

An analysis on outbreak management in Toronto Health Institutions from 2020 - 2022*

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Abstract

Outbreak management has always been one of the most important mission for healthcare institutions, not only to prevent transmissions of diseases/illnesses but also to protect public health. Especially in the COVID-19 era, outbreak response and management is considered as the top priority in healthcare institution operation. This paper discusses the outbreak management in Toronto health institutions from 2020 to 2022, as well as pointing out the relationship between healthcare setting, outbreak type and response duration.

1 Introduction

In the previous years, a lot has been learned with regards to the COVID-19 pandemic. With the unprecedented increase in the number of cases of different diseases, the responsibility for outbreak response and management in healthcare institutions has become more important than ever before. Outbreak management helps stop the further transmission of illnesses/diseases by identifying the source and implementing control measures.

In order to protect and improve public health, the Toronto Public Health works with healthcare institutions to prevent and control institutional outbreaks, including the use of best practices in infection prevention control. Healthcare institutions are required to monitor staff and patients/residents for signs and symptoms of gastroenteric and respiratory infections under the Ontario Health Protection and Promotion Act (HPPA) (Ontario 1990). The institutions must also actively seek, detect and report suspected and/or confirmed outbreaks to their local public health unit.

In the following paper, I will delve into the outbreaks in Toronto healthcare institutions during the COVID-19 period to shed light on the differences and trends in reacting to outbreaks. According to opendatatoronto (Gelfand 2022), an outbreak is defined as “a localized increase (e.g. in an institution, or a specific ward or floor within an institution) in the rate of infection or illness, above that which is expected.” I will first guide you through the data collection, methodology, and ethical concerns, which will be explained thoroughly in Section 2. Then I will discuss the data, visualize, and draw conclusions from the acquired data set.

2 Data

2.1 Source

All data used in this paper was obtained from the City of Toronto Open Data Portal and is titled “Outbreaks in Toronto Healthcare Institutions”. The dataset is published by Toronto Public Health and is refreshed weekly, with the latest refresh on Jan 19, 2023. The data provided on the portal include subsets of data from the year 2003 to the time of writing, which is 2023. For each year, the dataset displays each observation’s details, namely:

1. Outbreak setting: the type of facility, in terms of the type of healthcare provided, including Respiratory, Enteric (Gastroenteric), and Other
2. Type of Outbreak: the mode of transmission classification description of the outbreak

*Code and data are available at: <https://github.com/julieenguyennn/Outbreak-Management-in-Toronto-Health-Institutions>

3. Causative & Etiological Agent: the aetiological agent(s) that have been identified from one or more outbreak-related cases
4. Date Outbreak Began & Date Declared Over
5. Active Status
6. Institution Name & Address

2.2 Methodology

Based on the dataset, I first generated some questions that this paper aims to answer to gain a better understanding of outbreak management over the COVID-19 in Toronto health institutions, specifically:

- (1) What type of outbreak was the most encountered by the institutions during the period?
- (2) Which setting was more prone to expect an outbreak?
- (3) How long did it take for each type of setting control the outbreaks?

In order to answer those questions, I chose the 03 dataset that lies in the COVID-19 era - 2020, 2021, and 2022, to analyze, compare, and contrast. During the process, all the necessary libraries and packages, R package (R Core Team 2022) tidyverse (Wickham et al. 2019), janitor (Firke 2021), ggplot2 (Wickham 2016), RColorBrewer (Neuwirth 2022), and kableExtra (Zhu 2021), are utilised.

2.3 Ethical Concerns & Limitations

Before diving into the discussion, I would like to make some comments on the ethical concerns and limitations when acquiring and analyzing this dataset. The major ethical issue of this dataset is the blind spot created from excluding the reasons that caused the outbreaks. Particularly, resources such as human labors, systems, finance, workplace environment, patients' condition and medical history, etc. contribute to the outbreak management. Although the causative and etiological agent of the outbreaks were stated, the lack of those aforementioned information in the dataset may decrease the validity and capacity to compare the relationship between the settings and how long outbreaks were controlled, as well as limit the opportunity to make better suggestions on how to improve outbreak management in those institutions.

3 Discussion

To comprehend the context, let's first observe the overall landscape, of the total cases that were recorded. Throughout the period, there was a total of 2080 cases reported to experience an outbreak, with a surge from 2021 to 2022. In particular, Toronto health institutions underwent 553 cases in 2020, 394 cases in 2021, and 1133 cases in 2022. (Table 1)

Table 1: Total number of outbreaks from 2020 - 2022

| Year | No. of Outbreak |
|------|-----------------|
| 2020 | 553 |
| 2021 | 394 |
| 2022 | 1133 |

Looking deeper into these outbreaks, it is obvious that Respiratory diseases remain the major type of outbreak throughout the period, with a surge of approximately 700 cases from 2021 to 2022. While Enteric and other types of outbreak only accounted for a very small proportion of the outbreaks in total, these two types also remained constant throughout the period. See Figure 1 for illustration.

