

2-Sample t-Test

Independent t-Test

Independent t-Test

The independent t-Test compares the means of TWO samples **from different** populations

Independent t-Test

- The Means of the two Samples are compared in the t-test to determine if there is a Statistically Significant difference
- The test is sometimes called the Independent Samples t-test

(Samples are said to be independent if they come from unrelated Populations and the Samples have no effect on each other)

Independent t-Test

EXAMPLE

In a test of a new drug, one Population took the **drug** and the other Population took the **placebo**

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EXAMPLE

2-Sample <i>t</i> -test				
Sample 1 Not trained $n_1 = 6$			Sample 2 Trained $n_2 = 5$	
J. Black	72		A. Conrad	76
T. Gerard	80		J. David	78
M. Lowry	78		W. Johns	83
P. Mason	74		F. Lyons	86
R. Vargas	79		M. White	61
B. Wilson	70			

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EXAMPLE

Do males and females differ in terms of their exam scores?

Take a sample of males and a separate sample of females and apply the hypothesis testing steps to determine if there is a Significant difference in scores between the groups

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Conditions to perform the Independent t-Test

- Both samples the dependent variable should be normally distributed
- Both samples should be independent
- Both variances are equal
- Sample size **NOT** necessary the same

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Hypothesis statement

The **Null hypothesis** for the independent t-test is that the population means from the two unrelated groups are equal:

$$H_0: \mu_1 = \mu_2$$

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Alternative Hypothesis

The population means are not equal:

$$H_A: \mu_1 \neq \mu_2$$

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$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{S_{\bar{x}_1 - \bar{x}_2}}$$

$$S_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{s_{pooled}^2}{n_1} + \frac{s_{pooled}^2}{n_2}}$$

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Degrees of freedom for the independent t-Test

