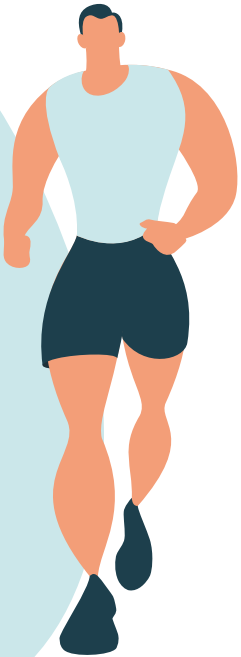
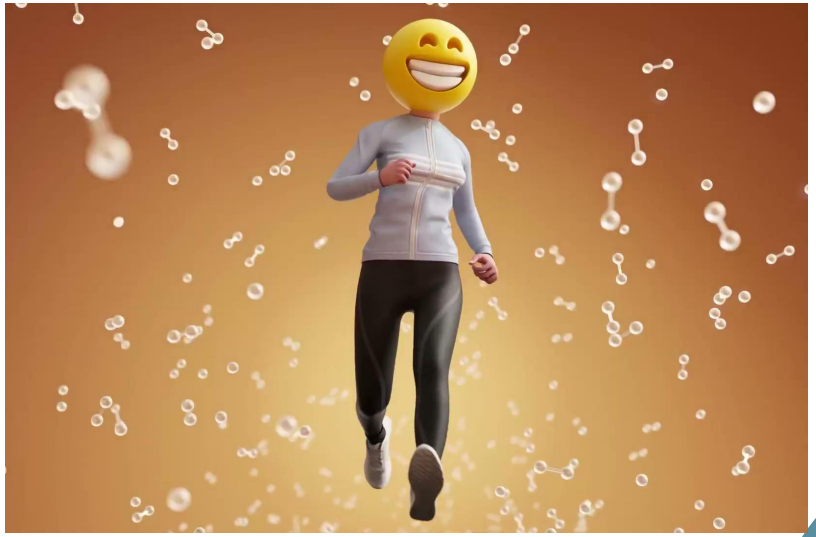
How does exercise intensity affect mood?

Mateo, Joey, Hannah, Jillian, & Mason



General Interest and Motivation

- Exercising releases endorphins → better mood
- Test out if this is true and the effect of different types of exercises
- From this study, we'll be able to better design our exercising schedule to help relieve stress and depression



[1] Friedman, D. How to Exercise to Improve Your Mood. *The New York Times* **2024**.

OUR RESEARCH QUESTION:

How does varying intensities of outdoor exercise affect negative self-reported mood among different age groups?

Choice of Population

Islanders born in Ironbard:

- We picked one island as our population (instead of all 3 islands) because it allows us to generalize our conclusions to a full island while using reasonable amount of sampling time and effort.

Town hall birth records provided us access to a complete and accurate sampling frame

- Allowing us to randomly sample participants within each age group

VARIABLES

RESPONSE

Difference in self-reported mood before/after exercise
- tension, depression, and anger

TREATMENT

Exercise intensity
(relax walk, brisk walk, run)

NUISANCE

Age bracket
(19-24) (25-44) (45-64)

Randomized Complete Block Design

3 treatment levels
3 balanced nuisance blocks
36 replicates of each treatment
108 total observations

Statistics Model – RCBD

$y_{ij} = \mu + \tau_i + \beta_j + \varepsilon_{ij}$

y is the response: mood
μ is the overall mean
τ is the contribution from treatment factor: different exercises
- i = 1, 2, 3 (3 exercise levels)

β is the contribution from nuisance factor: age brackets
- j = 1, 2, 3 (3 age levels)