When examining the correlation between the outbreak type and the setting, it is noticeable that the majority of outbreaks happened in Long-term Care Housings (LTCH). In 2020, those LTCHs witnessed 20 cases of Enteric outbreak and 296 cases of Respiratory outbreak. In 2021, the number of outbreak dropped down to 187 cases in both type, while that of in 2022 increased to more than 450 cases. Another notable detail to point out is that other types of outbreak only occurred in the Acute Care division of the hospitals. In 2022, Toronto also encountered the emergence of outbreak

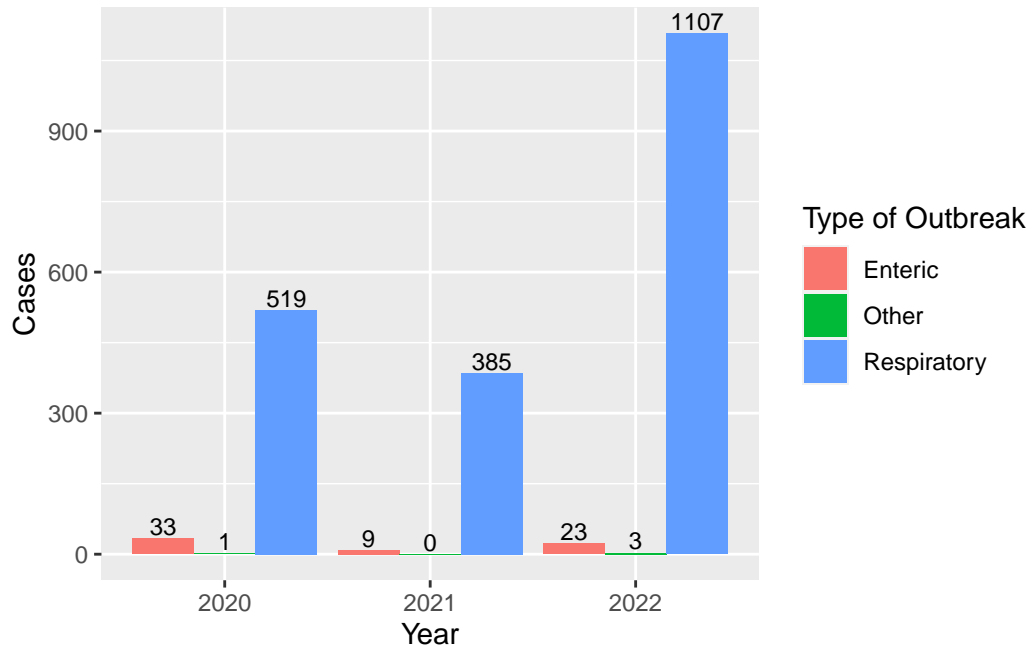


Figure 1: Outbreaks occurred by type, from 2020 - 2022

in Transitional Care with 9 cases. It is also apparent that hospital settings ceased to report cases for Enteric type of outbreak from 2021, on the other hand received more cases on respiratory diseases. (Table 2)

Table 2: The number cases of outbreak by setting from 2020 - 2022

| | 2020 | 2021 | 2022 |
|-----------------------|------|------|------|
| Enteric | | | |
| Hospital-Acute Care | 6 | NA | NA |
| Hospital-Chronic Care | 1 | NA | NA |
| LTCH | 20 | 7 | 18 |
| Retirement Home | 6 | 2 | 5 |
| Other | | | |
| Hospital-Acute Care | 1 | NA | 3 |
| Respiratory | | | |
| Hospital-Acute Care | 75 | 102 | 245 |
| Hospital-Chronic Care | 48 | 47 | 177 |
| Hospital-Psychiatric | 9 | 3 | 17 |
| LTCH | 296 | 180 | 459 |
| Retirement Home | 91 | 53 | 200 |
| Transitional Care | NA | NA | 9 |

Another significant aspect in outbreak response is the duration that the outbreak is controlled. In this case, I calculated the average days that each type of outbreak was controlled by the settings, as shown in Table 3. A limitation when looking into the duration that outbreak was controlled is that I only chose the observations that were successfully controlled by the end of 2022. In general, LTCHs had the highest response time in Respiratory disease with an average of 32 days in 2020, 35 days in 2021, followed by Retirement Home with 27 days in 2020 and 31 days in 2021. For Enteric disease, Retirement Home group remained stable in controlling the outbreaks throughout the period, with an average of 16 days. With the emergence of Respiratory disease in Transitional Care establishments in 2022, the average duration of outbreak control was rather high comparing to other kinds of setting.

Table 3: Outbreak control duration by setting from 2020 - 2022 (days)

| | 2020 | 2021 | 2022 |
|-----------------------|------|------|------|
| Enteric | | | |
| Hospital-Acute Care | 9 | NA | NA |
| Hospital-Chronic Care | 7 | NA | NA |
| LTCH | 12 | 6 | 10 |
| Retirement Home | 15 | 19 | 14 |
| Other | | | |
| Hospital-Acute Care | 27 | NA | 32 |
| Respiratory | | | |
| Hospital-Acute Care | 18 | 18 | 15 |
| Hospital-Chronic Care | 20 | 21 | 15 |
| Hospital-Psychiatric | 20 | 20 | 15 |
| LTCH | 32 | 35 | 23 |
| Retirement Home | 27 | 31 | 20 |
| Transitional Care | NA | NA | 22 |

4 Conclusion

In conclusion, during the period of 2020 to 2022, the total number of outbreaks in Toronto health institutions fluctuated and surged to more than 1100 cases by the end of 2022. Specifically, Respiratory diseases accounted for the majority of the cases and most cases emerged in Long-term Care Housings.

Through Table 2 and Table 3, it seems that one aspect that leads to longer response time is the number of cases reported in that setting. However, this cannot be concluded by just looking at this dataset. In particular, in 2022, although there were only 03 cases in experiences other types of outbreak but it took an average of 32 days to control them. In addition, as mentioned before, the lack of information of labor and environmental factors and the difference in the input for the number of cases and the average response days in 2022 affect the preciseness of the results. Therefore, the number of cases doesn't account for the amount of time that the outbreak can be controlled since it was influenced by other aspects - which was not mentioned in this dataset by opendatatoronto (Gelfand 2022).

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