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SAMPLE SIZE CALCULATION FOR ANALYSING THE IMPACT OF YOGIC INTERVENTION ON OCCUPATIONAL STRESS

Yoga

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ABSTRACT

Knowing minimum sample size for any experimental study is most critical. In absence of minimum sample size (MSS), the conclusion drawn for a statistical test is not valid, therefore for any experimental study, first we should find out how many minimum samples are required to get the correct conclusion. The sample size should be always calculated prior to starting any research study and sample size should not change during the study and data collection. In this paper, the minimum sample size table is reported for various possible combination of Power of the sample and the Effect size, which can be used by new researcher as a starting point. For most often used value of 95% confidence level with two-tailed normal distribution, power of 0.8, and moderate effect size of 0.5, minimum sample size was determined to be 31. Since it is always possible that few participants drop from the yogic session, considering 10% of drops from the participants, minimum Sample Size can be taken as 35.

KEYWORDS

Minimum Sample Size, type1 and type 2 error, alpha error, beta error, Effect size, Power

INTRODUCTION

Often, survey is done to find out an information. Survey is done on some selected people and based on survey; prediction is done on a whole population. This kind of prediction using sample data is done using Statistical test. To get a reliable and meaningful inference from a Statistical test, a most important criteria is to select a proper number of participants for the survey / study, called sample size. In statistics, we often rely on a sample - that is, a small subset of a larger set of data, to draw inferences about the larger set. The larger set is known as the population from which the sample is drawn. A sample is typically a small subset of the population.

Since collecting information from whole population is not feasible due to too long time, efforts, and money, therefore we collect the information from a sample, a small number of populations, which represents the population. Choosing number of samples, sample size, which is true representation of population is very critical so that right inference can be drawn about the population from the sample size.

A lot of work has been done on sample size estimation [1-4] yet a very few published papers report about the sample size calculation. Moher et al, [5] found in 1994 that only 32% null trials reported sample size calculations in published papers. Various studies have been done around the globe to prove the benefits of yoga on stress related diseases by using statistical test. The impact of yogic intervention which showed yoga is effective to help to reduce the occupational stress among health care workers, teachers/ school principals, army professionals, IT workers and Students but most of the paper do not show how is the sample size is chosen and if the chosen sample size is enough to deduce any meaningful results from the statistical test. In this paper we report how the minimum sample size is calculated before starting any research/ clinical study for a meaningful and reliable conclusion.

METHODOLOGY

The sample size is the total number of observations in the sample. The sample size depends mainly on three factors, accepted level of risk (α), power of the study (1-β) and Effect size (d). Alpha (type1) and beta error (type2) is defined during statistical hypothesis test. The sample size N can be calculated according to below formula.

$$N = 2(Z_{\alpha} + Z_{1-\beta})^2 / d^2$$

Where Z_{α}, and $Z_{1-\beta}$ are constants set by convention according to the accepted α and β error, taken from Z table, and d is effect size.

The power of a hypothesis test is the is the probability that the test correctly rejects the null hypothesis. If a test has low power, one might fail to detect an effect and mistakenly conclude that none exists. If a test has power that is too high, very small and possibly uninteresting effects might seem to be significant. No test is perfect; there is always the possibility that the results of a test will lead to reject the null hypothesis (H_0) when it is actually true (a type I error) or to fail to reject H_0 when it is actually false (a type II error). This is because in order to estimate population means, we have to take random samples, and random samples are just that, random. Thus, it is always possible that sample mean will be very different from the population mean. Type I error or α-error is failure to accept the null hypothesis when it is true. Usually, it is set at 5%. The sample size has to be increased if this value has to be lowered. The power of a study increases as the chances of committing a Type II error decrease. Power tells us how likely we detect a real effect. Usually, most studies accept a power of 80%. A Power value of 0.8 (80%) means that if same experiment is repeated many times (taking different random samples each time), about 80% of the time, we will end up correctly rejecting the null hypothesis The other 20 % of the time, sampling error will cause you to fail to reject H_0, even though it is false. Of course, you are not likely to go out and repeat the test more than one time, but it is good to know that the odds of getting a misleading sample are relatively small.

Effect size is calculated to know if an observed difference is not only statistically significant but also important or meaningful. Effect size is standardized. In other words, all effect sizes are calculated on a common scale - which allows you to compare the effectiveness of different programs on the same outcome. Effect size is an essential component when evaluating the strength of a statistical claim. In case of two groups namely pre and post data or control group and post data, effect size(d) is calculated by taking the difference between the two groups and dividing it by the standard deviation.

$$d = \frac{x1 - x2}{\sigma}$$

Where x1 and x2 are mean value of two groups and σ is pooled standard deviation of the two groups having standard deviation of σ1 and σ2. Pooled standard deviation σ is calculated as below

$$\sigma = \text{sqrt}[(\sigma_1^2 + \sigma_2^2)/2]$$

In case of a single group data, (x1-x2) represents the difference which we want to detect, also known as margin of error and σ will be standard deviation from single group data. One example of single group data is blood sugar reading for the diabetic patients where we like to detect the difference of 10mg/dL between measured values and target value of 100mg/dL.

To interpret the effect size, most researchers use this general guide developed by Cohen [6]:

- < 0.1 = trivial effect
- 0.1 - 0.3 = small effect
- 0.3 - 0.5 = moderate effect
- > 0.5 = large difference effect

Because effect size can only be calculated after data collection from program participants, one should use an estimate for the power analysis. Common practice is to use a value of 0.5 as an estimate for the power analysis. Estimate effect size of 0.5 indicates a moderate to large difference.

