My title*

My subtitle if needed

First author Another author

November 16, 2024

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

1 Introduction

Overview paragraph

Estimand paragraph

Results paragraph

Why it matters paragraph

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

2 Data

2.1 Overview Check packages

For this analysis, we combined four data sets all together into one. All these four data sets comes from **Worldbank** open data platform (Arel-Bundock (2022)). We employed **R** (R Core Team (2023)), a coding platform to download, clean and conduct statistical analysis. Besides, we also utilized R packages **tidyverse** (Wickham et al. (2019)), **rstanarm** (Goodrich et al. (2022)), **ggplot2** (Wickham (2016)), **knitr** (Xie (2014)), **arrow** (Richardson et al. (2024)), **here** (Müller (2020)), and **dpylr** (Wickham et al. (2023)). The paper is outlined in github using starter folder provided in **Telling Stories With Data** (Alexander (2023)).

*Code and data are available at: https://github.com/RohanAlexander/starter_folder.

2.2 Measurement

Some paragraphs about how we go from a phenomena in the world to an entry in the dataset.

2.3 Outcome variables

The response variable in our analysis is the mortality rate below 5 year-old children for all countries. Here Mortality rate is calculated based on number of deaths of children under 5 years old per 1000 person. The histogram of this variable is shown in Figure 1a. We observe that the data ranges from 0 to 120, with a peak at 10-15.

However, this data is extremely right skewed and have several outlyers, thus we decided to perform log transformation to stabilize the variance and in-proving the normality of our dataset for a better regression model latter. The distribution after we perform log transformation is shown in Figure 1b, here the distribution is approximately normal ranging from 2 to 5 with a peak at 3.

Talk more about it.

And also planes (**?@fig-planes**). (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.

2.4 Predictor variables

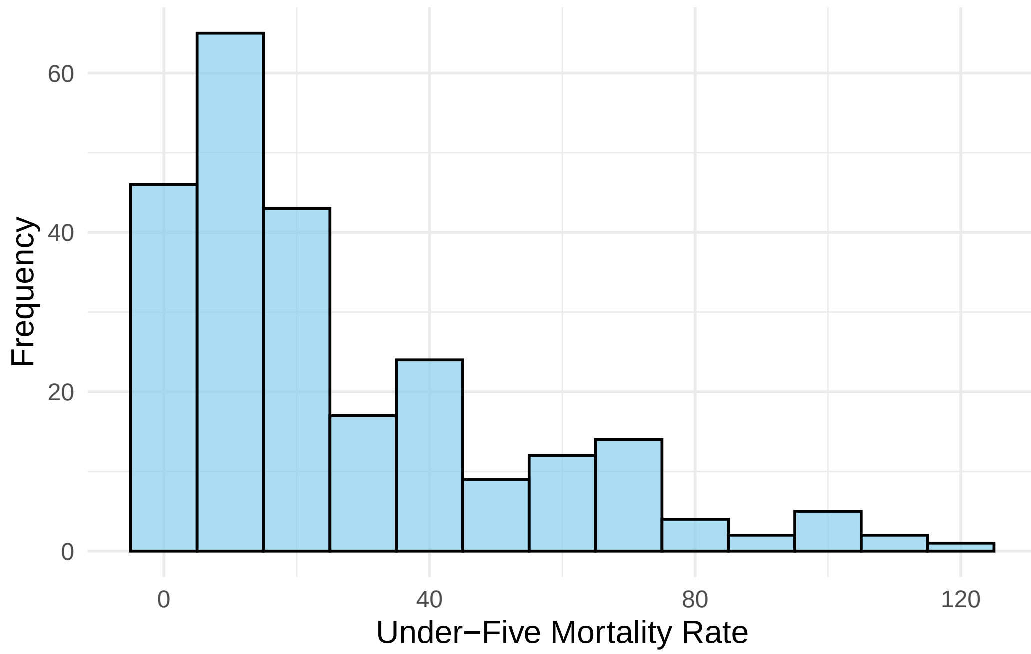
Add graphs, tables and text.

Use sub-sub-headings for each outcome variable and feel free to combine a few into one if they go together naturally.

