

# Assessing Immunization Coverage Rates in Toronto Schools

Ruoxian Wu

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This study investigates immunization coverage and exemption rates among school-aged children in Toronto, addressing a gap in localized public health data analysis. Utilizing records from Toronto Public Health for the 2017/2018 and 2018/2019 academic years, we conduct a descriptive statistical analysis to assess compliance with the Immunization of School Pupils Act (ISPA). Our findings highlight significant variations in immunization rates across schools and reveal trends in medical and philosophical exemptions. These insights are crucial for informing public health strategies and policies, underscoring the need for targeted interventions to enhance vaccine coverage. The paper contributes to the broader discourse on public health management in urban educational settings.

## Table of contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>Data</b>	<b>2</b>
<b>3</b>	<b>Model</b>	<b>3</b>
<b>4</b>	<b>Results</b>	<b>4</b>
<b>5</b>	<b>Discussion</b>	<b>5</b>
	<b>Reference</b>	<b>6</b>

# 1 Introduction

Immunization remains a cornerstone of public health strategy, particularly in safeguarding children’s health within school environments. In Ontario, the Immunization of School Pupils Act (ISPA) mandates that children attending elementary and secondary schools receive vaccinations against common communicable diseases or, alternatively, present valid exemptions “Immunization of School Pupils Act, r.s.o. 1990, c. i.1” (2021). This legislative framework not only aims to protect individual health but also to uphold community health standards through herd immunity. The recent years have seen a growing discussion around immunization coverage, fuelled by global health concerns and the emphasis on preventive healthcare.

This paper delves into an analysis of the Immunization Coverage Rates and exemption statuses for school pupils aged 7-17 in Toronto, spanning the academic years 2017-2019. The data, sourced from Toronto Public Health, offers a comprehensive view of the immunization landscape within the city’s educational institutions. It reflects the adherence to ISPA requirements, capturing both the up-to-date immunization status and recorded exemptions, whether philosophical or medical.

Despite the critical role of immunization in public health, there exists a gap in localized, data-driven insights into how effectively these mandates are being met at the ground level. This study aims to fill this gap by offering a detailed examination of immunization coverage and exemption patterns in Toronto’s schools. The objective is to provide a nuanced understanding of the current status of student immunization, identifying potential areas of concern and patterns that warrant closer attention from public health authorities.

The methodology of this study is grounded in Descriptive Statistics Analysis, which is pivotal for providing a foundational understanding of the data. This approach involves calculating fundamental statistical measures such as mean, median, mode, and standard deviation for key variables, namely immunization rates and exemption rates among school pupils in Toronto. By distilling this data into basic statistical terms, the analysis aims to shed light on the overall level of compliance with the ISPA requirements across different schools. This method provides a straightforward means of evaluating the current state of student immunization coverage in the city, offering a clear snapshot of both adherence to and deviations from public health mandates.

## 2 Data

Table 1: Sample of Cleaned immunization data from 2017-2018

school name	enrolled population	DTP coverage rate	MMR coverage rate
A Y JACKSON SECONDARY SCHOOL ACADEMIE	1070	91.0	95.7
ALEXANDRE-DUMAS ADAM BECK JUNIOR PUBLIC SCHOOL	110	88.2	90.0
AFRICENTRIC ALTERNATIVE SCHOOL	247	91.9	94.3
AGINCOURT COLLEGIATE INSTITUTE	66	71.2	72.7
AGINCOURT JUNIOR PUBLIC SCHOOL	1253	90.7	97.8
	109	98.2	98.2

Table 2: Sample of Cleaned immunization data from 2018-2019

school name	enrolled population	DTP coverage rate	MMR coverage rate
A Y Jackson S.S.	1027	89.0	96.5
Academie Alexandre-Dumas	129	86.8	89.1
Adam Beck Jr P.S.	309	96.1	95.8
Africentric Alternative School	77	71.4	72.7
Agincourt C.I.	1241	87.3	98.1
Agincourt Jr P.S.	141	99.3	98.6

Two dataset immunization-coverage-2017-2018 Table 1 and immunization-coverage-2018-2019 Table 2 are downloaded from opendatatoronto (“Immunization Coverage for Students” (2022)). This paper is interested in variables, including DTP coverage rate and MMR coverage rate. Thus, the cleaned data only contain the variables of interest.

