Low-frequency sound and nocebo

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3/10/2021

# Load data

# Clean df

# Rename follow-up symptom rating scales  
df <- df %>%   
 rename(tingling\_rating = Q23\_1,   
 pressure\_rating = Q23\_2,   
 anxious\_rating = Q23\_3,   
 tired\_rating = Q23\_4,   
 dizziness\_rating = Q23\_5,   
 salivate\_rating = Q23\_6,   
 headache\_rating = Q23\_7,   
 throat\_rating = Q23\_8,   
 nausea\_rating = Q23\_9,  
 gender = Q26,  
 age = Q27)  
  
names(df)

## [1] "StartDate" "EndDate" "Status"   
## [4] "IPAddress" "Progress" "Duration\_\_in\_seconds\_"   
## [7] "Finished" "RecordedDate" "ResponseId"   
## [10] "RecipientLastName" "RecipientFirstName" "RecipientEmail"   
## [13] "ExternalReference" "LocationLatitude" "LocationLongitude"   
## [16] "DistributionChannel" "UserLanguage" "Q15"   
## [19] "Q3" "Q17" "Q1"   
## [22] "Q32" "Q39\_First\_Click" "Q39\_Last\_Click"   
## [25] "Q39\_Page\_Submit" "Q39\_Click\_Count" "Q30\_1"   
## [28] "Q30\_2" "Q30\_3" "Q30\_4"   
## [31] "Q30\_5" "Q30\_6" "Q30\_7"   
## [34] "Q30\_8" "Q30\_9" "Q30\_DO\_1"   
## [37] "Q30\_DO\_2" "Q30\_DO\_3" "Q30\_DO\_4"   
## [40] "Q30\_DO\_5" "Q30\_DO\_6" "Q30\_DO\_7"   
## [43] "Q30\_DO\_8" "Q30\_DO\_9" "Q38\_First\_Click"   
## [46] "Q38\_Last\_Click" "Q38\_Page\_Submit" "Q38\_Click\_Count"   
## [49] "Q40\_First\_Click" "Q40\_Last\_Click" "Q40\_Page\_Submit"   
## [52] "Q40\_Click\_Count" "Q29" "Q20\_First\_Click"   
## [55] "Q20\_Last\_Click" "Q20\_Page\_Submit" "Q20\_Click\_Count"   
## [58] "Q36" "Q22\_First\_Click" "Q22\_Last\_Click"   
## [61] "Q22\_Page\_Submit" "Q22\_Click\_Count" "Q38"   
## [64] "tingling\_rating" "pressure\_rating" "anxious\_rating"   
## [67] "tired\_rating" "dizziness\_rating" "salivate\_rating"   
## [70] "headache\_rating" "throat\_rating" "nausea\_rating"   
## [73] "Q23\_10" "Q23\_11" "Q23\_12"   
## [76] "Q23\_13" "Q23\_14" "Q23\_15"   
## [79] "Q23\_DO\_1" "Q23\_DO\_2" "Q23\_DO\_3"   
## [82] "Q23\_DO\_4" "Q23\_DO\_5" "Q23\_DO\_6"   
## [85] "Q23\_DO\_7" "Q23\_DO\_8" "Q23\_DO\_9"   
## [88] "Q23\_DO\_10" "Q23\_DO\_11" "Q23\_DO\_12"   
## [91] "Q23\_DO\_13" "Q23\_DO\_14" "Q23\_DO\_15"   
## [94] "Q25\_1" "Q25\_2" "Q25\_3"   
## [97] "Q25\_4" "Q25\_5" "gender"   
## [100] "age" "Q2" "Q28"   
## [103] "SC0" "PROLIFIC\_PID" "FL\_26\_DO\_Information"   
## [106] "FL\_26\_DO\_Noinformation" "AllNegSxs\_Mean" "Group"   
## [109] "Tingling" "Pressure" "Anxious"   
## [112] "Tired" "Dizziness" "Salivate"   
## [115] "Headache" "Throat" "Nausea"   
## [118] "Dizzy\_Di" "Headache\_Di" "Nausea\_Di"   
## [121] "Throat\_Di"

table(df$Group)

##   
## no information negative information   
## 49 150

# Filter data for grouping variable (warning/no information) and follow-up symptom ratings  
df <- df %>%   
 dplyr::select(tingling\_rating:nausea\_rating,  
 Group:Nausea,  
 gender,  
 age)  
  
names(df)

