Frequent Inspections Fail to Curb Violations in Toronto's Good-Standing Food Establishments*

Jerry Xia

September 27, 2024

This study analyzes inspection patterns and compliance outcomes using Toronto's DineSafe dataset (2022-2024) to explore the relationship between inspection frequency and food safety infractions in restaurants and takeout establishments. The data reveals that restaurants have a higher percentage of inspections resulting in infractions compared to takeout establishments, highlighting more significant compliance challenges in full-service operations. These findings suggest that current regulatory practices may need to focus more on restaurants to ensure public safety. By identifying gaps in inspection frequency and infractions, this analysis highlights the need for more targeted oversight to improve food safety.

Table of contents

---

*Code and data are available at: https://github.com/Jerryx2020/toronto_dinesafe_analysis

1 Introduction

In large urban centers like Toronto, ensuring food safety is a critical public health priority. Foodborne illnesses pose significant risks, and the health of the population is closely tied to the hygienic practices of food establishments, including restaurants, food trucks, and takeout locations. To address this, the DineSafe program, managed by Toronto Public Health, enforces health and safety regulations by conducting regular inspections of all food service establishments (Gelfand 2022). These inspections result in outcomes ranging from a pass to a conditional pass or even closure, depending on the establishment's compliance with food safety standards. According to the Centers for Disease Control and Prevention (CDC), frequent and transparent food inspections are instrumental in reducing foodborne illness outbreaks, as public posting of inspection results can encourage better compliance in food service settings (Centers for Disease Control and Prevention 2024). Despite this, significant variations exist in the frequency of inspections and the severity of infractions, raising concerns about whether some establishments, particularly mobile or temporary food vendors, receive adequate regulatory attention (Analytics 2023).

This study focuses on analyzing Toronto's DineSafe dataset, covering inspections from 2022 to 2024, to investigate patterns in inspection frequency and compliance outcomes among different types of food establishments. While previous research has broadly examined compliance across food establishments, this paper delves deeper into the relationships between establishment types—such as traditional restaurants and takeout locations—and the severity of infractions identified during inspections. Restaurants exhibit a higher rate of severe infractions compared to takeout establishments, suggesting that full-service operations may require more regulatory oversight to address food safety challenges (Agency 2023).

To address this gap, the DineSafe inspection data for Toronto food establishments was obtained and cleaned as described in Section 2.1. The results, presented in Section 2.2, reveal key trends in the frequency of inspections and the prevalence of infractions across different establishment types. The findings indicate that while mobile food vendors undergo fewer inspections than restaurants, they exhibit a higher rate of severe infractions relative to the number of inspections conducted. These insights, as discussed in Section 3, highlight the need for more frequent inspections or stricter regulations in this sector to ensure public safety.

The remainder of this paper is organized as follows: Section 2.1 provides a detailed overview of the data and the methodology used to clean and analyze the dataset; Section 2.2 presents the key findings of the analysis, including the inspection frequency and infraction severity; and Section 3 concludes with recommendations for improving food safety oversight in Toronto. The appendix includes additional materials, such as code and data, ensuring full reproducibility of the results.

2 Data

2.1 Overview

This analysis utilizes the DineSafe dataset from Toronto's Open Data platform, accessed using the `opendatatoronto` package (Gelfand 2022). The dataset includes inspections conducted from 2022 to 2024, providing detailed information on health inspections of food establishments, including restaurants and takeout locations, throughout Toronto. Key variables in the dataset include inspection dates, infraction types, and establishment compliance statuses, which serve as the primary indicators for assessing food safety. These regular inspections are crucial for maintaining food hygiene standards, as highlighted by the CDC, which emphasizes the importance of routine inspections and the public posting of results, such as letter grades, to encourage compliance and reduce foodborne illnesses (Centers for Disease Control and Prevention 2024).

