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## Dolphin Therapy

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Swimming with dolphins can certainly be fun, but is it also therapeutic for patients suffering from clinical depression? To investigate this possibility, researchers recruited 30 study participants, aged 18–65, with a clinical diagnosis of mild to moderate depression. Study participants were required to discontinue use of any antidepressant drugs or psychotherapy four weeks prior to the experiment, and throughout the experiment. Prior to the experiment, participants' level of depression was measured and recorded.

These 30 participants went to an island off the coast of Honduras, where they were randomly assigned to one of two groups. Both groups engaged in the same amount of swimming and snorkeling each day, but one group did so in the presence of bottlenose dolphins and the other group did not. At the end of two weeks, participants' level of depression was again measured and compared to the pre-experiment measurement. The primary outcome was whether or not a participant had improved, based on a reduced level of depression (criteria which was set by the researchers) by the end of the study.

Does swimming with dolphins improve levels of clinical depression for patients suffering from it?

Each question is worth 1 point unless otherwise stated.

**Observed Data:** The researchers found that 10 of 15 study participants in the dolphin therapy group showed substantial improvement, compared to three of 15 participants in the control group.

### Explore the Observed Data

1. Organize these data/results (i.e., frequencies) into a 2x2 contingency table.
2. Identify the treatment variable used in the study. Also say whether it is quantitative or categorical.
3. Identify the response variable used in the study. Also say whether it is quantitative or categorical.



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4. Compute: (a) the percentage of participants in the treatment group who had an improved level of depression, (b) the percentage of participants in the control group who had an improved level of depression, and (c) the difference in these two percentages.
  5. Do the sample data suggest that there is a positive effect of swimming with dolphins on patients suffering from clinical depression? Explain.

### Model the Experimental Variation and Simulate

Set up a TinkerPlots sampler to model the experimental variation using dummy coding that would be expected in the difference in percentages if there was no effect of swimming with dolphins.

6. Copy and paste a picture of your sampler window into your word-processed document.

### Simulate

Carry out 500 trials of a randomization test using TinkerPlots to investigate whether the observed difference is more than would be expected by chance.

### Evaluate

7. Use TinkerPlots to create a plot of the distribution of simulated differences. Add a **Reference Line** to your plot at the value of the observed difference. Copy and paste (or sketch) this plot below.
8. Compute and report the  $p$ -value based on the observed difference. Show your work.
9. Interpret the  $p$ -value you computed.
10. Based on the  $p$ -value you computed, how compatible is the observed difference with the results produced by the model specified in the null hypothesis? What does this suggest about the answer to the research question? Explain. **(2pts)**
11. How would you rate the level of internal validity based on the study design?
12. Based on the level of internal validity, are you willing to conclude that swimming with dolphins causes a decrease in levels of depression?