Analysis the leading causes of death in Alberta*

Comparison the Poisson with negative binomial models

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This paper uses a dataset from the government of Alberta to fit Poisson and negative binomial models. When we focused on the top-fifteen causes of death in 2022, the result showed the negative binomial model is a better fit than the Poisson. This analysis revealed the fact that the negative binomial model may fit better than Poisson model in some reality circumstances. In addition, from the data about the cause of death, we can find the most widespread causes of death in Alberta. These insights can guide public health scientists and the policymaker in publishing healthy handbook or guidelines to decrease the mortality.

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*Code and data are available at: https://github.com/Yunshu921/mortality_in_Alberta.git.

1 Introduction

Due to the development of economy, the progress of medical and the electronization of life, our life expectancy has remarkably increased. We can perceive this point by the higher risk of developing chronic diseases compared to the past (Diaconu et al. 2016). An aging population is a problem endemic to the Western and industrialized countries. Therefore, by analyzing data about causes of death, we can provide insights to improve the old-age survival. More importantly, normal people can take the information as one's heath guideline. To be more specifically, we can take aged parents to do health check for checking specific and prevalent diseases.

In this paper, we will firstly examine the relationship between the time and the number of death for several leading causes of death by using linear regression analysis. Then we will utilize data from leading causes of death in 2022 to fit two models which are Poisson model and the negative binomial model. The estimand is which model fit better in this situation. The result of analysis showed the negative binomial model fit better than Poisson model.

After reviewing literature, they have pointed out the difference between Poisson regression and the negative binomial regression. Thus there is a gap about a specific example which shows advantages of the negative binomial model overweight that of Poisson model. Furthermore, during analying the data, some interesting findings can assist healthcare professionals and public health related department to allocate resources effectively.

In this paper, there are 4 sections, excludes the introduction. In the first section, we review the source of data from the government of Alberta, the advantages and disadvantages of data, methodologies that follow it, and data terminology. In addition, we have some plots to show the distribution of the time and the number of death for several leading causes of death. For the second section, we run two linear regression models and explain each variable in detail. In next section, we will display the results by using tables and plots. In the final section, we discuss our results and point out some weaknesses.

This paper is carried out using statistical programming language `R` (R Core Team 2024), the library `tidyverse` (Wickham et al. 2019) for preparation and analysis of data, the `janitor` (Firke 2023), the `here` (Müller 2020) for read data, the `ggplot2` for generating figures, the `dplyr` (Wickham et al. 2023), and were used in this paper.

2 Data

2.1 Data Description and Methodology

The dataset used in this paper is from the open data of government of Alberta and can be freely downloaded at their website (2022). This dataset was created at 2015 May 13 and last modification was done at 2023 Sept 22. The update frequency is annual and the publisher is

Service Alberta. We use this dataset not another dataset of other province since the representation of data in this dataset is clear and concise. There are some similar datasets, but the one we used is the more suitable for testing Poisson and the negative binomial models. At the same time, the government of Alberta has collected data regarding economy and finance, society and communities, employment and labour, environment, health and wellness, government, agriculture and other varied topics. The government of Alberta keeps records on a weekly,monthly, and yearly data.

The dataset consist first 30 leading causes of death from 2001 to 2022 and each cause has the corresponding number of deaths. In summary, there are 666 rows which contain four rows of descriptive words and two repeated ranking rows at row 34 and row 35. That is there are 664 variables.

2.2 Data Visualization

Now, we can explore this dataset by using ggplot2 packages (Wickham 2016) and and we found some interesting things such as some diseases just showed recently, for example the COVID-19.

Table 1: A summary table of cleaned data

calendar_year	cause	ranking	total_deaths	n
2001	All other forms of chronic …	1	1888	22
2001	Acute myocardial infarction	2	1330	22
2001	Malignant neoplasms of trac…	3	1095	22
2001	Other chronic obstructive p…	4	664	22
2001	Stroke, not specified as he…	5	663	22
2001	Atherosclerotic cardiovascu…	6	545	22
2001	Malignant neoplasm of breast	7	426	22
2001	Diabetes mellitus	8	397	22
2001	Other malignant neoplasms o…	9	389	16
2001	Malignant neoplasms of colon	10	386	22
2001	Congestive heart failure	11	338	22
2001	Malignant neoplasms of pros…	12	332	22
2001	Alzheimer's disease	13	329	22
2001	Organic dementia	14	280	22
2001	Atherosclerosis	15	253	11

Table 1 shows the detail of our dataset.

Table 2: A summary table of leading causes of death

calendar_year	cause	ranking	total_deaths	n
2001	All other forms of chronic …	1	1888	22
2001	Acute myocardial infarction	2	1330	22
2001	Malignant neoplasms of trac…	3	1095	22
2001	Organic dementia	14	280	22
2002	All other forms of chronic …	1	1847	22
2002	Acute myocardial infarction	2	1294	22
2002	Malignant neoplasms of trac…	3	1224	22
2002	Organic dementia	14	284	22
2003	All other forms of chronic …	1	1749	22
2003	Malignant neoplasms of trac…	2	1257	22
2003	Acute myocardial infarction	3	1242	22
2003	Organic dementia	15	281	22
2004	All other forms of chronic …	1	1739	22
2004	Acute myocardial infarction	2	1337	22
2004	Malignant neoplasms of trac…	3	1284	22

Table 2 shows

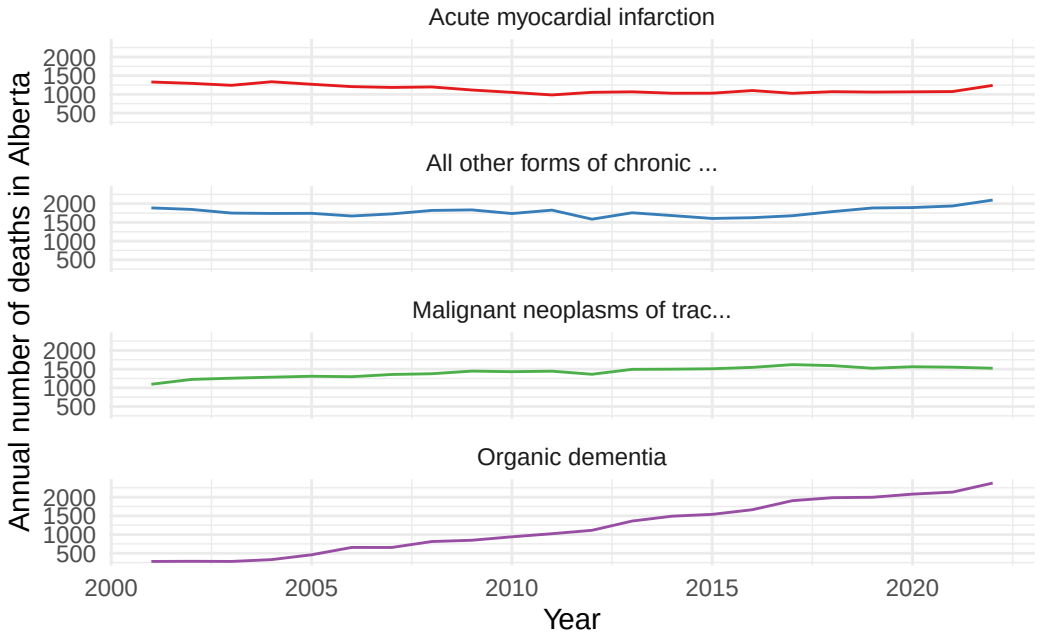

Figure 1: distribution of these deaths

Figure 1 shows

3 Model

4 Results

5 Discussion

6 Conclusion

References

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