For this study, only the inspection data for "Restaurant" and "Food Take Out" establishments that passed their most recent inspection were retained. This focus allows for an in-depth exploration of the correlation between inspection frequency and the occurrence of infractions in establishments that are deemed to be in compliance. The DineSafe dataset is updated regularly by Toronto Public Health, and is considered open data under Toronto's Open Data Licence (Section A.3), as long as proper attribution is provided (Toronto 2024).

The data analysis and processing were carried out using the R programming language (R Core Team 2023), employing a range of specialized packages. The `tidyverse` package (Hadley Wickham et al. 2019) was used extensively for filtering, cleaning, and summarizing the data. Additionally, the `ggplot2` package (H. Wickham 2016) was applied to visualize patterns in inspection frequency and the severity of infractions. Date-related data were managed using the `lubridate` package (Grolemund and Wickham 2011) to ensure consistency in handling inspection dates.

This analysis exclusively focuses on data for restaurants and takeout establishments, as these are among the most common food service types in Toronto, and represent a significant portion of the inspections carried out by public health authorities. As described in Section 2.2, the dataset was thoroughly cleaned and prepared for analysis, ensuring that all irrelevant fields were removed and the remaining data was formatted for accurate analysis.
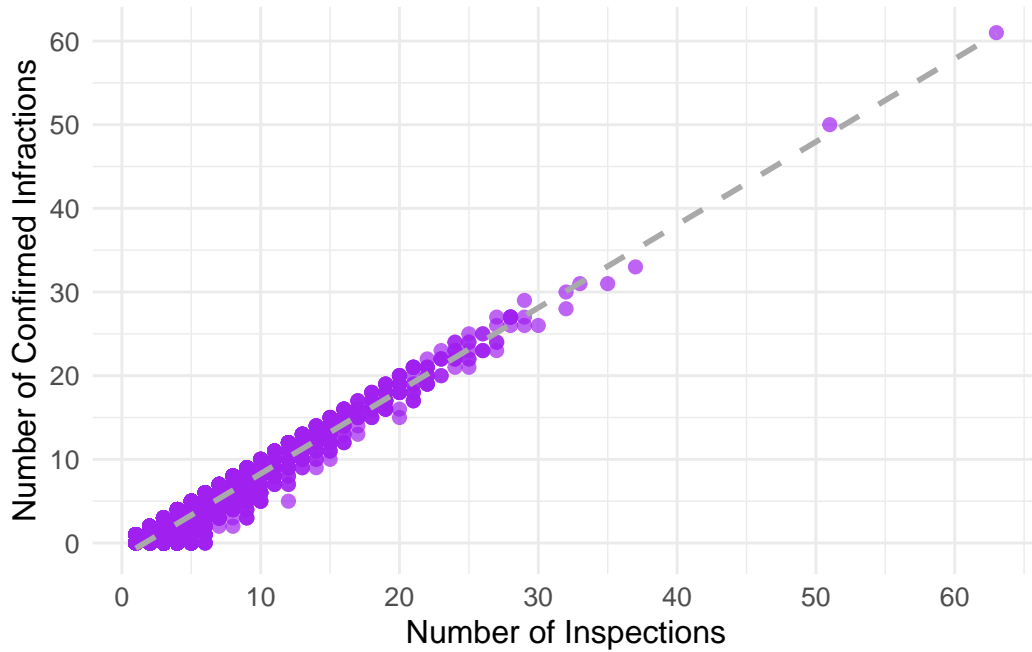
2.2 Results

