JMP® Introductory Lab Activities

Activity 12: Hypothesis Testing, Paired *t*-Test

Data Set: Therm.jmp

Summary

A health care center recently purchased a new eardrum probe thermometer that provides an easier way to measure patients' temperatures than the standard oral mercury thermometer. The nurses suspected, however, that the new device gives readings that ware consistently higher than with the old method.

To test this, readings were taken on some patients twice, once with the eardrum probe and the other with the oral thermometer. The patients were chosen randomly from the population of patients who visit the health care center.

You will conduct a paired *t*-test, and summarize your test results and conclusions in a report (required output and discussion is in italics). Note: In order to conduct a paired *t*-test, the paired data must be stored in two separate columns.

Exploring the Therm Data

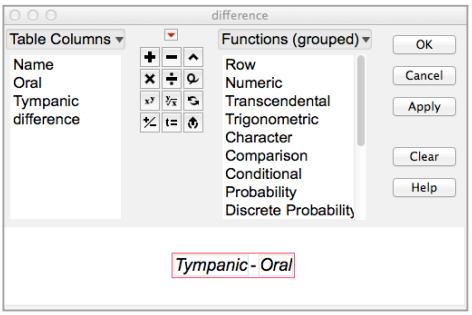
Open the file **Therm.jmp** from the JMP **Sample Data** directory. Readings taken for 20 patients with the standard oral thermometer are recorded in the Oral column, and readings taken with the new eardrum probe thermometer are recorded in the Tympanic column.

Choose **Analyze > Distribution** using both **Oral** and **Tympanic** as the **Y, Columns** variables, and click **OK**. To compare the two distributions more easily, select **Uniform Scaling** from the top red triangle, and select **Stack** for a horizontal layout.

Compare the histograms, box plots, quantiles and summary statistics. Does there appear to be a difference between the two thermometers?

Conducting a Paired *t*-Test in JMP®

The last column represents the differences between the two temperature measurements. This difference was calculated using the **JMP Formula Editor**.



To view the formula, right click on the **difference** column in the data table and select **Formula** (or, **click on the plus sign** next to **difference** in the **Columns** panel.)

Look at the distribution of the differences to see if the conditions for using the *t*-test are reasonable by choosing **Analyze > Distribution** for the variable **difference**.

Conduct a hypothesis test on the differences by selecting **Test Mean** from the red triangle for **difference**. Enter the correct hypothesized mean for the hypothesis of interest.

Using your results from JMP, conduct a complete hypothesis test using one of the commonly used significance levels.

Include:

- *Assumptions*
- *Hypotheses*
- *Sample statistic values*
- *The test statistic*
- *The* p*-value, and*
- *Conclusions in the context of the problem.*

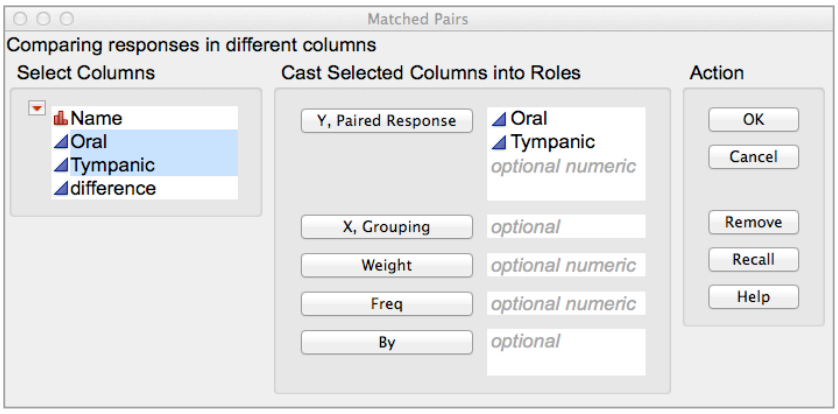
In your report discuss why a matched pairs design was appropriate for this problem.

Include graphical displays for temperatures for both types of thermometer and for the difference in temperatures. Also include JMP output for the hypothesis test results with the correct p*-value circled.*

Explain how you chose the proper p*-value for this test, and remember to answer the original question posed.*

Conducting a Paired *t*-Test in JMP® Using Matched Pairs

A paired *t*-test is a one-sample *t*-test on paired differences. This test also can be conducted in JMP, without creating a column of differences, using the **Analyze > Matched Pairs** platform.



Conduct a paired t*-test for the difference in temperatures using the* ***Matched Pairs*** *platform.*

- *Compare the results to those in the previous section. Does this test lead to the same conclusions?*
- *Is any additional information provided?*
- *Describe what is displayed in the graph. What does each point represent? What is the solid line in the graph? What are the dashed red lines?*