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Homework 2

Problem 1

To investigate the effectiveness of an experimental drug to reduce blood pressure, a random sample of 20 patients were randomly assigned to receive either an experimental drug, or the current standard of care. Patients were administered the drug therapy for 6 months. After 6 months, the Systolic Blood Pressure (SBP) for each patient was measured and recorded. The following results were obtained.

DRUG A (Experimental)	DRUG B (Standard of Care)
158	188
163	183
173	198
178	178
168	193
186	185
191	190
196	195
181	200
176	180

Is there a significant difference in effectiveness between the two drugs?

Hypothesis

Given the random sample of 20 patients and the use of two different drugs distributed equally among half of the population at random, the effect of the test is to consider if the new experimental drug is equivalent (or has no improved effect) as the current standard of care (or placebo). From this we have the null and alternative hypothesis stated below.

H_0 – The two drug treatments are equivalent

H_1 – The two drug treatments are not equivalent and are statistically different (.05 or lower)

Assumptions

- The sample was taken as a simple random sample.
- The 2 different groups are independent and unrelated with no cross over between the two groups
- Our dependent variable of Systolic Blood Pressure (SBP) is ratio (or continuous)
- Our independent variable is the drug being administered to our independent objects (the subjects) and is categorical with 2 levels.

Given the above assumptions, an independent sample t-test would be the appropriate test to prove or disprove our hypothesis.

Results

Group Statistics

	Treatment	N	Mean	Std. Deviation	Std. Error Mean
SBP	Experimental	10	177.00	12.065	3.815
	Standard of Care	10	189.00	7.528	2.380

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SBP	Equal variances assumed	1.670	.213	-2.668	18	.016	-12.000	4.497	-21.448	-2.552
	Equal variances not assumed			-2.668	15.085	.017	-12.000	4.497	-21.580	-2.420

Inference

In comparing the results from the above, we can clearly see that there **IS** a difference between the experimental drug and the standard drug. Considering the highlighted values in red, we see that the SBP are lower with the new drug (178.00) versus the current standard of care drug (189.00). We therefore would reject the null hypothesis and accept the alternative hypothesis. Accepting the alternative hypothesis accepts our assumptions and recognizes that the two drugs are not equivalent and further accepts that the experimental drug is better. An assumption made was that equal variance existed so Levene's test does not apply. Since the significance test is below .05, we do have significant results and this again supports the fact that we reject the null hypothesis.

Problem 2

To see if vocabulary test performance improves on a second administration of a test, 10 examinees were administered different forms of the same test, on two consecutive days. The following results were obtained.

Examinee First	Administration	Second Administration
1	52	61
2	38	44
3	65	63
4	56	59
5	44	47
6	72	89
7	33	29
8	62	67
9	55	60
10	77	80

Compare the scores on the first and second administration of the test. Do the data present sufficient evidence (alpha =.05) to indicate that performance improves, on average, on the second administration? Compute and interpret the 95 percent confidence interval for the difference between the two means.

Hypothesis

The test above research seeks to compare examination results across 10 examinees. The two different test results are from the same test examinees on two separate attempts. The research seeks to explain if there is any improvement in the second exam results by the examinee for the same test administered. Given that the same examinee is considered across two administered tests, there is cross over between the two variables. Because of this we would use a paired sample test. The hypothesis being considered are

H_0 – The test results between two different administered testings will produce the same average scores with no performance improvement between the two.

H_1 – The test results between two different administered testings will produce different average scores with performance improving on the second administered test.

Assumptions

- 95 percent confidence interval used to show a difference between the two average tests scores
- alpha of .05 to indicate that performance improves on average on the second administration.

Results

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	First Result	55.40	10	14.238	4.502
	Second Result	59.9000	10	17.27844	5.46392

Paired Samples Correlations

	N	Correlation	Sig.

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	First Result & Second Result	10	.951	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	First Result - Second Result	-4.50000	5.77831	1.82726	-8.63356	-.36644	-2.463	9	.036

Inference

From the above results we can quickly see that we have a significance factor of .036 which is less than .05. We also see that the mean average Improved from the first result of 55.40 (the null hypothesis) to 59.90 (the alternative hypothesis). We therefore should reject the null hypothesis. In rejecting the null hypothesis we are saying that we accept our assumptions and accept the alternative hypothesis and realize that the second scores from the second administration of the test did improve on average with the 10 examinees considered.

