

# How to Perform a One-Way ANOVA in Stata: A Step-by-Step Guide

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One-Way ANOVA (Analysis of Variance) is a statistical test used to compare the means of three or more groups. In order to perform a One-Way ANOVA in Stata, the following steps should be followed:

1. Import the data: The first step is to import the data into Stata. This can be done by either typing in the data or by uploading a dataset from an external source.
2. Assign variables: Once the data is imported, the variables for the groups and outcome variable should be assigned in Stata. The groups should be categorical and the outcome variable should be continuous.
3. Run the ANOVA command: The "oneway" command in Stata is used to perform One-Way ANOVA. The syntax for the command is "oneway outcome variable, by(group variable)".
4. Check assumptions: Before interpreting the results, it is important to check for the assumptions of One-Way ANOVA. These include normality, homogeneity of variances, and independence of observations.
5. Interpret the results: Stata will generate an ANOVA table with the F-statistic, p-value, and degrees of freedom. If the p-value is less than the chosen significance level (usually 0.05), it indicates that there is a significant difference between the means of the groups.

In conclusion, Stata provides a simple and efficient way to perform One-Way ANOVA, allowing researchers to compare means across multiple groups and draw meaningful conclusions from their data.

## Perform a One-Way ANOVA in Stata

**A is used to determine whether or not there is a statistically significant difference between the means of three or more independent groups.**

**This type of test is called a *one-way* ANOVA because we are analyzing how *one* predictor variable impacts a response variable. If we were instead interested in how**

two predictor variables impact a response variable, we could conduct a .

This tutorial explains how to conduct a one-way ANOVA in Stata.

Example: One-Way ANOVA in Stata

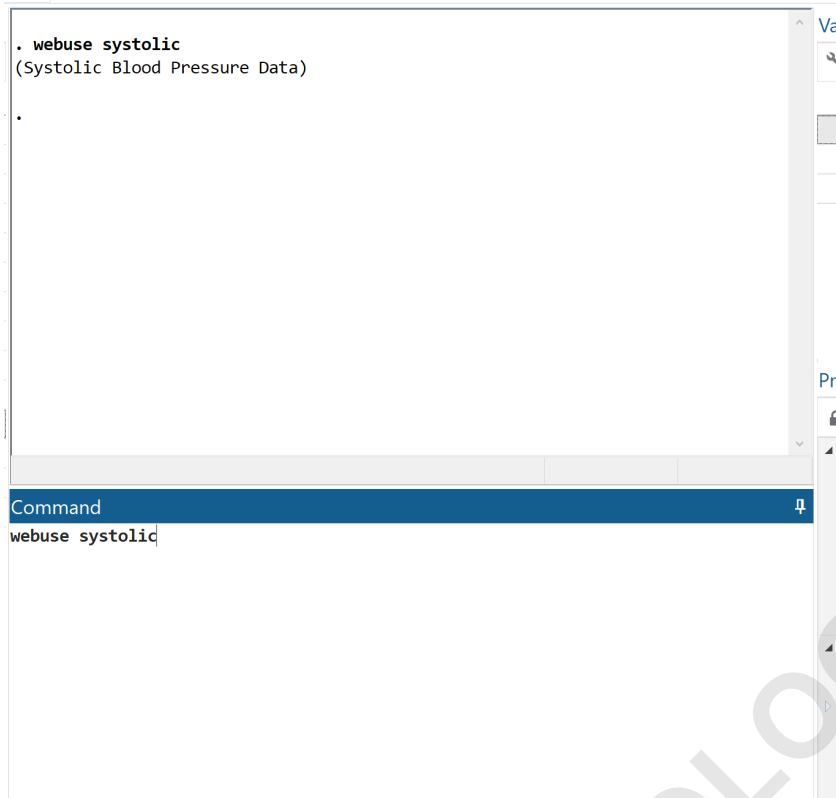
In this example we will use the built-in Stata dataset called *systolic* to perform a one-way ANOVA. This dataset contains the following three variables for 58 different individuals:

Drug used  
Patient's disease  
Change in systolic blood pressure

We will use the following steps to perform a one-way ANOVA to find out if the type of drug used leads to a significant impact in the change in systolic blood pressure.

