



One- and Two-way ANOVA

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December, 2022

Outline

- ANOVA(One vs Two Way)
- Assumption
- Test on SPSS
- Interpretation

ANalysis Of VAriance (ANOVA)

- is a set of statistical methods used to assess the mean differences across two or more groups
- One-way ANOVA : where we have a continuous variable paired with an ordinal or nominal variable with more than two categories,
- It splits the total variance into two groups: between variance and within variance.

-
- The between variance measures the variation between groups, whereas the within variance measures the variation within groups.
 - Whenever the between variation is considerably larger than the within variation, we can say that there are differences within groups.
 - The formula for an ANOVA analysis or f-test is **between-group variance/within-group variance**

One-way ANOVA

- What it does: it will tell you whether there are significant differences in the mean scores on the dependent variable across the three or more groups.
- Post-hoc tests can then be used to find out where these differences lie.
- Assumptions: 6 assumptions
- Non-parametric alternative: Kruskal-Wallis Test



■ Two different types of one-way ANOVA:

- **Between-groups ANOVA**, which is used when you have different subjects or cases in each of your groups (this is referred to as an independent groups design); and
- **Repeated-measures analysis of variance**, which is used when you are measuring the same subjects under different conditions (or measured at different points in time) (this is also referred to as a within-subjects design).

Assumptions

- Level of measurement
- Random sampling
- Independence of observations
- Normal distribution
- Homogeneity of variance

Checking Normality

PracticedataANOVA.sav [DataSet2] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Visible: 3 of 3 Variables

| | Age | Sex | ward_admitted |
|----|-----|--------|--------------------|
| 1 | 58 | Male | Obstetrics/Gyne... |
| 2 | 70 | Male | Medical Ward |
| 3 | 64 | Female | Medical Ward |
| 4 | 55 | Male | Medical Ward |
| 5 | 50 | Female | Surgical Ward |
| 6 | 48 | Male | Medical Ward |
| 7 | 70 | Male | Medical Ward |
| 8 | 61 | Female | Medical Ward |
| 9 | 35 | Female | Obstetrics/Gyne... |
| 10 | 28 | Female | Obstetrics/Gyne... |
| 11 | 34 | Female | Obstetrics/Gyne... |
| 12 | 82 | Male | Medical Ward |
| 13 | 48 | Male | Medical Ward |
| 14 | 28 | Female | Obstetrics/Gyne... |
| 15 | 38 | Male | Surgical Ward |
| 16 | 19 | Female | Obstetrics/Gyne... |
| 17 | 35 | Female | Obstetrics/Gyne... |
| 18 | 27 | Female | Obstetrics/Gyne... |
| 19 | 30 | Female | Obstetrics/Gyne... |
| 20 | 51 | Female | Surgical Ward |
| 21 | 27 | Male | Surgical Ward |
| 22 | 35 | Female | Surgical Ward |
| 23 | 43 | Male | Surgical Ward |

Explore

Dependent List: _102_Age_in_Year...

Factor List: _101_Sex (Sex), _108_What_is_the_...

Label Cases by:

Display: ☒ Both ☐ Statistics ☐ Plots

OK Paste Reset Cancel Help

Explore

Explore: Plots

Boxplots: ☐ Factor levels together, ☐ Dependents together, ☒ None

Descriptive: ☐ Stem-and-leaf, ☐ Histogram

☒ Normality plots with tests

Spread vs Level with Levene Test: ☒ None, ☐ Power estimation, ☐ Transformed Power: Natural log, ☐ Untransformed

Display: ☒ Both ☐

Continue Cancel Help

*Output1 [Document1] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Output

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 - Case Processing S...
 - Descriptives
 - Tests of Normality
 - _102_Age_in_Year
 - Normal Q-Q P...
 - Detrended No...

| | | | |
|----------------------------------|-------------|---------|------|
| 95% Confidence Interval for Mean | Lower Bound | 48.78 | |
| | Upper Bound | 52.99 | |
| 5% Trimmed Mean | | 50.92 | |
| Median | | 52.00 | |
| Variance | | 297.289 | |
| Std. Deviation | | 17.242 | |
| Minimum | | 18 | |
| Maximum | | 90 | |
| Range | | 72 | |
| Interquartile Range | | 30 | |
| Skewness | | -.093 | .151 |
| Kurtosis | | -1.048 | .301 |

