

Examples of two group comparison hypotheses and statistical summaries

Schizophrenia case study

The outcome variable is: the left hippocampus volume (cm³)
Group 1: Schizophrenics Group 2: Non-schizophrenics

Is the study a controlled experiment? No.

If I pick one subject does it have a natural pair in the other group? Yes

A pair is: a schizophrenic and their non-schizophrenic twin

Box C:

μ = the population mean difference in left hippocampus volume between a schizophrenic and their non-schizophrenic twin.

Null hypothesis: The population mean difference in left hippocampus volume between a schizophrenic and their non-schizophrenic twin is zero, $\mu = 0$.

Alternative hypothesis: The population mean difference in left hippocampus volume between a schizophrenic and their non-schizophrenic twin is not zero, $\mu \neq 0$.

Do a one-sample test of the differences in volume between pairs. From the book, a t-test gives a two-sided p-value of 0.006. Estimate of difference is 0.2.

Statistical Summary

There is convincing evidence that the population mean difference in the left hippocampus volume between a schizophrenic and their non-schizophrenic twin is not equal to zero (paired t-test, two-sided p-value = 0.006). The mean left hippocampus volume for the schizophrenic is estimated to be 0.20 cm³ less than their non-schizophrenic twin (95% confidence interval 0.07 to 0.33 cm³). Since the twins were not selected at random from a larger population, the statistical inferences are limited to the twins selected in this study.

Creativity Study

The outcome variable is: the creativity score (points)

Group 1: Extrinsic motivation questionnaire Group 2: Intrinsic motivation questionnaire

Is the study a controlled experiment? Yes

If I pick one subject does it have a natural pair in the other group? No

Box B:

δ = the mean treatment effect on the creativity score of being assigned the intrinsic motivation questionnaire compared to the extrinsic motivation questionnaire.

Null hypothesis: The mean treatment effect on the creativity score of being assigned the intrinsic motivation questionnaire compared to the extrinsic motivation questionnaire is zero, $\delta = 0$

Alternative hypothesis: The mean treatment effect on the creativity score of being assigned the intrinsic motivation questionnaire compared to the extrinsic motivation questionnaire is greater than zero, $\delta > 0$

Do a two-sample test. From the book (section 2.4.1), a two-sample t-test gives a one-sided p-value of 0.0027. Estimate of difference is 4.14.

Statistical Summary

There is convincing evidence that the treatment effect of the intrinsic motivation questionnaire compared to the extrinsic motivation questionnaire on creativity score is greater than zero (two-sample t-test, one-sided p-value = 0.0027). The intrinsic motivation questionnaire is estimated to increase the creativity score 4.14 points more than the extrinsic motivation questionnaire, (95% confidence interval 1.29 to 6.99 points). Since the subjects were not selected at random from a larger population, the statistical inferences are limited to the subjects selected in this study.

Bumpus Data

The outcome variable is: humerus length (inches)

Group 1: sparrows that perished Group 2: sparrows that survived

Is the study a controlled experiment? No

If I pick one subject does it have a natural pair in the other group? No

Box D:

μ_1 = the population mean humerus length for sparrows that perished

μ_2 = the population mean humerus length for sparrows that survived

Null: The population mean humerus length for sparrows that perished is equal to the population mean humerus length for sparrows that survived, $\mu_1 = \mu_2$.

Alternative: The population mean humerus length for sparrows that perished is not equal as the population mean humerus length for sparrows that survived, $\mu_1 \neq \mu_2$.

Do a two-sample test. From the book, a two-sample t-test gives a two-sided p-value of 0.08. Estimate of difference is 0.010.

Statistical Summary

There is suggestive but inconclusive evidence that the mean humerus length for sparrows that perished is not equal as the population mean humerus length for sparrows that survived (two-sample t-test, two-sided p-value = 0.08). The population mean humerus length of sparrows that perished is estimated to be 0.010 inches shorter than the population mean humerus length for sparrows that survived (95% confidence interval -0.001 to 0.021 inches). Since the subjects were not selected at random from a larger population, the statistical inferences are limited to the subjects selected in this study.

Fish Oil Study HINTS

Homework #3, Question 1:

The outcome variable is: blood pressure (mm of mercury)

Group 1: after the regular oil diet Group 2: before the regular oil diet

Homework #3, Question 2:

The outcome variable is: the **reduction** in blood pressure (mm of mercury)

Group 1: regular oil diet Group 2: fish oil diet