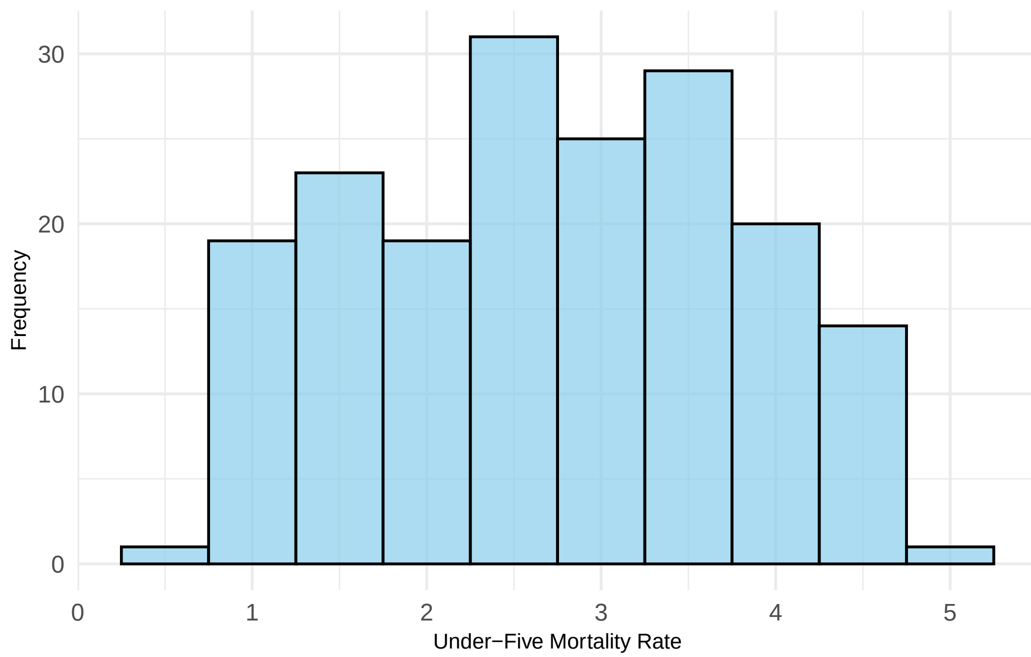
3 Model

The goal of our modeling strategy is to investigate how the DDT vaccine coverage, food production index, and current health expenditure per capita (current US$) relate to the under-five mortality rate for each nation.

We aim to use this model to understand how the above mentioned three factors' impact on child mortality and identify opportunities for improving health outcomes, especially for high mortality rate nations. Background details and diagnostics are included in Appendix B.



(a) Dsitribution before log tranformation



(b) Distribution after log transformation

Figure 1: Histogram for Mortality rate of different countries

3.1 Model set-up

Let y_i be the logrithm of under-five mortality rate for nation i. We define the following predictors:

x_{1i}: DDT vaccine coverage for nation i. x_{2i}: Food production index for nation i. x_{3i}: Logrithm of current health expenditure per capita (current US$) for nation i. The model is specified as:

$$y_i \mid \mu_i, \sigma \sim \text{Normal}(\mu_i, \sigma) \tag{1}$$
$$u_i = \alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} \tag{2}$$
$$\alpha \sim \text{Normal}(5,) \tag{3}$$
$$\beta_1 \sim \text{Normal}(0, 2.5) \tag{4}$$
$$\beta_2 \sim \text{Normal}(0, 2.5) \tag{5}$$
$$\beta_3 \sim \text{Normal}(0, 2.5) \tag{6}$$
$$\sigma \sim \text{Exponential}(1) \tag{7}$$

We implement this model in R (R Core Team 2023) using the rstanarm package (Goodrich et al. 2022), employing its default priors for predictors and a distribution of Normal(_i,).

3.1.1 Model justification

We use a multivariate linear model to capture the relationship between the predictors and the response variable. This choice is justified by the linear trends observed in the data (see Section 2). The logarithmic transformation of the under-five mortality rate and current health expenditure per capita is applied to stabilize variance and linear relationships, ensuring model validity.

The Bayesian framework is employed due to its ability to incorporate prior knowledge, improve uncertainty quantification, and handle small sample sizes effectively.

4 Results

Our results are summarized in **?@tbl-modelresults**.

###Intercept: The intercept estimate of 6.643 represents the expected logarithm of the under-five mortality rate when all predictors are held constant at their reference or baseline values (e.g., average food production, average vaccine coverage, and average health expenditure). This serves as a baseline for interpreting the effects of the predictors.

###Food: Food Production Index: The coefficient for the food production index is 0.003, indicating a very slight positive relationship between food production and the under-five mortality rate. This naïvely suggests that reducing food production could also reduce mortality, which is counter-intuitive.

However, a closer examination of the confidence interval for this predictor shows that it includes 0. This implies that the relationship is not statistically significant, and food production is not strongly related to overall under-five mortality rates. This finding suggests that while food production is essential for societal well-being, its immediate impact on reducing child mortality might depend on other factors such as food access, distribution systems, and nutritional quality.