### 3 Model

The goal of our modelling strategy is to uncover and understand the underlying patterns and trends in immunization coverage rates and exemption rates within the studied school populations. This includes identifying variations across different schools, time periods, and possibly demographic groups.

This model also aim to evaluate the level of compliance with the ISPA across schools in Toronto. The model aims to quantify how well schools are adhering to the requirements set forth by the ISPA.

We run the model in R (R Core Team 2022) using the `rstanarm` package of Goodrich et al. (2022). We use the default priors from `rstanarm`.

We create the boxplots using the `ggplot2` package Wickham (2016).

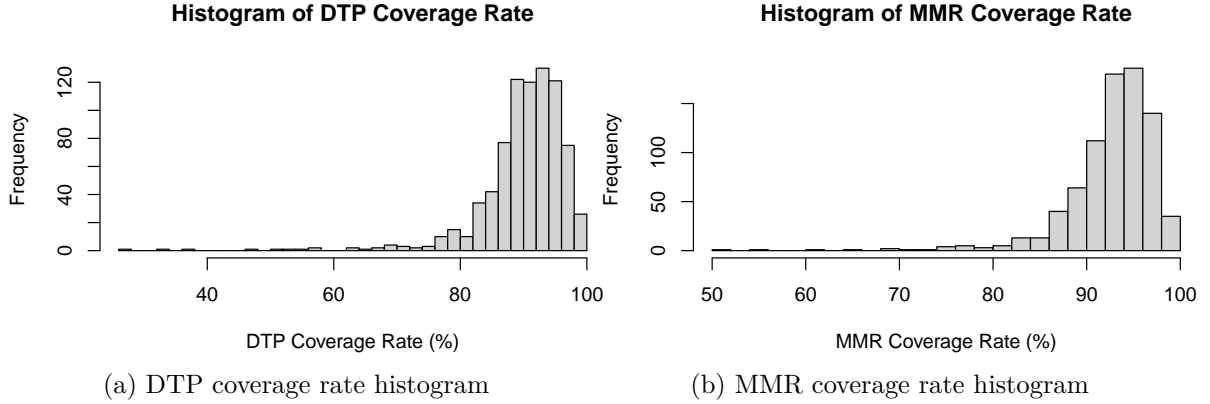


Figure 1: histogram of DTP coverage rate percent from 2017 to 2018

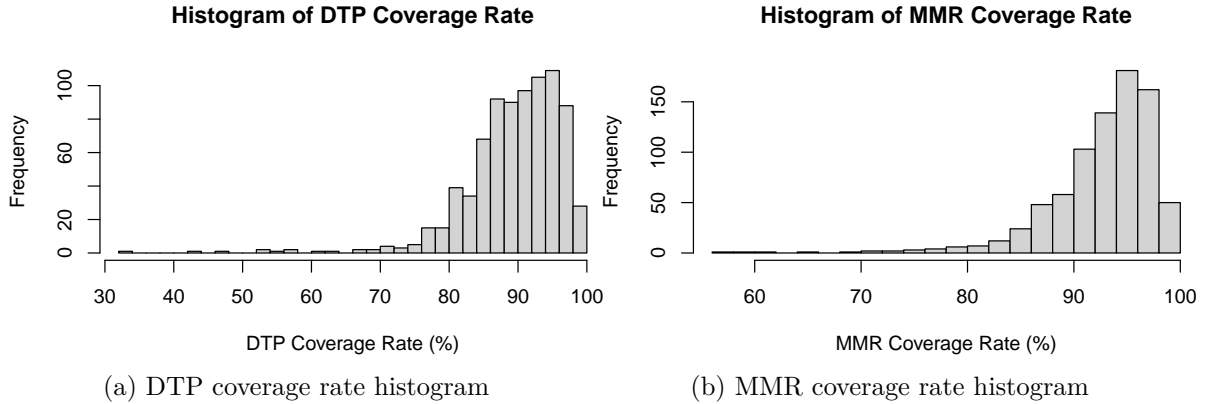


Figure 2: Histograms of DTP coverage rate percent from 2018 to 2019

## 4 Results

The boxplots Figure 3 representing the distribution of vaccination coverage rates for MMR (Measles, Mumps, and Rubella) and DTP (Diphtheria, Tetanus, and Pertussis) among school pupils in Toronto.

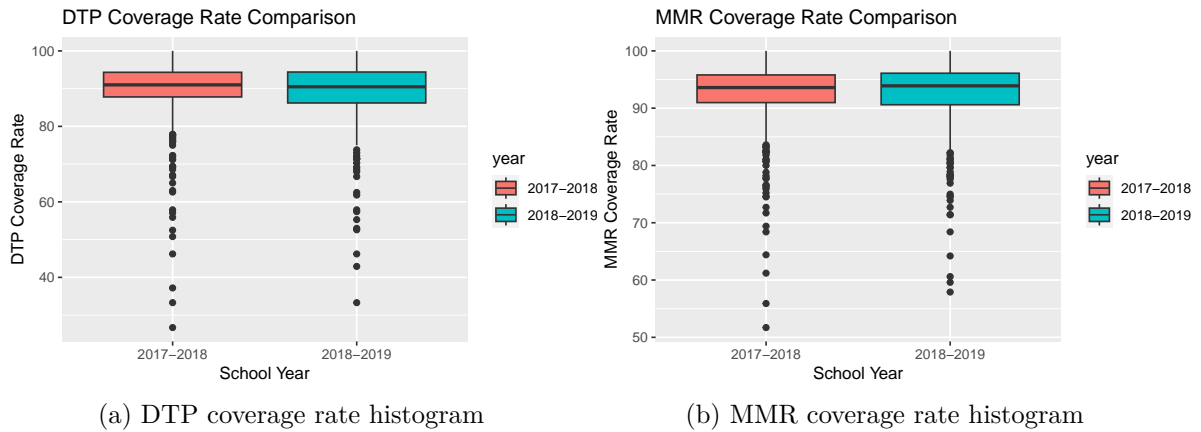


Figure 3: Boxplots comparing DTP and MMR coverage rate percent across two years

## 5 Discussion

The analysis of Toronto school immunization data highlights some interesting trends. Larger schools showed a tendency towards slightly lower DTP coverage rates and marginally higher exemption rates for both DTP and MMR, but these relationships were relatively weak. On the other hand, the same larger schools exhibited moderately higher MMR coverage rates.

In terms of vaccine-specific data, there was a notable trend where higher exemption rates corresponded with lower coverage rates for both DTP and MMR vaccines. Additionally, the exemption rates for DTP and MMR were highly consistent across schools, suggesting similar patterns in how exemptions are granted for these vaccines.

Descriptive statistics revealed that the vaccination coverage and exemption rates across schools in Toronto vary, with some schools meeting or exceeding public health targets, while others fall short. This variation underscores the importance of tailored public health strategies to address the specific needs of different school communities.

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## Reference

- Goodrich, Ben, Jonah Gabry, Imad Ali, and Sam Brilleman. 2022. “Rstanarm: Bayesian Applied Regression Modeling via Stan.” <https://mc-stan.org/rstanarm/>.
- “Immunization Coverage for Students.” 2022.
- “Immunization of School Pupils Act, r.s.o. 1990, c. i.1.” 2021. <https://www.ontario.ca/laws/statute/90i01>.
- R Core Team. 2022. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. <https://www.R-project.org/>.
- Wickham, Hadley. 2016. “Ggplot2: Elegant Graphics for Data Analysis.” Springer-Verlag New York. <https://ggplot2.tidyverse.org>.