

In this example with SPSS annotated output, I am going to show you how to interpret the results for an **independent-samples** t-test and then a **one-sample** t-test.

Use an independent samples T-test when you want to examine different subgroups coded on the **same** independent variable (e.g., 1=male,0=non-male) to see how different their means are for another variable (e.g., income coded into a 9-level index). If you want to compare mean values on a dependent variable for an independent variable with several categories (e.g., 1=White, 2=Latino, 3=African American, 4=other), you need to figure out which two groups you want to compare or run multiple T-tests. For example, if you wanted to compare average the income level of three other racial groups to whites, you would run the t-test three different times.

With a one-sample t-test, you compare a variables subgroups' mean values on a second variable to a value that you have specified. The two most-common uses of this test are to compare several groups' mean value on a dependent variable with the mean for the whole sample or with the mean value for a specific group. This t-test is your choice if you want to examine the means of **groups measured with different variables**. For example, we could use an independent samples t-test to compare the average income for males versus non-males. We then could compare the mean income for males versus Republicans with a one-sample test. To do the second test, we first need to split our dataset on the variable that identifies respondents' partisanship (this step will allow us to figure what the mean income is for just Republicans). Then we would run a one-sample T-test to compare the average income for Republicans against the mean income (i.e., our test value) for males that that we previously calculated. Now that you understand the different between the two t-tests, let's look at annotated SPSS output.

For the annotated SPSS output below, let's assume that I am interested in seeing whether non-evangelicals, strong liberals, and then highly conservative people differ from evangelicals with respect to their average level of religious service attendance (which we will assume is an interval variable, even though the structure of the original variable is ordinal). First, I'll use an **independent samples t-test** to compare evangelicals and non-evangelicals. I'm using the independent samples test because I am only looking at variations involving one independent variable:

```
T-TEST GROUPS=BornAgainChristian(1 0)
/MISSING=ANALYSIS
/VARIABLES=ReligAttend6
/ES DISPLAY(TRUE)
/CRITERIA=CI(.95).
```

T-Test

Group Statistics					
	Evangelical Christian	N	Mean	Std. Deviation	Std. Error Mean
How frequently attend relig services?	Evangelical Christian	377	4.5650	1.38058	.07110
	Non-Evangelical	1109	3.2299	1.60166	.04810

The means for each variable are obviously different ... at least in this sample. Not unexpectedly, it looks like evangelicals attend services more than non-evangelicals, but with only 377 evangelicals in that sample, we will need to verify in the next block of output to see how confident we can be that what we see in this sample reflects what we would find if we were dealing with the whole US, which is what this sample is supposed to accurately represent.

It's not relevant to the t-test, but the standard deviation is higher among non-evangelicals, which tells us that there is more variation in how much they go to religious services is higher than for non-evangelicals (at least in this sample)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means			95% Confidence Interval of the Difference			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
How frequently attend relig services?	Equal variances assumed	36.791	<.001	14.460	1484	<.001	1.33505	.09233	1.15395	1.51615
	Equal variances not assumed			15.552	745.798	<.001	1.33505	.08584	1.16653	1.50357

Continuing with the output, we see that the difference between evangelicals and non-evangelicals' religious attendance is 1.34 points on the 6-point measure.

The standard t-test measure unless, you want to run some other checks, assumes **equal variances**. You don't need to know why this is the only row we care about as long you have a large sample with hundreds of observations for each group.

We can say with near certainty that evangelicals attend services more than non-evangelicals. The significance statistic indicates that if similar sampling were repeated, we would reach the same conclusion more than 99.9% of the time.

Next, we want to see if evangelicals' average level of religious attendance is statistically different from groups that involve other variables (here, political ideology). We first split the data by the new variable we are interested in and then use a one-sample T-test. Here's what that code looks like when I use SPSS point-click-paste to carry out these steps:

```

SORT CASES BY Liberal5.
SPLIT FILE LAYERED BY Liberal5.

T-TEST
  /TESTVAL=4.5650
  /MISSING=ANALYSIS
  /VARIABLES=ReligAttend6
  /ES DISPLAY(TRUE)
  /CRITERIA=CI(.95).

SPLIT FILE OFF.
  
```

First, I tell SPSS to split my data (Data -> split file -> compare groups) by political ideology (Liberal5).

Then I point-click-and paste: Analyze -> Compare Means -> One sample t-test. I indicate that I want to look at the variable for religious attendance and, **for the test value, I enter the mean level of religious attendance for evangelicals that I calculated earlier** (For this example, this is the reference group I want to compare everyone to. If I had wanted to, I could have just compared all my groups of interest to the average level of religious attendance for the entire sample, in which case, I would be testing which groups' means are different from the average).

And then, I tell SPSS to turn the split off (Data -> split file -> analyze all cases).

Notice that if I point-click-and paste my way through these three sets of commands just one time, I could then rerun this same code several times, switching out the Liberal5 variable for different variables that have the groups whose mean level of religious service attendance, I wanted to compare to evangelicals.

In the SPSS output, there are three boxes with results, but you only need to look at the one with the T-Test results (the mean levels of religiosity for each group are reported in a separate box if you want that information, too):

One-Sample Test

Test Value = 4.5650

How liberal is respondent (5-pt scale)		t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
						Lower	Upper
.	How frequently attend relig services?	-4.546	43	<.001	-1.11045	-1.6031	-.6178
Very conservative	How frequently attend relig services?	-1.400	104	.165	-.21262	-.5138	.0886
Conservative	How frequently attend relig services?	-7.251	451	<.001	-.52739	-.6703	-.3845
Moderate	How frequently attend relig services?	-16.398	523	<.001	-1.13561	-1.2717	-.9996
Liberal	How frequently attend relig services?	-14.533	243	<.001	-1.51992	-1.7259	-1.3139
Very liberal	How frequently attend relig services?	-10.981	116	<.001	-1.75303	-2.0692	-1.4369

I can see the difference (versus the mean for evangelicals calculated earlier) in the average level of attendance for the two groups I am interested in (the most and least liberal). Both groups have lower attend5 means than evangelicals.

The significance statistics indicate that very conservative individuals are not statistically different (i.e., sig. > .05) from evangelicals in their level of religious attendance, but everyone else's average level of service attendance is lower. We can be very confident this conclusion (i.e., at least 99.9% of the time similar surveys would show the same thing).

If this was a study of what factors shape how much a person attends religious services, it would be easy enough to repeat the steps above (especially if I had template syntax where I could copy, paste and replace each independent variable quickly) to create a table summarizing how much each independent variable group's mean attendance score differed from evangelicals'. I would convert the significance tests reported in the original SPSS output into asterisks (<.001= ***; < .01=**, < .05=*, >.05 = ns) to show how confident we can be that each group's mean is truly different than what we found for evangelicals.

Table 1: Gap in Average Religious Service Attendance vs. Evangelical Christians

Group	Attendance Gap (on a 6-point measure)
Not born-again	-1.34***
White	-1.60***
African-American	-0.47***
Asian	-1.39***
Latino	-0.57**
Female	-0.80***
Male	-1.16***
Very conservative	-0.53
Very liberal	-1.75***

Note: Cell entries are T-tests comparing each group's average religious attendance index score to the mean for evangelicals (4.565/6). * p , .05; ** p , .01; *** p , .001.