Didgeridoos & Sleep Apnea

HARLEY CLIFTON

An Alternative Treatment for Sleep Apnea

Determine whether **Didgeridoo** lessons
can improve breath control—

alleviating symptoms of **obstructive sleep apnea**
and improving sleep quality—

and subsequently **decrease daytime sleepiness**,
as assessed by the *Epworth Sleepiness Scale*.

Terminology

Didgeridoo

A wind instrument.

It is played with vibrating lips to produce a continuous drone while using a special breathing technique called circular breathing.

Sleep Apnea

A disorder in which breathing repeatedly stops and starts.

Your brain tries to protect you by waking you up enough to breathe, but this prevents restful, healthy sleep.

Epworth Score

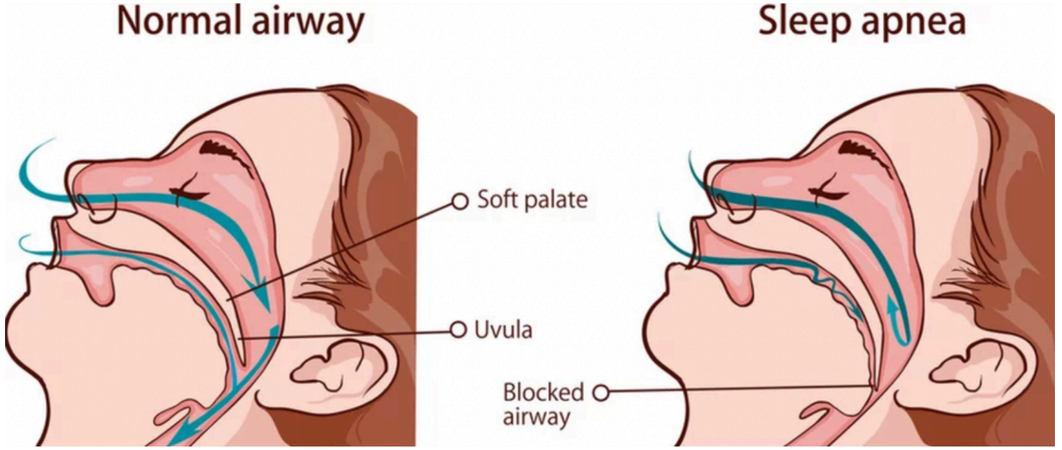
Epworth sleepiness scale results range from 0 to 24.

0-10: average (normal) daytime sleepiness.

11-24: indicates excessive (abnormal) daytime sleepiness.

Didgeridoo

Sleep Apnea



Epworth Score

Epworth Sleepiness Scale

Scale
0= No chance of dozing 1= Slight chance of dozing 2= Moderate chance of dozing 3= High chance of dozing

How often do you doze?

Sitting and reading	0	1	2	3
Watching television	0	1	2	3
Sitting in a public inactive place (theater or meeting)	0	1	2	3
Riding in a car for one hour without a break (as a passenger)	0	1	2	3
Lying down in the afternoon when circumstances permit	0	1	2	3
Sitting and talking to someone	0	1	2	3
Sitting quietly after lunch, without alcohol	0	1	2	3
Stopped in traffic for a few minutes	0	1	2	3

Total _____

The Study

DESIGN

Randomized controlled trial

- patients were stratified for disease severity
- then randomly assigned to treatment group

PARTICIPANTS

25 patients

- ages > 18 years old
- apnoea-hypopnoea index between 15 & 30
- self-reported snoring

INTERVENTION

4 months

- Private didgeridoo lessons
- daily practice at home
- standardised instruments

OUTCOME MEASUREMENT

Daytime Sleepiness

- measured via the Epworth Sleepiness Scale

Variables

Subject

Indicator Variable
- indicated which subject (1-25) the observation is for

Group

Binary Variable
- either ‘C’ for the control group or ‘D’ for Didgeridoo Intervention group

---

Baseline_Followup

Categorical Variable
- indicates whether the measurement is the baseline or follow-up