Problem 3

The following data represent cholesterol levels for a randomly selected group of patients. As part of an alternative therapy experiment, the patients will receive an herbal dietary supplement. Before initiating the study, the researcher wants to be certain that the sample of patients is representative of the desired target population, of which the average cholesterol level is known to be 200. Using an alpha level of .05, do these patients appear to have been drawn from a population with a mean cholesterol level of 200?

177 206 221 195 232 222 196 205
231 213 189 195 222 204 209

Hypothesis

The hypothesis being considered are considers cholesterol tests of 15 individuals that were randomly selected. Given the random selection of the objects and considering the variables are nominal, it is appropriate to apply a one-sample t-test.

H_0 – The mean average of the objects Cholesteral results is equal to 200.

H_1 – The mean average of the objects Cholesteral results is anything other than 200.

Assumptions

- The objects are a randomly selected group of patients where the number (n) is 15.
- Confidence level is 95% where alpha of .05 will be used to show a difference between the null and alternative hypothesis
- Average cholesterol (mean) is 200

Results

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Cholesterol Result	15	**207.80**	15.866	4.097

One-Sample Test

	Test Value = 200					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Cholesterol Result	1.904	14	**.078**	7.800	-.99	16.59

Inference

We can see from above that the mean or average of cholesterol is 207.80 which is not equal to 200 stated in our null hypothesis. For the test value 200 was considered. The Mean Difference is 7.8. However, we see from the 2-tailed test that there is a significance factor of .078 which is

higher than .05 so we accept the null hypothesis and given all the assumptions we accept that the populations mean cholesterol score does appear to be equal on average to 200.

Problem 4

Psychologists in a private practice developed a new type of therapy to help treat clients with depression. To investigate this new therapy, a sample of depressed clients who were treated with the new therapy were compared to a sample of depressed clients who were not treated with the new therapy. The psychologist recorded their scores on a depression inventory. The following results were obtained.

New Therapy	Traditional Therapy
52	61
38	44
65	63
56	59
44	47
72	89

Is there sufficient evidence to suggest the scores for patients receiving the new therapy are different than the scores for patients receiving the traditional therapy? Use the .01 level of significance and interpret the 99% confidence interval for the mean difference of the two groups.

Hypothesis

The hypothesis being considered are considers cholesterol tests of 15 individuals that were randomly selected. Given the random selection of the objects and considering the variables are nominal, it is appropriate to apply a one-sample t-test.

H_0 – The results of drug therapy given to patients suffering from depression yielded no difference between patients that did not receive the new drug therapy.

H_1 – The results of drug therapy given to patients improved results in patients suffering from depression compared to those patients that did not receive the patient

Assumptions

- No mention of random sample given

- The patients that did not receive the new drug therapy received were given a traditional therapy.
- 99% confidence level or alpha of .01.

Results

Group Statistics

	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Evaluation Score	New	6	**54.50**	12.708	5.188
	Standard	6	60.50	15.972	6.520

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									99% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Evaluation Score	Equal variances assumed	.016	.902	-.720	10	**.488**	-6.000	8.333	-32.408	20.408
	Equal variances not assumed			-.720	9.519	.489	-6.000	8.333	-32.710	20.710

Inference

In evaluating the above results, we can infer to accept the null hypothesis and agree that the new drug treatment had no improved effects on the depression scores to the population observed. We can see that the average score decreased from 60.50 to 54.50. The significance factor is 4.8 % and higher than 1% and supports the decision to reject.

It is interesting to note that if were decrease the confidence factor to 95% with a alpha of .05, we would have rejected the null hypothesis as the significance factor would have been 4.88% and less than 5%. The higher confidence level affected our inference in this case. See the below example with a 95% confidence level considered.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Evaluation Score	Equal variances assumed	.016	.902	-.720	10	.488	-6.000	8.333	-24.566	12.566
	Equal variances not assumed			-.720	9.519	.489	-6.000	8.333	-24.694	12.694