## [1] "tingling\_rating" "pressure\_rating" "anxious\_rating" "tired\_rating"   
## [5] "dizziness\_rating" "salivate\_rating" "headache\_rating" "throat\_rating"   
## [9] "nausea\_rating" "Group" "Tingling" "Pressure"   
## [13] "Anxious" "Tired" "Dizziness" "Salivate"   
## [17] "Headache" "Throat" "Nausea" "gender"   
## [21] "age"

# Item check  
df$x <- as.numeric(df$headache\_rating)  
table(df$x, df$headache\_rating)

##   
## Not at all (0) (1) (2) (3) (4) (5) (6) Very much (7)  
## 1 131 0 0 0 0 0 0 0  
## 2 0 25 0 0 0 0 0 0  
## 3 0 0 8 0 0 0 0 0  
## 4 0 0 0 11 0 0 0 0  
## 5 0 0 0 0 6 0 0 0  
## 6 0 0 0 0 0 11 0 0  
## 7 0 0 0 0 0 0 4 0  
## 8 0 0 0 0 0 0 0 3

# Coding matches, therefore recode all side effect ratings as.numeric  
df <- df %>%   
 mutate(across(tingling\_rating:nausea\_rating, as.numeric))

# Descriptive statistics

# library  
library(psych)

## Warning: package 'psych' was built under R version 4.0.5

##   
## Attaching package: 'psych'

## The following objects are masked from 'package:ggplot2':  
##   
## %+%, alpha

library(gmodels)

## Warning: package 'gmodels' was built under R version 4.0.5

# check gender differences  
CrossTable(df$gender, df$Group,  
 expected = TRUE,  
 chisq = TRUE,  
 fisher = TRUE,  
 resid = TRUE,  
 format = "SPSS")

## Warning in chisq.test(t, correct = FALSE, ...): Chi-squared approximation may be  
## incorrect

##   
## Cell Contents  
## |-------------------------|  
## | Count |  
## | Expected Values |  
## | Chi-square contribution |  
## | Row Percent |  
## | Column Percent |  
## | Total Percent |  
## | Residual |  
## |-------------------------|  
##   
## Total Observations in Table: 199   
##   
## | df$Group   
## df$gender | no information | negative information | Row Total |   
## --------------------------|----------------------|----------------------|----------------------|  
## Male | 11 | 49 | 60 |   
## | 14.774 | 45.226 | |   
## | 0.964 | 0.315 | |   
## | 18.333% | 81.667% | 30.151% |   
## | 22.449% | 32.667% | |   
## | 5.528% | 24.623% | |   
## | -3.774 | 3.774 | |   
## --------------------------|----------------------|----------------------|----------------------|  
## Female | 38 | 99 | 137 |   
## | 33.734 | 103.266 | |   
## | 0.540 | 0.176 | |   
## | 27.737% | 72.263% | 68.844% |   
## | 77.551% | 66.000% | |   
## | 19.095% | 49.749% | |   
## | 4.266 | -4.266 | |   
## --------------------------|----------------------|----------------------|----------------------|  
## Non-binary / third gender | 0 | 2 | 2 |   
## | 0.492 | 1.508 | |   
## | 0.492 | 0.161 | |   
## | 0.000% | 100.000% | 1.005% |   
## | 0.000% | 1.333% | |   
## | 0.000% | 1.005% | |   
## | -0.492 | 0.492 | |   
## --------------------------|----------------------|----------------------|----------------------|  
## Column Total | 49 | 150 | 199 |   
## | 24.623% | 75.377% | |   
## --------------------------|----------------------|----------------------|----------------------|  
##   
##   
## Statistics for All Table Factors  
##   
##   
## Pearson's Chi-squared test   
## ------------------------------------------------------------  
## Chi^2 = 2.648073 d.f. = 2 p = 0.2660592   
##   
##   
##   
## Fisher's Exact Test for Count Data  
## ------------------------------------------------------------  
## Alternative hypothesis: two.sided  
## p = 0.2829005   
##   
##   
## Minimum expected frequency: 0.4924623   
## Cells with Expected Frequency < 5: 2 of 6 (33.33333%)

