Stat 218 - Final Exam (Practice - KEY)

Itchy Pups

A veterinary medicine company is doing final trials of a new type of flea and tick medication. In trials of new medicine, it is common to compare the results to the current "gold standard" of treatment, that is, the current commonly used medication. The company recruits 60 dogs who are randomly selected from the population of current canine customers, and randomly assigns 30 of them to receive the new treatment and 30 to receive the old treatment. Each pup receives 60 days of medication; after the first 30 days, which are necessary for the treatment to take effect, the dogs are monitored to assess how many times a day they scratch themselves. The 30 days of scratch counts are averaged together for each dog, and the distribution of average number of scratches are shown below.

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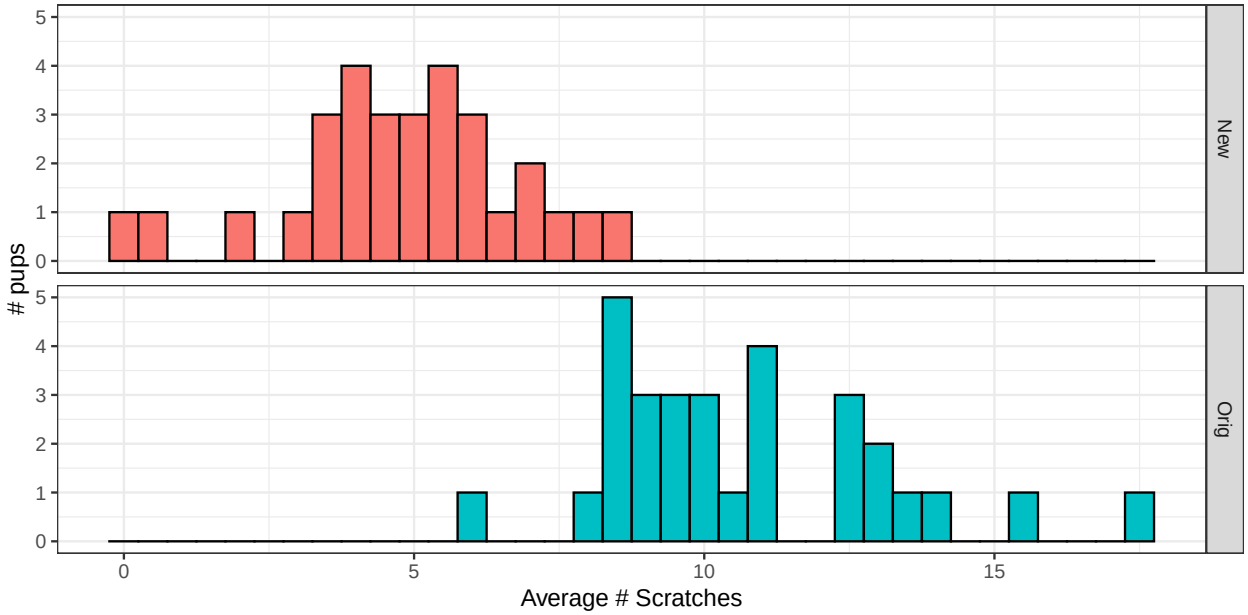
## Warning: It is deprecated to specify `guide = FALSE` to remove a guide. Please
## use `guide = "none"` instead.
```



1. What is the population of interest?

   The company's current canine customers. (Also acceptable - all canines)

2. Which group has the largest median? Draw a vertical line corresponding to the approximate median on the chart.

   The original group has the largest median. The vertical line for the new group should be at approximately 4.8 and the vertical line for the original group should be at approximately 9.849.

3. Suppose we would like to compare the average itchiness of the pups receiving the original treatment to the average itchiness of pups receiving the new treatment (Original - New). What is the parameter of interest, in words and in symbols?

   The population mean itchiness of pups receiving the original treatment minus the population mean itchiness of pups receiving the new treatment, or $\mu_o - \mu_n$ where μ_o is the population mean itchiness of pups receiving the original treatment and μ_n is the population mean itchiness of pups receiving the new treatment.

4. Set up the appropriate null and alternative hypotheses to examine the parameter of interest.
   $H_0 : \mu_o - \mu_n = 0$
   $H_A : \mu_o - \mu_n \neq 0$

5. Are theory-based validity conditions met for this problem?

   Yes. The validity conditions are either (1) symmetric distribution of both groups or (2) 20 observations for each group and a distribution which is not too skewed for each group. The data were actually simulated from a symmetric distribution, so technically (1) is met, but if we didn't know that, we can definitely say that (2) is met because we have 30 observations per group and the distributions are not too skewed.

6. Suppose that the new group of pups scratches on average 4.817 times per day (SD = 1.91) and the old group of pups scratches on average 10.652 times per day (SD = 2.458). What is the observed statistic?

   $\overline{x}_o - \overline{x}_n = 10.652 - 4.817 = 5.835$

7. What is the standard deviation of the difference (i.e. the standard deviation of the statistic?)
   $$\sqrt{\frac{s_o^2}{n_o} + \frac{s_n^2}{n_n}} = \sqrt{\frac{(2.458)^2}{30} + \frac{(1.91)^2}{30}} = \sqrt{0.201 + 0.122} = 0.568$$

8. What is the test statistic, t?
   $$t = \frac{\overline{x}_o - \overline{x}_n - 0}{SE(\overline{x}_o - \overline{x}_n)} = \frac{5.835}{0.568} = 10.267$$

9. What is your conclusion in the context of the study?
   With $t = 10.267$ we have strong evidence to reject the hypothesis that the two treatments are equally effective at reducing dog itchiness. We reject H_0 and conclude that dogs who received the new treatment are less itchy than dogs who receive the standard treatment. The new treatment is thus more effective at reducing the amount of irritation experienced by dogs treated with flea and tick medication.