Activity 8

dolphin therapy

# directions

Have one group member upload this docx file to your Google Drive and share it with your groupmates and your instructor. Name your document “**GroupX\_Activity8”** (where X is your group number). Work together to type up your responses to each question. Download your document as a PDF and submit this to Canvas individually.

# introduction

Researchers wanted to investigate a new form of animal therapy on depression. To do this, they recruited 30 participants aged 18-65 with a clinical diagnosis of mild to moderate depression. These 30 participants went to an island off the coast of Honduras, where they were randomly assigned to one of two groups (15 participants in each group). Both groups engaged in the same amount of swimming and snorkeling each day, but one group (the Dolphin Therapy group) did so in the presence of bottlenose dolphins, while the other group (the Regular Therapy group) did not. When the experiment was completed each participant’s level of depression was evaluated in order to determine whether or not a participant showed substantial improvement after the participant’s therapy (Dolphin Therapy or Regular Therapy). The results of the study are presented in the table below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **No Improvement** | **Improvement** | **Total** |
| **Regular Therapy** | 12 | 3 | 15 |
| **Dolphin Therapy** | 5 | 10 | 15 |
| **Total** | 17 | 13 | 30 |

Dolphin Therapy is quite expensive; thus, researchers will only continue using Dolphin Therapy if there is evidence that it did a better job of improving depression than the Regular Therapy group (see Antonioli and Reveley, 2005 for study details).

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# part 1: making conjectures

1. As part of your pre-work assignment, you conducted a physical simulation with cards for the Dolphin Therapy problem. How would you use the information provided in the problem context to conduct a simulation with cards that would allow you to generate other possible random re-pairings of outcomes (i.e., Improvement/Not Improvement) and treatments (Dolphin Therapy/Regular Therapy)? Please be sure to describe this in such a way that another person would be able to understand and replicate the physical simulation you conducted with the cards.
2. Imagine that you were to use the cards to generate another possible random re-pairing of outcomes (i.e., Improvement/Not Improvement) and treatments (Dolphin Therapy/Regular Therapy).
3. Using the table below, make a conjecture for how you think the numbers of improved participants and not improved participants would be distributed between the Dolphin and Regular Therapy groups as a result of this random process. Explain your reasoning.
4. What cells of the table (if any) do you think might vary in their values? Explain and state some range you think would be reasonable in terms of how much a value in a cell might vary.
5. What cells of the table (if any) do you think will remain constant? Explain why you think that.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **No Improvement** | **Improvement** | **Total** |
| **Regular Therapy** |  |  | 15 |
| **Dolphin Therapy** |  |  | 15 |
| **Total** |  |  | 30 |

1. Suppose you were to assume the Dolphin Therapy group was no more effective at treating depression than the Regular Therapy group.
2. Make a conjecture for how you think the numbers of improved participants and not improved participants would be distributed between the Dolphin and Regular Therapy groups under this assumption (fill in the table below based on your conjectures)? Give a justification for your answer.

1. In making your conjectures, did you make any assumptions about the *total number* of No Improvement and the *total number* of Improvement for both groups? Explain.

1. In making your conjectures, did you make any assumptions about the number of No Improvement *for Regular Therapy* and *for Dolphin Therapy*? Did you make any assumptions about the number of Improvement for *Regular Therapy* and for *Dolphin Therapy*? Explain.

1. Do your conjectures for the table below differ at all from how you completed the table in Problem 2? Why or why not?

|  |  |  |  |
| --- | --- | --- | --- |
|  | **No Improvement** | **Improvement** | **Total** |
| **Regular Therapy** |  |  | 15 |
| **Dolphin Therapy** |  |  | 15 |
| **Total** |  |  | 30 |

1. The results of the study are presented in the table below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **No Improvement** | **Improvement** | **Total** |
| **Regular Therapy** | 12 | 3 | 15 |
| **Dolphin Therapy** | 5 | 10 | 15 |
| **Total** | 17 | 13 | 30 |

1. What do these results indicate to you about the effectiveness of Dolphin Therapy? Explain.

1. If we assumed that the Dolphin Therapy was no more effective at treating depression than Regular Therapy, do the total counts of improvement and no improvement surprise you? Why or why not?