Figure 1: Inspection Count vs Infraction Count per Establishment

As shown in Figure 1, the graph now excludes only inspections where "No Infraction" was recorded. The results show that establishments inspected more frequently tend to have higher counts of infractions. This positive correlation reflects findings from the literature that increased inspection frequency does not necessarily reduce violations but instead highlights pre-existing issues (Public Health 2023; Centers for Disease Control and Prevention 2024). The data was processed using the `tidyverse` package for summarization and visualization (Hadley Wickham et al. 2019), while the plots were generated using `ggplot2` (H. Wickham 2016).
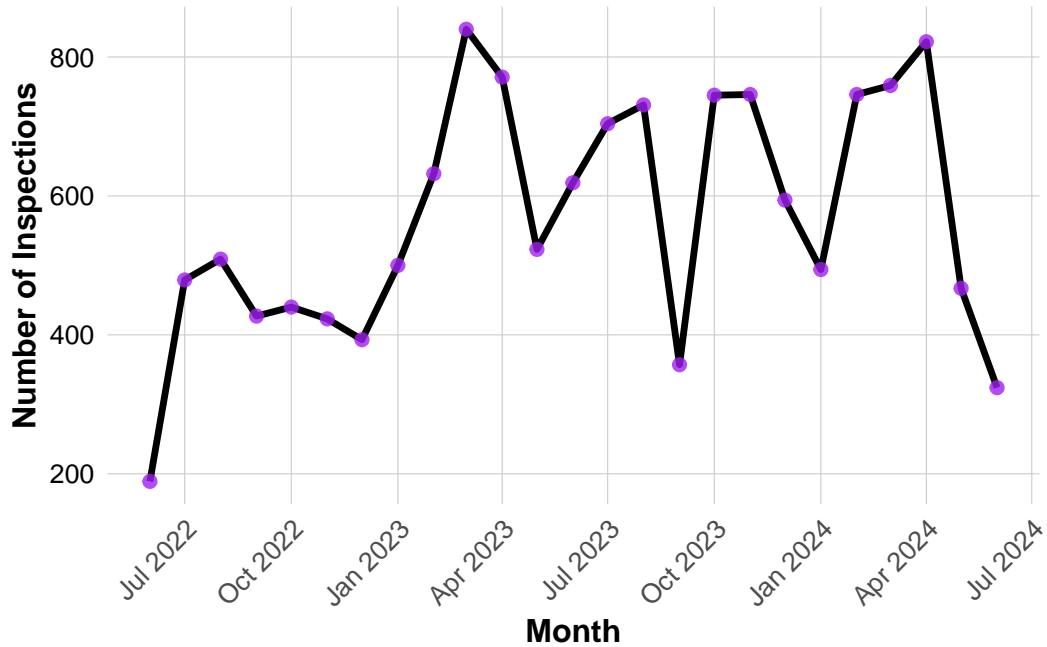
Figure 2: Number of Inspections Conducted Over Time (Monthly)

As shown in Figure 2, the number of inspections fluctuates month by month. Several external factors, such as regulatory changes, seasonal variations, or public health crises like the COVID-19 pandemic, likely influence these inconsistencies in inspection activity (Analytics 2023). The visualization was created using `ggplot2` (H. Wickham 2016) for plotting and `lubridate` (Grolemund and Wickham 2011) for time-based grouping.
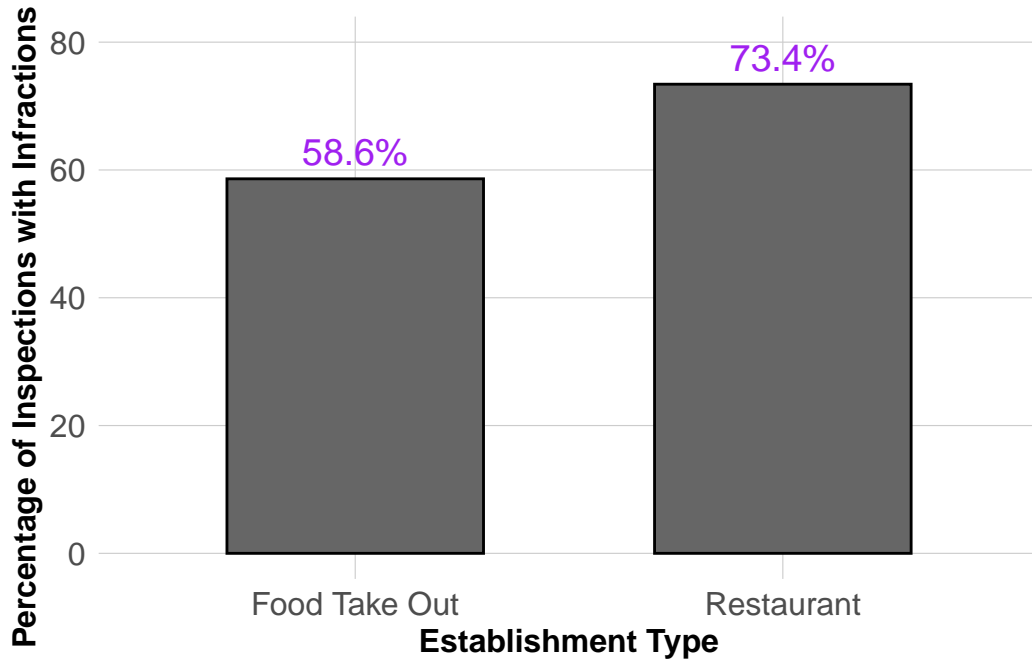
Figure 3: Percentage of Inspections Resulting in Infractions: Restaurants vs. Takeout

