# My title*

**My subtitle if needed**

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First sentence. Second sentence. Third sentence. Fourth sentence.

## Table of contents



*Code and data are available at: LINK.

# 1 Introduction

This paper begins with Introduction framing the impact of mental health on one's well being. The Data section details variables, methodology, and cleaning processes used for analyses. In Model section, a model is proposed for determining how individual's depression status and counted days of mental unwellness in the past 30 days impacts their counted days of physical unwellness in the past 30 days. Results section analyzes how demographic and other mental health related factors would affect physical health with model calculations.

? Still need to fix this part Discussion section includes . We later acknowledge our paper's [Limitations], suggest paths for [Future Research], especially on enhancing response rates, and conclude with a synthesis of our insights. The Appendix provides further survey information.

# 2 Data

The paper uses data collected from the US General Social Survey (GSS) from NORIC at the University of Chicago ("General Social Survey" 2024). From the dataset, this paper focuses on the "number of hours worked last week" variable, from the years 1992 to 2022. This longitudinal approach allows us to compare labour dynamics across different economic downturns, including the 1998 Asian Financial Crisis, the 2008 Global Financial Crisis, and the COVID-19 pandemic in 2020.

## 2.1 Source Data

The data was downloaded and filtered for the selected variables from the selected data variables from GSS[1]. The data cleaning was performed based on value definitions as defined in the GSS codebooks (NORC 2018). The variable names are renamed to be more informative (Table 1).

[1]https://gss.norc.org/documents/stata/GSS_stata.zip

Table 1: Source data retrieved from GSS

| Variable | New Name | Description | Example |
|---|---|---|---|
| ID_ | id | Response ID | 1 |
| YEAR | year | Year of the Data Recorded | 1977 |
| SEX | sex | Respondent's gender | Female/2 |
| AGE | age | Respondent's age | 25 |
| HEALTH | health | Respondents' health condition | Good |
| PHYSHLTH | phys_days | Days of Respondents' physical health being not good | 15 |
| MNTLHLTH | ment_days | Days of Respondents' mental health being not good | 20 |
| DEPRESS | depress | Whether respondents have been told having depression | Yes/1 |

## 2.2 Data Cleaning

The data was cleaned by using the open source statistically programming language R (R Core Team 2024), with libraries `tidyverse` (Wickham et al. 2019), `ggplot2` (Wickham 2016), `dplyr` (Wickham et al. 2022), `readr` (Wickham, Hester, and Bryan 2022), `tibble` (Muller and Wickham 2022), `here` (Müller 2020), `kableExtra` (Zhu 2021), `janitor` (Firke 2023), `arrow` (Richardson et al. 2024), and `knitr` (Xie 2014).

## 2.3 Survey Methodology

some words

## 2.4 Demographic Variables

Table 2: Counted days of Physical and Mental unwellness of Population by Age and Gender Groups

| ID | Gender | Age | Physical Unwellness | Mental Unwellness | Age Cohort |
|---|---|---|---|---|---|
| 1 | Female | 25 | 0 | 0 | 20-39 |
| 2 | Male | 43 | 0 | 0 | 40-59 |
| 3 | Female | 30 | 0 | 2 | 20-39 |
| 4 | Female | 55 | 0 | 0 | 40-59 |
| 5 | Male | 37 | 0 | 30 | 20-39 |

| | | | | | |
|---|---|---|---|---|---|
| 6 | Male | 47 | 0 | 0 | 40-59 |

## 2.5 Mental and Physical Unwellness and Depression Diagnosis

Table 3: Counted days of Physical and Mental unwellness with Depression Diagnosis

| ID | Physical Unwellness | Mental Unwellness | Depression Diagnosis |
|---|---|---|---|
| 1 | 0 | 0 | 2 |
| 2 | 0 | 0 | 1 |
| 4 | 0 | 0 | 2 |
| 14 | 0 | 0 | 2 |
| 16 | 14 | 7 | 2 |
| 19 | 0 | 0 | 2 |

## 2.6 Mental Unwellness and General Health Status

Table 4: Counted days of Mental unwellness with General Health Status

| ID | Mental Unwellness | General Health |
|---|---|---|
| 1 | 0 | 1 |
| 2 | 0 | 2 |
| 3 | 2 | 2 |
| 5 | 30 | 2 |
| 6 | 0 | 1 |
| 9 | 5 | 2 |

## 2.7 Non-response Rate

As shown in Figure 1, some of the questions in the dataset are not included resulting no responses collected in certain years due to the change in survey methodology. This fact requires extra attention when cleaning and handling since the number of available responses will decrease when additional variables are added. Hence, an additional sub set of the data that only includes counted days of mental and physical un-wellness in the past 30 days (Table 5) is also included for only speculating these two variables while keeping as many responses as possible.