---

Epworth

Daytime Sleepiness
- measured via the Epworth Sleepiness Scale
- the Epworth scale is from 0 (no daytime sleepiness) to 24

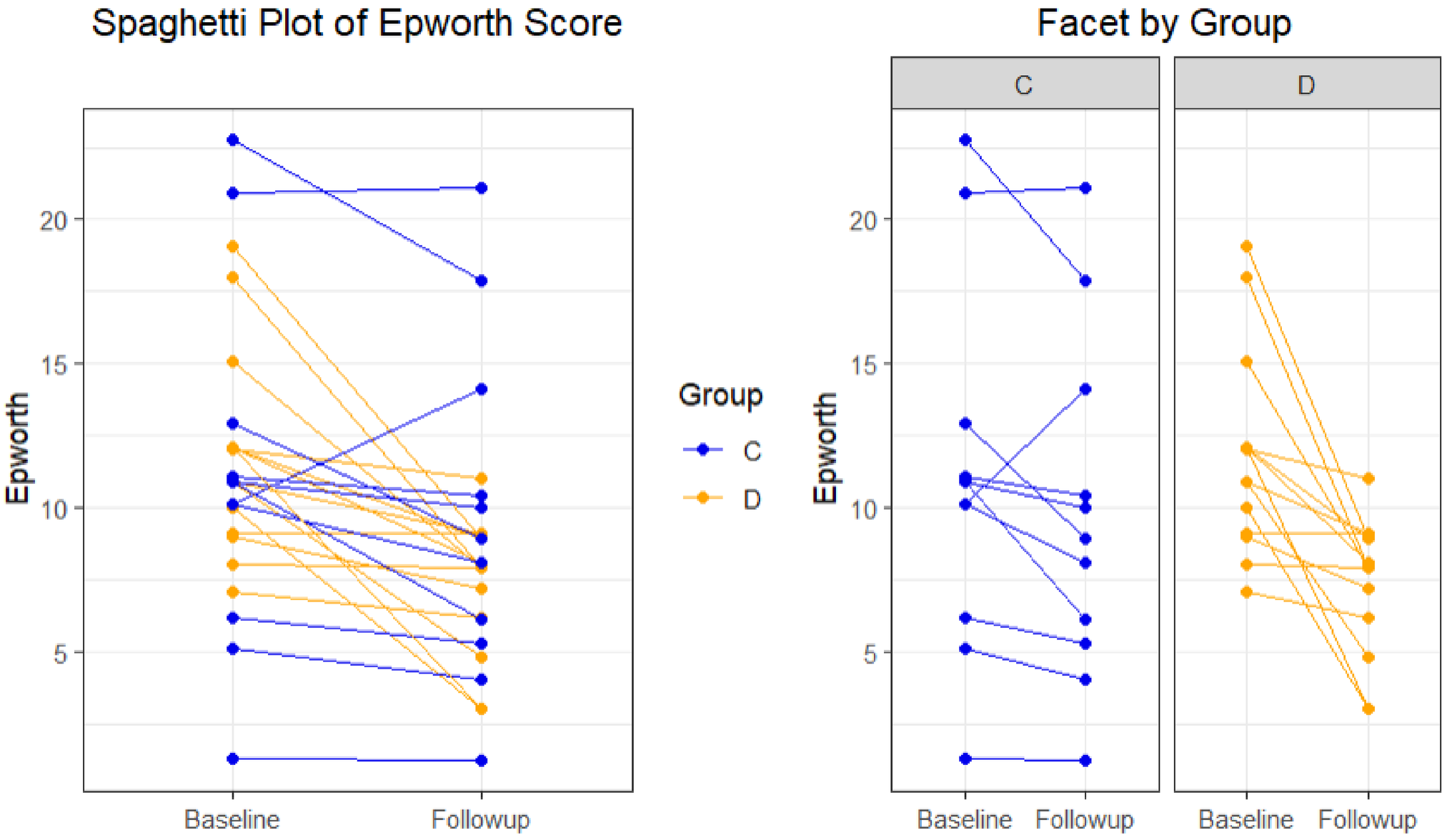
Dataset

Subject	Group	Baseline_Followup	Epworth
1	D	Baseline	19.1
1	D	Followup	8.9
2	D	Baseline	18.0
2	D	Followup	7.9
…	…	…	…
23	C	Baseline	5.1
23	C	Followup	4.0
24	C	Baseline	1.3
24	C	Followup	1.2
…	…	…	…