Tests of Normality

| | Kolmogorov-Smirnov ^a | | | Shapiro-Wilk | | |
|------------------|---------------------------------|-----|------|--------------|-----|------|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| _102_Age_in_Year | .083 | 260 | .000 | .966 | 260 | .000 |

a. Lilliefors Significance Correction

SPSS Steps to run One-Way ANOVA

- Step 1: Go to Analyze → Compare Means → One-Way ANOVA.
- Step 2: Put your continuous variable (age) as **Dependent Variable** and your categorical variable (ward_admitted) as **Factor**
- Step 3: Click on the **option** box and mark the Descriptive and Homogeneity of Variance test options → click continue → click on **Post Hoc** box and select a test which can give you the result of comparison between the groups. Since we run ANOVA when the homogeneity of variance assumption is met, select a test under Equal variance assumed (Eg. LSD) → Click ok → check the output





6 :

Visible: 3 of 3 Variables

| | Age | Sex | ward_admitted | var | var | var | var | var | var | var | var | var | var | var | var |
|----|-----|--------|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 58 | Male | Obstetrics/Gyne... | | | | | | | | | | | | |
| 2 | 70 | Male | Medical Ward | | | | | | | | | | | | |
| 3 | 64 | Female | Medical Ward | | | | | | | | | | | | |
| 4 | 55 | Male | Medical Ward | | | | | | | | | | | | |
| 5 | 50 | Female | Surgical Ward | | | | | | | | | | | | |
| 6 | 48 | Male | Medical Ward | | | | | | | | | | | | |
| 7 | 70 | Male | Medical Ward | | | | | | | | | | | | |
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| 9 | 35 | Female | Obstetrics/Gyne... | | | | | | | | | | | | |
| 10 | 28 | Female | Obstetrics/Gyne... | | | | | | | | | | | | |
| 11 | 34 | Female | Obstetrics/Gyne... | | | | | | | | | | | | |
| 12 | 82 | Male | Medical Ward | | | | | | | | | | | | |
| 13 | 48 | Male | Medical Ward | | | | | | | | | | | | |
| 14 | 28 | Female | Obstetrics/Gyne... | | | | | | | | | | | | |
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| 16 | 19 | Female | Obstetrics/Gyne... | | | | | | | | | | | | |
| 17 | 35 | Female | Obstetrics/Gyne... | | | | | | | | | | | | |
| 18 | 27 | Female | Obstetrics/Gyne... | | | | | | | | | | | | |
| 19 | 30 | Female | Obstetrics/Gyne... | | | | | | | | | | | | |
| 20 | 51 | Female | Surgical Ward | | | | | | | | | | | | |
| 21 | 27 | Male | Surgical Ward | | | | | | | | | | | | |
| 22 | 35 | Female | Surgical Ward | | | | | | | | | | | | |
| 23 | 43 | Male | Surgical Ward | | | | | | | | | | | | |

One-Way ANOVA

Dependent List:

_101_Sex [Sex]

_102_Age_in_Year...

Factor:

_108_What_is_the_...

OK Paste Reset Cancel Help

Contrasts... Post Hoc... Options... Bootstrap...



Visible: 3 of 3 Variables

| | Age | Sex | ward_admitted | var | var | var | var | var | var | var | var | var | var | var | var |
|----|-----|-----|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 58 | 1 | 3 | | | | | | | | | | | | |
| 2 | 70 | 1 | 1 | | | | | | | | | | | | |
| 3 | 64 | 2 | 1 | | | | | | | | | | | | |
| 4 | 55 | 1 | 1 | | | | | | | | | | | | |
| 5 | 50 | 2 | 2 | | | | | | | | | | | | |
| 6 | 48 | 1 | 1 | | | | | | | | | | | | |
| 7 | 70 | 1 | 1 | | | | | | | | | | | | |
| 8 | 61 | 2 | 1 | | | | | | | | | | | | |
| 9 | 35 | 2 | 3 | | | | | | | | | | | | |
| 10 | 28 | 2 | 3 | | | | | | | | | | | | |
| 11 | 34 | 2 | 3 | | | | | | | | | | | | |
| 12 | 82 | 1 | 1 | | | | | | | | | | | | |
| 13 | 48 | 1 | 1 | | | | | | | | | | | | |
| 14 | 28 | 2 | 3 | | | | | | | | | | | | |
| 15 | 38 | 1 | 2 | | | | | | | | | | | | |
| 16 | 19 | 2 | 3 | | | | | | | | | | | | |
| 17 | 35 | 2 | 3 | | | | | | | | | | | | |
| 18 | 27 | 2 | 3 | | | | | | | | | | | | |
| 19 | 30 | 2 | 3 | | | | | | | | | | | | |
| 20 | 51 | 2 | 2 | | | | | | | | | | | | |
| 21 | 27 | 1 | 2 | | | | | | | | | | | | |
| 22 | 35 | 2 | 2 | | | | | | | | | | | | |
| 23 | 43 | 1 | 2 | | | | | | | | | | | | |

