THE UNIVERSITY of EDINBURGH
Edinburgh Medical School

Biomedical Sciences

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General Neuroscience

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Data Analysis ICA

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898

Question 1

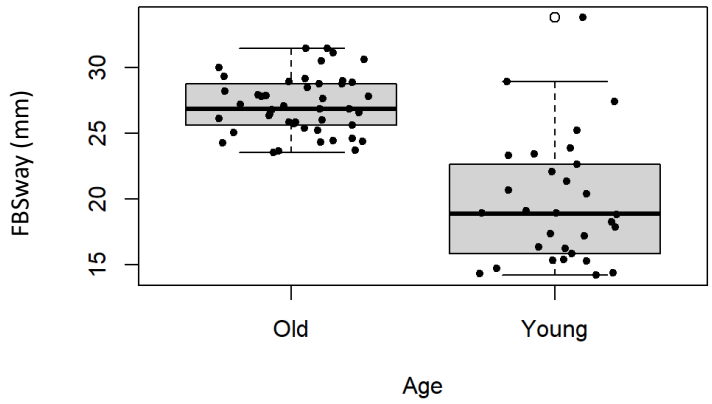

Figure 1 *Showing A scatter plot showing the two age groups, Young (n= 30) and Old (n=35) measurement of balance (FBSway (mm)) . The boxplot indicates the median values with a thick horizontal line and quartile values with thin horizontal lines.*

The aim of the study was to test if the ability to balance differs between young and elderly people. Since balancing is a task that requires concentration, the subjects were asked to press a button as fast as possible after hearing an unpredictable noise whilst balancing on a platform and the outputs measured (FBSway (mm)). The data was plotted (Figure 1) and a visual examination of the boxplot shows non-normality in the Young group, confirmed by carrying out a Shapiro-Wilk test (W = 0.90559, p-value = 0.01154).

The Wilcoxon test was used and the null hypothesis for the data is that the distribution of the two groups do not differ (or they differ by a distance μ which is 0 by default). The assumptions for a Wilcoxon test are that the dependant variable is measured on a continuous level, the independent variable consists of two categorical related groups or matched pairs and that the underlying distributions of the two samples are the same or sufficiently similar. The distribution was checked by visual inspection of a histogram and the assumptions were met so the test deemed appropriate. The Wilcoxon test provided strong evidence (p= 2.839e-11) that we can reject the null hypothesis therefore showing that the ability to balance differs between the young (mean +/- SE = 19.72+/- 0.8734765) and old group (mean +/- SE = 27.14126 +/- 0.369875) with a 95% CI of 0.4010117-0.1041144. The older group showed a higher level of movement during the tests than the young group.

Word Count: 250

Question 2

A

Occurrence of Different APOE alleles

	Genotype					
Group	APOE2/2	APOE2/3	APOE2/4	APOE3/3	APOE3/4	APOE4/4
Alzheimer	1	3	1	15	26	6
Control	2	5	3	26	11	1

B

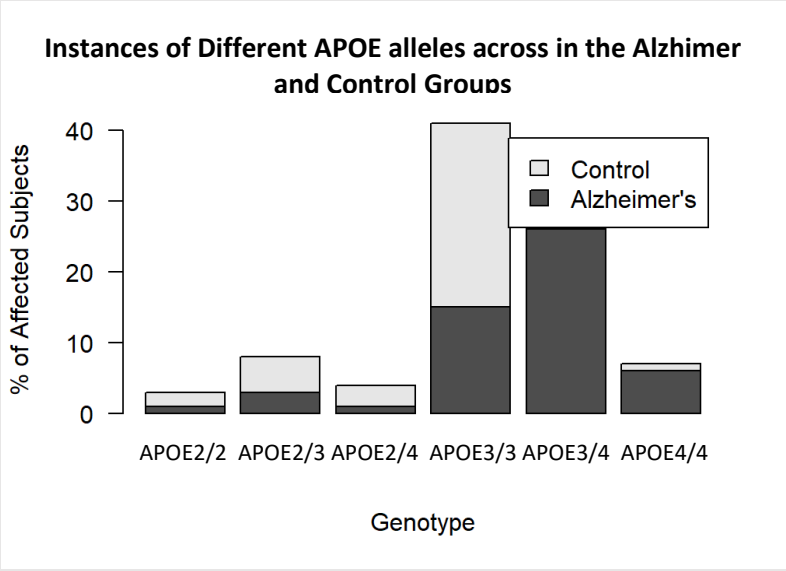

Figure 2: showing (***A***) A table with the number of subjects in the Alzheimer's (n=52) and Control (n=48) groups with each of the APOE alleles that was used to conduct the Fishers Exact test and (***B***) a bar plot showing the number of affected subjects as a percentage for each allele

