Disease Outbreaks in Toronto Healthcare Institutions*

Analysis of Outbreak Patterns Based on Its Type and Settings

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(specify the general area of the paper and encourage the reader) (specify the dataset and methods at a general level) (specify headline result). (implications).

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*Code and data are available at: https://github.com/koyunkyung/toronto_outbreaks

1 Introduction

As of September 9 2024, 1,016 infections of pertussis, a contagious respiratory disease also known as whopping cough, were reported in Ontario (Staff 2024). In all of Toronto, the figure is more than triple the five-year, pre-pandemic average of 31 cases for the same period (Ontario 2024).

Unexpected disease outbreaks significantly disrupt society by inducing widespread fear, anxiety, and economic losses (Magis-Weinberg et al. 2021). Especially in Canada, where people continue to face some of the longest medical wait times for treatment in the developed world (Goldstein 2023), costs are likely to increase exponentially in an instant. Before Toronto overspends the cost of medical care, this paper is intending to analyze the trends of outbreaks reported in Toronto healthcare institutions.

(high-level results, focuesd on the one key result that is the main part of the story) (broadly discuss next steps in a sentence or two)

The paper starts with analyzing the overall pattern of outbreak occurrence frequency over the time period of 2016 to 2024. Then, it sorts the outbreaks into two different types, respiratory and enteric, to reiterate the analysis of outbreak frequency patterns. Diving deeper into the analysis, outbreak settings would also come into consideration. Finally, discussions about how specific healthcare institutions should reallocate their resources for particular outbreak types would proceed.

2 Data

2.1 Data Overview

(after clearly describing the dataset, use tables to display relevant cross-tabs and graphs to contrast groups) (thoroughly discuss the variables in the dataset we are using. graph the analysis data and table for summary stats)

The 'Outbreaks in Toronto Healthcare Institutions' dataset (Toronto 2024), obtained from City of Toronto Open Data Portal, was used for the trend analysis of outbreak occurrence. Published by Toronto Public Health under the requirement to monitor symptoms of infections, this dataset contains reports of suspected and confirmed outbreaks of gastroenteric (e.g., nausea, vomiting, diarrhea, fever) and respiratory (e.g., cough, runny nose, sore throat, fever) illness. An outbreak is defined as a localized increase in the rate of infection or illness, above that which is expected. Please note that this dataset was last updated on September 24, 2024, and contains only the information up to then.

In this paper, R for statistical computing (R Core Team 2023) is used to handle data. In particular, packages like `tidyverse` (Wickham et al. 2019), `ggplot2` (Wickham, Chang, et al.

2023), `dplyr` (Wickham, François, et al. 2023), `readr` (Wickham, Hester, and Kuhn 2023), `lubridate` (Grolemund and Wickham 2011) were utilized to analyze data from the City of Toronto (Gelfand, Greiner, and Firman 2022). Data from year 2016 to 2024 were combined, and several variables were removed in the filtering process for analysis data.