# check for age differences  
levels(df$age)

## [1] "<18" "18" "19" "20" "21" "22" "23" "24" "25" "26"   
## [11] "27" "28" "29" "30" "31" "32" "33" "34" "35" "36"   
## [21] "37" "38" "39" "40" "41" "42" "43" "44" "45" "46"   
## [31] "47" "48" "49" "50" "51" "52" "53" "54" "55" "56"   
## [41] "57" "58" "59" "60" "61" "62" "63" "64" "65" "66"   
## [51] "67" "68" "69" "70" "71" "72" "73" "74" "75" "76"   
## [61] "77" "78" "79" "80" "81" "82" "83" "84" "85" "86"   
## [71] "87" "88" "89" "90" "91" "92" "93" "94" "95" "96"   
## [81] "97" "98" "99" "100+"

df$age\_2 <- as.numeric(as.character(df$age))  
  
describe(df$age\_2)

## vars n mean sd median trimmed mad min max range skew kurtosis se  
## X1 1 199 34.21 10.9 32 33.38 11.86 18 62 44 0.59 -0.41 0.77

kruskal.test(df$Group ~ df$age\_2)

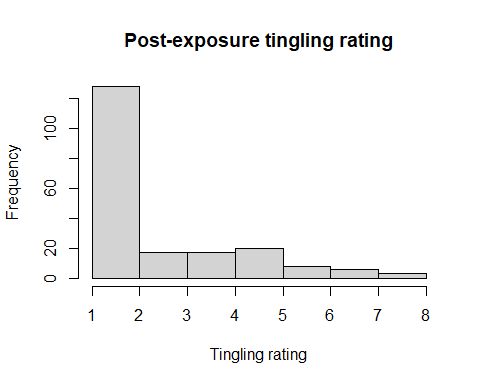
##   
## Kruskal-Wallis rank sum test  
##   
## data: df$Group by df$age\_2  
## Kruskal-Wallis chi-squared = 43.617, df = 43, p-value = 0.4451

summary(df$nausea\_rating)

## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 1.000 1.000 1.000 1.719 2.000 7.000

# Statistical analysis

# Non-normal distributions. E.g., 'vibrating or tingling sensations'  
hist(df$tingling\_rating, main = "Post-exposure tingling rating", xlab = "Tingling rating")



## Test each symptom per grouping var  
  
# Tingling  
wilcox.test(df$tingling\_rating ~ df$Tingling, na.rm = TRUE)

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: df$tingling\_rating by df$Tingling  
## W = 1224.5, p-value = 1  
## alternative hypothesis: true location shift is not equal to 0

# Tired  
wilcox.test(df$tired\_rating ~ df$Tired)

## Warning in wilcox.test.default(x = c(2, 3, 1, 1, 1, 6, 1, 1, 5, 5, 1, 1, :  
## cannot compute exact p-value with ties

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: df$tired\_rating by df$Tired  
## W = 1380.5, p-value = 0.1877  
## alternative hypothesis: true location shift is not equal to 0

# Anxious  
wilcox.test(df$anxious\_rating ~ df$Anxious)

## Warning in wilcox.test.default(x = c(4, 6, 1, 6, 1, 7, 1, 1, 4, 1, 7, 7, :  
## cannot compute exact p-value with ties

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: df$anxious\_rating by df$Anxious  
## W = 1412, p-value = 0.1181  
## alternative hypothesis: true location shift is not equal to 0

# Salivate  
wilcox.test(df$salivate\_rating ~ df$Salivate)

## Warning in wilcox.test.default(x = c(1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, :  
## cannot compute exact p-value with ties

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: df$salivate\_rating by df$Salivate  
## W = 974, p-value = 0.1486  
## alternative hypothesis: true location shift is not equal to 0

# Throat  
wilcox.test(df$throat\_rating ~ df$Throat)

## Warning in wilcox.test.default(x = c(1, 5, 1, 1, 1, 1, 2, 1, 1, 1, 1, 8, :  
## cannot compute exact p-value with ties

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: df$throat\_rating by df$Throat  
## W = 1010.5, p-value = 0.06045  
## alternative hypothesis: true location shift is not equal to 0

# Pressure  
wilcox.test(df$pressure\_rating ~ df$Pressure)

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: df$pressure\_rating by df$Pressure  
## W = 1235.5, p-value = 0.9216  
## alternative hypothesis: true location shift is not equal to 0

