Lab Activity: Hypothesis Testing – Two Population Variances

In this lab activity, you will conduct hypothesis testing for claims involving the variances of two independent populations.

Student Learning Outcomes

By the end of this chapter, you should be able to do the following:

- Perform hypothesis testing for two independent population variances using Statcato

Preliminary

Read Chapter 13 F Distribution and ANOVA in:

Illowsky, Barbara, and Susan Dean. Collaborative Statistics. Connexions. 2 Mar. 2010 <http://cnx.org/content/col10522/1.37/>.

Background

In this lab, you will use data from ClinicalTrials.gov, which is a web site that provides information on clinical trials for a wide range of diseases and conditions. A clinical trial is a research study in which human subjects answer specific health questions; in particular, interventional trials study whether experimental treatments are safe and effective under controlled environments. You will use the results of several interventional trials in this lab.

Guided Problem

1. The **baseline characteristics** of the treatment groups are data collected for each participant at the beginning of the trial and are provided so that the different groups can be compared. For instance, in a study that determines whether the combination of aerobic physical exercise and alprazolam in patients with panic disorder has a better therapeutic response than the treatment with alprazolam alone, the following baseline characteristics were recorded (University of Buenos Aires. Efficacy of Aerobic Exercise Added to Alprazolam in Panic Disorder Treatment (AEIPDT). In: ClinicalTrials.gov [Internet]. Bethesda (MD): National Library of Medicine (US). 2000- [cited 2010 Jun 21]. Available from: http://clinicaltrials.gov/show/NCT00803400 NLM Identifier: NCT00803400.):

	Alprazolam	**Alprazolam + Aerobic Exercise**
Number of Participants **[units: participants]**	75	75
Age **[units: participants]**		
<=18 years	0	0
Between 18 and 65 years	75	75
>=65 years	0	0
Age **[units: years]** **Mean ± Standard Deviation**	34.01 ± 8.07	35.68 ± 7.67

Using a 0.05 significance level, test the claim that the two treatment groups have **ages with the same amount of variation**.

Formulating the Hypothesis Test

Answer the following questions in **LR: Problem 1 – Hypotheses**.

- State the claim that you are testing.

- State the **null** and **alternative hypotheses**.

  - H_0:

  - H_a:

- Is this a **right-tailed**, **left-tailed**, or **two-tailed** test?

Performing the Hypothesis Test

Using Statcato, you will perform calculations for the hypothesis test.

TATCATO **Performing a Hypothesis Test for Two Variances**

Go to `Statistics > Hypothesis Tests > 2-Population Variances`.

- In the **Inputs** panel, select **Summarized sample data** radio button. Enter the sample sizes of the two treatment groups in the provided text box. Select **Standard Deviation** and enter the sample standard deviations for the two groups.

- For **Significance Level**, enter **0.05**.

- In the **Alternative Hypothesis** panel, select the form of the alternative hypothesis ($<$, $\neq$, or $>$).

- Click **OK**.

The results of the hypothesis test are shown in the Log window. Copy the computation results from the Log window to **LR: Problem 1 – Hypothesis Test**.

Interpreting the Results

Based on the computer-generated results, you will draw conclusions for the hypothesis test. Record your answers in **LR: Problem 1 -- Conclusion**.

For a hypothesis test of two variances, Statcato calculates the critical value(s), *F* statistic, and the p-value.

Decision on Null Hypothesis

Based on the significance level α and the computed p-values (or critical value(s) and F statistic), decide whether to reject H_0 and explain why.

Conclusion

Based on your decision on the null hypothesis, make a conclusion about your claim.

Discussion

Is it important to have treatment groups that have similar baseline characteristics? Why?

Problems

Repeat the procedures described above for the following two problems (record answers in **LR: Problem 2** and **LR: Problem 3**):

2. In a clinical trial comparing duloxetine to other antidepressants in the treatment of severe depression, the following baseline characteristics of two treatment groups were recorded (Eli Lilly and Company. A Study Comparing Duloxetine to Other Antidepressants in the Treatment of Severe Depression. In: ClinicalTrials.gov [Internet]. Bethesda (MD): National Library of Medicine (US). 2000- [cited 2010 Jun 21]. Available from: http://clinicaltrials.gov/show/NCT00666757 NLM Identifier: NCT00666757.):

	Duloxetine	Selective Serotonin Reuptake Inhibitor (SSRI)
Number of Participants [units: participants]	372	378
Age [units: years] Mean ± Standard Deviation	44.3 ± 13.01	43.8 ± 13.05

Use a 0.01 significance level to test the claim that subjects from the two treatment groups have ages with different amounts of variation.

3. In a study comparing the efficacy of two drugs for Type 2 diabetes, Exubera and Lantus, the changes in body weight at observation from body weight at baseline were measured (Pfizer. A Clinical Trial Comparing the Efficacy and Safety of Exubera® and Lantus®. In: ClinicalTrials.gov [Internet]. Bethesda (MD): National Library of Medicine (US). 2000- [cited 2010 Jun 21]. Available from: http://clinicaltrials.gov/show/NCT00391027 NLM Identifier: NCT00391027.). The measured values are as follows:

	Inhaled Human Insulin (Exubera®)	Insulin Glargine (Lantus®)
Number of Participants Analyzed [units: participants]	125	118
Change From Baseline in Body Weight [units: kilograms (kg)] Mean ± Standard Deviation	2.2 ± 3.57	1.1 ± 3.43

Use a 0.01 significance level to test the claim that the group using Exubera has changes in body weight that vary more than the group using Lantus.