ε is the random error

PROCEDURE

01

SAMPLING

Random sampling from birth records, random assignment of treatments

02

INITIAL MOOD

Ask the mood questions and record initial mood

03

EXERCISE

Have the islanders perform the assigned treatment

04

FINAL MOOD

Ask the mood questions and record final mood

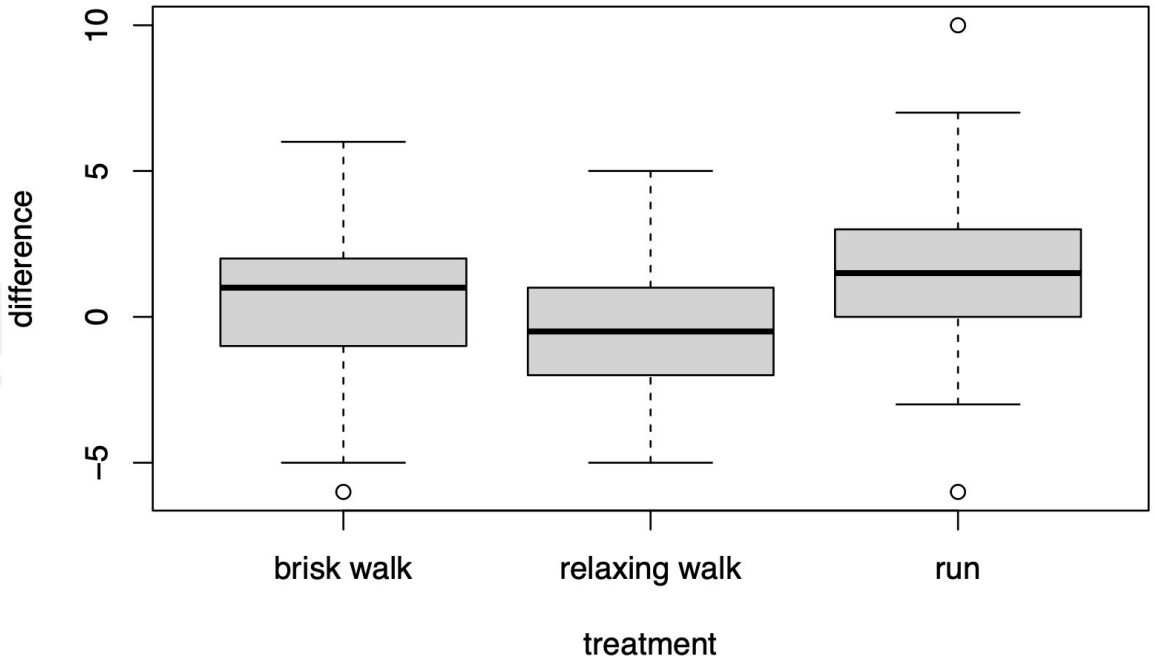
ANOVA

```
##                          Df Sum Sq Mean Sq F value   Pr(>F)
## factor(treatments)        2  107.6   53.81   7.420 0.000977 ***
## factor(block)             2   19.2    9.59   1.323 0.270939
## Residuals               103  747.1    7.25
```

← $\sigma \approx$ sqrt(MSE) ≈ sqrt(7.25)

- P-value = 0.000977 < 0.05
  - The treatment is statistically significant
  - At least one treatment mean is different from the others
- MS_{block} is only slightly larger than MSE, meaning that the blocking was not really necessary

EXPLORATORY ANALYSIS



The mean response is -0.639 for relaxing walk, 0.639 for brisk walk, and 1.81 for run.

Note: these are all 1 unit apart

This pattern suggests that more intense exercise leads to greater mood improvement

POST-HOC

```
TukeyHSD(x=model, 'factor(treatments)', conf.level=0.95)
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = difference ~ factor(treatments) + factor(block), data = data)
##
## $`factor(treatments)`
##                                diff        lwr       upr     p adj
## relaxing walk-brisk walk -1.277778 -2.7873313 0.2317757 0.1141948
## run-brisk walk            1.166667 -0.3428868 2.6762202 0.1624543
## run-relaxing walk         2.444444  0.9348909 3.9539979 0.0005956
```

- Run and relaxing walk are significantly different from each other
- Brisk walk is not significantly different from either of the others

POST-HOC

run-relaxing walk	2.444444	0.9348909	3.9539979	0.0005956

Participants who went on a run had a mean mood improvement 2.44 points higher than those who did a relaxing walk. This difference is statistically significant (p = 0.0006), and the confidence interval does not include zero, confirming that the effect is unlikely due to chance.

Therefore, Running significantly improves mood more than relaxing walking.

