Global suicide Rates and its correlation to country income, region, age, and gender in 2019*

An analysis of global suicide rates in 2019 using negative binomial and multilevel negative binomial modelling

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Suicide has become a main cause of deaths globally over the decades. This creates curiosity in what immutable factors may be affecting suicide rates. This paper looks into the correlation between suicide rates and gender, sex, age, country income, and region. Then further analysis is done by looking into human resources available in each country.

1 Introduction

Suicide is defined as the act of intentionally causing one's own death. The main risk factors of suicide are mental disorders, physical disorders, and substance abuse. In 2019, 1.3% of all deaths resulted from suicide and is the fourth leading cause of deaths in 15~29 years old. This paper will dive deeper into suicide rates and its correlation between country income, age, gender, and region in 2019. The most recent year with relevant data is for 2019, from the WHO[citation] and since we are only looking into one year, we look at the global trends and world bank income group trends to get a more thorough understanding of the trends of suicide rates of 2019. Because one of the goals of the paper is to observe the correlation between suicide rates and country income and region, the countries are classified based on the world bank income group; with four income groups - low, lower-middle, upper-middle, and high. Low-income economies is defined as a country with a gross national income less than $1135, and in the manner lower-middle is between the range $1136 to $4465, upper-middle in the range of $4455 to $13845 and high is $13846 or more. Region is defined based on the

*Code and data are available at: https://github.com/anggimude/Health.

continents; Asia, Africa, North America, South America, and Europe. The total number of countries is [number].

This paper will produce a negative binomial and a multilevel negative binomial model to analyze the correlation coefficients of each factor. The results of the two models will be compared to check whether the results are credible to make conclusions. In addition, we will be able to study the trends of the factors of suicide. We want to analyze the change in demographics for the different age groups, country income, region, and gender, [write more about the data used]. R Core Team (2023) was used to clean the raw data to what we use for modelling.

This paper has 4 sections in total not including the introduction. In Section 2 we look at the data that used to carry out the reports including tables and graphs of cleaned data that will be used for the models and the summary statistics. In the next section, we discuss about the models that will be used to analyze our cleaned data, how it is set up and the justifications of it. Next we display and examine the results obtained from the models including tables of the model summaries which helps us make predictions. Lastly, we make final discussions of our results and research based on each cause and dive into some weaknesses that our paper has. In addition, we explore some next steps we or anyone else interested is willing to take after reading this paper. [make this paragraph more specific]

2 Data

Some of our data is of penguins (Figure 1), from Horst, Hill, and Gorman (2020).

Talk more about it.

And also planes (Figure 2). (You can change the height and width, but don't worry about doing that until you have finished every other aspect of the paper - Quarto will try to make it look nice and the defaults usually work well once you have enough text.)

Talk way more about it.

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.