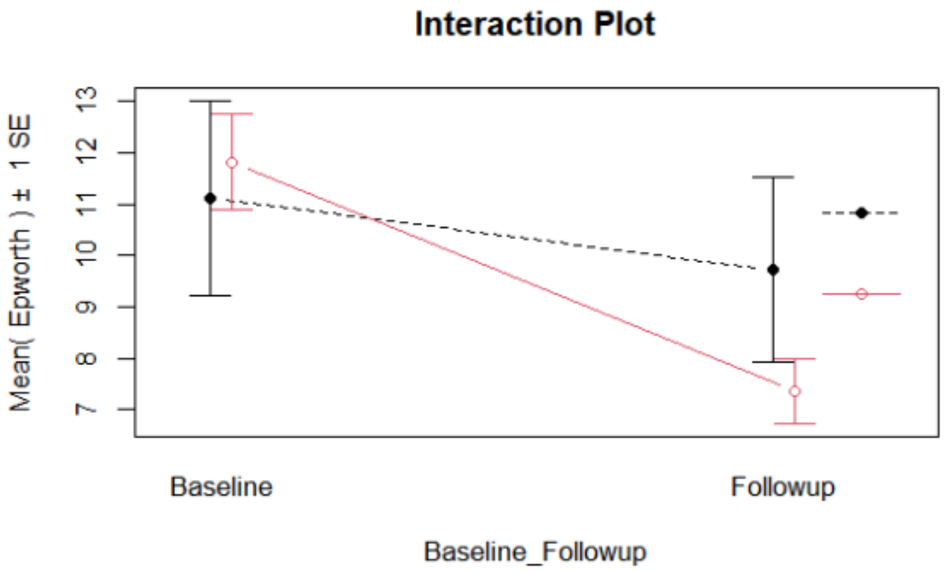
Note on Groups:

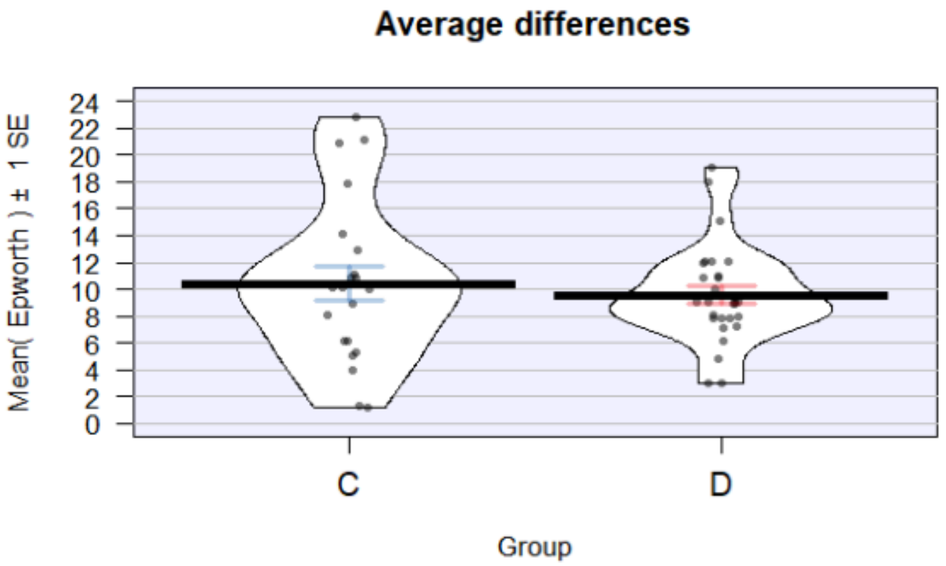
- 11 subjects in the Control (C) Group
- 14 subjects in the Didgeridoo (D) Intervention Group

