



One Sample T-test

The One Sample t Test examines whether the mean of a population is statistically different from a known or hypothesized value. The One Sample t Test is a parametric test.

This test is also known as:

- Single Sample t Test

The variable used in this test is known as:

- Test variable

In a One Sample t Test, the test variable's mean is compared against a "test value", which is a known or hypothesized value of the mean in the population. Test values may come from a literature review, a trusted research organization, legal requirements, or industry standards. For example:

Common Uses:

The One Sample t Test is commonly used to test the following:

- Statistical difference between a mean and a known or hypothesized value of the mean in the population.
- Statistical difference between a change score and zero.

This approach involves creating a change score from two variables, and then comparing the mean change score to zero, which will indicate whether any change occurred between the two time points for the original measures. If the mean change score is not significantly different from zero, no significant change occurred.

The One Sample t Test can only compare a single sample mean to a specified constant. It can not compare sample means between two or more groups. If you wish to compare the means of multiple groups to each other, you will likely want to run an Independent Samples t Test (to compare the means of two groups) or a One-Way ANOVA (to compare the means of two or more groups).



Data Requirements:

Your data must meet the following requirements:

1. Test variable that is continuous (i.e., interval or ratio level)
2. Scores on the test variable are independent (i.e., independence of observations)
 - There is no relationship between scores on the test variable
 - Violation of this assumption will yield an inaccurate p value
3. Random sample of data from the population
4. Normal distribution (approximately) of the sample and population on the test variable
 - Non-normal population distributions, especially those that are thick-tailed or heavily skewed, considerably reduce the power of the test
 - Among moderate or large samples, a violation of normality may still yield accurate p values
5. Homogeneity of variances (i.e., variances approximately equal in both the sample and population)
6. No outliers

Hypotheses

The null hypothesis (H_0) and (two-tailed) alternative hypothesis (H_1) of the one sample T test can be expressed as:

$H_0: \mu = \mu_0$ ("the population mean is equal to the [proposed] population mean")

$H_1: \mu \neq \mu_0$ ("the population mean is not equal to the [proposed] population mean")

where μ is the "true" population mean and μ_0 is the proposed value of the population mean.

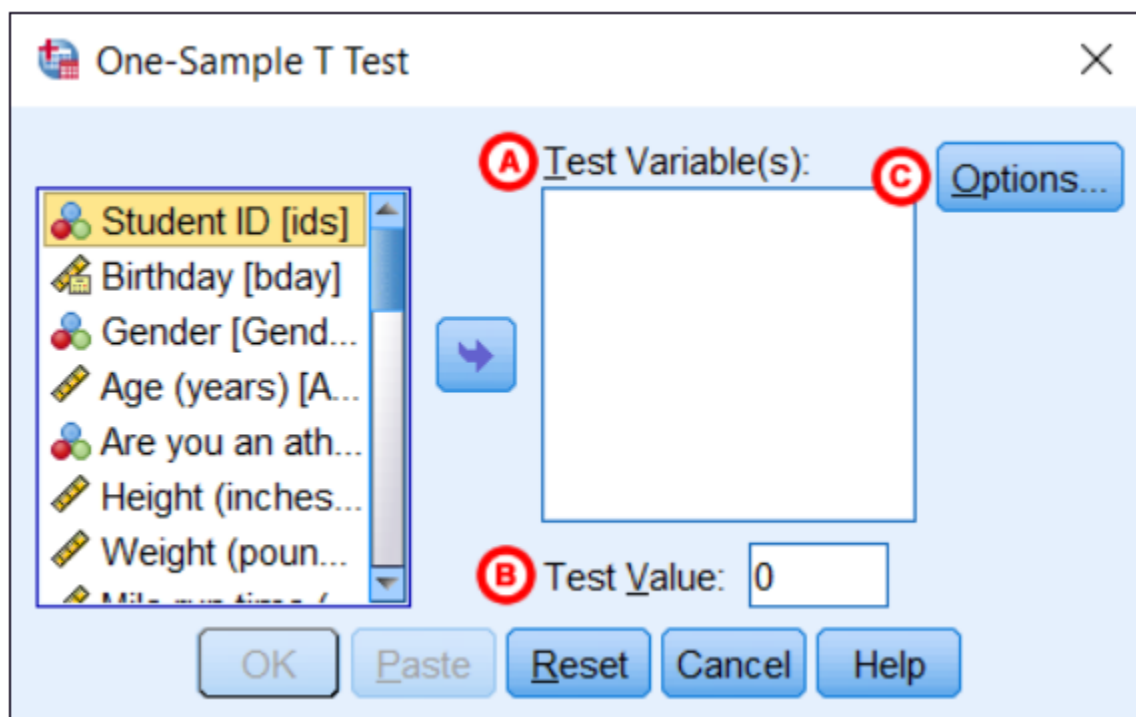
Data Setup

Your data should include one continuous, numeric variable (represented in a column) that will be used in the analysis. The variable's measurement level should be defined as Scale in the Variable View window.

