Significant declines in standardised test scores due to COVID-19 school closures disproportionately affect vulnerable students*

A replication analysis using data from the United States and a case study on the Netherlands

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Abstract

School closures due to the COVID-19 pandemic have raised significant concerns about the consequences on student learning and achievement gaps. This paper replicates a data analysis of the scope of school closures in the United States in the 2020-2021 school year, the inequitable distribution of such closures by demographic characteristics, and the resultant declines in pass rates on standardised tests in mathematics and English Language Arts (ELA) done by students in grades 3-8 across 21 states. We apply secondary research regarding the scope of school closures in the Netherlands in same year and the declines in national examination scores in reading, spelling and mathematics of Dutch students in grades 4-7. Although the Netherlands is regarded as 'best-case' scenario, with a short lockdown, equitable school funding, and high degree of technological preparedness, we find that Dutch students still experienced a significant learning loss, equivalent to one-fifth of that of the United States, with a disproportionate impact on vulnerable students. These findings suggest that COVID-19 school closures imposed significant costs of learning loss and widened inequality gaps in the United States and the Netherlands, with impacts likely larger in countries disenfranchised by weaker infrastructure or longer closures.

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*Code and data are available at: https://github.com/AbbassSleiman/COVID19-US-School-Closures; Minimal and Full Replication on Social Science Reproduction platform available at https://doi.org/10.48152/ssrp-9vc2-gp37 and https://doi.org/10.48152/ssrp-qvfh-0r62, respectively.

1 Introduction

You can and should cross-reference sections and sub-sections. We use R Core Team (2023) and Wickham et al. (2019a).

The remainder of this paper is structured as follows. Section 2....

2 Data

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

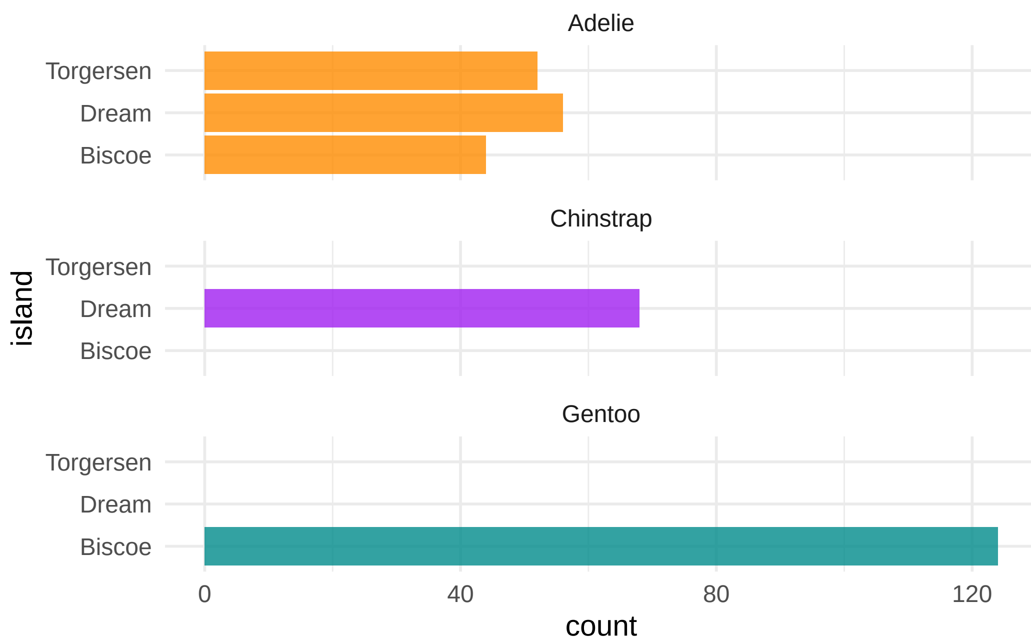


Figure 1: Bills of penguins

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.)

