

## 10.1: Introduction to One-Way ANOVA

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The **one-way ANOVA** is used when you want to test whether the means of three or more independent groups are significantly different. This inferential test can also be referred to as a simple ANOVA or a single-factor ANOVA. ANOVA is short for analysis of variance because the formula takes variability into account. If the means are distinct enough even after accounting for the fact that each independent group has some variability around their own mean, the result will be significant. One-way ANOVA is a bivariate technique. One variable is a qualitative grouping variable and the other is a comparison or focal quantitative variable. Essentially, one way ANOVA is similar to an independent samples  $t$ -test but without the limitation of only being able to compare two groups (see Chapter 8 to review the independent samples  $t$ -test).

It is worth noting when and why a one-way ANOVA is used in place of an independent samples  $t$ -test. An ANOVA can be used to compare two independent groups but it is more complex than the  $t$ -test. Therefore, it is advisable to use the simpler independent samples  $t$ -test to compare two groups. It is also possible to use independent samples  $t$ -tests to compare more than two groups, but this is inefficient and introduces a greater probability of a Type I Error. Recall that a Type I Error refers to when data support a hypothesis when the hypothesis is not true of the population and that we generally take a 5% risk of this occurring each time we test a hypothesis (See Chapter 6 for a review of Type I Error). For example, three groups could be compared using three independent samples  $t$ -tests as follows: 1. Comparing Group 1 to Group 2, 2. Comparing Group 1 to Group 3, and 3. Comparing Group 2 to Group 3. That is a lot of work and each time the  $t$ -test is performed using an alpha level of 0.05, there is a 5% risk of a Type I Error. Thus, if three such tests are performed, there is a 15% chance that at least one of the three  $t$ -tests has a Type I Error. For these reasons, a one-way ANOVA is the preferred and appropriate method for comparing the scores of three or more independent groups.

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