

Statistical Consulting Project: Stroke Rehabilitation Dataset

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BACKGROUND

The data from Cropper's 1977 study and was conducted at the University of Queensland Department of Occupational Therapy. The purpose of the study was to understand the effectiveness of three rehabilitation programs for stroke patients.

METHODS

In this study, there were eight stroke patients in each of the three groups (E, F, G) that were evaluated. Patients were given a Barthel Index Score every week for 8 weeks, to measure functional ability. Due to small sample size (n=24), there were many restrictions in conducting statistical tests. Further information on methods is unknown because we did not have access to the research article.

VARIABLES

Group: This variable denotes which rehabilitation group the stroke patients were put into. Group E was given an experimental program developed by the investigator. Group F utilized the pre-existing stroke rehabilitation program.

Side: The side of the brain effected by the stroke.

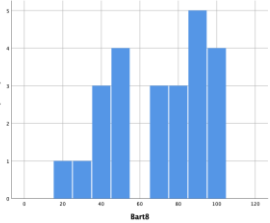
Sex: The sex of the study participant.

Age: The age of the study participant in years.

Barthel Index Score (BIS): This is the measurement of how well patients were able to perform activities of daily living. This is based on an ordinal scale of 0-100 where 0 is the lowest functional ability and 100 is the ability to perform activities of daily living perfectly.

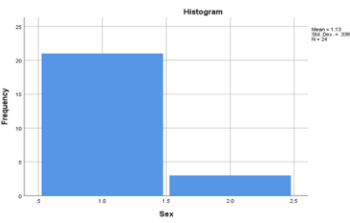
INFORMATION ABOUT THE DATASET

Barthel Index Score



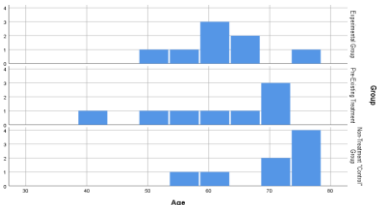
The BIS of the patients at week 8 of the program ranged from 20 to 100 (\bar{x} = 68.13, n = 24). The histogram is not normally distributed.

Sex



The distribution of the sex of the patients is severely right-skewed (skewness = 2.422), with most participants being male (males = 21, females = 3, n = 24).

Age within Groups



The distribution of age overall ranges from 41 to 77 years. The distribution of age in group E is normal, while the distribution of age in groups F and G is slightly skewed to the left.

MULTIPLE LINEAR REGRESSION

RESEARCH QUESTION: Do relationship exist between Barthel Index Score at week 8 and T treatment Group, side of brain affected and age?

EQUATIONS:

$$BIS = \beta_0 + \beta_1 (\text{Group_E}) + \beta_2 (\text{Group_F}) + \beta_3 (\text{Side}) + \beta_4 (\text{Age})$$

$$BIS_E = [\beta_0 + \beta_1 (\text{Group_E})] + \beta_3 (\text{Side}) + \beta_4 (\text{Age})$$

$$BIS_F = [\beta_0 + \beta_1 (\text{Group_F})] + \beta_3 (\text{Side}) + \beta_4 (\text{Age})$$

$$BIS_G = \beta_0 + \beta_3 (\text{Side}) + \beta_4 (\text{Age})$$

ASSUMPTIONS: Linearity is hard to assess based on scatterplot, we must assume that independence is met, normality is met, equality of variance is met, no multicollinearity.

RESULT: This model with age, experimental group, and side of the brain affected as predictors works well in explaining week 8 Barthel Index Score. Not all the predictors are individually significant, we can still use this model successfully to predict the week 8 Barthel Index Score of patients recovering from stroke. ($R^2 = 0.554$)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	97.066	40.068		2.423	.026
	Age	-.715	.527	-.275	-1.358	.190
	GroupE	18.835	10.163	.366	1.853	.079
	GroupF	-1.841	9.924	-.036	-.185	.855
	SideR	21.120	8.958	.434	2.358	.029

WILCOXON MATCHED PAIRS TEST

RESEARCH QUESTION: Subjects' mean Barthel Index Score (BIS) at week 8 of treatment is greater than the subjects' mean BIS at week 1.