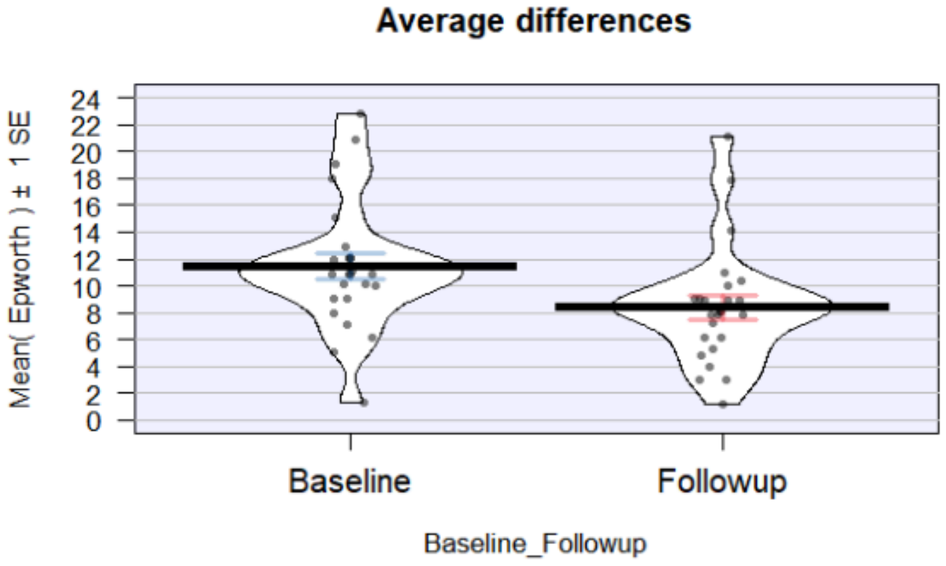
Exploratory Data Analysis

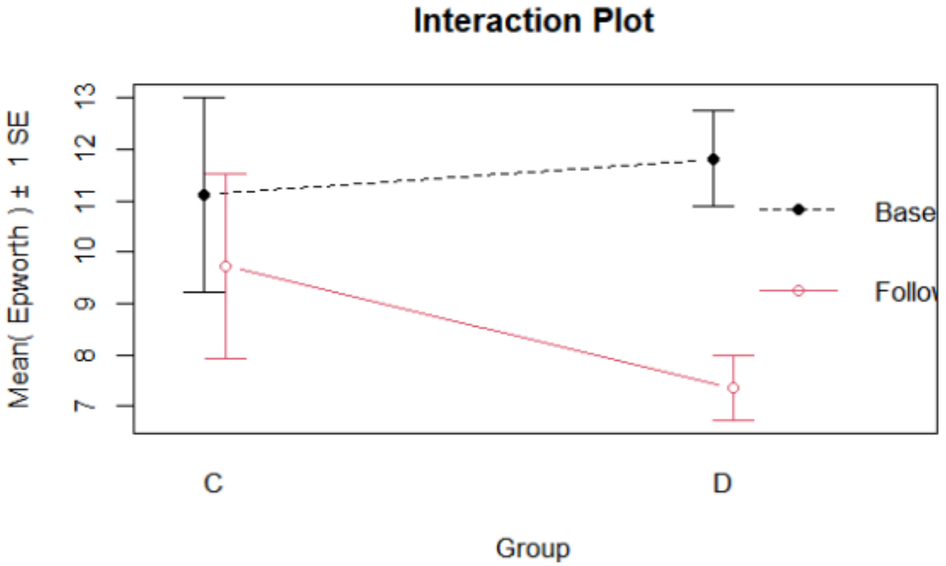


Exploring the Potential for Interactions









Modeling the Data

*Epworth ~ Baseline_Followup * Group + Subject*

A model was fit that controlled for Subject and included the interaction between Baseline_Followup and Group

