Alberta Mortality 2000 to 2022*

My subtitle if needed

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March 10, 2024

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

1 Introduction

2 Data

Our data is from Alberta Government opendata, the dataset includes a ranking of the 30 most common causes of death each year in Alberta starts from 2000 to 2022, by ranking and total number of deaths (Government 2015).

3 Model

3.1 Model set-up

Two models generated, one follows poisson distribution and another follows negative binomial distribution. We are interested in how total number of deaths differs by different causes of deaths.

Define y_i as the total number of deaths for the i-th observation. Then β_0 is the expected log count of total deaths when none of the causes in the model are present. It's the starting point of the model's prediction.

*Code and data are available at: https://github.com/peachvegetable/Alberta-mortality

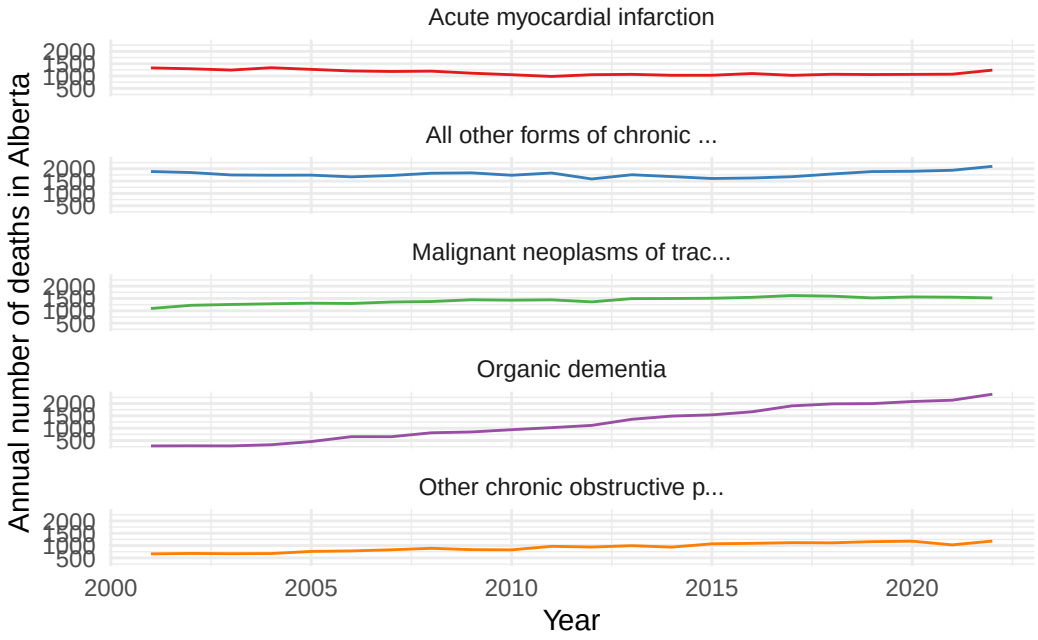


Figure 1: Top 5 causes of deaths from 2000 to 2022, for Alberta, Canada

$$
\begin{aligned}
y_i|\lambda_i &\sim \text{Poisson}(\lambda_i) \\
\log(\lambda_i) &= \beta_0 + \beta_1 \times \text{cause}_i \\
\beta_0 &\sim \text{Normal}(0, 2.5) \\
\beta_1 &\sim \text{Normal}(0, 2.5)
\end{aligned}
$$

Define y_i as the total deaths for the i-th observation. θ is the additional parameter to model overdispersion. μ_i is the mean of the Negative Binomial distribution for the i-th observation, β_0 is the intercept, and β_1 represents the effect of each cause of death.

$$
\begin{aligned}
y_i|\lambda_i, \theta &\sim \text{NegativeBinomial}(\mu_i, \theta) \\
\log(\mu_i) &= \beta_0 + \beta_1 \times \text{cause}_i \\
\beta_0 &\sim \text{Normal}(0, 2.5) \\
\beta_1 &\sim \text{Normal}(0, 2.5) \\
\theta &\sim \text{SomePrior}(.)
\end{aligned}
$$

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: Modeling the cause deaths in Alberta, 2000 - 2022

