Test of Mean Differences Series Part 1: Independent Samples $t$ test

Zin Htway, Ph.D., MBA, CT (ASCP, IAC)
Zin Htway, Ph.D., MBA, CT (ASCP, IAC)
Introduction to Independent Samples t-test

• The independent-samples t-test (or independent t-test, for short) compares the means between two unrelated groups on the same continuous, dependent variable.

• This is a similar, but different test than a paired or matching t-test.
Statistical Assumptions of Independent Samples t-test

- Dependent variable should be measured on a continuous scale
- Independent variable should consist of two categorical, independent groups.
- Independence of observations.
- No significant outliers.
- Dependent variable should be approximately normally distributed for each group of the independent variable.
- Homogeneity of variances.
Essentials of Independent Samples t-test

- **Test:** Unpaired t-test
- **AKA:** Two-sample t-test; independent samples t-test.
- **Goal:** Compare to means
- **Example:** Comparing pulse rate in people taking two different drugs
- **Additional Assumption:** Both data sets are samples from Gaussian distributions with the same population standard deviation
- **Effect size:** Difference between the two means
- **Confidence interval:** Confidence interval of the difference between the two means
- **Null hypothesis:** The two population means are identical
- **Alternative hypothesis:** The two population means are not identical
- **Question the P value answers:** If the two population means are identical, what is the chance of observing such a large difference by chance alone in an experiment of this size?
Gaussian distribution (Normal, Bell-shaped curve)
The null hypothesis ($H_0$) is that these two means come from underlying populations with the same mean $\mu$ (so the difference between them is 0 and $\mu_1 - \mu_2 = 0$).
Research question

• Is there a difference in the heart rate of patients taking Drug A versus Drug B for high blood pressure 15 minutes following ingestion?
Research question

• Dependent variable (DV) = Heart rate 15 minutes following ingestion of drug (scale).
• Independent variable (IV) = Drug A or Drug B (two independent groups, random selection).
SPSS > Analyze > Compare Means > Independent Samples T Test
Test Variable (s): Heart_rate
Grouping Variable: groups
[Define Groups] <click>
Group 1 = 1 (Drug A), Group 2 = 2 (Drug B)
[Continue] <click>  > [Ok] <click>
<table>
<thead>
<tr>
<th>Heart_rate</th>
<th>group number</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Drug A</td>
<td>15</td>
<td>107.4000</td>
<td>23.38131</td>
<td>6.03703</td>
</tr>
<tr>
<td></td>
<td>Drug B</td>
<td>15</td>
<td>110.8667</td>
<td>21.95406</td>
<td>5.66852</td>
</tr>
</tbody>
</table>
Independent Samples Test

<table>
<thead>
<tr>
<th>Heart_rate</th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>t</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-.419</td>
<td>27.890</td>
<td>.679</td>
</tr>
</tbody>
</table>
APA style write-up of Independent Samples t-Test

Results of the independent samples t-test showed that the mean heart rate after 15 minutes between patients taking Drug A ($M = 107.40$, $SD = 23.38$, $n = 15$) and patients taking Drug B ($M = 110.87$, $SD = 21.95$, $n = 15$) was not statistically significant at the .05 level of significance ($t(28) = -0.419$, $df = 28$, $p > .05$). On average, heart rate after 15 minutes between patients taking Drug A and those taking Drug B were approximately the same. The null hypothesis which suggested that there was no significant difference in the mean heart rate after 15 minutes between patients taking Drug A and those taking Drug B cannot be rejected.
Research question

- Is there a difference in the heart rate of patients taking Drug B versus Drug C for high blood pressure 15 minutes following ingestion?
Research question

• Dependent variable (DV) = Heart rate 15 minutes following ingestion of drug (scale).
• Independent variable (IV) = Drug B or Drug C (two independent groups, random selection).
SPSS > Analyze > Compare Means > Independent Samples T Test
Test Variable (s): Heart_rate
Grouping Variable: groups
[Define Groups] <click>
Group 1 = 2 (Drug B), Group 2 = 3 (Drug C)
[Continue] <click> > [Ok] <click>
## Group Statistics

<table>
<thead>
<tr>
<th>Heart_rate</th>
<th>group number</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Drug B</td>
<td>15</td>
<td>110.8667</td>
<td>21.95406</td>
<td>5.66852</td>
</tr>
<tr>
<td></td>
<td>Drug C</td>
<td>15</td>
<td>144.6000</td>
<td>7.18928</td>
<td>1.85626</td>
</tr>
</tbody>
</table>
## Independent Samples Test

<table>
<thead>
<tr>
<th></th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>t</td>
</tr>
<tr>
<td>Heart_rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>assumed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances</td>
<td>-5.655</td>
<td>16.968</td>
<td>.000</td>
</tr>
<tr>
<td>not assumed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APA style write-up of Independent Samples t-Test

Results of the independent samples t-test showed that the mean heart rate after 15 minutes between patients taking Drug B ($M = 110.87$, $SD = 21.95$, $n = 15$) and patients taking Drug C ($M = 144.60$, $SD = 7.19$, $n = 15$) was statistically significant at the .05 level of significance ($t(28) = -5.56$, $df = 28$, $p < .05$). On average, heart rate after 15 minutes of patients taking Drug C was higher than those taking Drug C. The null hypothesis which suggested that there was no significant difference in the mean heart rate after 15 minutes between patients taking Drug B and those taking Drug C is rejected.
Questions ???
More questions? Stay Informed!

Current Walden students, e-mail our tutoring team at:  
[AS Ctutoring@Waldenu.edu](mailto:AS Ctutoring@Waldenu.edu)

Subscribe to our [Facebook](https://www.facebook.com) & [Twitter](https://twitter.com) channels to keep up-to-date on new information, ask questions and share your knowledge.  
Subscribe to our [YouTube](https://www.youtube.com) channel (free!) to have instant access to new tutorials and webinar archives.

Visit our [website](http://www.WaldenU.edu) for tutorials, event schedules, tutoring services, courses and workshops.