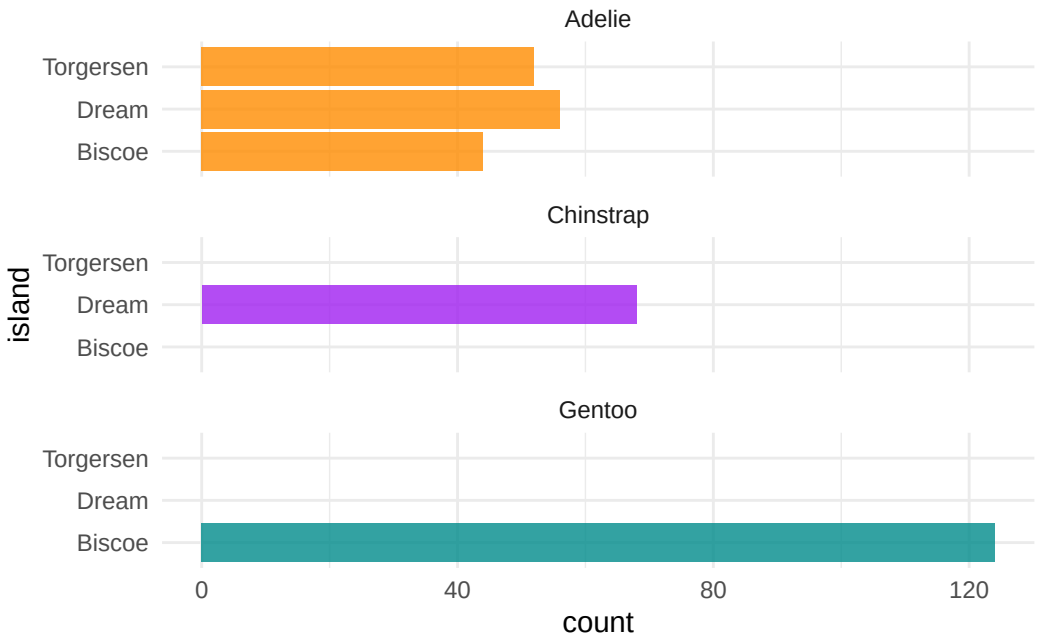


Figure 1: Bills of penguins

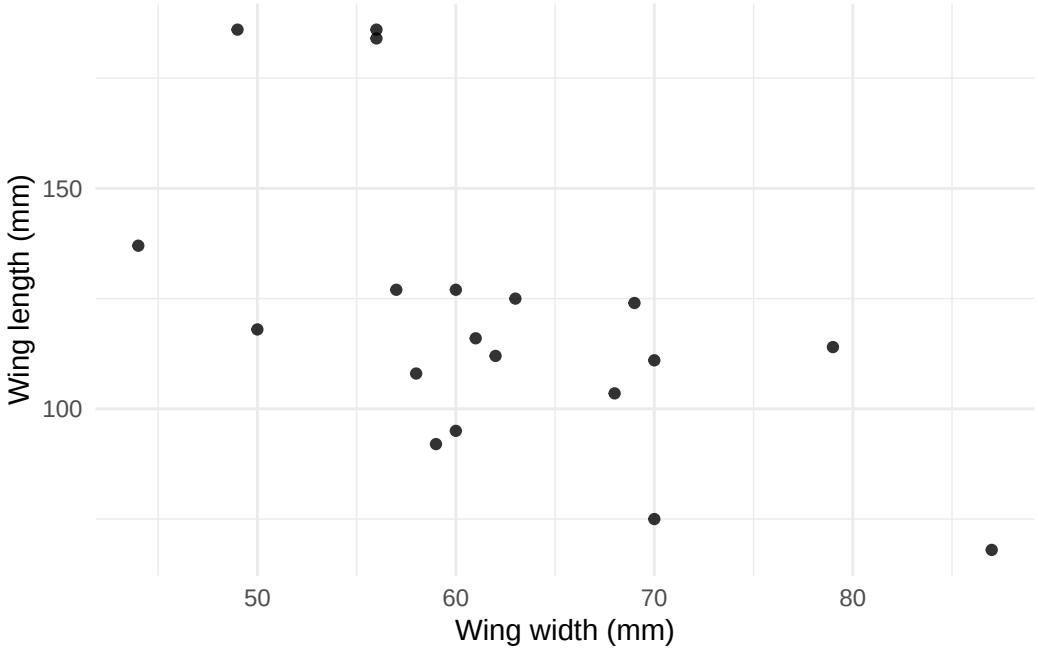


Figure 2: Relationship between wing length and width

3.1 Model set-up

Define y_i as the number of seconds that the plane remained aloft. Then β_i is the wing width and γ_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 2023) using the `rstanarm` package of Goodrich et al. (2022). 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 θ.

4 Results

Our results are summarized in Table 1.

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.

Table 1: Explanatory models of flight time based on wing width and wing length

	First model
(Intercept)	1.12
	(1.70)
length	0.01
	(0.01)
width	−0.01
	(0.02)
Num.Obs.	19
R2	0.320
R2 Adj.	0.019
Log.Lik.	−18.128
ELPD	−21.6
ELPD s.e.	2.1
LOOIC	43.2
LOOIC s.e.	4.3
WAIC	42.7
RMSE	0.60

5.2 Second discussion point

5.3 Third discussion point

5.4 Weaknesses and next steps

Weaknesses and next steps should also be included.