	Poisson	Negative binomial
(Intercept)	7.037	7.037
		(0.070)
causeAll other forms of chronic ...	0.446	0.448
		(0.101)
causeMalignant neoplasms of trac...	0.223	0.226
		(0.102)
causeOrganic dementia	0.046	0.048
		(0.101)
causeOther chronic obstructive p...	−0.206	−0.202
		(0.101)
Num.Obs.	110	110
Log.Lik.	−5718.182	−810.965
ELPD	−5906.6	−815.4
ELPD s.e.	1211.7	10.5
LOOIC	11 813.2	1630.9
LOOIC s.e.	2423.5	21.1
WAIC	11 965.6	1630.8
RMSE	325.38	325.38

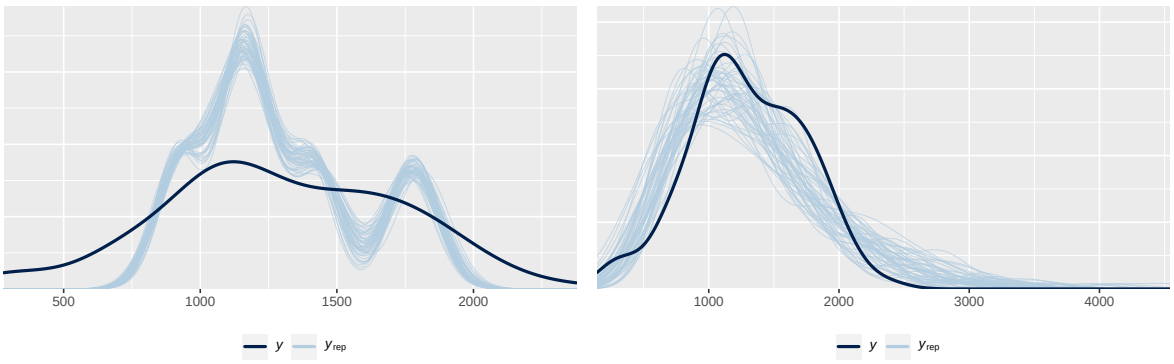
Table 2: **?(caption)**

	elpd_diff	se_diff
neg_binomial_model	0.0	0.0
poisson_model	-5091.2	1201.6

We calculate the total number of deaths by the formula

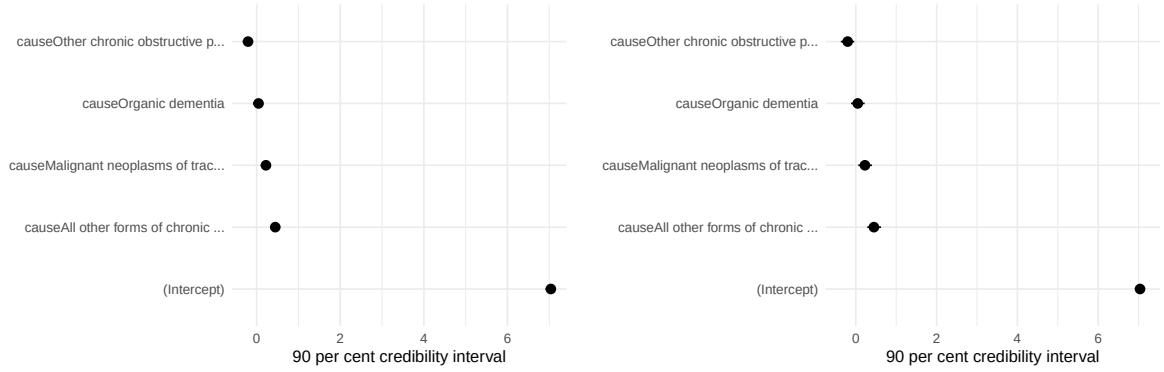
$$\text{total deaths} = e^{\beta_0 + \sum_{i=0}^{5} \beta_i X_i} \tag{1}$$

Where X_1, X_2, X_3, X_4, and X_5 represent $X_{\text{Acute myocardial infarction}}$, $X_{\text{All other forms of chronic}}$, $X_{\text{Malignant neoplasms}}$, $X_{\text{Organic dementia}}$, and $X_{\text{Other chronic}}$ respectively.



(a) Poisson model (b) Negative binomial model

Figure 2: Comparing Poisson and negative binomial models



(a) Poisson model (b) Negative binomial model

Figure 3: 90% Confidence Interval

3.2 Model summary

4 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.

Appendix

A Additional data details

B Model details

B.1 Posterior predictive check

B.2 Diagnostics

References

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

Government, Alberta. 2015. *Leading Causes of Death*. https://open.alberta.ca/dataset/03339dc5-fb51-4552-97c7-853688fc428d/resource/1a10c821-7399-4d0f-95fb-f96728d01fae/download/deaths-leading-causes.xlsx.

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