$$n1 + n2 - 2$$

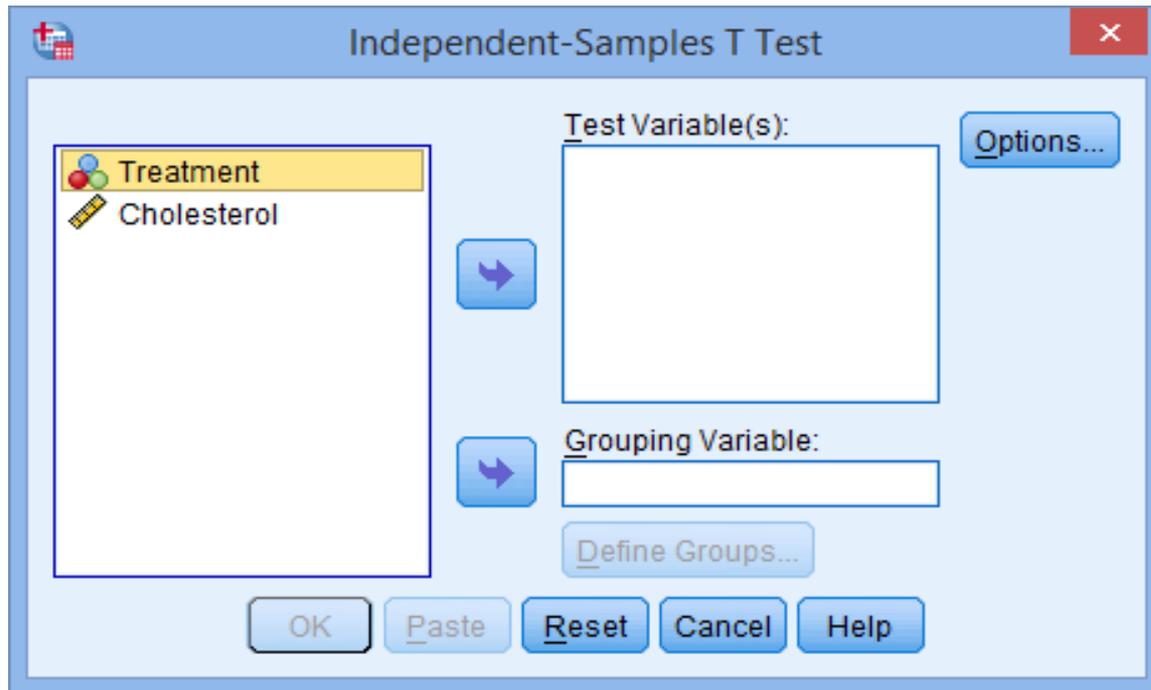
Independent t-Test

The screenshot shows the IBM SPSS Statistics interface. The title bar reads "independent-samples t-test.sav [DataSet0] - IBM SPSS Stati...". The menu bar includes File, Edit, View, Data, Transform, Analyze, Graphs, Utilities, Add-ons, Window, and Help. The "Analyze" menu is open, showing options like Reports, Descriptive Statistics, Compare Means, General Linear Model, etc. The "Compare Means" sub-menu is also open, highlighting "Independent-Samples T Test...".

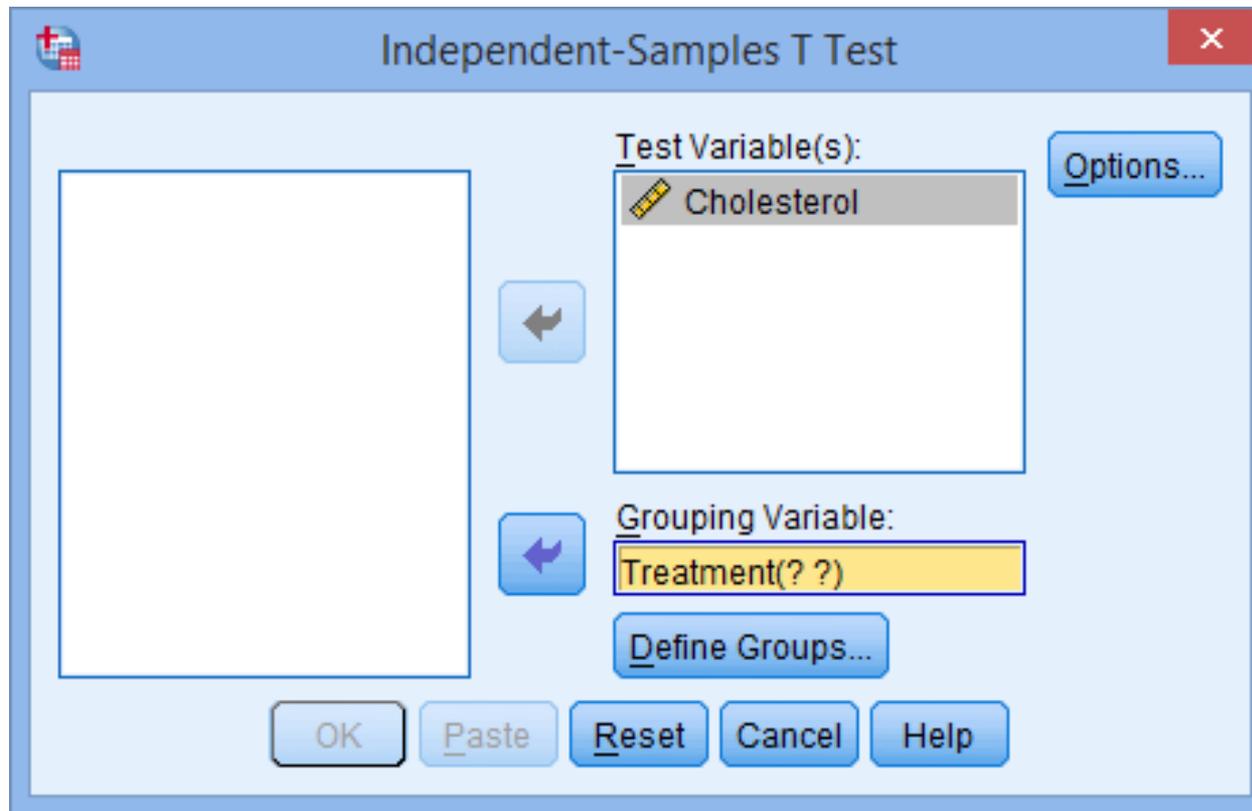
The data editor shows a variable named "Cholesterol" with 18 rows of data. The "Treatment" column contains "Diet group" for all rows. The "Cholesterol" column has values 6.24 for row 17 and 6.01 for row 18.

