
90%	6.65639
75% Q3	6.18058
50% Median	5.56068
25% Q1	4.84190
10%	4.09351
5%	3.93104
1%	3.47259
0% Min	3.07177

**The UNIVARIATE Procedure**  
**Variable: LOG\_FD806**

**Freq: WeightD**

**Spouse - Sex=Male**

Extreme Observations					
Lowest			Highest		
Value	Freq	Obs	Value	Freq	Obs
3.07177	347	1236	7.33995	1345	791
3.08374	1372	1154	7.34003	776	1527
3.08374	3250	1030	7.34357	669	915
3.15274	132	1335	7.35361	491	1382
3.25810	975	793	7.35843	4907	1128

**The UNIVARIATE Procedure**  
**Variable: LOG\_FD806**

**Freq: WeightD**

**Spouse - Sex=No spouse**

Moments			
<b>N</b>	2907981	<b>Sum Weights</b>	2907981
<b>Mean</b>	5.19840979	<b>Sum Observations</b>	15116876.9
<b>Std Deviation</b>	0.93942162	<b>Variance</b>	0.88251299
<b>Skewness</b>	-0.0590322	<b>Kurtosis</b>	-0.3875657
<b>Uncorrected SS</b>	81150051.1	<b>Corrected SS</b>	2566330.12
<b>Coeff Variation</b>	18.0713268	<b>Std Error Mean</b>	0.00055089

**The UNIVARIATE Procedure**  
**Variable: LOG\_FD806**

**Freq: WeightD**

**Spouse - Sex=No spouse**

Basic Statistical Measures			
Location		Variability	
Mean	5.198410	Std Deviation	0.93942
Median	5.235165	Variance	0.88251
Mode	5.958166	Range	4.70633
		Interquartile Range	1.28658

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	9436.387	Pr >  t	<.0001
Sign	M	1453991	Pr >=  M	<.0001
Signed Rank	S	2.114E12	Pr >=  S	<.0001

Tests for Normality				
Test	Statistic		p Value	
Kolmogorov-Smirnov	D	0.034118	Pr > D	<0.0100
Cramer-von Mises	W-Sq	364.6552	Pr > W-Sq	<0.0050
Anderson-Darling	A-Sq	2814.721	Pr > A-Sq	<0.0050

Quantiles (Definition 5)	
Level	Quantile
100% Max	7.35109
99%	7.11486
95%	6.81928
90%	6.40723



**The UNIVARIATE Procedure**  
**Variable: LOG\_FD806**

**Freq: WeightD**

**Spouse - Sex=No spouse**

Quantiles (Definition 5)	
Level	Quantile
75% Q3	5.83115
50% Median	5.23516
25% Q1	4.54457
10%	3.95891
5%	3.66356
1%	3.05777
0% Min	2.64476

Extreme Observations					
Lowest			Highest		
Value	Freq	Obs	Value	Freq	Obs
2.64476	15313	1994	7.27783	46	1615
2.71337	1520	2209	7.27891	505	2118
3.02237	4062	1975	7.28345	442	1629
3.03495	8060	2018	7.33743	836	1656
3.05777	7665	2032	7.35109	759	1841

Null hypothesis: equal variances

a.If variances are equal, then a pooled t-test is appropriate

b.If variances are unequal, then a Satterthwaite (also known as Welch's) test is appropriate

**The GLM Procedure**

Class Level Information		
Class	Levels	Values
SP_Sex	3	Female Male No spouse

Number of Observations Read	2327
Number of Observations Used	2327
Sum of Frequencies Read	8128876
Sum of Frequencies Used	8128876

**The GLM Procedure****Dependent Variable: LOG\_FD806****Frequency: WeightD**

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	152973.029	76486.514	88127.1	<.0001
Error	8.13E6	7055137.985	0.868		
Corrected Total	8.13E6	7208111.014			

R-Square	Coeff Var	Root MSE	LOG_FD806 Mean
0.021222	17.30926	0.931617	5.382190

Source	DF	Type I SS	Mean Square	F Value	Pr > F
SP_Sex	2	152973.0289	76486.5145	88127.1	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SP_Sex	2	152973.0289	76486.5145	88127.1	<.0001

### The GLM Procedure

Levene's Test for Homogeneity of LOG_FD806 Variance ANOVA of Absolute Deviations from Group Means					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
SP_Sex	2	371.6	185.8	652.09	<.0001
Error	8.13E6	2316009	0.2849		

Welch's ANOVA for LOG_FD806			
Source	DF	F Value	Pr > F
SP_Sex	2.0000	87455.0	<.0001
Error	5372470		