One-Way ANOVA: Options

Statistics

- ☒ Descriptive
- ☐ Fixed and random effects
- ☒ Homogeneity of variance test
- ☐ Brown-Forsythe
- ☐ Welch
- ☐ Means plot

Missing Values

- ☒ Exclude cases analysis by analysis
- ☐ Exclude cases listwise

Continue Cancel Help



Visible: 3 of 3 Variables

| | Age | Sex | ward_admitted | var | var | var | var | var | var | var | var | var | var | var | var |
|----|-----|-----|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 58 | 1 | 3 | | | | | | | | | | | | |
| 2 | 70 | 1 | 1 | | | | | | | | | | | | |
| 3 | 64 | 2 | 1 | | | | | | | | | | | | |
| 4 | 55 | 1 | 1 | | | | | | | | | | | | |
| 5 | 50 | 2 | 2 | | | | | | | | | | | | |
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| 7 | 70 | 1 | 1 | | | | | | | | | | | | |
| 8 | 61 | 2 | 1 | | | | | | | | | | | | |
| 9 | 35 | 2 | 3 | | | | | | | | | | | | |
| 10 | 28 | 2 | 3 | | | | | | | | | | | | |
| 11 | 34 | 2 | 3 | | | | | | | | | | | | |
| 12 | 82 | 1 | 1 | | | | | | | | | | | | |
| 13 | 48 | 1 | 1 | | | | | | | | | | | | |
| 14 | 28 | 2 | 3 | | | | | | | | | | | | |
| 15 | 38 | 1 | 2 | | | | | | | | | | | | |
| 16 | 19 | 2 | 3 | | | | | | | | | | | | |
| 17 | 35 | 2 | 3 | | | | | | | | | | | | |
| 18 | 27 | 2 | 3 | | | | | | | | | | | | |
| 19 | 30 | 2 | 3 | | | | | | | | | | | | |
| 20 | 51 | 2 | 2 | | | | | | | | | | | | |
| 21 | 27 | 1 | 2 | | | | | | | | | | | | |
| 22 | 35 | 2 | 2 | | | | | | | | | | | | |
| 23 | 43 | 1 | 2 | | | | | | | | | | | | |

One-Way ANOVA: Post Hoc Multiple Comparisons

Equal Variances Assumed

☒ LSD ☐ S-N-K ☐ Waller-Duncan
☐ Bonferroni ☐ Tukey Type I/Type II Error Ratio: 100
☐ Sidak ☐ Tukey's-b ☐ Dunnett
☐ Scheffe ☐ Duncan Control Category: Last
☐ R-E-G-W F ☐ Hochberg's GT2
☐ R-E-G-W Q ☐ Gabriel Test
☒ 2-sided ☐ < Control ☐ > Control

Equal Variances Not Assumed

☐ Tamhane's T2 ☐ Dunnett's T3 ☐ Games-Howell ☐ Dunnett's C

Significance level: 0.05

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| |
|----------------------------------|
| Output |
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| Title |
| Notes |
| Active Dataset |
| Case Processing |
| Descriptives |
| Tests of Normality |
| _102_Age_in_Year |
| Title |
| Normal Q-Q Plot |
| Detrended Normal Q-Q Plot |
| Log |
| Oneway |
| Title |
| Notes |
| Active Dataset |
| Descriptives |
| Test of Homogeneity of Variances |
| ANOVA |
| Post Hoc Tests |
| Title |
| Multiple Comparisons |

[DataSet2] C:\Users\User\Desktop\ARCFPNC\Downloads\PracticedataANOVA.sav

Descriptives

_102_Age_in_Year

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|----------------------------|-----|-------|----------------|------------|----------------------------------|-------------|---------|---------|
| | | | | | Lower Bound | Upper Bound | | |
| Medical Ward | 175 | 56.65 | 14.889 | 1.126 | 54.42 | 58.87 | 18 | 90 |
| Surgical Ward | 53 | 43.92 | 16.448 | 2.259 | 39.39 | 48.46 | 19 | 80 |
| Obstetrics/Gynecology Ward | 32 | 30.94 | 10.236 | 1.809 | 27.25 | 34.63 | 19 | 62 |
| Total | 260 | 50.89 | 17.242 | 1.069 | 48.78 | 52.99 | 18 | 90 |