	Treatment	Cholesterol
1	Diet group	
2	Diet group	
3	Diet group	
4	Diet group	
5	Diet group	
6	Diet group	
7	Diet group	
8	Diet group	
9	Diet group	
10	Diet group	
11	Diet group	
12	Diet group	
13	Diet group	
14	Diet group	
15	Diet group	
16	Diet group	
17	Diet group	6.24
18	Diet group	6.01

Independent t-Test

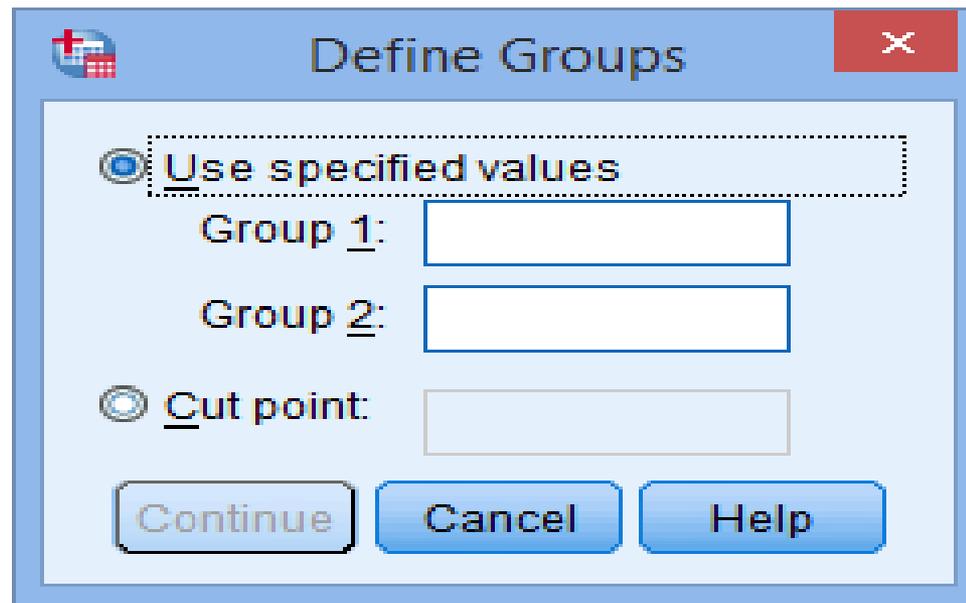


Independent t-Test



Independent t-Test

You then need to define the groups (treatments). Click on the  button



The image shows a dialog box titled "Define Groups" with a standard Windows-style title bar (minimize, maximize, close buttons). The dialog contains two radio button options. The first option, "Use specified values", is selected and highlighted with a dashed border. Below it are two text input fields labeled "Group 1:" and "Group 2:". The second option, "Cut point:", is unselected and has a single text input field below it. At the bottom of the dialog are three buttons: "Continue", "Cancel", and "Help".