The aim of the study is to test if the APOE genotype is associated with an individual's risk of developing Alzheimer's disease, as it is possible that some genes my increase Alzheimer's disease risk. The genotype of subjects with Alzheimer's disease and healthy age matched controls were analysed and the presences of three alleles of the APOE gene; APOE2, APOE3 and APOE4 were assessed (***Figure 2(A)***). The hypotheses to be tested are as follows;

H_0 = APOE genotype does not affect an individual chance of developing Alzheimer's disease

H_A = APOE genotype has an effect on an individuals chance of developing Alzheimer's disease

A Fishers Exact test was carried out in order to analyse the data. The assumptions of the test are as that the subjects must be randomly selected and independent from one another, and the two groups of the categorical variable have to be mutually exclusive from one another. The assumptions of the test were met and the test deemed appropriate. The results of the test showed strong evidence that APOE genotype is associated with an Alzheimer's disease diagnosis ($p = 0.00722$), hence we can refute the null hypothesis and accept the alternative hypothesis.

Word Count: 196

Question 3

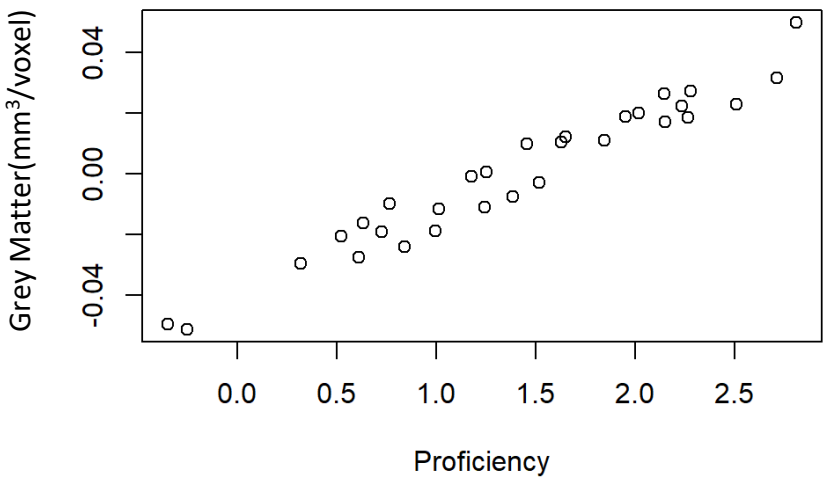

***Figure 3**: A scatterplot (n= 30) showing the correlation between language proficiency score (arbitrary unit) and Grey Matter (mm^3/voxel)*

The aim of the study was to test to see if proficiency at a second language is associated with brain structure. Native Italian speakers who had English as a second language were given a proficiency in English score based on their reading, writing and speech and the subjects had their grey-matter density in the inferior parietal cortex measured using neuroimaging. A correlation test was carried out to analyse the data and the assumptions for the test are as follows;

H_0 = That proficiency at English as a second language is not associated with Grey Matter volume

H_A=The proficiency in English as a second language is associated with Grey Matter volume

The assumptions for this test are that the samples are random, independent and monotonically related, there are no outliers and that the data are normally distributed for each variable. Furthermore the data must show homoscedasticity. The data was plotted in a scatterplot (*Figure 3*) and it could be seen that the data is monotonically related, there are no outliers and shows homoscedasticity. Plotting histograms of the data for each group allowed for a visual inspection to confirm that the data was normally distributed for each variable so the test was deemed appropriate. The analysis showed that there was a positive correlation between second language proficiency and Grey Matter volume as the correlation coefficient was 0.9733582 ($p<0.001$, 95% CI 0.9441886-0.9873814), meaning there is strong evidence the null hypothesis can be rejected.