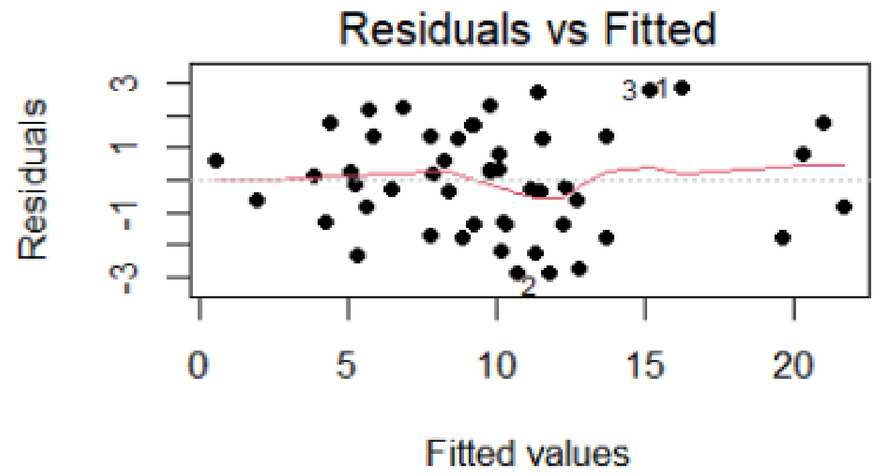
Two-Way Anova

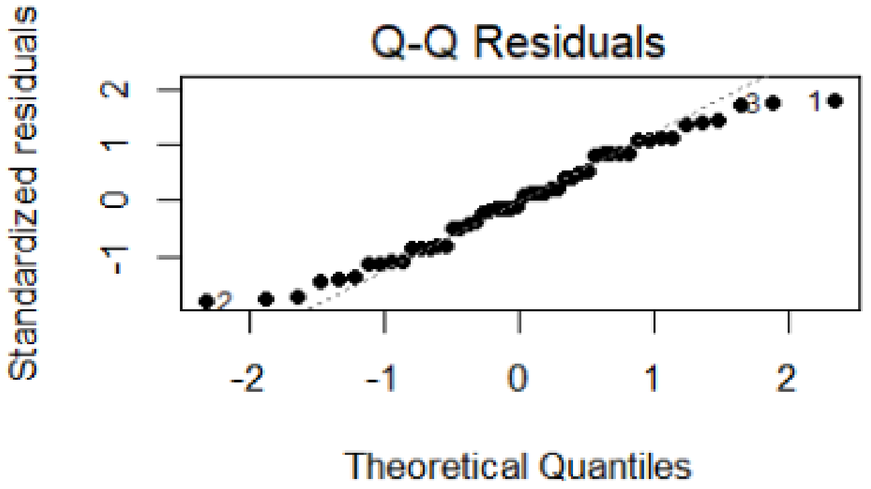
A Two-Way Anova was run on the model:

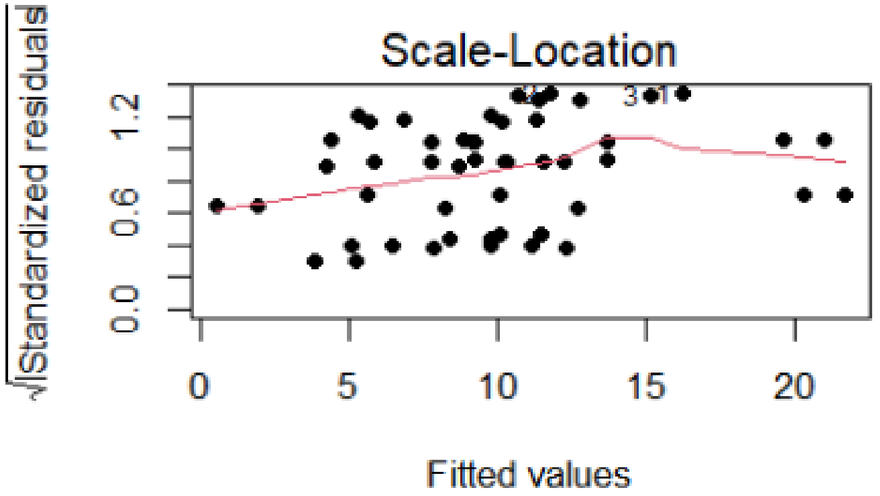
```
Anova Table (Type II tests)

Response: Epworth
                         Sum Sq Df F value    Pr(>F)
Baseline_Followup        120.75  1 22.4101 9.035e-05
Group                             0
Subject                  858.62 23  6.9286 8.677e-06
Baseline_Followup:Group   29.26  1  5.4315   0.02891
Residuals                123.92 23
```