**Step 1: Load the data.**

First, load the data by typing `webuse systolic` in the command box and clicking Enter.



## Step 2: View the raw data.

Before we perform a one-way ANOVA, let's first view the raw data. Along the top menu bar, go to **Data > Data Editor > Data Editor (Browse)**. This will show us the actual data for all 58 patients:

Data Editor (Browse) - [systolic]

File Edit View Data Tools

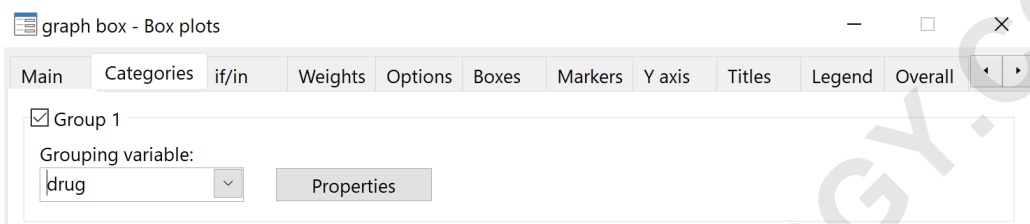
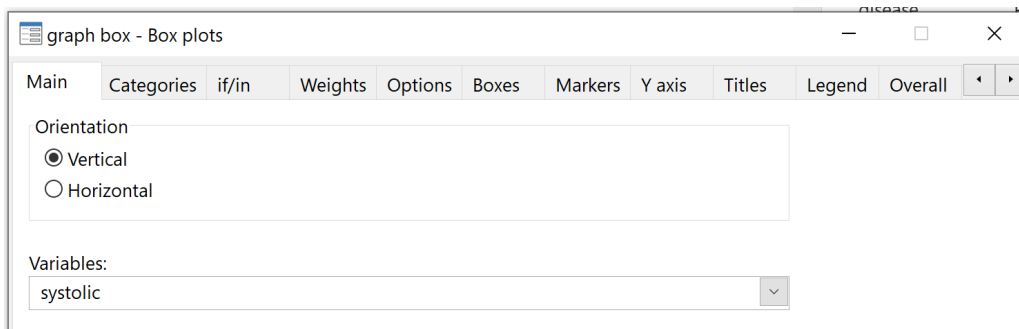
systolic[1] 42

	drug	disease	systolic
1	1	1	42
2	1	1	44
3	1	1	36
4	1	1	13
5	1	1	19
6	1	1	22
7	1	2	33
8	1	2	26
9	1	2	33
10	1	2	21
11	1	3	31
12	1	3	-3
13	1	3	25
14	1	3	25
15	1	3	24
16	2	1	28
17	2	1	23
18	2	1	34