Word count:240

Question 4

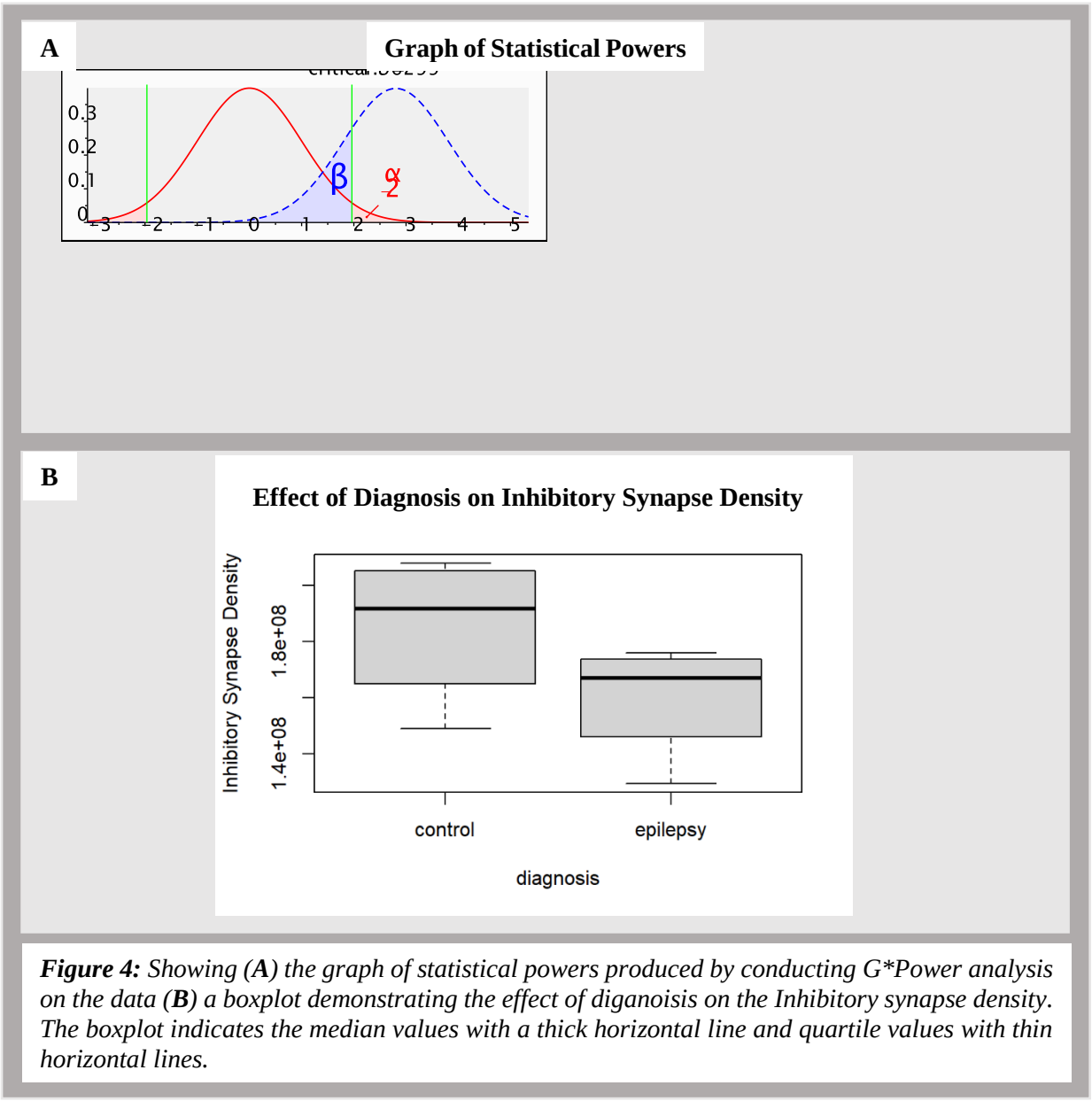

Figure 4: *Showing (**A**) the graph of statistical powers produced by conducting G*Power analysis on the data (**B**) a boxplot demonstrating the effect of diganoisis on the Inhibitory synapse density. The boxplot indicates the median values with a thick horizontal line and quartile values with thin horizontal lines.*

The hypothesis for this study is "Do people with epilepsy have altered density of inhibitory synapses in the temporal neocortex?". A high resolution synaptome mapping technique was used to take samples from 4 people with epilepsy and 4 controls. The aim of the analysis is to determine how many subjects would be needed per group to detect a difference in inhibitory synapses between groups and t-test difference between two means priori power test was conducted using G*Power 3.1. The assumptions of the t-test are as follows, that the data is independent and randomly selected, the sample is normally distributed within each group and has equal variances. A Shapiro-Wilk test confirmed normality in the control (W = 0.90554, p-value = 0.45910) and epilepsy (W = 0.8434, p-value = 0.2055) groups and equal variance can be seen by a visual examination of ***Figure 4(B).***

The assumptions were met and the test deemed appropriate, a G*Power analysis with a power of 0.8, significance level of 0.05, and effect size informed by knowledge of the system, which suggests that a change in density due to epilepsy should be at least 20% to be biologically interesting. The analysis showed that for each group the sample size would need to be 394 per group under these parameters.

Word Count = 212