Test of Homogeneity of Variances

_102_Age_in_Year

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 5.981 | 2 | 257 | .003 |

ANOVA

_102_Age_in_Year

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|--------|------|
| Between Groups | 21108.158 | 2 | 10554.079 | 48.531 | .000 |
| Within Groups | 55889.607 | 257 | 217.469 | | |
| Total | 76997.765 | 259 | | | |



| |
|---------------------|
| Output |
| Log |
| Explore |
| Title |
| Notes |
| Active Dataset |
| Case Processing |
| Descriptives |
| Tests of Normality |
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| Title |
| Notes |
| Active Dataset |
| Descriptives |
| Test of Homogeneity |
| ANOVA |
| Post Hoc Tests |
| Title |
| Multiple Com |

| Statistic | df1 | df2 | Sig. |
|-----------|-----|-----|------|
| 5.981 | 2 | 257 | .003 |

ANOVA

_102_Age_in_Years

| | Sum of Squares | df | Mean Square | F | Sig. |
|----------------|----------------|-----|-------------|--------|------|
| Between Groups | 21108.158 | 2 | 10554.079 | 48.531 | .000 |
| Within Groups | 55889.607 | 257 | 217.469 | | |
| Total | 76997.765 | 259 | | | |

Post Hoc Tests

Multiple Comparisons

Dependent Variable: _102_Age_in_Years

LSD

| (I) | (J) | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|--|----------------------------|-----------------------|------------|------|-------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| _108_What_is_the_ward_tient is admitted to | Surgical Ward | 12.721* | 2.312 | .000 | 8.17 | 17.27 |
| | Obstetrics/Gynecology Ward | 25.708* | 2.835 | .000 | 20.12 | 31.29 |
| Surgical Ward | Medical Ward | -12.721* | 2.312 | .000 | -17.27 | -8.17 |
| | Obstetrics/Gynecology Ward | 12.987* | 3.301 | .000 | 6.49 | 19.49 |
| Obstetrics/Gynecology Ward | Medical Ward | -25.708* | 2.835 | .000 | -31.29 | -20.12 |
| | Surgical Ward | -12.987* | 3.301 | .000 | -19.49 | -6.49 |

*. The mean difference is significant at the 0.05 level.

- Check the **Test of homogeneity of variance table** for the p-value of Leven's statistics(if p-value >0.05 , then assumption is met)
- Check the **ANOVA** table for the p-value of the independent group ANOVA test(If p-value < 0.05 , it means there is statically significant difference in the mean of the three or more groups we are comparing). If there is significant difference between the groups, then check the Post Hoc table to identify where the difference is.
- Check the **Post Hoc Tests** table to identify between which variables there is statistically significant difference
- Check the **Descriptive table** to get the mean with CI values of the variables. Using these values we assess which variables has a higher or lower mean values

Interpretation

- There is a statistically significant difference in the mean age of patients between the three inpatient wards. Being admitted to the medical ward is associated with a relatively older age(56.65), followed by surgical ward(43.92) and then Oby/gyn ward(30.94)

Two-way between groups ANOVA

- Looks at the individual and joint effect of two independent variables on one dependent variable
- The advantage of using a two-way design is that we can test the 'main effect' for each independent variable and also explore the possibility of an 'interaction effect'.
- An interaction effect occurs when the effect of one independent variable on the dependent variable depends on the level of a second independent variable.

- What you need: Three variables;
 - two categorical independent variables and
 - one continuous dependent variable

- What it does: it allows you to simultaneously test for the effect of each of your independent variables on the dependent variable and also identifies any interaction effect.

Procedure for two-way ANOVA

- 1. From the menu at the top of the screen, click on Analyze, then click on General Linear Model, then on univariate
- 2. Click on your dependent, continuous variable and move these into the box labelled **Dependent variable**
- 3. Click on your two independent, categorical variables and move these into the box labelled **Fixed Factors**
- 4. Click on the **Option** button.
 - Click on Descriptive Statistics, Estimates of effect size and Homogeneity tests
 - Click on Continue
- 5. Click on the **Post Hoc** button
 - From the Factors listed on the left-hand side, choose the independent variables(s) you are interested in (these variables should have three or more levels or groups)
 - Click on the arrow button to move it into the Post Hoc Tests for section
 - Choose the test you wish to use
 - Click on Continue