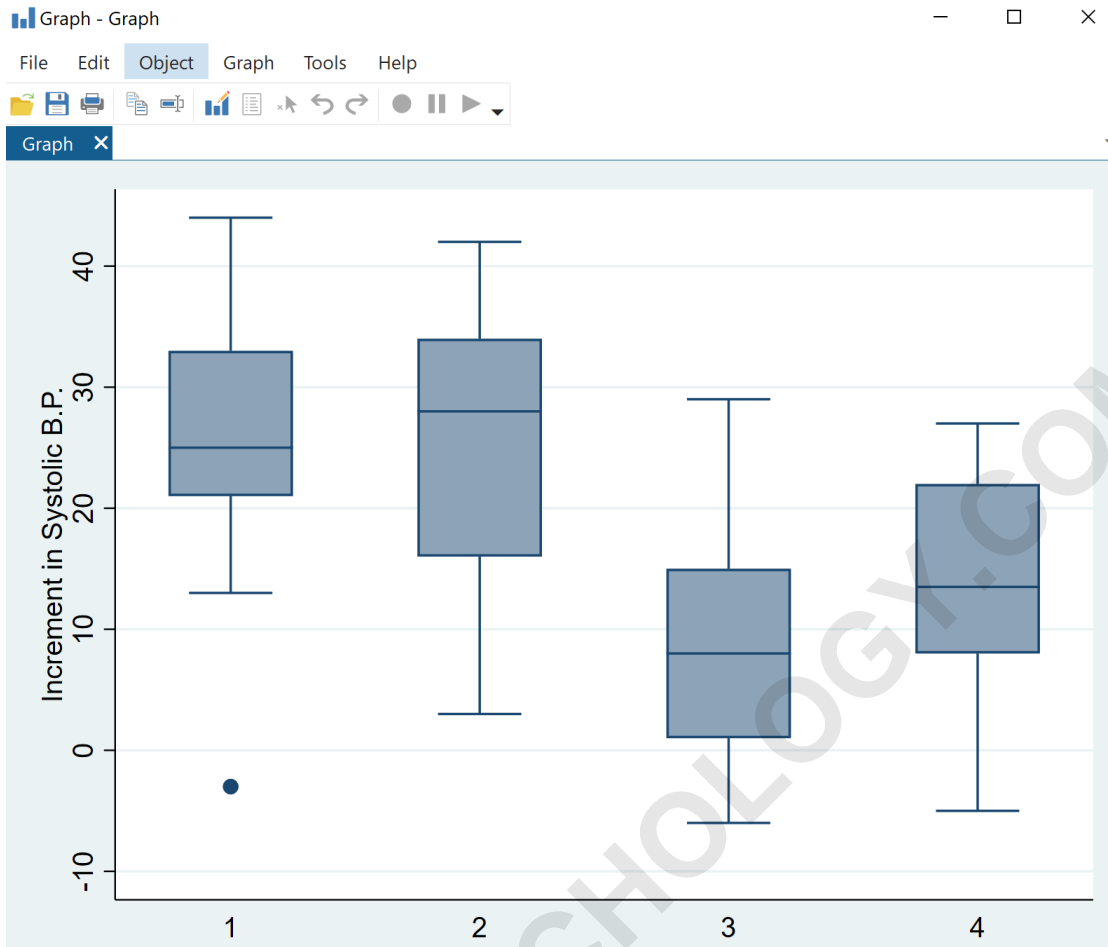
### Step 3: Visualize the data.

Next, let's visualize the data. We'll create to view the distribution of systolic blood pressure values for each category of drug.

Along the top menu bar, go to Graphics > Box plot. Under variables, choose Systolic:



**Click OK. A chart with four boxplots will automatically be displayed:**



**We can immediately see that the distribution of changes in systolic blood pressure vary between the drug categories, but a one-way ANOVA will tell us if these differences are statistically significant.**

**Step 4: Perform a one-way ANOVA.**

**Along the top menu bar, go to Statistics > Linear models and related > ANOVA/MANOVA > One-Way ANOVA.**

**Under response variable, choose systolic. Under factor variable, choose drug. Then click the box next to *Produce summary table* so that we can see some basic descriptive statistics for each group. Then click *OK*.**

oneway - One-way analysis of variance

Main by/if/in Weights

Response variable: systolic

Factor variable: drug

Multiple-comparison tests

Bonferroni  Scheffe  Sidak

Output

Produce summary table

Suppress means

Suppress standard deviations

Suppress frequencies

Suppress number of obs.

Other

Suppress the ANOVA table

Show numeric codes, not labels

Do not break wide tables

Treat missing values as categories

? ↻ 📄 OK Cancel Submit

**The following output will be displayed:**

. oneway systolic drug, tabulate

Drug Used	Summary of Increment in Systolic B.P.		
	Mean	Std. Dev.	Freq.
1	26.066667	11.677002	15
2	25.533333	11.61813	15
3	8.75	10.0193	12
4	13.5	9.3238047	16
Total	18.87931	12.800874	58

Source	Analysis of Variance			F	Prob > F
	SS	df	MS		
Between groups	3133.23851	3	1044.41284	9.09	0.0001
Within groups	6206.91667	54	114.942901		
Total	9340.15517	57	163.862371		

The F-statistic is 9.09 and the corresponding p-value is 0.0001. Since the p-value is less than  $\alpha = 0.05$ , we can reject the null hypothesis that the mean change in systolic blood pressure for each group is equal.