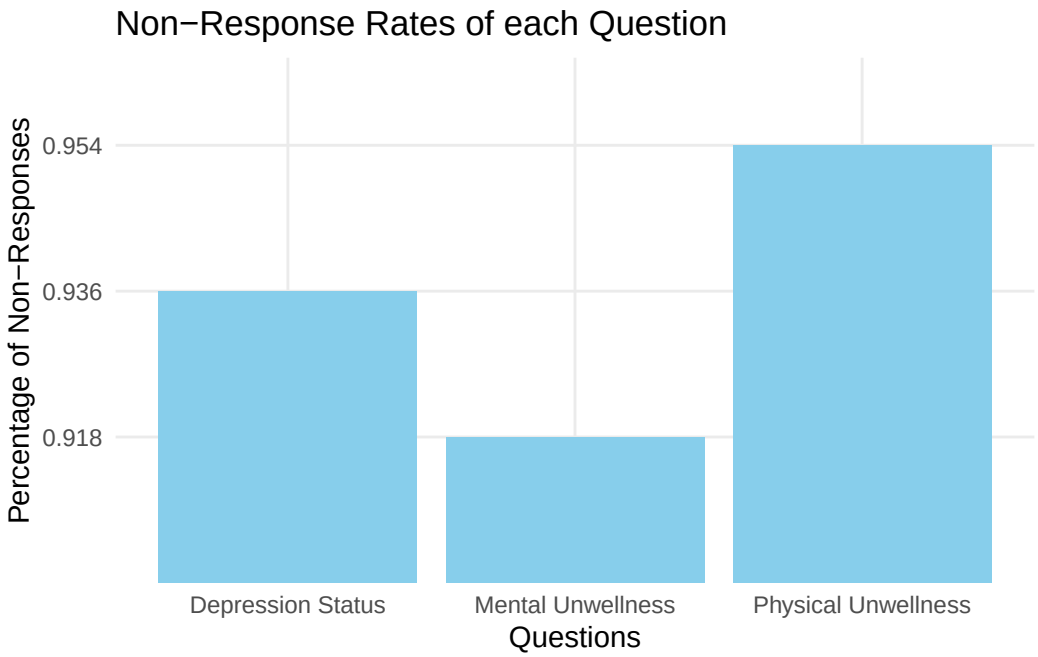



Figure 1: Nonresponse Rates

Table 5: Counted days of Mental unwellness with General Health Status

| ID | Physical Unwellness | Mental Unwellness |
|---|---|---|
| 1 | 0 | 0 |
| 2 | 0 | 0 |
| 3 | 0 | 2 |
| 4 | 0 | 0 |
| 5 | 0 | 30 |
| 6 | 0 | 0 |

# 3 Model

The goal of our modelling strategy is twofold. Firstly,...

Here we briefly describe the Bayesian analysis model used to investigate... Background details and diagnostics are included in Appendix B.

### 3.1 Model set-up

Define $y_i$ as the number of seconds that the plane remained aloft. Then $\beta_i$ is the wing width and $\gamma_i$ is the wing length, both measured in millimeters.

$$y_i|\mu_i, \sigma \sim \text{Normal}(\mu_i, \sigma) \tag{1}$$
$$\mu_i = \alpha + \beta_i + \gamma_i \tag{2}$$
$$\alpha \sim \text{Normal}(0, 2.5) \tag{3}$$
$$\beta \sim \text{Normal}(0, 2.5) \tag{4}$$
$$\gamma \sim \text{Normal}(0, 2.5) \tag{5}$$
$$\sigma \sim \text{Exponential}(1) \tag{6}$$

We run the model in R (R Core Team 2024) using the `rstanarm` package of Goodrich et al. (2024). We use the default priors from `rstanarm`.