2.2 Results

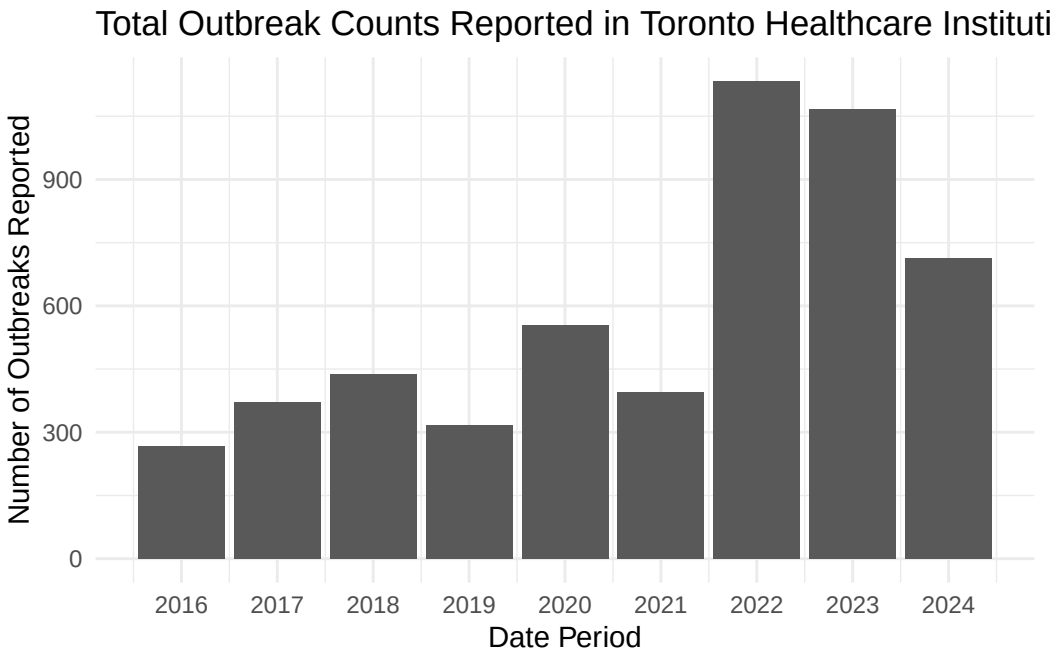


Figure 1: Total Outbreaks Count in Toronto Healthcare Institutions

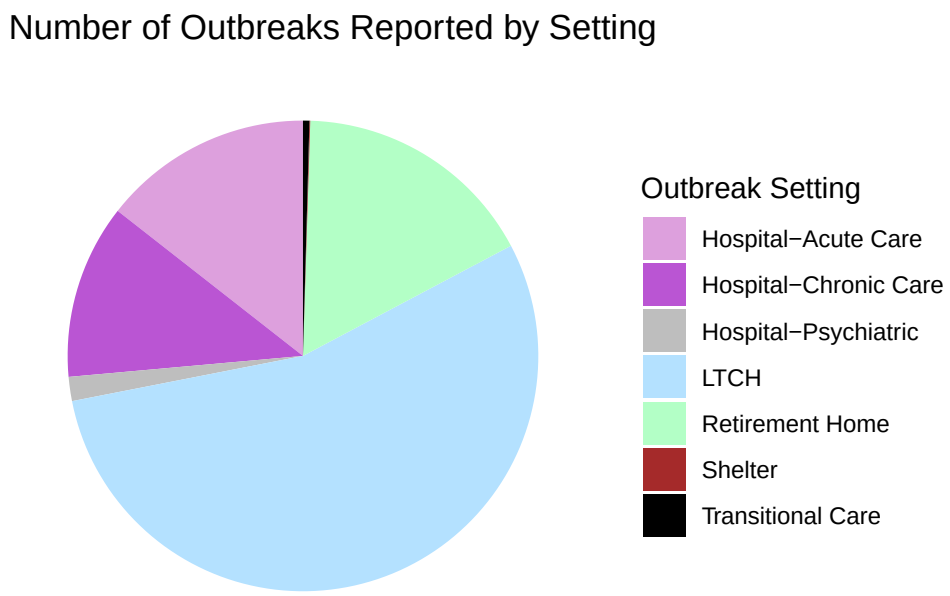
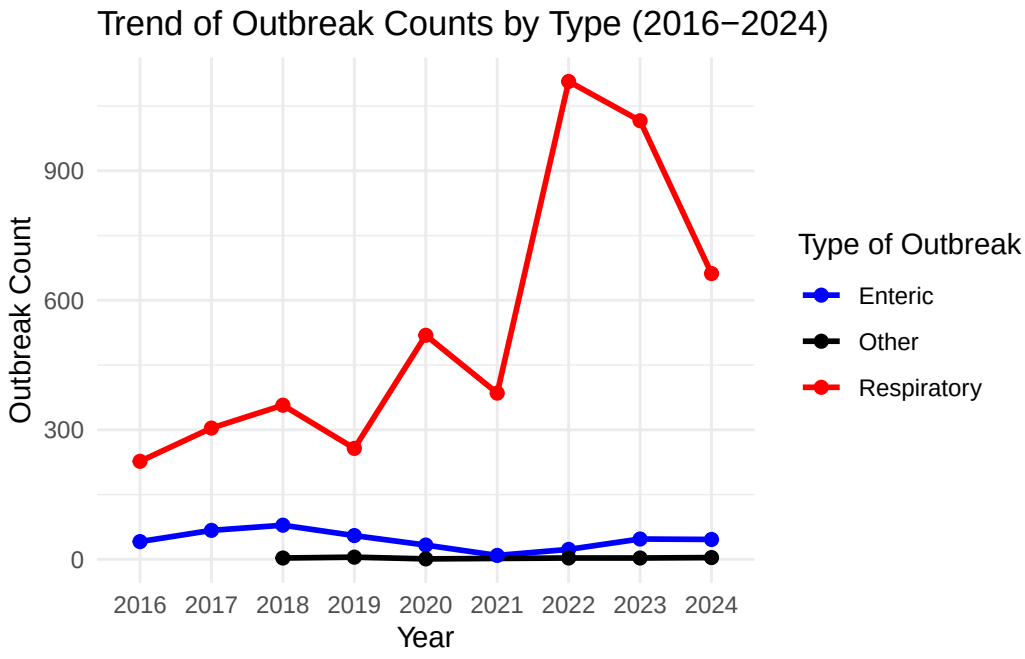
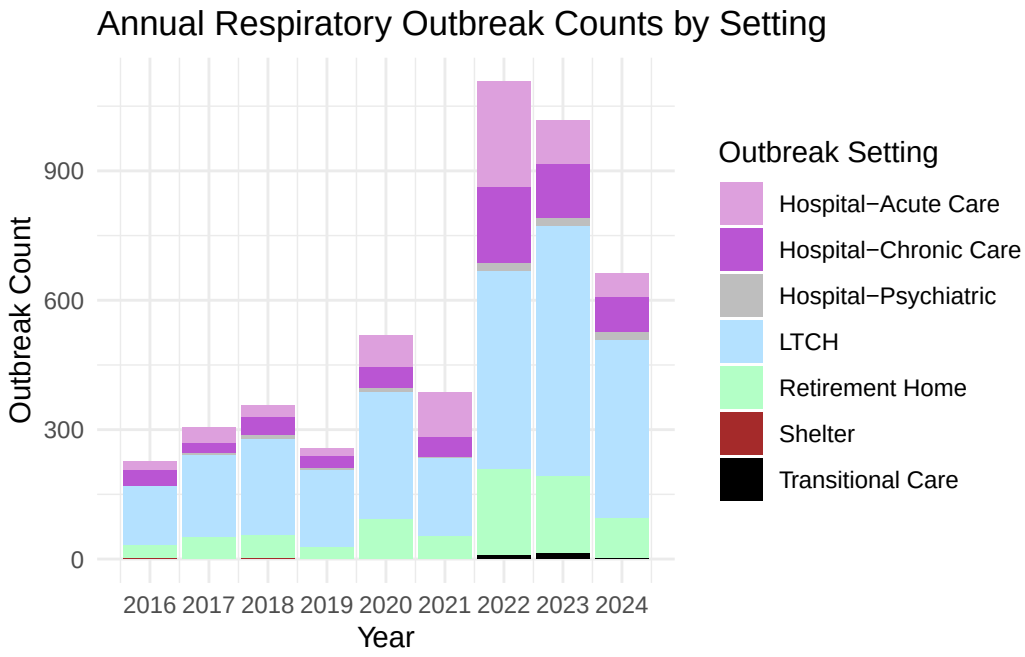