In other words, there is a statistically significant difference in the mean change in systolic blood pressure between at least two of the drug groups.

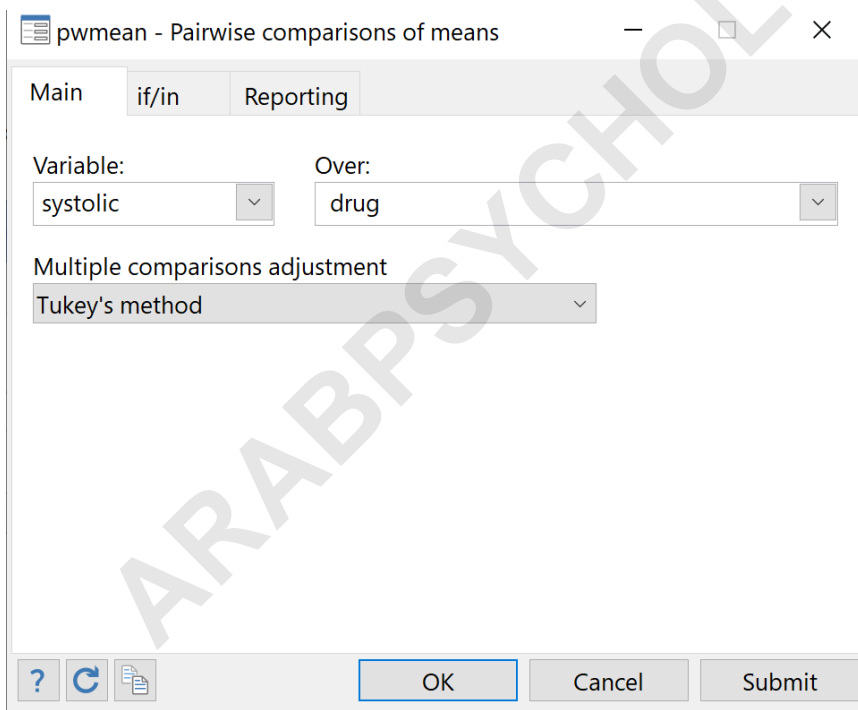
**Step 5: Perform multiple comparison tests.**

Next, we can perform multiple comparison tests to actually find out which group means are different from

each other.

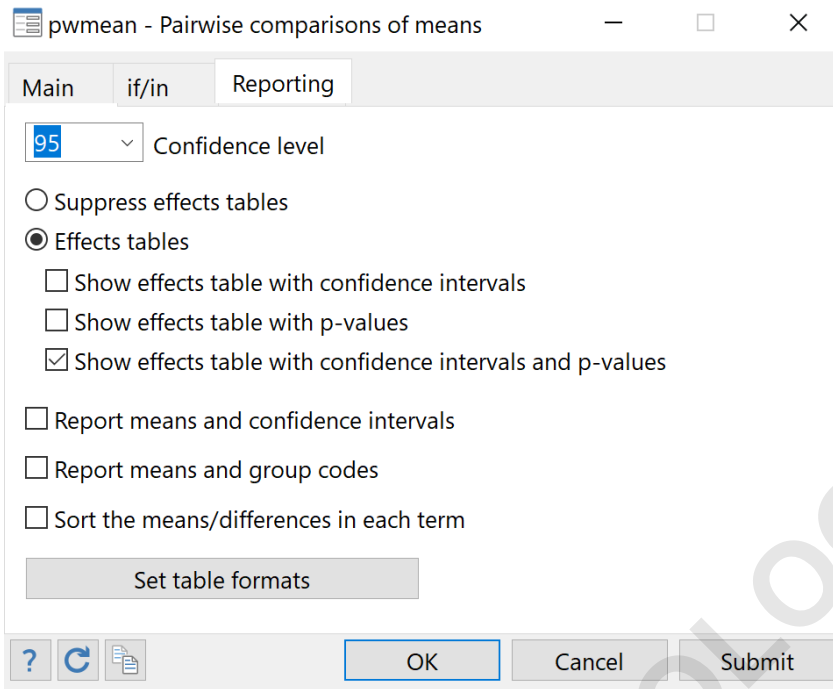
Along the top menu bar, go to **Statistics > Summaries, tables, and tests > Summary and descriptive statistics > Pairwise comparisons of means**.