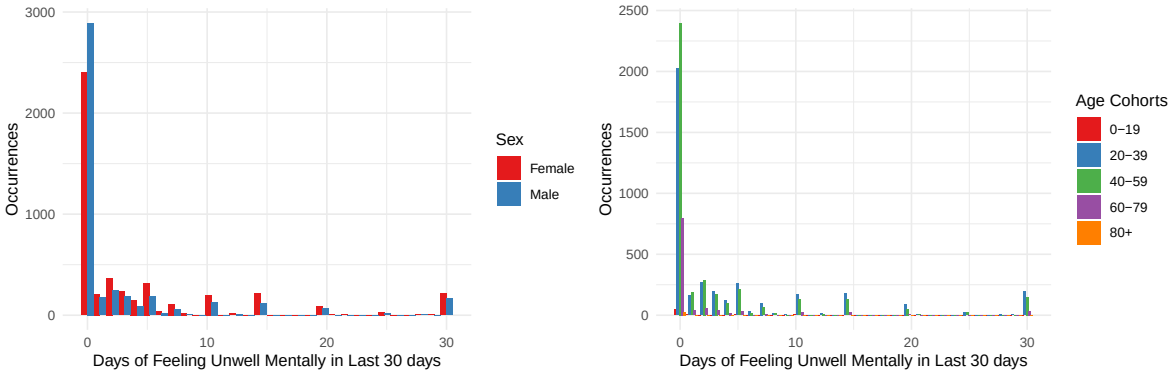
#### 3.1.1 Model justification

We expect a positive relationship between the size of the wings and time spent aloft. In particular...

We can use maths by including latex between dollar signs, for instance $\theta$.

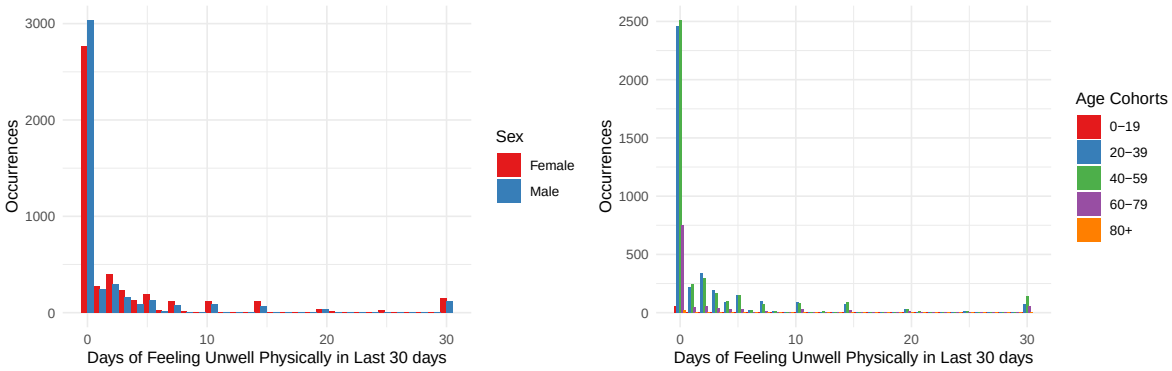
## 4 Results

Our results are summarized in Table 6.




(a) Gender (b) Age cohorts

Figure 2: Female Participants from 20 to 59 Years Old are More likely to Experience Mental Unwellness




(a) Gender (b) Age cohorts

Figure 3: Female Participants from 20 to 59 Years Old are More likely to Experience Physical Unwellness

Include some research about female having trouble due to medical racism etc. and possible reason why these age cohorts are more likely to experience both physical and mental unwellness.