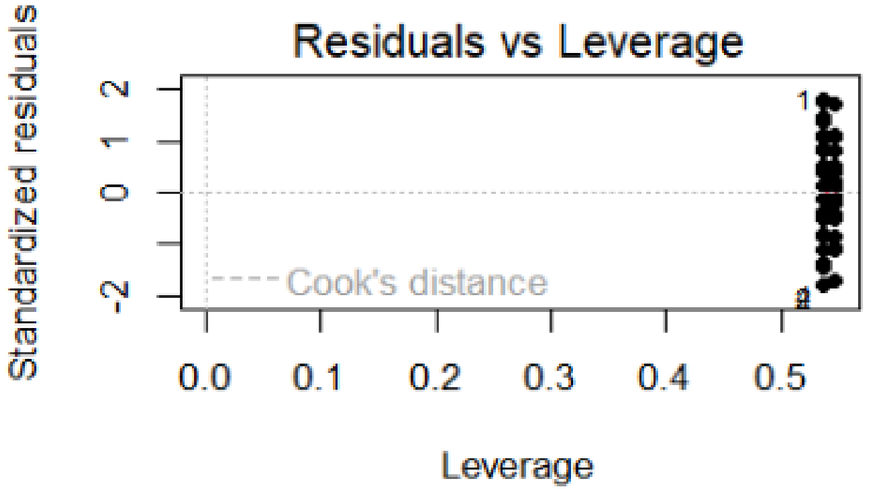
This confirmed that the interaction was necessary in the model.