HYPOTHESES: $D = BIS_{\text{Week 1}} - BIS_{\text{Week 8}}$ $H_0: \mu_D = 0$, $H_A: \mu_D \leq 0$

ASSUMPTIONS: Because our data is not normally distributed and we have small sample sizes, it is appropriate to use this non-parametric test. Our assumptions are met as the sample is random, Barthel Index Score is continuous, the populations are symmetrically distributed about their respective means, and BIS is at least interval.

RESULT: We found evidence that the difference in means between Barthel Index Score week 1 and week 8 is less than 0. This means that week 8 Barthel Index Score mean is significantly greater than the mean of week 1, suggesting that subjects had better functional ability at the end of the stroke treatment program ($Z = -4.206$, $p < 0.001$).

Ranks				Test Statistics ^a	
		N	Mean Rank	Bar1 - Bar8	
Bar1 - Bar8	Negative Ranks	23 ^a	12.00	Z	-4.206 ^b
	Positive Ranks	0 ^b	.00		
	Ties	1 ^c			
	Total	24			
				Asymp. Sig. (2-tailed)	.000

DISCUSSION

After analyzing the dataset we found that Group E and F had a higher BIS. Due to the small sample size, we were not able to run some statistical tests we wanted to. A larger sample size would allow us to draw more conclusions about our dataset.

MANTEL HAENSZEL CHI SQUARE

RESEARCH QUESTION: We are interested in the association between the side of the brain affected during stroke and Barthel Index Score (BIS) at week 8 after controlling for age.

HYPOTHESES: H_0 : After controlling for age, there is no association between side of the brain affected (L, R) and week 8 Barthel Index score ($\leq 50, > 50$). H_A : After controlling for age, there is an association between side of the brain affected (L, R) and week 8 Barthel Index score ($\leq 50, > 50$).

ASSUMPTIONS: We assume that the observations in this dataset are independent and the data, regardless of strata, were obtained in the same way.

RESULT: We did not find evidence of an association between side of the brain affected (L, R) and week 8 Barthel Index score ($> 50, \leq 50$) when age is controlled for, chi-square = 1.008, $df = 1$, $p = 0.315$.

FACTORIAL ANOVA

RESEARCH QUESTION: Do side of brain affected, and treatment group have interactive effects or individual effects on week 8 Barthel Index Score?

HYPOTHESES:

Treatment:

$H_0: \mu_E = \mu_F = \mu_G$ (All the treatment group have the same average Barthel index score)

H_A : At least one μ is different (At least one of the treatment groups have a different average Barthel index score)

Side:

$H_0: \mu_R = \mu_L$ (Right and left-brain groups have the same average Barthel Index score)

$H_A: \mu_R \neq \mu_L$ (Right and left-brain groups do not have the same average Barthel Index score)

Interaction:

H_0 : There is no interaction between Treatment and Side in terms of Barthel index score.

H_A : There is an interaction between Treatment and Side in terms of Barthel index score.

ASSUMPTIONS: We assume the populations are normally distributed with equal variances.

RESULTS: We failed to find evidence of an interaction between treatment group and side of the brain affected on average week 8 Barthel Index Score ($F(2, 18) = 1.520$; $p = 0.245$). We did find evidence that at least one treatment group had a different average Barthel Index Score ($F(2, 18) = 4.569$, $p = 0.025$). Specifically, patients in the model-based rehabilitation program (Group E) have higher average functional ability (Barthel Index Score) than patients in the control group (Group G) who did not receive any rehabilitation program ($p = 0.058$). Finally, we found evidence that the left side brain groups have lower average functional ability (Barthel Index Score) than the right-side brain groups ($F(1, 18) = 13.936$, $p = 0.002$).