### 4.1 Depression Playing an Role

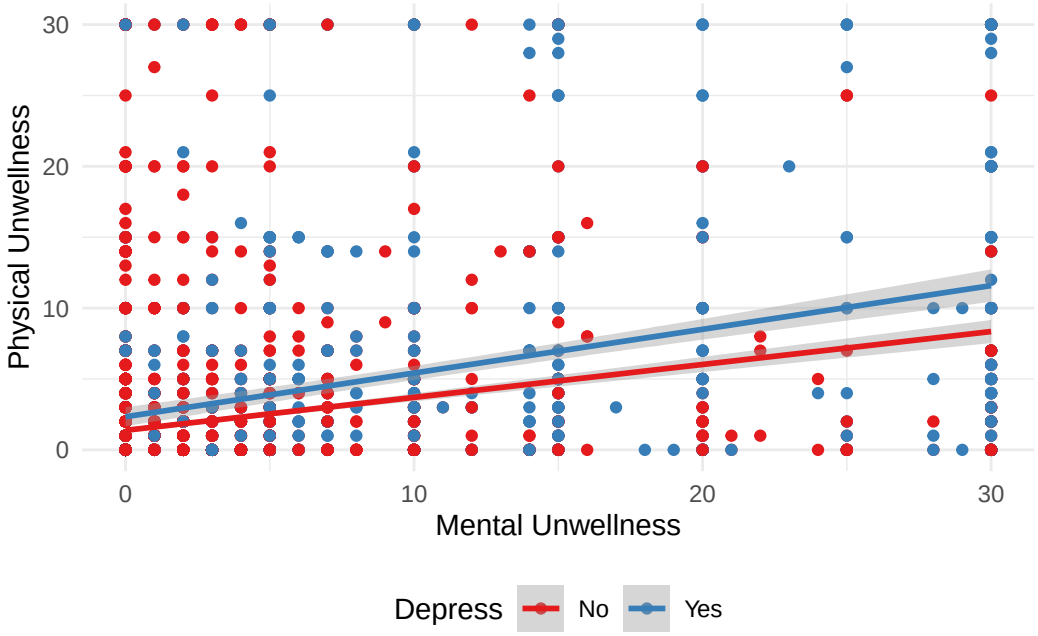



Figure 4: Counts of Days Feeling Unwell in Last 30 Days

### 4.2 Mental Health and Health in General

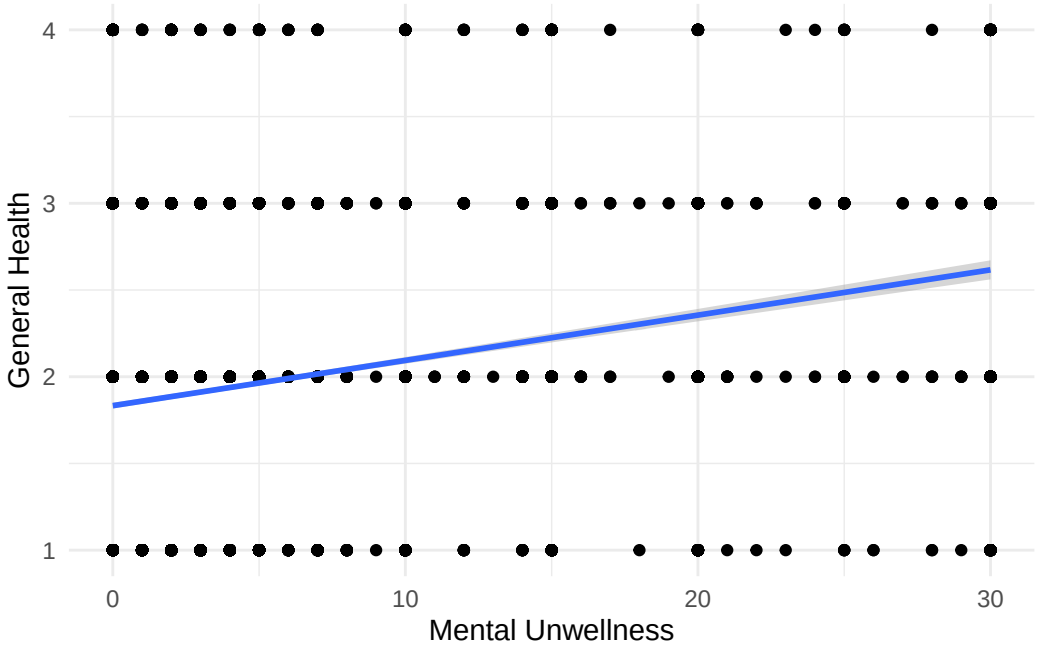



Figure 5: Counts of Days Feeling Unwell in Last 30 Days

Table 6: Explanatory models of flight time based on wing width and wing length

| | First model |
|---|---|
| (Intercept) | 4.15 |
| | (0.43) |
| ment_days | 0.27 |
| | (0.01) |
| depress | −1.43 |
| | (0.22) |
| Num.Obs. | 4527 |
| R2 | 0.132 |
| R2 Adj. | 0.130 |
| Log.Lik. | −14 351.092 |
| ELPD | −14 358.6 |
| ELPD s.e. | 118.8 |
| LOOIC | 28 717.1 |
| LOOIC s.e. | 237.7 |
| WAIC | 28 717.1 |
| RMSE | 5.76 |

### 4.3 Model Results

## 5 Discussion

### 5.1 First discussion point

If my paper were 10 pages, then should be be at least 2.5 pages. The discussion is a chance to show off what you know and what you learnt from all this.