As shown in Figure 3, the percentage of inspections resulting in infractions is higher for restaurants (73.4%) compared to takeout establishments (58.6%). This indicates that despite takeout establishments being subject to fewer total inspections due to their smaller numbers, restaurants have a greater percentage of infractions per inspection. This could suggest that full-service restaurants face more complex operational challenges that increase the likelihood of non-compliance with food safety regulations. Research has shown that full-service restaurants, due to the complexity of food handling processes, tend to have higher rates of infractions compared to smaller or more specialized establishments (Analytics 2023; Agency 2023). These findings underscore the need for continued regulatory focus on restaurants, where maintaining compliance appears more difficult, reflecting the operational differences between full-service restaurants and takeout locations (Centers for Disease Control and Prevention 2024).

3 Discussion

The analysis of the DineSafe data revealed several key insights into food safety practices across Toronto's restaurants and takeout establishments. One notable observation, as depicted in Figure 1 and discussed in Section 2.2, is the positive correlation between the number of inspections conducted at an establishment and the number of infractions identified. This finding suggests that more frequent inspections tend to uncover more infractions. However, it raises the question of whether these inspections are uncovering ongoing compliance issues rather than fostering improvements. Similar conclusions have been noted in previous studies, which found that increased inspection frequency highlights existing compliance problems without necessarily reducing the overall number of violations (Public Health 2023; Centers for Disease Control and Prevention 2024).

When examining the number of inspections conducted over time, as shown in Figure 2, and detailed in Section 2.2, the data indicates inconsistencies in inspection activity. These variations are likely influenced by external factors such as regulatory changes, public health events (e.g., the COVID-19 pandemic), or operational adjustments (Analytics 2023). While spikes in inspection activity may correspond to heightened public health concerns, ensuring sustained compliance requires consistent follow-up actions. Without continuous enforcement measures, temporary increases in inspections may not lead to long-term reductions in infractions.

Figure 3 in Section 2.2 compares the percentage of inspections resulting in infractions between restaurants and takeout establishments. Restaurants, with a 73.4% infraction rate compared to 58.6% for takeout establishments (Figure 3), face greater compliance challenges, suggesting a need for enhanced regulatory scrutiny. This suggests that full-service restaurants, due to their operational complexity, may face greater compliance challenges with food safety regulations. This observation is consistent with other research that highlights the difficulties full-service restaurants experience in maintaining hygiene and safety standards, as their more complex operations involve multiple stages of food preparation and handling (Analytics 2023; Agency 2023). These findings underscore the importance of focused regulatory oversight on restaurants, where compliance challenges appear more prevalent.