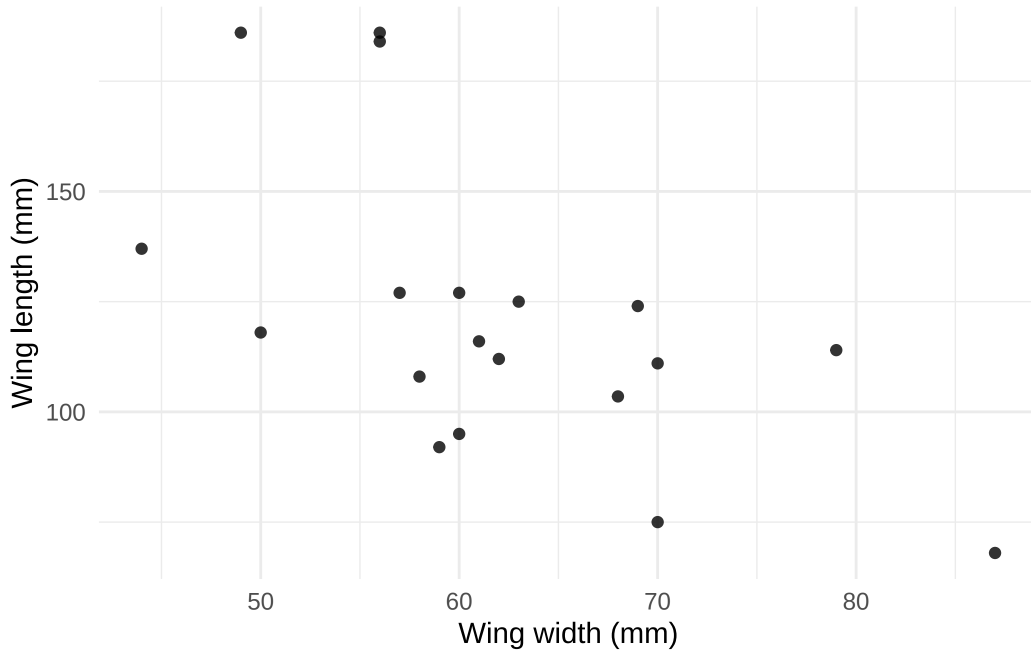


Figure 2: Relationship between wing length and width

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.

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`.

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

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.

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

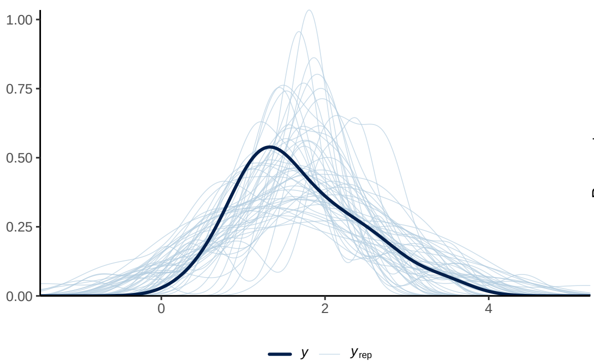
A Additional data details

B Model details

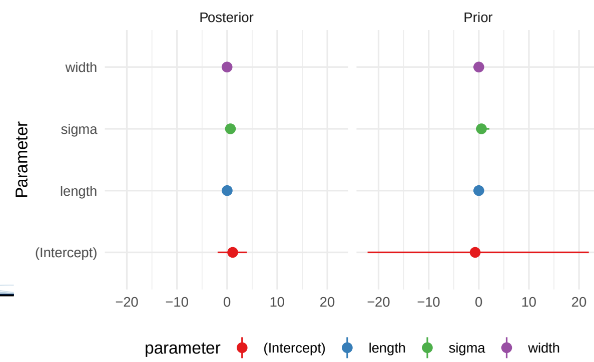
B.1 Posterior predictive check

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



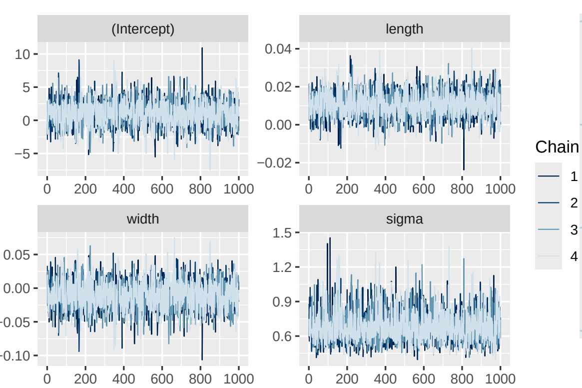
(b) Comparing the posterior with the prior

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

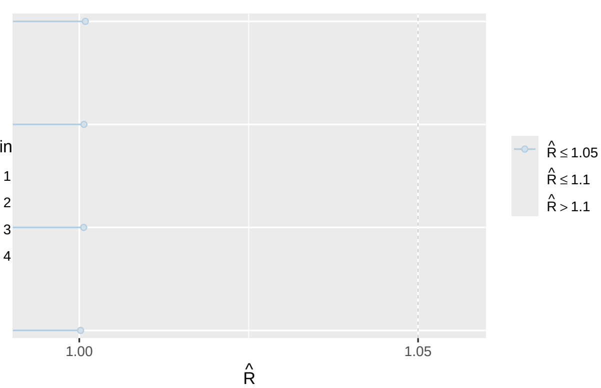
B.2 Diagnostics

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

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