■ 6. Click on the **Plots** button

- In the Horizontal box, put the independent variable that has the most groups
- In the box labelled Separate Lines, put the other independent variable
- Click on **Add**
- In the section labelled Plots, you should now see your two variables listed

■ 7. Click on Continue and then Ok



1: Length_of_stay2 1 Visible: 4 of 4 Variables

| | Age | Sex | ward_admitted | Length_of_stay2 | var | var | var | var | var | var | var | var | var | var |
|----|-----|-----|---------------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 58 | 1 | 3 | 1 | | | | | | | | | | |
| 2 | 70 | 1 | | | | | | | | | | | | |
| 3 | 64 | 2 | | | | | | | | | | | | |
| 4 | 55 | 1 | | | | | | | | | | | | |
| 5 | 50 | 2 | | | | | | | | | | | | |
| 6 | 48 | 1 | | | | | | | | | | | | |
| 7 | 70 | 1 | | | | | | | | | | | | |
| 8 | 61 | 2 | | | | | | | | | | | | |
| 9 | 35 | 2 | | | | | | | | | | | | |
| 10 | 28 | 2 | | | | | | | | | | | | |
| 11 | 34 | 2 | | | | | | | | | | | | |
| 12 | 82 | 1 | | | | | | | | | | | | |
| 13 | 48 | 1 | | | | | | | | | | | | |
| 14 | 28 | 2 | | | | | | | | | | | | |
| 15 | 38 | 1 | | | | | | | | | | | | |
| 16 | 19 | 2 | | | | | | | | | | | | |
| 17 | 35 | 2 | | | | | | | | | | | | |
| 18 | 27 | 2 | | | | | | | | | | | | |
| 19 | 30 | 2 | | | | | | | | | | | | |
| 20 | 51 | 2 | 2 | 1 | | | | | | | | | | |
| 21 | 27 | 1 | 2 | 2 | | | | | | | | | | |
| 22 | 35 | 2 | 2 | 3 | | | | | | | | | | |
| 23 | 43 | 1 | 2 | 1 | | | | | | | | | | |

Univariate

Dependent Variable:

Fixed Factor(s):

- ☐ _108_What_is_the_...
- ☒ _101_Sex [Sex]
- ☒ Length_of_stay2 [Le...]

Random Factor(s):

Covariate(s):

WLS Weight:

Model... Contrasts... Plots... Post_Hoc... Save... Options... Bootstrap...

OK Paste Reset Cancel Help

Data View Variable View



1 : Length_of_stay2

1

Visible: 4 of 4 Variables

| | Age | Sex | var | var | var | var | var | var | var |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 58 | 1 | | | | | | | |
| 2 | 70 | 1 | | | | | | | |
| 3 | 64 | 2 | | | | | | | |
| 4 | 55 | 1 | | | | | | | |
| 5 | 50 | 2 | | | | | | | |
| 6 | 48 | 1 | | | | | | | |
| 7 | 70 | 1 | | | | | | | |
| 8 | 61 | 2 | | | | | | | |
| 9 | 35 | 2 | | | | | | | |
| 10 | 28 | 2 | | | | | | | |
| 11 | 34 | 2 | | | | | | | |
| 12 | 82 | 1 | | | | | | | |
| 13 | 48 | 1 | | | | | | | |
| 14 | 28 | 2 | | | | | | | |
| 15 | 38 | 1 | | | | | | | |
| 16 | 19 | 2 | | | | | | | |
| 17 | 35 | 2 | | | | | | | |
| 18 | 27 | 2 | | | | | | | |
| 19 | 30 | 2 | | | | | | | |
| 20 | 51 | 2 | | | | | | | |
| 21 | 27 | 1 | | | | | | | |
| 22 | 35 | 2 | 2 | | 3 | | | | |
| 23 | 43 | 1 | 2 | | 1 | | | | |

Univariate: Options

Estimated Marginal Means

Factor(s) and Factor Interactions:

(OVERALL)
Sex
Length_of_stay2
Sex*Length_of_stay2

Display Means for:

(OVERALL)
Sex
Sex*Length_of_stay2
Length_of_stay2

☒ Compare main effects

Confidence interval adjustment:
LSD(none)

Display

☒ Descriptive statistics
☒ Estimates of effect size
☐ Observed power
☐ Parameter estimates
☐ Contrast coefficient matrix

☒ Homogeneity tests
☐ Spread vs. level plot
☐ Residual plot
☐ Lack of fit
☐ General estimable function