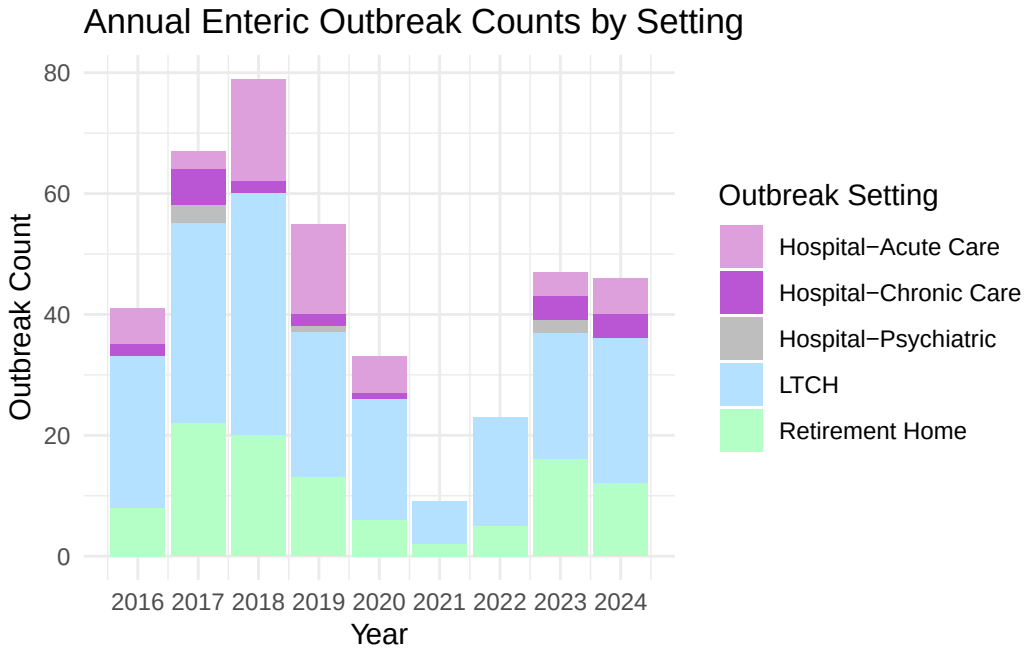
Figure 2: Outbreaks Count by Outbreak Settings