# 'Dizziness or blurred vision'  
wilcox.test(df$dizziness\_rating ~ df$Dizziness)

## Warning in wilcox.test.default(x = c(1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, :  
## cannot compute exact p-value with ties

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: df$dizziness\_rating by df$Dizziness  
## W = 998.5, p-value = 0.02608  
## alternative hypothesis: true location shift is not equal to 0

effect\_dizz <- df %>%   
 wilcox\_effsize(dizziness\_rating ~ Dizziness)  
  
# 'Dull headache'  
wilcox.test(df$headache\_rating ~ df$Headache)

## Warning in wilcox.test.default(x = c(2, 2, 1, 1, 2, 1, 1, 1, 6, 1, 1, 7, :  
## cannot compute exact p-value with ties

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: df$headache\_rating by df$Headache  
## W = 870.5, p-value = 0.007735  
## alternative hypothesis: true location shift is not equal to 0

effect\_head <- df %>%   
 wilcox\_effsize(headache\_rating ~ Headache)  
  
# 'Nausau or queasiness'  
wilcox.test(df$nausea\_rating ~ df$Nausea)

## Warning in wilcox.test.default(x = c(3, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, :  
## cannot compute exact p-value with ties

##   
## Wilcoxon rank sum test with continuity correction  
##   
## data: df$nausea\_rating by df$Nausea  
## W = 932.5, p-value = 0.02817  
## alternative hypothesis: true location shift is not equal to 0

effect\_naus <- df %>%   
 wilcox\_effsize(nausea\_rating ~ Nausea)  
  
effect\_dizz

## # A tibble: 1 x 7  
## .y. group1 group2 effsize n1 n2 magnitude  
## \* <chr> <chr> <chr> <dbl> <int> <int> <ord>   
## 1 dizziness\_rating no information warned 0.225 49 49 small

effect\_head

## # A tibble: 1 x 7  
## .y. group1 group2 effsize n1 n2 magnitude  
## \* <chr> <chr> <chr> <dbl> <int> <int> <ord>   
## 1 headache\_rating no information warned 0.271 49 48 small

effect\_naus

## # A tibble: 1 x 7  
## .y. group1 group2 effsize n1 n2 magnitude  
## \* <chr> <chr> <chr> <dbl> <int> <int> <ord>   
## 1 nausea\_rating no information warned 0.223 49 48 small

# Create prop.table data frames for each symptom and multiply by 100 (by row) to get percentages  
# Dizziness:  
prop.table(table(df$Dizziness, df$dizziness\_rating), 1)\*100

##   
## 1 2 3 4 5 6  
## no information 91.836735 0.000000 2.040816 2.040816 4.081633 0.000000  
## warned 75.510204 2.040816 4.081633 4.081633 4.081633 8.163265  
##   
## 7 8  
## no information 0.000000 0.000000  
## warned 2.040816 0.000000

# Headache:  
prop.table(table(df$Headache, df$headache\_rating), 1)\*100

##   
## 1 2 3 4 5 6  
## no information 79.591837 12.244898 0.000000 2.040816 0.000000 4.081633  
## warned 56.250000 12.500000 4.166667 4.166667 4.166667 10.416667  
##   
## 7 8  
## no information 2.040816 0.000000  
## warned 4.166667 4.166667

# Nausea:  
prop.table(table(df$Nausea, df$nausea\_rating), 1)\*100

##   
## 1 2 3 4 5 6  
## no information 81.632653 6.122449 6.122449 2.040816 0.000000 4.081633  
## warned 60.416667 16.666667 8.333333 6.250000 4.166667 4.166667  
##   
## 7  
## no information 0.000000  
## warned 0.000000

Considering the bulk of participants rated ‘Not at all (0)’ on symptom ratings, the differences between “no information” and “warned” groups for each side effect in those lower ratings looks substantial. Take dizziness for example, where 92% of non-warned participants reported no dizziness symptoms that dropped to 75% when participants were warned. What’s more, fully 10% of participants in the warned condition for dizziness reported symptoms at the high end of the scale compared to none in the no information group, indicating not only did fewer people report no symptoms in the warned group, they reported **stronger** symptoms. This pattern plays out more-or-less across all three significant symptoms.