Significance level: .05 Confidence intervals are 95.0 %

Continue Cancel Help

Data View

Variable View



1: Length_of_stay2 1

Visible: 4 of 4 Variables

| | Age | Sex | ward_admitted | Length_of_stay2 | var | var | var | var | var | var | var | var | var | var |
|----|-----|-----|---------------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 58 | 1 | | | | | | | | | | | | |
| 2 | 70 | 1 | | | | | | | | | | | | |
| 3 | 64 | 2 | | | | | | | | | | | | |
| 4 | 55 | 1 | | | | | | | | | | | | |
| 5 | 50 | 2 | | | | | | | | | | | | |
| 6 | 48 | 1 | | | | | | | | | | | | |
| 7 | 70 | 1 | | | | | | | | | | | | |
| 8 | 61 | 2 | | | | | | | | | | | | |
| 9 | 35 | 2 | | | | | | | | | | | | |
| 10 | 28 | 2 | | | | | | | | | | | | |
| 11 | 34 | 2 | | | | | | | | | | | | |
| 12 | 82 | 1 | | | | | | | | | | | | |
| 13 | 48 | 1 | | | | | | | | | | | | |
| 14 | 28 | 2 | | | | | | | | | | | | |
| 15 | 38 | 1 | | | | | | | | | | | | |
| 16 | 19 | 2 | | | | | | | | | | | | |
| 17 | 35 | 2 | | | | | | | | | | | | |
| 18 | 27 | 2 | | | | | | | | | | | | |
| 19 | 30 | 2 | | | | | | | | | | | | |
| 20 | 51 | 2 | | | | | | | | | | | | |
| 21 | 27 | 1 | 2 | 2 | | | | | | | | | | |
| 22 | 35 | 2 | 2 | 3 | | | | | | | | | | |
| 23 | 43 | 1 | 2 | 1 | | | | | | | | | | |

Univariate: Post Hoc Multiple Comparisons for Observed Means

Factor(s):
Sex
Length_of_stay2

Post Hoc Tests for:
Length_of_stay2

Equal Variances Assumed

☐ LSD ☐ S-N-K ☐ Waller-Duncan
☐ Bonferroni ☒ Tukey Type I/Type II Error Ratio: 100
☐ Sidak ☐ Tukey's-b ☐ Dunnett
☐ Scheffe ☐ Duncan Control Category: Last
☐ R-E-G-W-F ☐ Hochberg's GT2-Test
☐ R-E-G-W-Q ☐ Gabriel ☒ 2-sided ☐ < Control ☐ > Control

Equal Variances Not Assumed

☐ Tamhane's T2 ☐ Dunnett's T3 ☐ Games-Howell ☐ Dunnett's C

Continue Cancel Help

Data View Variable View



1 : Length_of_stay2 1

Visible: 4 of 4 Variables

| | Age | Sex | ward_admitted | Length_of_stay2 | var | var | var | var | var | var | var | var | var |
|----|-----|-----|---------------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 58 | 1 | 3 | 1 | | | | | | | | | |
| 2 | 70 | 1 | | | | | | | | | | | |
| 3 | 64 | 2 | | | | | | | | | | | |
| 4 | 55 | 1 | | | | | | | | | | | |
| 5 | 50 | 2 | | | | | | | | | | | |
| 6 | 48 | 1 | | | | | | | | | | | |
| 7 | 70 | 1 | | | | | | | | | | | |
| 8 | 61 | 2 | | | | | | | | | | | |
| 9 | 35 | 2 | | | | | | | | | | | |
| 10 | 28 | 2 | | | | | | | | | | | |
| 11 | 34 | 2 | | | | | | | | | | | |
| 12 | 82 | 1 | | | | | | | | | | | |
| 13 | 48 | 1 | | | | | | | | | | | |
| 14 | 28 | 2 | | | | | | | | | | | |
| 15 | 38 | 1 | | | | | | | | | | | |
| 16 | 19 | 2 | | | | | | | | | | | |
| 17 | 35 | 2 | | | | | | | | | | | |
| 18 | 27 | 2 | | | | | | | | | | | |
| 19 | 30 | 2 | | | | | | | | | | | |
| 20 | 51 | 2 | 2 | 1 | | | | | | | | | |
| 21 | 27 | 1 | 2 | 2 | | | | | | | | | |
| 22 | 35 | 2 | 2 | 3 | | | | | | | | | |
| 23 | 43 | 1 | 2 | 1 | | | | | | | | | |

Univariate

Univariate: Profile Plots

Factors:

Sex
Length_of_stay2

Horizontal Axis:
Length_of_stay2

Separate Lines:
Sex

Separate Plots:

Plots:
Length_of_stay2*Sex

Continue Cancel Help

OK Paste Reset Cancel Help

Data View Variable View

Output

*Output1.spv [Document1] - IBM SPSS Statistics Viewer

File Edit View Data Transform Insert Format Analyze Direct Marketing Graphs Utilities Add-ons Window Help

Length_of_stay2

Log

Univariate Analysis

Title

Notes

Active Dataset

Between-Subjects

Descriptive Statistics

Levene's Test of Equality of Variances

Tests of Between-Subjects Effects

Estimated Marginal Means

Title

1. Grand Means

2. _101_Sex

Title

Estimate

Pairwise

Univariate

3. _101_Sex

4. Length_of_stay2

Title

Estimate

Pairwise

Univariate

Post Hoc Tests

Title

Length_of_stay2

Title

Multiple Comparisons

Homogeneity of Variance

Profile Plots

Title

Length_of_stay2

Descriptive Statistics

Dependent Variable: _102_Age_in_Years

| 101 Sex | Length_of_stay2 | Mean | Std. Deviation | N |
|---------|-----------------|-------|----------------|-----|
| Male | 1-6 days | 52.86 | 16.400 | 65 |
| | 7-13 days | 58.08 | 14.460 | 65 |
| | >= 14 days | 44.14 | 15.115 | 7 |
| | Total | 54.89 | 15.742 | 137 |
| Female | 1-6 days | 43.43 | 16.305 | 74 |
| | 7-13 days | 55.58 | 19.332 | 36 |
| | >= 14 days | 38.15 | 11.539 | 13 |
| | Total | 46.43 | 17.800 | 123 |
| Total | 1-6 days | 47.84 | 16.960 | 139 |
| | 7-13 days | 57.19 | 16.312 | 101 |
| | >= 14 days | 40.25 | 12.839 | 20 |
| | Total | 50.89 | 17.242 | 260 |

Levene's Test of Equality of Error Variances^a

Dependent Variable: _102_Age_in_Years

| F | df1 | df2 | Sig. |
|-------|-----|-----|------|
| 1.884 | 5 | 254 | .098 |

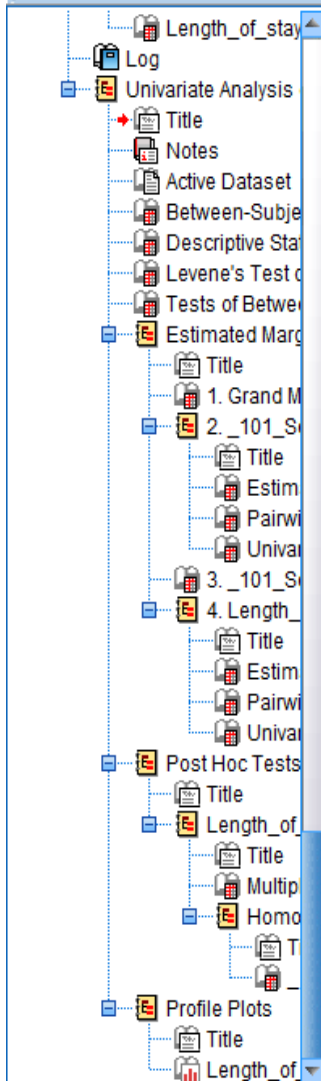
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Sex + Length_of_stay2 + Sex * Length_of_stay2

Open output document

IBM SPSS Statistics Processor is ready

H: 3.95, W: 4.89 in



Levene's Test of Equality of Error Variances^a

Dependent Variable: _102_Age_in_Years

| F | df1 | df2 | Sig. |
|-------|-----|-----|------|
| 1.884 | 5 | 254 | .098 |

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Sex +
Length_of_stay2 + Sex *
Length_of_stay2

