Power Analysis on a Pilot Study of the Caloric Intake of Children Helping Prepare Meals Versus Children Not

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INTRODUCTION

The purpose of this analysis is to determine the sample size needed for a study that will be used to discover if there is a difference in the caloric intake of children who help with meal preparation and children who do not help with meal preparation. Promoting healthy eating habits in children is becoming increasingly important as the obesity rates in children rise across the country. Klazine Van der Horst, Aurore Ferrage, and Andreas Rytz are looking to study if involving children in food preparation promoted healthy eating habits in children and improved a child's health. Approximately 17% of U.S. youth have obesity and "nearly one in three children and adolescents are either overweight or have obesity." ("Facts…") Obesity effects all communities regardless of race, ethnicity, or family income. This study will be on children ages 6 to 10, which happens to be the in the age category with the most increase in child obesity. The obesity rate for children ages 6-11 has more than quadrupled during the past 40 years. The obesity rate of children ages 6-11 is now an astonishing 17.4%, according to the National Health and Nutrition Examination. As health care costs continue to increase, it is becoming more and more important to find ways to promote healthy habits at home. An overweight child has a 70% chance of becoming an overweight adult and an increasingly high chance of developing diabetes. This causes an abundance of problems. For example, more than one in four 17-24-year old's in the United States are now too heavy to serve in the military, which healthcare officials say has the potential to endanger national security. ("Facts…) Hopefully involving children in meal preparation will have a subsequent effect on caloric intake, so that families can aid in combatting obesity in children by simply involving children in cooking at home.

PILOT STUDY

The pilot study to be used for the is from a database of compiled research. The specific dataset to be studied is from an experiment conducted to determine the effect of children participating in mean preparation on caloric intake. This study was done in 2014 by three researchers: Klazine Van der Horst, Aurore Ferrage, and Andreas Rytz. This dataset was one of many that they studied in their hundreds of pages of research that eventually was published in a book called *Appetite*. The data has two variables: *treatment* and *caloric intake*. In the treatment variable, a 1 is representative of a child who participated in preparing a lunch meal (pasta, breaded chicken, cauliflower, and salad) with their guardians and a 2 is representative of a child whose guardians prepared the meal alone. The caloric intake variable is representative of the number of calories in kilocalories that the child consumed during that meal. The study was done with 47 children aged 6 to 10 years.

METHODS

To find the minimum sample size needed for the research study looking to discover if there is a difference in the caloric intake of children who help with meal preparation and children who do not help with meal preparation, a power analysis will be computed on a pilot study done by Klazine Van der Horst, Aurore Ferrage, and Andreas Rytz . Using a pilot study is a good approach to conducting a power analysis. A pilot study is not a hypothesis testing study. It is a phase in developing an approach to a larger-scale study. (Leon) In this analysis, a pilot study will be used to determine the minimum sample size needed to perform a larger-scale study on the effect of involving children in meal preparation. The power analysis will determine the required, or minimum sample size to complete an independent samples t-test with a certain power. Power is the probability of rejecting the null hypothesis appropriately. For example, if a study had a power of 0.7, and given that the study had statistically significant data, then one would make determine a statistically significant difference in the data with 70% accuracy. This means that the possibility of a type two error is 30%. To calculate the required sample size you need to determine the power, the type 1 error rate (confidence level) and the effect size. In this analysis, the industry standard power level of 0.80 will be used. This power level is conservative, but not overly conservation. The type one error rate, or the confidence level for this analysis will be .95, which is also the industry standard. The effect size is how large an effect of something is. This will be calculated using Cohens d. Cohens d can be computed using a built-in function in R denoted as *cohens.d*. The code for computing the Cohens d is *cohen.d(dat$Calories~ as.factor(dat$Trt))*. Cohen's d is calculated by taking the mean of one group and subtracting it from the mean of a second group and dividing that by the pooled standard deviation for the two groups. The formula is denoted below.

$$d = (M_1 - M_2)/s_{\{pooled\}}, \text{ where } s_{\{pooled\}} \text{ can be calculated by}$$
$$s_{\{pooled\}} = \frac{\sqrt{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}}{n_1 + n_2}$$

As a general rule of thumb, a Cohens d of 0.2 has a small effect, an effect of 0.5 has a medium effect and an effect of 0.8 has a large effect. After the effect size is determined, the power analysis can be computed using a built-in function in R. The command for a power analysis on a t-test is *pwr.t.test.* Using the Cohen's, a 95% confidence level and a power of 0.8, the power analysis can be calculated.

RESULTS

When the Cohen's d was calculated, the results generated an effect size of 0.8225. Using the general rule of the thumb, this means that the data has a large effect size. This means that there is a large effect of whether of children who prepared the meal with parents compared to children who did not help prepare the meal with their parents on caloric intake. The power analysis computed with an effect size=0.8225, a confidence level of .95, and a power of 0.8, resulted in a minimum sample size of n=24.20152. It is inappropriate to round down to 24 because the n-value is the minimum sample size required to have same power. At least 25 participants is required per group because the n-value is the sample size per group. In this study, there are two groups, so it would be appropriate to have a minimum of 25 children cook the lunch meal with their parents and a minimum of 25 children not help their parents prepare the lunch meal.

CONCLUSIONS

After using the data compiled by Klazine Van der Horst, Aurore Ferrage, and Andreas Rytz as a pilot study for conducting a power analysis for a study on determining if there is a difference in the caloric intake of children who help with meal preparation and children who do not help with meal preparation, a minimum sample size of 25 children per treatment group was determined. This means that when the study is being conducted, there must be a minimum of 25 children in each treatment group. So, at least 25 children in the study must help their parents prepare the lunch meal and at least 25 children in the study will not help their parents prepare the lunch meal. There must be a minimum of 50 randomly selected children in the study in total. After computing the power analysis of the pilot study, it would be appropriate to continue to the larger scale study and make conclusions with a power of 0.8.

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