Run a One Sample T-test

To run a One Sample t Test in SPSS, click **Analyze > Compare Means > One-Sample T Test**.

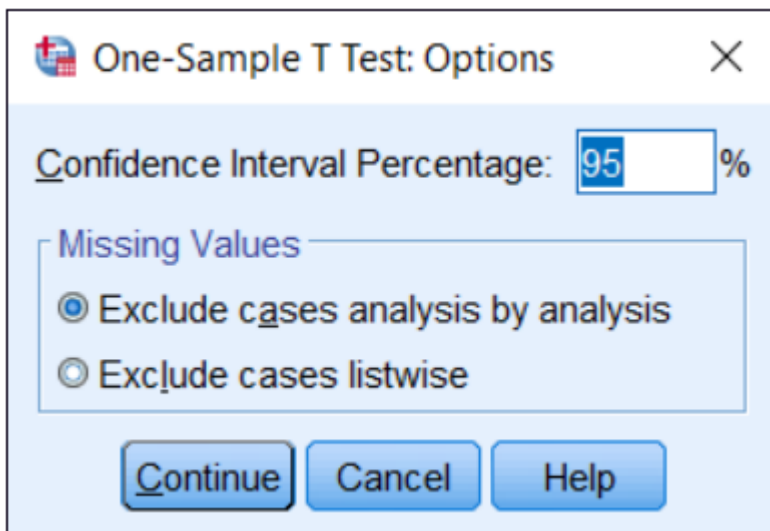
The One-Sample T Test window opens where you will specify the variables to be used in the analysis. All of the variables in your dataset appear in the list on the left side. Move variables to the **Test Variable(s)** area by selecting them in the list and clicking the arrow button.



A Test Variable(s): The variable whose mean will be compared to the hypothesized population mean (i.e., Test Value). You may run multiple One Sample *t* Tests simultaneously by selecting more than one test variable. Each variable will be compared to the same Test Value.

B Test Value: The hypothesized population mean against which your test variable(s) will be compared.

C Options: Clicking **Options** will open a window where you can specify the **Confidence Interval Percentage** and how the analysis will address **Missing Values** (i.e., **Exclude cases analysis by analysis** or **Exclude cases listwise**). Click **Continue** when you are finished making specifications.



Practical Part

The Data

Our working assumption, as per usual, is that you've opened SPSS, and that you're looking at the Data View within which you've got some data.



	Duration	Sex	Height	var	var	var	var	var	var
1	3.86	Female	67						
2	6.66	Male	61						
3	10.21	Female	66						
4	6.21	Female	64						
5	11.82	Female	73						
6	5.81	Female	65						
7	7.49	Male	65						
8	7.71	Male	65						
9	5.93	Male	65						
10	10.72	Female	72						
11	7.43	Male	70						
12	6.99	Female	74						
13	7.10	Female	69						
14	10.39	Male	64						
15	5.09	Male	71						
16	3.24	Male	71						
17	7.87	Female	68						
18	6.26	Female	62						
19	5.99	Female	65						
20	6.17	Male	56						