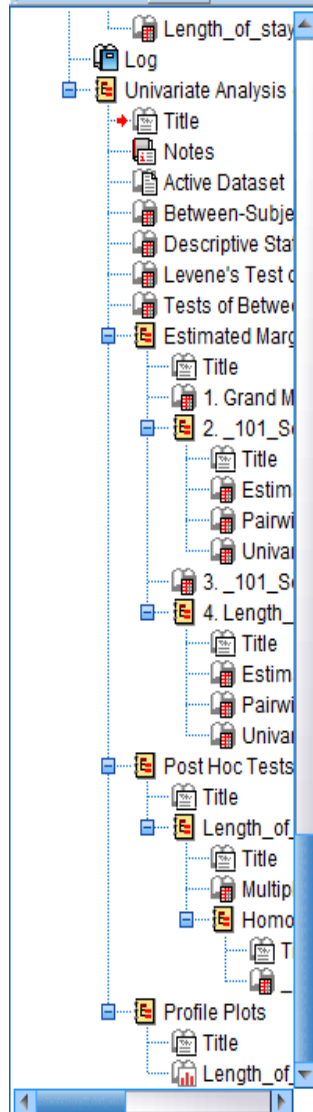
Tests of Between-Subjects Effects

Dependent Variable: _102_Age_in_Years

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|-----------------------|-------------------------|-----|-------------|----------|------|---------------------|
| Corrected Model | 10945.935 ^a | 5 | 2189.187 | 8.418 | .000 | .142 |
| Intercept | 292661.696 | 1 | 292661.696 | 1125.420 | .000 | .816 |
| Sex | 1099.330 | 1 | 1099.330 | 4.227 | .041 | .016 |
| Length_of_stay2 | 6038.463 | 2 | 3019.231 | 11.610 | .000 | .084 |
| Sex * Length_of_stay2 | 669.344 | 2 | 334.672 | 1.287 | .278 | .010 |
| Error | 66051.831 | 254 | 260.047 | | | |
| Total | 750303.000 | 260 | | | | |
| Corrected Total | 76997.765 | 259 | | | | |

a. R Squared = .142 (Adjusted R Squared = .125)

Estimated Marginal Means



The F tests the effect of Length_of_stay2. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

Post Hoc Tests

Length_of_stay2

Multiple Comparisons

Dependent Variable: _102_Age_in_Years

Tukey HSD

| (I) Length of stay2 | (J) Length of stay2 | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---------------------|---------------------|-----------------------|------------|------|-------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| 1-6 days | 7-13 days | -9.35* | 2.108 | .000 | -14.32 | -4.38 |
| | >= 14 days | 7.59 | 3.857 | .122 | -1.50 | 16.68 |
| 7-13 days | 1-6 days | 9.35* | 2.108 | .000 | 4.38 | 14.32 |
| | >= 14 days | 16.94* | 3.947 | .000 | 7.63 | 26.24 |
| >= 14 days | 1-6 days | -7.59 | 3.857 | .122 | -16.68 | 1.50 |
| | 7-13 days | -16.94* | 3.947 | .000 | -26.24 | -7.63 |

Based on observed means.

The error term is Mean Square(Error) = 260.047.

*. The mean difference is significant at the .05 level.

Homogeneous Subsets

_102_Age_in_Years

Tukey HSD^{a,b,c}

| Length of stay2 | N | Subset | |
|-----------------|---|--------|---|
| | | 1 | 2 |
| Length of stay2 | N | 1 | 2 |

INTERPRETATION

- **Descriptive statistics:** These provide the Mean scores, Std deviations and N for each subgroup.
- **Levene's Test of Equality of Error Variances:** This test provides a test of one of the assumptions underlying analysis of variance. The value you are most interested in is the Sig. level. You want this to be greater than .05 and therefore not significant.

- **Tests of Between Subjects Effects**

- ☐ Interaction effect
- ☐ Main effect
- ☐ Effect size

| Size | Eta squared (% of variance explained) | Cohen's d (standard deviation units) |
|--------|---|--|
| Small | .01 or 1% | .2 |
| Medium | .06 or 6% | .5 |
| Large | .138 or 13.8% | .8 |

- **Post-hoc tests**
 - ☐ Multiple comparisons

PRESENTING THE RESULTS FROM TWO-WAY ANOVA

- A two-way between-groups analysis of variance was conducted to explore impact of length of stay and sex on mean age of patients. Subjects were divided into three groups according to their length of stay (Group 1: 1-6 days; Group 2: 7-13 days; Group 3: 14 days and above). The interaction effect between sex and length of stay group was not statistically significant, $P = 0.29$. There was a statistically significant main effect for both sex ($P = 0.04$) and length of stay ($P = 0.0001$). The effect size was small (partial eta squared = .02) for sex and medium (partial eta squared = .08) for length of stay.
- Post-hoc comparisons using the Tukey HSD test indicated that the mean age for the 7-13 days group ($M = 57.19$, $SD = 16.31$) was significantly different from the 1-6 days group ($M = 47.84$, $SD = 16.96$) and ≥ 14 days group ($M = 40.25$, $SD = 12.84$). The mean age of 1-6 days group and ≥ 14 days group did not differ significantly.

■ Thank You.