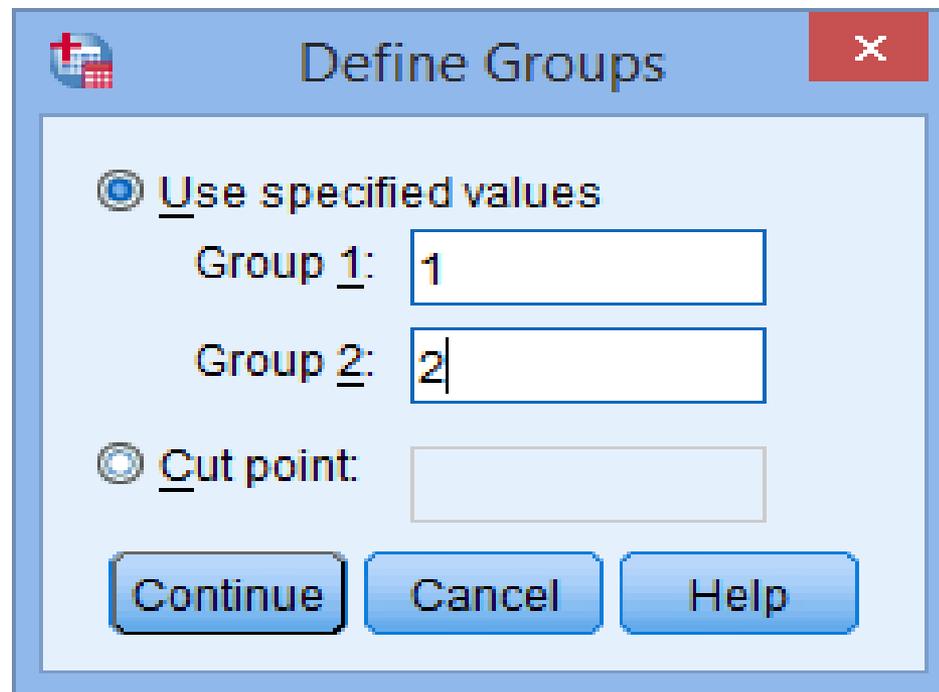
Use specified values

Group 1:

Group 2:

Cut point:

Independent t-Test



The image shows a 'Define Groups' dialog box from a statistical software application. The dialog has a blue title bar with a red close button (X) on the right. Inside the dialog, there are two radio buttons. The first radio button is selected and is labeled 'Use specified values'. Below this, there are two text input fields: 'Group 1:' with the value '1' and 'Group 2:' with the value '2'. The second radio button is labeled 'Cut point:' and is currently unselected, with an empty text input field next to it. At the bottom of the dialog, there are three buttons: 'Continue', 'Cancel', and 'Help'.

Define Groups

Use specified values

Group 1: 1

Group 2: 2

Cut point:

Continue Cancel Help

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Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Cholesterol Concentration	Diet	20	6.1450	.51959	.11618
	Exercise	20	5.7950	.38179	.08537

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Independent Samples Test

		Cholesterol Concentration		
		Equal variances assumed	Equal variances not assumed	
Levene's Test for Equality of Variances	F	.314		
	Sig.	.579		
t-test for Equality of Means	t	2.428	2.428	
	df	38	34.886	
	Sig. (2-tailed)	.020	.021	
	Mean Difference	.35000	.35000	
	Std. Error Difference	.14418	.14418	
	95% Confidence Interval of the Difference	Lower	.05813	.05727
		Upper	.64187	.64273

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Effect of Sleep and Caffeine on Memory

A study in which a sample of 24 adults are randomly divided equally into two groups and given a list of 24 words to memorize. During a break, one group takes a 90-minute nap while another group is given a caffeine pill.

The response variable of interest is the number of words participants are able to recall following the break. We are testing to see if there is a difference in the average number of words a person can recall depending on whether the person slept or ingested caffeine.

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Sleep	14	18	11	13	18	17	21	9	16	17	14	15
Caffeine	12	12	14	13	6	18	14	16	10	7	15	10

**Which has more effect on the memory?
Sleep OR Caffeine**

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Quiz vs Lecture Pulse Rate

Do you think that students undergo physiological changes when in potentially stressful situations such as taking a quiz or exam? A sample of statistics students were interrupted in the middle of quiz and asked to record their pulse rates (beats for 1-minute period). Ten of the students had also measured their pulse rate while sitting in class listening to a lecture, and these values were matched with their quiz pulse rates

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Student	1	2	3	4	5	6	7	8	9	10
Quiz	75	52	52	80	56	90	76	71	70	66
Lecture	73	53	47	88	55	70	61	75	61	78