Despite the valuable insights provided by this analysis, certain limitations must be acknowledged. As noted in Section 2.2, the DineSafe dataset may not capture all infractions, especially for establishments classified as low-risk and inspected less frequently. This underrepresentation could result in an incomplete view of food safety compliance across the city. Moreover, some infractions may not lead to immediate enforcement actions (e.g., fines or closures), potentially allowing non-compliance to persist over time. Addressing these limitations may require additional measures such as follow-up inspections and broadening the range of establishments subject to frequent scrutiny (Gelfand 2022).

Future research could investigate the application of machine learning techniques to predict which establishments are most likely to fail inspections based on historical data, allowing regulatory bodies to allocate resources more efficiently (Public Health 2023). Additionally, more

detailed studies into the effectiveness of enforcement actions, such as fines and mandatory re-inspections, could provide insights into strategies for improving compliance rates. Comparative analyses between cities with varying levels of transparency, such as public disclosure of inspection scores, could further illuminate best practices for reducing foodborne illness outbreaks and enhancing compliance, as discussed in Section 3.

In conclusion, while the DineSafe program has been successful in identifying non-compliant establishments, this study suggests that frequent inspections alone are not enough to prevent food safety violations. Targeted regulatory interventions, particularly in high-risk and complex food service sectors like full-service restaurants, may be required to strengthen compliance and safeguard public health in Toronto.

A Appendix

A.1 Dataset and Graph Sketches

Sketches depicting both the desired dataset and the graphs generated in this analysis are available in the GitHub Repository.

A.2 Data Cleaning

The data cleaning process was essential to prepare the raw DineSafe dataset for accurate analysis. Initially, we filtered the data to focus exclusively on "Restaurant" and "Food Take Out" establishments that had passed their most recent inspection. This ensured that our analysis targeted establishments in good standing, allowing us to assess how inspection frequency correlates with violations in compliant establishments.

Next, we removed irrelevant columns to simplify the dataset and enhance clarity. For example, columns unrelated to inspection outcomes or establishment types were excluded. Additionally, we ensured consistency across the dataset by renaming certain columns for clarity and ease of analysis.

To handle date-related data, we utilized the lubridate package (Grolemund and Wickham 2011), which enabled consistent date formatting and facilitated time-based analysis. The entire data cleaning process was carried out using the tidyverse package (Hadley Wickham et al. 2019), which streamlined the filtering, mutating, and summarizing operations essential for preparing the dataset for further exploration.

A.3 Attribution Statement

"Contains information licensed under the Open Government Licence – Toronto" (Toronto 2024).

References

Agency, Food Standards. 2023. "The Impact of Displaying Food Hygiene Ratings on Compliance." *FSA Research and Evidence.* https://science.food.gov.uk/.

Analytics, Hazel. 2023. "Post-Pandemic Food Safety Compliance: Key Insights from Health Inspections." *Nation's Restaurant News.* https://www.nrn.com/food-safety/post-pandemic-food-safety-compliance.

Centers for Disease Control and Prevention. 2024. "Posting Inspection Scores Reduces Foodborne Illness Outbreaks in Restaurants." *Food Safety Insights.* https://www.cdc.gov/foodsafety/.

Gelfand, D. 2022. *Opendatatoronto: Access the Toronto Open Data Portal.* https://CRAN.R-project.org/package=opendatatoronto.

Grolemund, Garrett, and Hadley Wickham. 2011. *Lubridate: Make Dealing with Dates a Little Easier.* https://CRAN.R-project.org/package=lubridate.

Public Health, MDPI Journal of. 2023. "Using Machine Learning to Predict Non-Compliant Food Outlets." *MDPI Open Access.* https://www.mdpi.com/journal/publichealth.

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

Toronto, City of. 2024. "Open Government Licence – Toronto." https://open.toronto.ca/open-data-license/.

Wickham, H. 2016. *Ggplot2: Elegant Graphics for Data Analysis.* Springer-Verlag New York. https://ggplot2.tidyverse.org.

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.