###Vaccine Coverage: The coefficient for vaccine coverage is -0.013, meaning that for every 1 percentage point increase in vaccine coverage, the logarithm of the under-five mortality rate decreases by 1.3%, holding other variables constant.

This highlights the critical role of vaccination programs in reducing child mortality. For example, increasing vaccine coverage by 10 percentage points could reduce the mortality rate by approximately 13%, emphasizing the importance of robust immunization initiatives.

###Health Expenditure (Log-Transformed): The coefficient for the log-transformed health expenditure is -0.529, indicating that a 1% increase in health expenditure per capita is associated with a 0.529 unit decrease in the log of the under-five mortality rate, holding all other predictors constant.

Term	Estimate	Std. Error	2.5% CI	97.5% CI
(Intercept)	6.643	0.363	6.047	7.222
Food	0.003	0.002	0.000	0.007
Vacinne	-0.013	0.003	-0.019	-0.008
Health_expense	-0.529	0.029	-0.578	-0.482

“‘

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

Please don't use these as sub-heading labels - change them to be what your point actually is.

5.3 Third discussion point

5.4 Weaknesses and next steps

Weaknesses and next steps should also be included.

Appendix

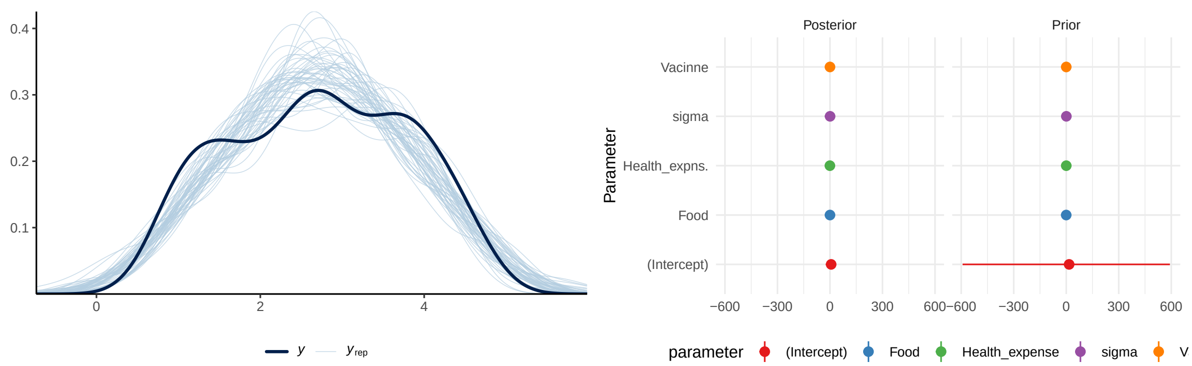
A Additional data details

B Model details

B.1 Posterior predictive check

In Figure 2a we implement a posterior predictive check. This shows...

In Figure 2b we compare the posterior with the prior. This shows...



(a) Posterior prediction check

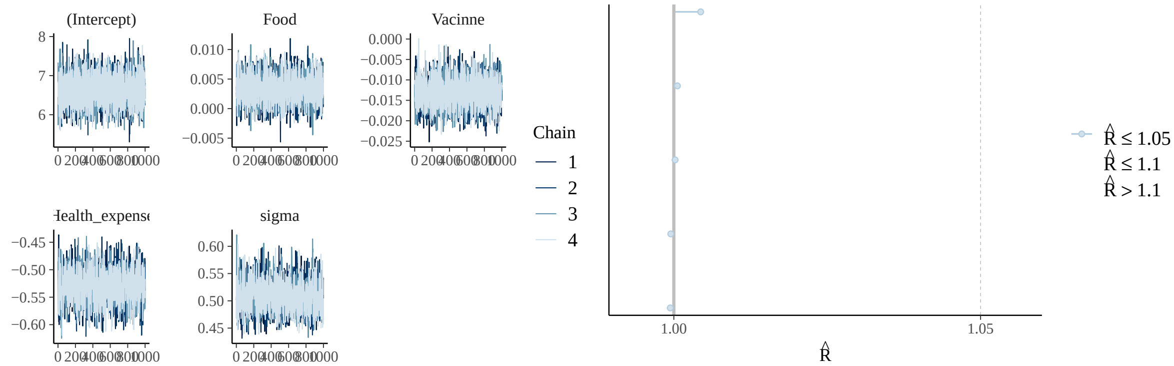
(b) Comparing the posterior with the prior

Figure 2: Examining how the model fits, and is affected by, the data

B.2 Diagnostics

Figure 3a is a trace plot. It shows... This suggests...

Figure 3b is a Rhat plot. It shows... This suggests...



(a) Trace plot

(b) Rhat plot

Figure 3: Checking the convergence of the MCMC algorithm

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