Model Diagnostics

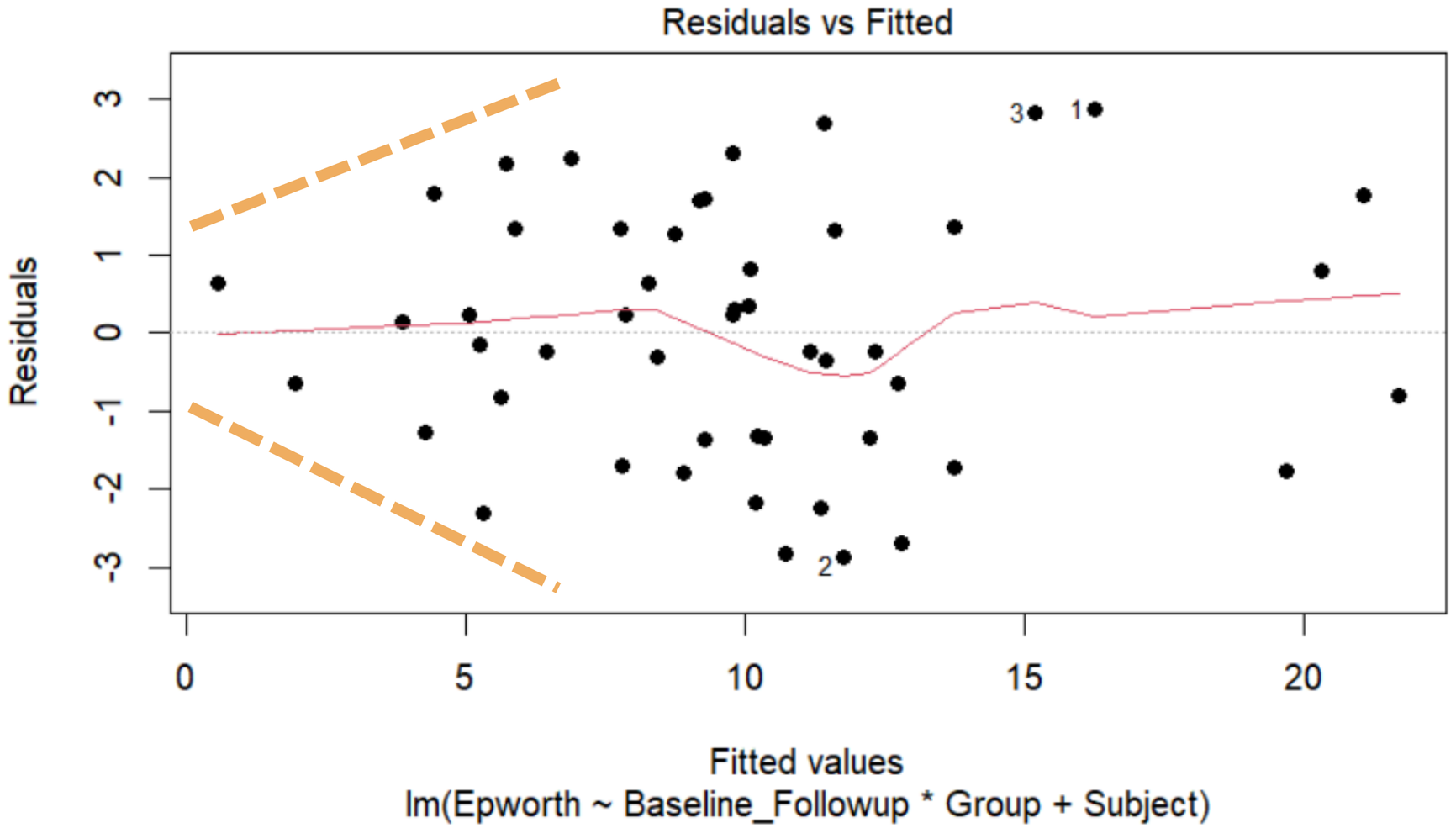








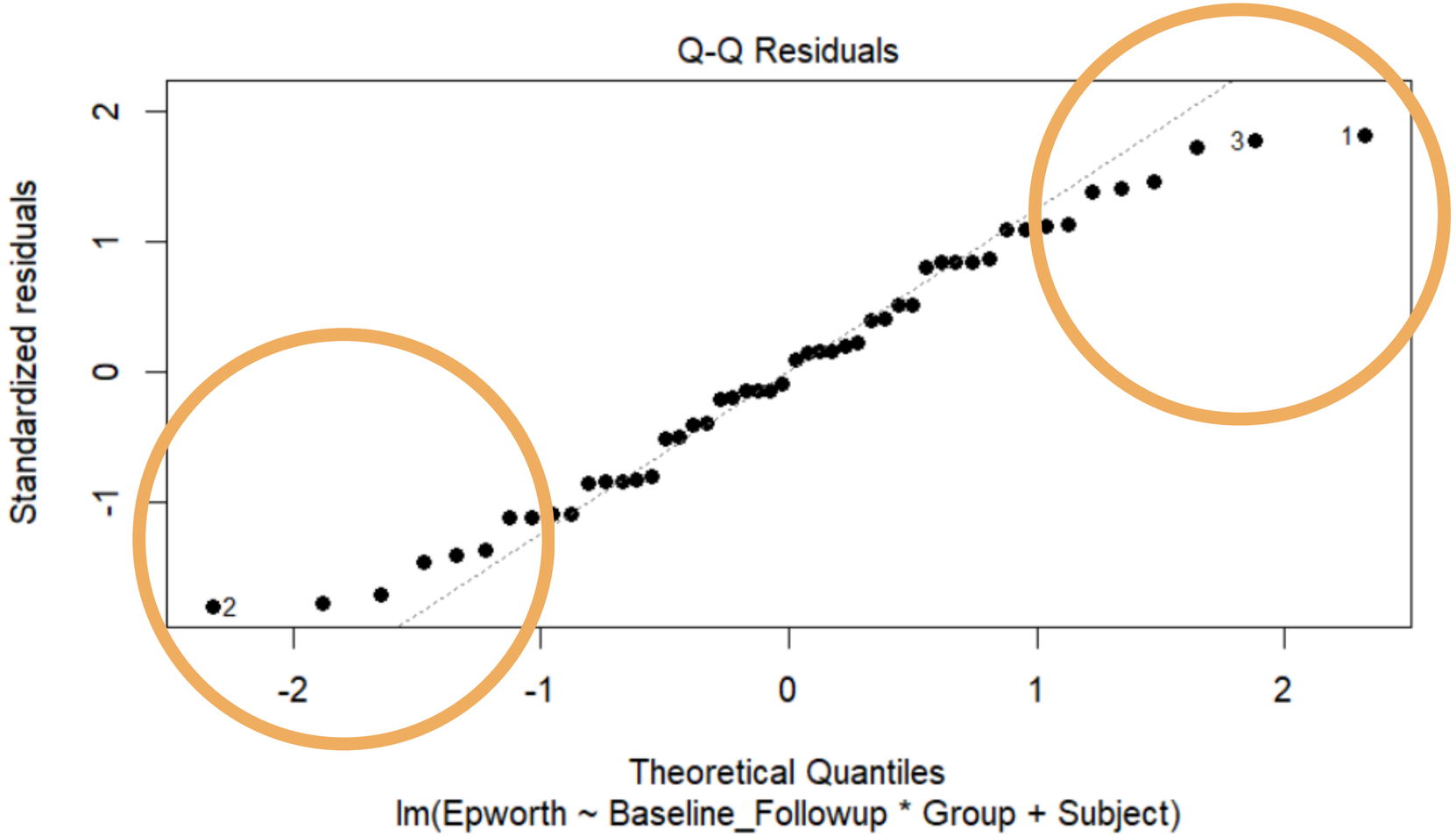
Model Diagnostics: Heteroskedasticity



Slight Fanning Pattern

- **Some Evidence Against Equal Variance Assumption**

Model Diagnostics: Normality of Residuals



Light-Tailed Pattern => Good!

Contrasts

Allows us to test whether: $\mu_{Followup.D} - \mu_{Baseline.D} = \mu_{Followup.C} - \mu_{Baseline.C}$

Does the average change in baseline to follow-up Epworth score differ between the control and didgeridoo intervention group?

```
 contrast estimate   SE df t.ratio p.value
 gamma2       -3.08 1.32 23  -2.331  0.0289

Results are averaged over the levels of: Subject
 contrast estimate   SE df lower.CL upper.CL
 gamma2       -3.08 1.32 23    -5.82   -0.346
```

Contrast Results

Evidence:

There is a difference in average improvement in sleepiness associated with the subjects' treatment conditions.

Size:

The mean Epworth Score is estimated to be -3.08 points different between the Control and Didgeridoo treatment groups (Control - Didgeridoo) after controlling for subject-to-subject variation (95% CI: -5.82 to -0.035).

In other words, subjects in the didgeridoo group had an average drop in daytime sleepiness of 3.08 Epworth points MORE than subjects in the control group.

Conclusion

Regular didgeridoo playing is an effective treatment alternative for patients with moderate obstructive sleep apnoea syndrome.

References

Lenth R (2024). emmeans: Estimated Marginal Means, aka Least-Squares Means. R package version 1.10.4.900001, https://rvlenth.github.io/emmeans/.

Puhan, M. A., Suarez, A., Lo Cascio, C., Zahn, A., Heitz, M., & Braendli, O. (2006). Didgeridoo playing as alternative treatment for obstructive sleep apnoea syndrome: randomised controlled trial. BMJ (Clinical research ed.), 332(7536), 266–270. https://doi.org/10.1136/bmj.38705.470590.55

RStudio Team (2020). RStudio: Integrated Development for R. RStudio, PBC, Boston, MA URL http://www.rstudio.com/.

Wickham H (2016). ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag New York. ISBN 978-3-319-24277-4, https://ggplot2.tidyverse.org.