1. If we assumed that the Dolphin Therapy was no more effective at treating depression than Regular Therapy, do the counts of improvement from the dolphin and regular therapy groups surprise you? Why or why not?

1. Now suppose that rather than a total of 13 participants improving and a total of 17 participants not improving, the researchers found that 21 participants improved and 9 did not. Consider the results of two different studies under these conditions below:

**Study A**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **No Improvement** | **Improvement** | **Total** |
| **Regular Therapy** | 5 | 10 | 15 |
| **Dolphin Therapy** | 4 | 11 | 15 |
| **Total** | 9 | 21 | 30 |

**Study B**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **No Improvement** | **Improvement** | **Total** |
| **Regular Therapy** | 8 | 7 | 15 |
| **Dolphin Therapy** | 1 | 14 | 15 |
| **Total** | 9 | 21 | 30 |

1. How does the change in the total number of people that improve or didn’t improve overall impact the effectiveness of dolphin therapy relative to the regular therapy?

1. If we assumed that the dolphin therapy was no more effective at treating depression than regular therapy, which table has data that we might expect to see, the one from study A or B? Which table has data that would be relatively surprising to see, the one from study A or B? Explain.

1. Why do you think we asked you to assume Dolphin Therapy was no more effective at treating depression than the Regular Therapy in Problems 3-5? Do you think this is a reasonable assumption? Explain.

1. If you were interested in studying the effectiveness of dolphin therapy…

1. What null hypothesis would you use to study this?

1. How do you think that the process of re-randomizing the pairings of outcomes and treatment groups (described in Problem 1) connects to the null hypothesis you stated in Problem 7a?

# part II – translating the physical simulations into tinkerplots

1. If you were going to translate what you did with the cards into TinkerPlots, what would you do? To answer this question please build a sampler in TinkerPlots that you feel aligns with the physical simulation we conducted in class and that you described in Problem 1.

As part of your work, please include the following:

1. Copy and paste a picture of your TinkerPlots sampler below.

1. Describe how the **setup** of the sampler you created aligns with the physical simulation you described in Problem 1? Please make sure to describe this in a way that incorporates the problem context. Explain how your TinkerPlots sampler connects to the null hypothesis you stated in Problem 7a.
2. Describe if the device(s) in your sampler are set to sample with or without replacement and explain why.
3. If you were to run this sampler, describe what it would do and how that relates to the physical simulation you described in Problem 1.  Please make sure to describe this in a way that incorporates the problem context.
4. Predict how many participants you think would improve in the dolphin therapy group and regular therapy group if you were to run this sampler. Explain how, if at all, your predictions relate to your null hypothesis.
5. Run a single trial of the simulation and make a plot of the results.
6. Paste your plot below and describe what a dot in the plot represents.

1. How does what you observe compare to what you expected to see in a single trial?

1. Run 500 trials of the simulation and create a sampling distribution of the statistics of your choice.
   1. Copy and paste a plot of the sampling distribution below.
   2. Describe what a dot in this plot represents.
   3. Where is the center of the sampling distribution located? In light of the assumptions that you made when constructing your model (see Problem 8b), does this make sense? Why or why not?
2. Of the 13 participants that improved in the study, 10 of them were in the Dolphin Therapy group and 3 of them were in the Regular Therapy group. Of the 17 participants that did not improve in the study, 5 of them were in the Dolphin Therapy group and 12 of them were in the Regular Therapy group (see the table below for a summary of the observed results). What do you think of this result in light of the sampling distribution from your simulation? Explain.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **No Improvement** | **Improvement** | **Total** |
| **Regular Therapy** | 12 | 3 | 15 |
| **Dolphin Therapy** | 5 | 10 | 15 |
| **Total** | 17 | 13 | 30 |

1. What is the p-value for this study?  Please describe what the p-value means in the context of this problem.

1. Based on your response to Problem 12, how strong is the evidence against the null model? What does this suggest about the answer to the research question? Explain.