### The GLM Procedure

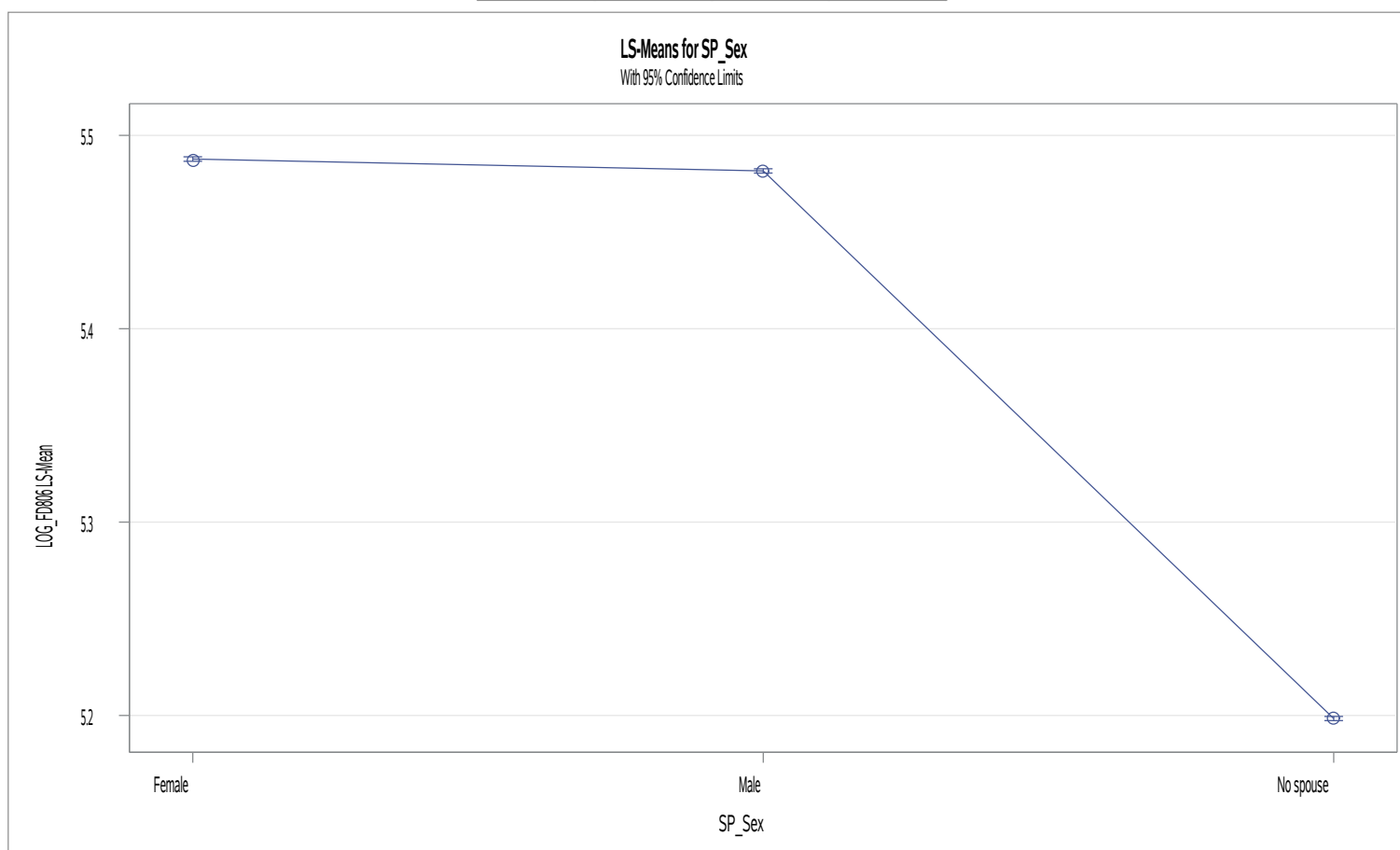
Level of SP_Sex	N	LOG_FD806	
		Mean	Std Dev
Female	2493849	5.48775798	0.93420326
Male	2727046	5.48162384	0.92083002
No spouse	2907981	5.19840979	0.93942162

### The GLM Procedure Least Squares Means Adjustment for Multiple Comparisons: Tukey

SP_Sex	LOG_FD806 LSMEAN	LSMEAN Number
Female	5.48775798	1
Male	5.48162384	2
No spouse	5.19840979	3

**The GLM Procedure**  
**Least Squares Means**  
**Adjustment for Multiple Comparisons: Tukey**

Least Squares Means for effect SP_Sex Pr >  t  for H0: LSMean(i)=LSMean(j)			
Dependent Variable: LOG_FD806			
i/j	1	2	3
1		<.0001	<.0001
2	<.0001		<.0001
3	<.0001	<.0001	



**The GLM Procedure**  
**Least Squares Means**  
**Adjustment for Multiple Comparisons: Tukey**

