Appendix R

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The one-sample t-test is used only for tests of the sample mean. Thus, our hypothesis tests whether the average of our sample (M) suggests that our students come from a population with a know mean (m) or whether it comes from a different population.

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One-Sample T-Test using SPSS Statistics

Introduction

The one-sample t-test is used to determine whether a sample comes from a population with a specific mean. This population mean is not always known, but is sometimes hypothesized. For example, you want to show that a new teaching method for pupils struggling to learn English grammar can improve their grammar skills to the national average. Your sample would be pupils who received the new teaching method and your population mean would be the national average score. Alternately, you believe that doctors that work in Accident and Emergency (A & E) departments work 100 hour per week despite the dangers (e.g., tiredness) of working such long hours. You sample 1000 doctors in A & E departments and see if their hours differ from 100 hours.

This "quick start" guide shows you how to carry out a one-sample t-test using SPSS Statistics, as well as interpret and report the results from this test. However, before we introduce you to this procedure, you need to understand the different assumptions that your data must meet in order for a one-sample t-test to give you a valid result. We discuss these assumptions next.

One-Sample *t*-Test

Hypothesis

The one-sample *t*-test is used when we want to know whether our sample comes from a particular population but we do not have full population information available to us. For instance, we may want to know if a particular sample of college students is similar to or different from college students in general. The one-sample *t*-test is used only for tests of the sample mean. Thus, our hypothesis tests whether the average of our sample (M) suggests that our students come from a population with a know mean (μ) or whether it comes from a different population.

The statistical hypotheses for one-sample *t*-tests take one of the following forms, depending on whether your research hypothesis is directional or nondirectional. In the equations below μ_1 refers to the population from which the study sample was drawn; μ is replaced by the actual value of the population mean. The statistical hypotheses are identical to those used for one-sample *Z* tests.

$$H_0 : \mu_1 = \mu$$
$$H_A : \mu_1 \neq \mu$$

$$H_0 : \mu_1 \leq \mu$$
$$H_A : \mu_1 > \mu$$

$$H_0 : \mu_1 \geq \mu$$
$$H_A : \mu_1 < \mu$$

Study Design

The name of the one-sample *t*-test tells us the general research design of studies in which this statistic is selected to test hypotheses. We use the one-sample *t*-test when we collect data on a single sample drawn from a defined population. In this design, we have one group of subjects, collect data on these subjects and compare our sample statistic (M) to the population parameter (μ). The population parameter tells us what to expect if our sample came from that population. If our sample statistic is very different (beyond what

we would expect from sampling error), then our statistical test allows us to conclude that our sample came from a different population. Again, in the one-sample *t*-test, we are comparing the mean (M) calculated on a single set of scores (one sample) to a known population mean (μ).

Available Information

The one-sample *t*-test compares a sample to a defined population. When we say "defined" population, we are saying that the parameters of the population are known. We typically define a population distribution in terms of central tendency and variability/dispersion. But, for a one-sample *t*-test, only the population μ is known. The one-sample *t*-test cannot be done if we do not have μ . The population s is not required for the one-sample *t*-test. All *t*-tests estimate the population standard deviation using sample data (S). Population means are available in the technical manuals of measurement instruments or in research publications. Population information for the attachment scales used in the class dataset is available in the articles on reserve.

Test Assumptions

All parametric statistics have a set of assumptions that must be met in order to properly use the statistics to test hypotheses. The assumptions of the one-sample *t*-test are listed below. These assumptions are identical to those of the one-sample *Z* test.

- Random sampling from a defined population
- Interval or ratio scale of measurement
- Population is normally distributed

When reading the psychological literature, we can find many studies in which all of these assumptions are violated. Random sampling is required for all statistical inference because it is based on probability. Random samples are difficult to find, however, and psychologists and researchers in other fields will use inferential statistics but discuss the sampling limitations in the article. We learned in our scale of measurement tutorial that psychologists will apply parametric statistics like the *t* test for dependent means on approximately interval scales even though the tests require interval or ratio data. This is an accepted practice in psychology and one that we use when we analyze our class data. Finally, the assumption of normal distribution in the population is considered "robust". This means that the the statistic has been shown to yield useful results even when the assumption is violated. The central limit theorem tells us that even if the population distribution is unknown, we know that the sampling distribution of the mean will be

approximately normally distributed if the sample size is large. This helps to contribute to the *t*-test being robust for violations of normal distribution. There are conditions we may encounter when we should not use the t-test for dependent means. If we are conducting a directional test and our sample data are highly skewed, we should consider a nonparametric alternative.

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