Appendix

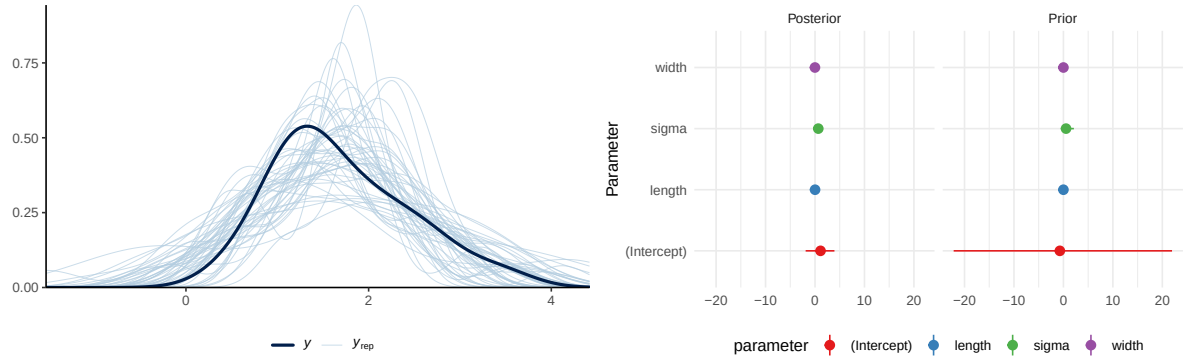
A Additional data details

B Model details

B.1 Posterior predictive check

In Figure 3a we implement a posterior predictive check. This shows...

In Figure 3b we compare the posterior with the prior. This shows...



(a) Posterior prediction check

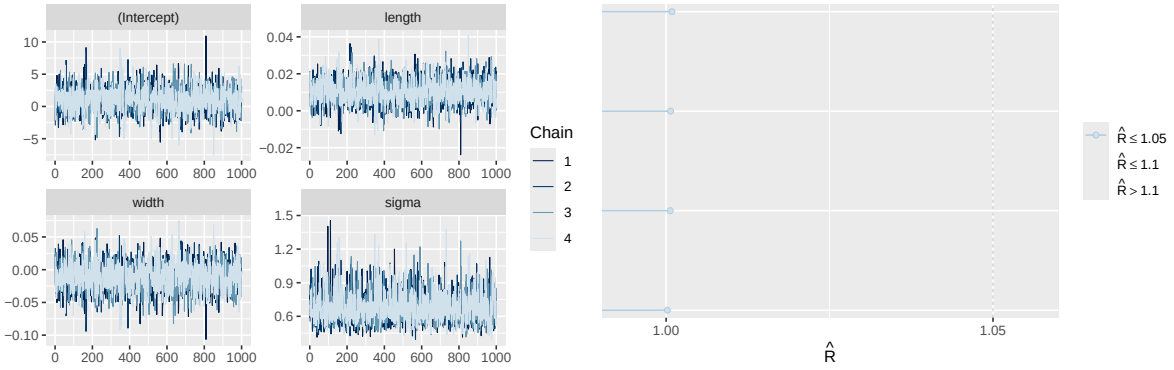
(b) Comparing the posterior with the prior

Figure 3: Examining how the model fits, and is affected by, the data

B.2 Diagnostics

Figure 4a is a trace plot. It shows... This suggests...

Figure 4b is a Rhat plot. It shows... This suggests...



(a) Trace plot

(b) Rhat plot

Figure 4: Checking the convergence of the MCMC algorithm

References

Goodrich, Ben, Jonah Gabry, Imad Ali, and Sam Brilleman. 2022. "Rstanarm: Bayesian Applied Regression Modeling via Stan." https://mc-stan.org/rstanarm/.

Horst, Allison Marie, Alison Presmanes Hill, and Kristen B Gorman. 2020. *Palmerpenguins: Palmer Archipelago (Antarctica) Penguin Data*. https://doi.org/10.5281/zenodo.3960218.

R Core Team. 2023. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.