Power Calculations

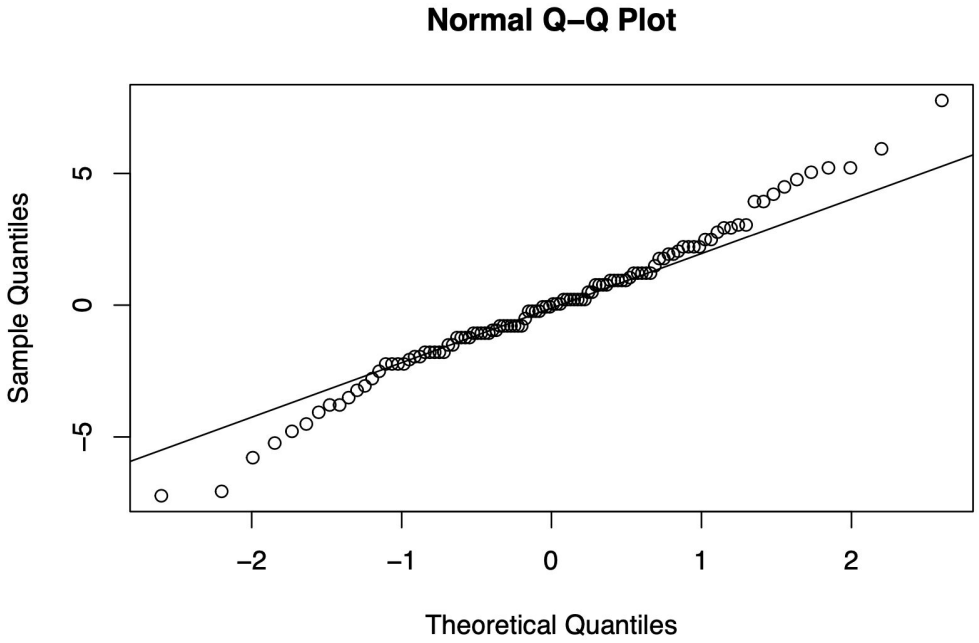
Calculate f:

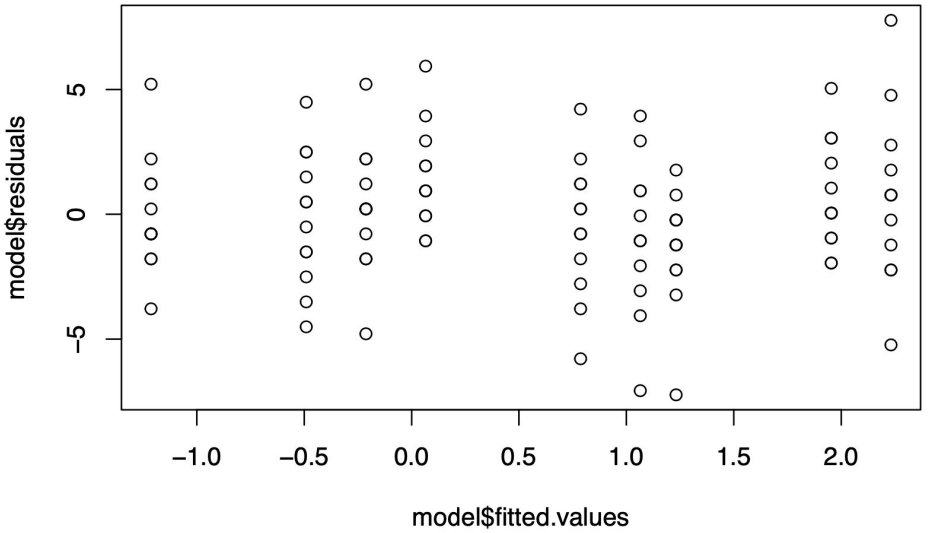
- Recall that the difference in treatment means is greater than 1 → ensure d ≥ 1
- Recall that σ ≈ sqrt(7.25) → f = d/σ = 0.3713907

```
Balanced one-way analysis of variance power calculation

              k = 3
              n = 31.60263
              f = 0.3713907
      sig.level = 0.05
          power = 0.9

NOTE: n is number in each group
```

← our n = 36 for each exercise level is sufficient

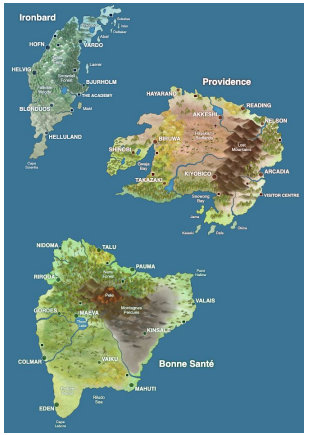
MODEL ASSUMPTIONS





Conclusion/Discussion

- Run and relaxing walk have significantly different effect on mood (running improved mood significantly more than relaxing walk)
- According to a Harvard Medical School study, “running for 15 minutes a day or walking for an hour reduces the risk of major depression.”[2]
    - Walking for 30 minutes might not have significant effects
- Many islanders born in Ironbard moved away → no representative of islander living in Ironbard now



Future

- Perform the same analysis for the other islands – Providence and Bonne Santé
- Include the effect of different islands on mood
- Investigate how exercise affects tension, depression, and anger individually

[2] More evidence that exercise can boost mood. *Harvard Health Publishing* **2019**

Thank you