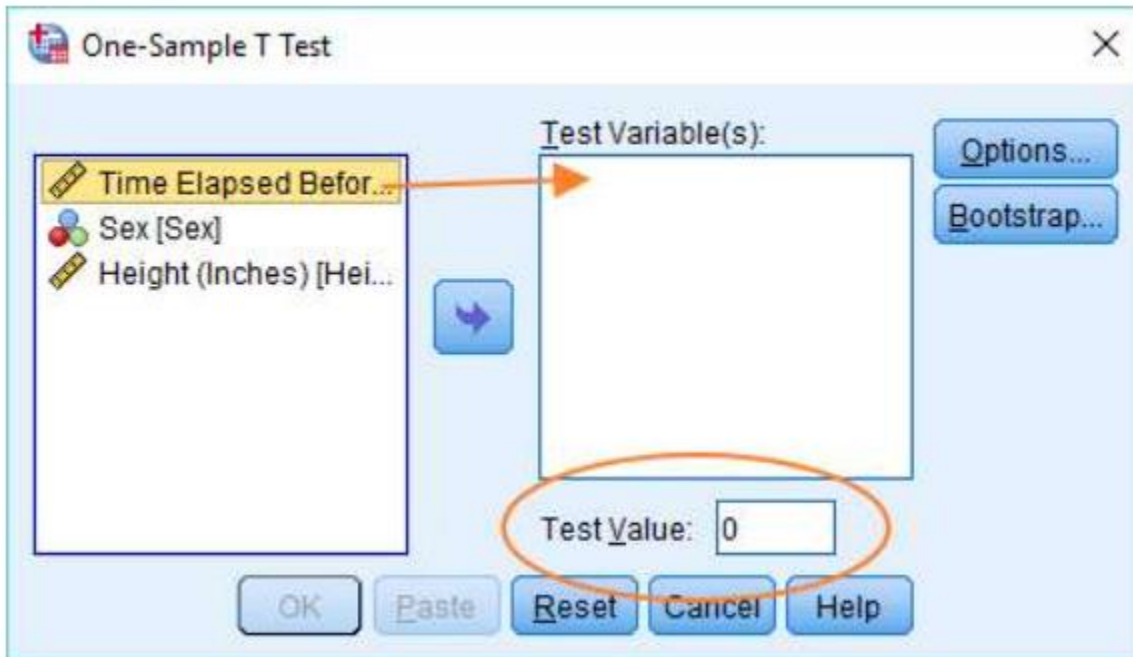
Our data is from a hypothetical study that examines how long it takes people to fall asleep during a statistics lesson.

we're only interested in the Duration variable, which is the number of minutes that elapses from the start of the lesson before a subject falls asleep.

Imagine we already know that in the population as a whole the average amount of time it takes for somebody to fall asleep is 8.45 minutes. This compares to the average time in our sample of 7.35 minutes. The question is whether the difference between these two means is large enough for us to conclude there is a real difference between our sample group and the wider population in terms of the amount of time it takes to fall asleep.

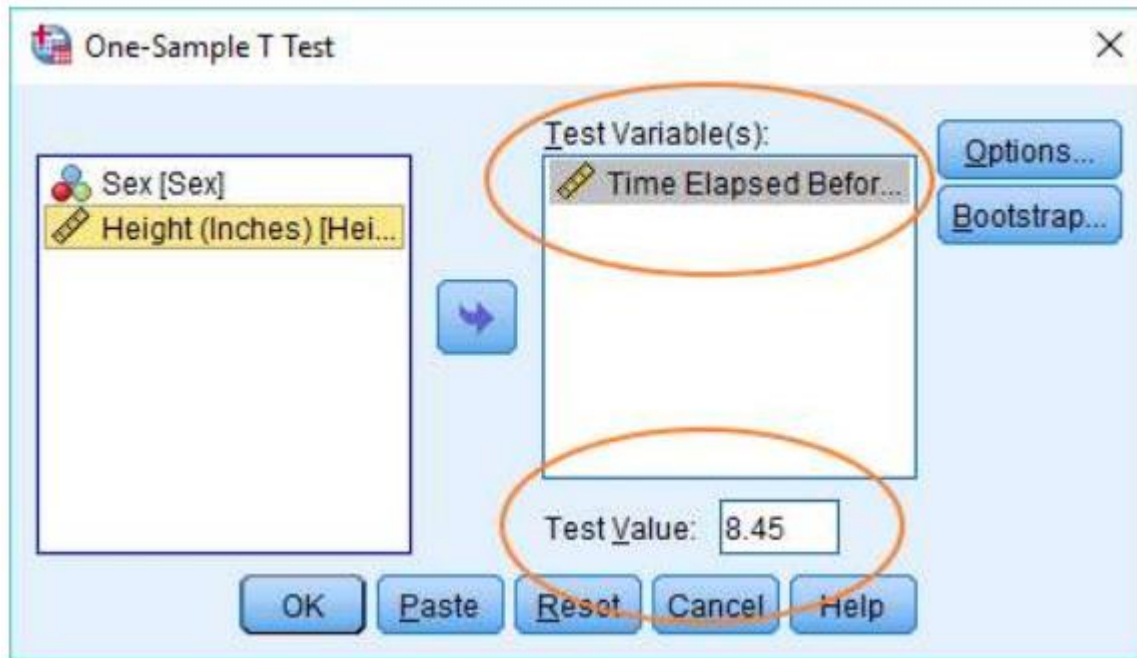
If we knew the population standard deviation, we could do a z test to answer this question, but we don't, which means a one sample t test is the appropriate test.

To begin the one sample t test, click on **Analyze -> Compare Means -> One-Sample T Test**. This will bring up the One-Sample T Test dialog box.



You've got to get the variable you want to test – in our case, the Duration variable – into the right hand Test Variable(s) box, and input the population mean into the Test Value box. For the variable, you can just drag and drop, or use the arrow in the middle of the dialog box.