### 5.2 Second discussion point

### 5.3 Third discussion point

### 5.4 Weaknesses and next steps

Weaknesses and next steps should also be included.

# A Appendix

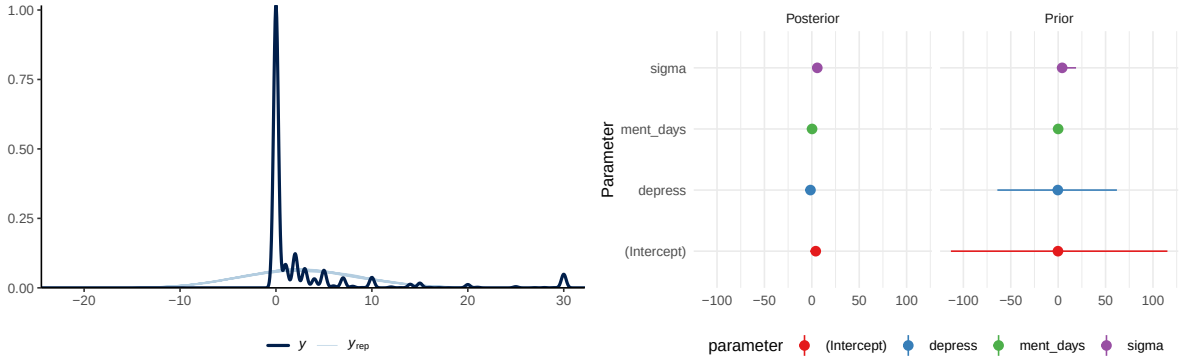
## A.1 Additional data details

# B Model details

## B.1 Posterior predictive check

In Figure 6a we implement a posterior predictive check. This shows...

In Figure 6b we compare the posterior with the prior. This shows...




(a) Posterior prediction check

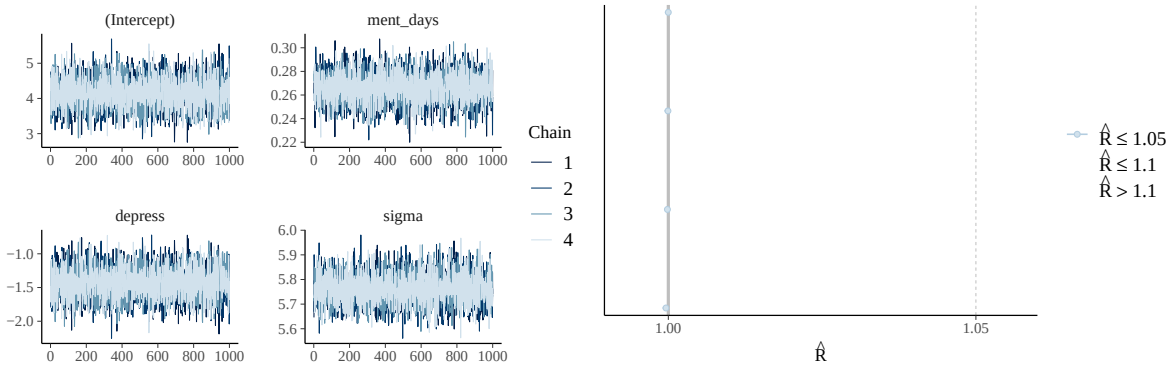
(b) Comparing the posterior with the prior

Figure 6: Examining how the model fits, and is affected by, the data

## B.2 Diagnostics

Figure 7a is a trace plot. It shows... This suggests...

Figure 7b is a Rhat plot. It shows... This suggests...




(a) Trace plot (b) Rhat plot

Figure 7: Checking the convergence of the MCMC algorithm

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