For **Variable**, choose the response variable *systolic*. For **Over**, choose the explanatory variable *drug*. For **Multiple comparisons adjustment**, choose *Tukey's method*.



Then, under the *Reporting* subheading click the button next to *Effects tables* and check the box next to *Show effects table with confidence intervals and p-values*.

**Then click *OK*.**



**The following results will be displayed:**

```
. pwmean systolic, over(drug) mcompare(tukey) effects
```

Pairwise comparisons of means with equal variances

```
over      : drug
```

	Number of Comparisons
drug	6

systolic	Contrast	Std. Err.	Tukey t	P> t	Tukey [95% Conf. Interval]
drug					
2 vs 1	-.5333333	3.914808	-0.14	0.999	-10.911 9.844337
3 vs 1	-17.31667	4.152281	-4.17	0.001	-28.32385 -6.309485
4 vs 1	-12.56667	3.853153	-3.26	0.010	-22.7809 -2.352435
3 vs 2	-16.78333	4.152281	-4.04	0.001	-27.79051 -5.776152
4 vs 2	-12.03333	3.853153	-3.12	0.015	-22.24757 -1.819101
4 vs 3	4.75	4.094204	1.16	0.654	-6.103227 15.60323

Each row represents a comparison between two specific drug groups. For example, the first row compares the mean systolic blood pressure change between drug group 2 and drug group 1. The p-value for this comparison is 0.999, which is extremely high and not smaller than 0.05. This means there is no statistically significant difference between drug groups 1 and 2.

However, we can see that the p-values for the following comparisons are all less than 0.05:

**drug 3 vs. 1 | p-value = 0.001**  
**drug 4 vs. 1 | p-value = 0.010**  
**drug 3 vs. 2 | p-value = 0.001**  
**drug 4 vs. 2 | p-value = 0.015**

This means that the difference in mean systolic blood pressure change is statistically significant between each of these groups.

**Step 6: Report the results.**

Lastly, we will report the results of our One-Way ANOVA analysis. Here is an example of how to do so:

A one-way ANOVA was performed to determine if four different types of drugs had different impacts on systolic blood pressure.

The following table summarizes the number of participants in each group along with the mean change in systolic blood pressure and the standard deviation in systolic blood pressure for each group:

Drug Used	Summary of Increment in Systolic B.P.		
	Mean	Std. Dev.	Freq.
1	26.066667	11.677002	15
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3	8.75	10.0193	12
4	13.5	9.3238047	16
Total	18.87931	12.800874	58

**A one-way ANOVA revealed that there was a statistically significant difference between at least two groups ( $F(3, 54) = 9.09, p = 0.001$ ).**

**Tukey's test for multiple comparisons found that the change in systolic blood pressure was statistically significantly higher for drug 3 compared to drug 1 ( $17.32 \pm 4.15, p = 0.001$ ), for drug 3 compared to drug 2 ( $16.78 \pm 4.15, p = 0.001$ ), for drug 4 compared to drug 1 ( $12.57 \pm 3.85, p = 0.010$ ), and for drug 4 compared to drug 2 ( $12.03 \pm 3.85, p = 0.015$ ).**

**There was no statistically significant difference between drug groups 1 and 2 ( $.533 \pm 3.91, p = 0.999$ ) or between drug groups 3 and 4 ( $4.75 \pm 4.09, p = 0.654$ ).**