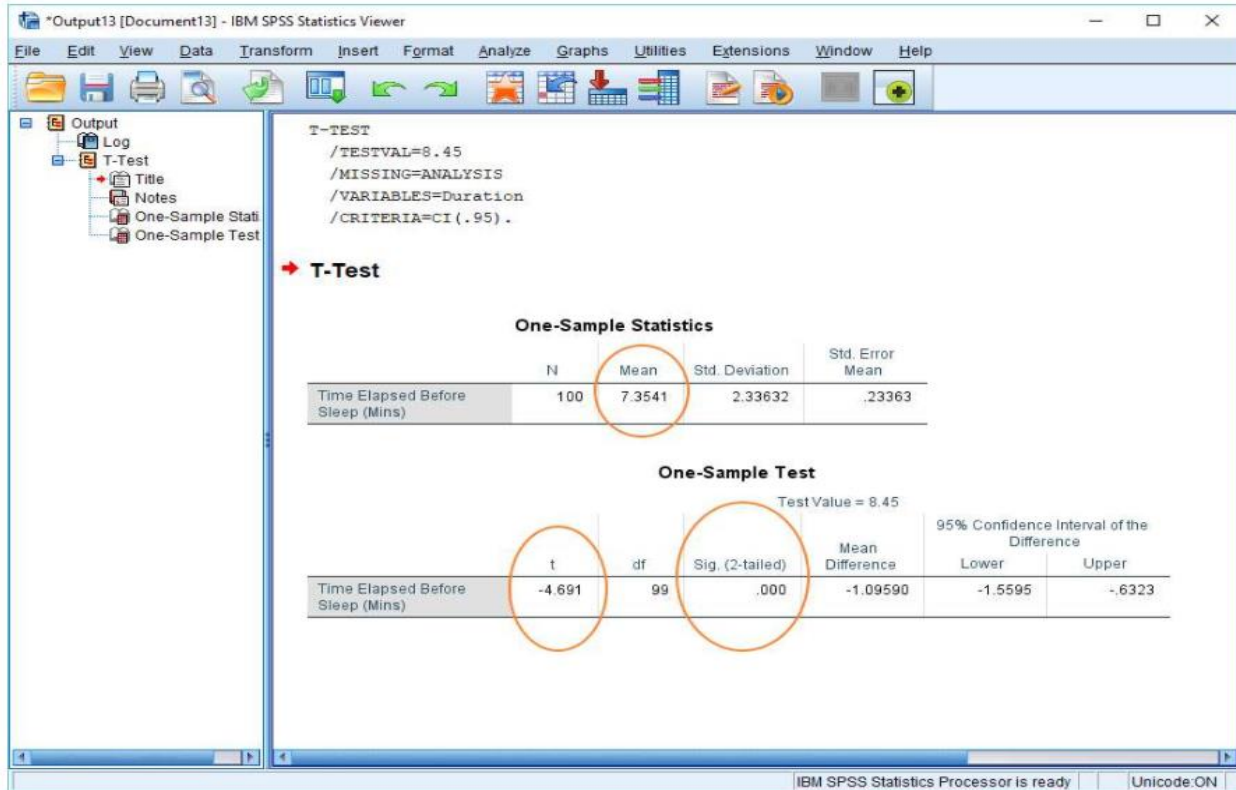
Once it's set up, it should look like this.



If you've got this far, you're ready to run the test. Just hit the OK button.

The Results

The result of the one sample t test will appear in the SPSS output viewer. It will look like this.



T-TEST
/TESTVAL=8.45
/MISSING=ANALYSIS
/VARIABLES=Duration
/CRITERIA=CI (.95).

T-Test

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Time Elapsed Before Sleep (Mins)	100	7.3541	2.33632	.23363

One-Sample Test

Test Value = 8.45

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Time Elapsed Before Sleep (Mins)	-4.691	99	.000	-1.09590	-1.5595	-.6323

This output is relatively easy to interpret.

The t value is -4.691 (see the One-Sample Test table, above), which gives us a *p*-value (or 2-tailed significance value) of .000. This is going to be a significant result for any realistic alpha level.

A standard alpha level is .05, and .000 is smaller than .05, so we're going to reject the null hypothesis which asserts there is no difference between our sample mean and the population mean.

More technically, what the result shows is that on the assumption that the null hypothesis is true, a difference as big as we've got between our sample mean and the population mean is extremely unlikely to have arisen purely by chance.



This counts as evidence that the difference between our sample group and the population as a whole is real. Put simply, it seems that our subjects fall to sleep in statistics lessons more quickly than is true of the population as a whole.