{#fig-outbreaks count by types}



{#fig-respiratory outbreaks count by outbreak settings}



{#fig-enteric outbreaks count by outbreak settings}

Talk way more about it.

3 Discussion

(brief summary of what was done in the paper)

3.1 First discussion point

analyze the total outbreak frequency trend over the time period given. (in relation to the social/political background in healthcare)

3.2 Second discussion point

figure out what might be the main causative agent for the rapid increase in outbreak reports starting from 2022. acknowledging the causative agent that we should be aware of might help us prevent further outbreak increase from happening -> know what is causing this rise in outbreak reports and research about that specific disease settings

3.3 Third discussion point

from the results of the data analysis above, discuss a way we could prevent further increase of outbreak occurrence. in largely three dimensions: personal/ society/ government

3.4 Weaknesses and next steps

Dividing a year into just two could influence the analysis result. (ex. weather affecting the outbreak occurrence) Many 'N/A', 'Unable to identify' data in Causative Agent.

For further inspection, taking the place information in consideration might also have been meaningful.

Appendix

A Additional data details

A.1 Other Similar Datasets

A.2 Raw Data Variables Overview

References

Gelfand, Sharla, Thomas Greiner, and Mariya Firman. 2022. *Opendatatoronto: Access Open Data from the City of Toronto*. https://sharlagelfand.github.io/opendatatoronto/.

Goldstein, Lorrie. 2023. "Long Medical Wait Times Costing Canadians Billions, Report Says." *Toronto Sun*. https://torontosun.com/opinion/columnists/goldstein-long-medical-wait-times-costing-canadians-billions-report-says.

Grolemund, Garrett, and Hadley Wickham. 2011. *Lubridate: Make Dealing with Dates a Little Easier*. https://lubridate.tidyverse.org/.

Magis-Weinberg, Lucia, Gabriela R. LaFuente, Camila A. Hidalgo, Elyse Sandler, Rodolfo Magis-Rodríguez, and Tania Magis-Weinberg. 2021. "Impact of Unexpected Outbreaks: Early Psychological Responses to the COVID-19 Pandemic and Its Implications." *Frontiers in Psychology* 12: 576301. https://doi.org/10.3389/fpsyg.2021.576301.

Ontario, Public Health. 2024. *Pertussis in Ontario: Surveillance Report*. https://www.publichealthontario.ca/-/media/Documents/P/24/pertussis-ontario.pdf.

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

Staff, Now Toronto. 2024. "Whooping Cough Is on the Rise Across Ontario, Including in Toronto." *NOW Toronto*. https://nowtoronto.com/news/whooping-cough-is-on-the-rise-across-ontario-including-in-toronto/.

Toronto, City of. 2024. "Outbreaks in Toronto Healthcare Institutions Dataset." https://open.toronto.ca/dataset/outbreaks-in-toronto-healthcare-institutions/.

Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Grolemund, et al. 2019. "Welcome to the tidyverse." *Journal of Open Source Software* 4 (43): 1686. https://doi.org/10.21105/joss.01686.

Wickham, Hadley, Winston Chang, Lionel Henry, Thomas Lin Pedersen, Kohske Takahashi, Claus Wilke, Kara Woo, Hiroaki Yutani, and Dewey Dunnington. 2023. *Ggplot2: Create Elegant Data Visualisations Using the Grammar of Graphics*. https://ggplot2.tidyverse.org/.

Wickham, Hadley, Romain François, Lionel Henry, and Kirill Müller. 2023. *Dplyr: A Grammar of Data Manipulation*. https://dplyr.tidyverse.org/.

Wickham, Hadley, Jim Hester, and Max Kuhn. 2023. *Readr: Read Rectangular Text Data*. https://readr.tidyverse.org/.