In below table minimum sample size is calculated considering various possible values of the power and the effect size. Minimum value of

sample size is calculated as 31 for the most accepted value of significance α (5%) and power (80%) with medium effect size of 0.5. The actual sample size can be calculated after collecting the sample

α	1-β	Zα	Z(1-β)	effect size		Sample Size
5%	80%	1.96	0.8416	0.01	very small	1570
5%	80%	1.96	0.8416	0.2	small	78
5%	**80%**	**1.96**	**0.8416**	**0.5**	**Medium**	**31**
5%	**80%**	**1.96**	**0.8416**	**0.8**	**Large**	**20**
5%	80%	1.96	0.8416	1.2	Very large	13
5%	80%	1.96	0.8416	2	Huge	8
5%	85%	1.96	1.0364	0.01	very small	1796
5%	85%	1.96	1.0364	0.2	small	90
5%	**85%**	**1.96**	**1.0364**	**0.5**	**Medium**	**36**
5%	**85%**	**1.96**	**1.0364**	**0.8**	**Large**	**22**
5%	85%	1.96	1.0364	1.2	Very large	15
5%	85%	1.96	1.0364	2	Huge	9
5%	90%	1.96	1.2816	0.01	very small	2102
5%	90%	1.96	1.2816	0.2	small	105
5%	**90%**	**1.96**	**1.2816**	**0.5**	**Medium**	**42**
5%	**90%**	**1.96**	**1.2816**	**0.8**	**Large**	**26**
5%	90%	1.96	1.2816	1.2	Very large	18
5%	90%	1.96	1.2816	2	Huge	11

Table 1: Minimum Sample Size table considering various possibility of effect size and power. Zα, and Z(1-β), is a constant taken from Z table

In our studies [7-8], the effect of yogic intervention on occupational stress among Indian Software professionals was studied. A sample of 60 IT professionals consisting of 30 males and 30 females from the age group of 30 to 55 years old, has been chosen from Techno Engineering firm in Ahmedabad Gujrat region. The research participants were not involved in any formal exercise program. There was no control group in this study and analysis was conducted based on pre and post measurements. According to sample size table (1), minimum 31 participants were needed when power = 0.8, alpha level = 0.05, two-tailed and moderate effect size of 0.5 is selected. The pre and post stress score from the participants were noted and then actual sample size is performed.

The pre and post mean value of stress score were 135.8 (x1) and 121.1 (x2), while standard deviation of pre and post stress score were 21.97 (σ1) and 17.84 (σ2), respectively.

Pooled standard deviation.

$$\sigma = \text{sqrt}[(\sigma_1^2 + \sigma_2^2)/2] = 20.01$$

Effect size (d):

$$d = \frac{x1-x2}{\sigma} = \frac{135.8-121.8}{20.01} = 0.736$$

In our study, calculated effect size is 0.736 compared to assumed moderate effect size of 0.5. If the effect size is higher, sample size will be lower. The sample size (N) based on effect size = 0.736, power = 0.8, alpha level = 0.05, two-tailed, can be calculated now using below formula.

$$N = 2(Z_\alpha + Z_{1-\beta})^2 / d^2 = 27.91 = 28$$

taking 5% of loss to follow-up into consideration, the minimum sample size was 30, which is in close agreement with the sample size table (1). Our sample size table can be used as a rough guideline for the new researchers to decide minimum sample size.

CONCLUSION

To sum up, determining the sample size is a crucial part of every investigation. According to the kind of the research topic and study design, it should be done at the time of study planning. When publishing their articles, authors are required to include a thorough explanation of the sample size calculation that was employed. A reduced sample size in many null experiments may make them underpowered to find the intended difference. The results of the underpowered studies should be regarded with caution, and the "absence of evidence" found there shouldn't be understood as "evidence of absence." For most often used value of 95% confidence level with two-tailed normal distribution, power of 0.8, and moderate effect size of 0.5, minimum sample size was 31.

REFERENCES

1. Prashant Kadam and Supriya Bhalerao, Sample size calculation", Int J Ayurveda Research. Jan-Mar; 1 2010, :55-57,
2. Gogate N. Principles of sample size calculation. Indian J Ophthalmol 2010; 58:517-8.
3. Whitley E, Ball J. Statistics review 4: Sample size calculations. Crit Care 2002; 6: 335
4. Biau DJ, Kerneis S, Porcher R. Statistics in brief: The importance of sample size in the planning and interpretation of medical research. Clin Orthop Relat Res 2008; 466: 2282
5. Moher D, Dulberg CS, Wells GA. Statistical power, sample size, and their reporting in randomized controlled trials. JAMA 1994; 272:122-4.
6. Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). New Jersey: Lawrence Erlbaum
7. Effect of Yoga on Occupational Stress, Pallavi Tiwari, Dr. Vivek Maheshwari, Dr. A P Vajpeyi, International Journal of Latest Technology in Engineering, Management & Applied Science, Volume VIII, Issue VI, June 2019, ISSN 2278-2540
8. Effect of Yogic Intervention on occupational Stress of Female employees working in Software Industries, Pallavi Tiwari, J K Savalia, A P Vajpeyi, International Journal of Yoga, Physiotherapy and Physical Education, Volume 6, Issue 6, 2021, Pages 7-10