Inequitable Access*

An Analysis of Licensed Child Care in Toronto's 25 Wards

Thomas Fox

April 21, 2024

Child care is essential for the well being of families, communities, and the children able to attend these facilities. This paper examines the accessibility of licensed child care centres across Toronto's 25 wards. Findings indicate that there are more children per existing child care space in wards with lower household incomes, lower proportions of English speaking households, and higher proprotions of the population identifying as racialized. These findings suggest inequitable access to licensed child care spaces based on a variety of social factors, supporting initiatives aimed at increasing access to licensed child care in the city of Toronto.

Table of contents

*Code and data are available at: https://github.com/ThomasWilliamFox/child_care_access.git.

1 Introduction

Equitable access to child care is essential to the social and economic health of a community such as the City of Toronto. Access to child care has been shown have a positive impact occupational and educational opportunities for parents, especially those in lower income brackets (Gunaseelan 2021). These economic advantages for parents and families bring benefits to their physical and social well-being (Gunaseelan 2021). Child care access also impacts the health and development of children attending these facilities (Rhijn et al. 2021). Vulnerable children disproportionately benefit from child care access as these centers help to facilitate early intervention methods (Underwood and Frankel 2012). Equitable access to child care is therefore a vital facet of community health and development.

This paper explores child care data from Toronto Children's Services (2024) and ward data from Toronto City Planning (2024) to explore child care access across the city of Toronto. These data sets are made freely available by Open Data Toronto (Gelfand 2022). Data analysis and processing was performed using the programming language `R` (R Core Team 2023). Various packages were used throughout the writing of this paper including `tidyverse` (Wickham et al. 2019), `arrow` (Richardson et al. 2023), `here` (Müller 2020), `ggmap` (Kahle and Wickham 2013), `maps` (Richard A. Becker, Ray Brownrigg. Enhancements by Thomas P Minka, and Deckmyn. 2023), `knitr` (Xie 2023), `dplyr` (Wickham et al. 2023), `janitor` (Firke 2023), and `rstanarm` (Goodrich et al. 2022).

This analysis explores relationships between child care demand and various demographic metrics across Toronto's 25 wards (see Section 4). The paper's estimand is that average household income is negatively correlated with the number of children per child care space by ward. The paper also explores the relationships between existing child care spaces and the proportion of racialized and non-native-English speaking populations by ward. These findings demonstrate inequitable access to child care across the city of Toronto. As child care plays a central role in the social and economic well-being of communities, and has an especially positive impact

on vulnerable children and low-income families, these findings support measures and initiatives aimed at ensuring more equitable access to child care in the city of Toronto (see Toronto 2017).

The remainder of this paper is structured as follows. Section 2 outlines the data sets used throughout this paper made available by Open Data Toronto (Gelfand 2022). Section 2.1 explores the "Licensed Child Care Centres" data set provided by Toronto Children's Services (2024), while Section 2.2 explores the "Ward Profiles (25-Ward Model)" data set provided by Toronto City Planning (2024). A model built to explore the impact of income on child care spaces in Toronto is outlined in Section 3. Results of modeling and data analysis are found in Section 4. This is followed by a discussion surrounding these findings and their implications in Section 5. This section also includes discussions around potential weaknesses and next steps regarding this research.

2 Data

2.1 Licensed Child Care Centres

The "Licensed Child Care Centres" data set is provided to Open Data Toronto (Gelfand 2022) by the City of Toronto's Children's Services division (Toronto Children's Services 2024). The data set contains 1,066 entries, each corresponding to a licensed child care facility in Toronto. Variables chosen to isolate after cleaning include the facility ID number, the ward number where the facility is located, and the total number of individual child care spaces at the facility. Each facility's operation type is also isolated, with the data showing that there are 703 non profit, 324 commercial, and 39 public (City operated) facilities in Toronto. Information about whether the each facility has a fee subsidy contract or participates in the Canada-Wide Early Learning & Child Care (CWELCC) system is also included, with 68% of facilities having subsidy contracts and 87% of facilities participating in CWELCC. Table 1 shows the first six entries in this data set and Figure 1 shows the location of each facility across Toronto.

Table 1: Sample of Cleaned Toronto Licensed Child Care Centre Data

Facility ID	Ward Number	Total Spaces	Type	Subsidy	CWELCC
1	3	164	Non Profit Agency	Y	Y
2	8	83	Non Profit Agency	Y	Y
3	25	102	Non Profit Agency	Y	Y
4	10	65	Non Profit Agency	Y	Y
5	20	26	Non Profit Agency	Y	Y
6	24	62	Non Profit Agency	Y	Y

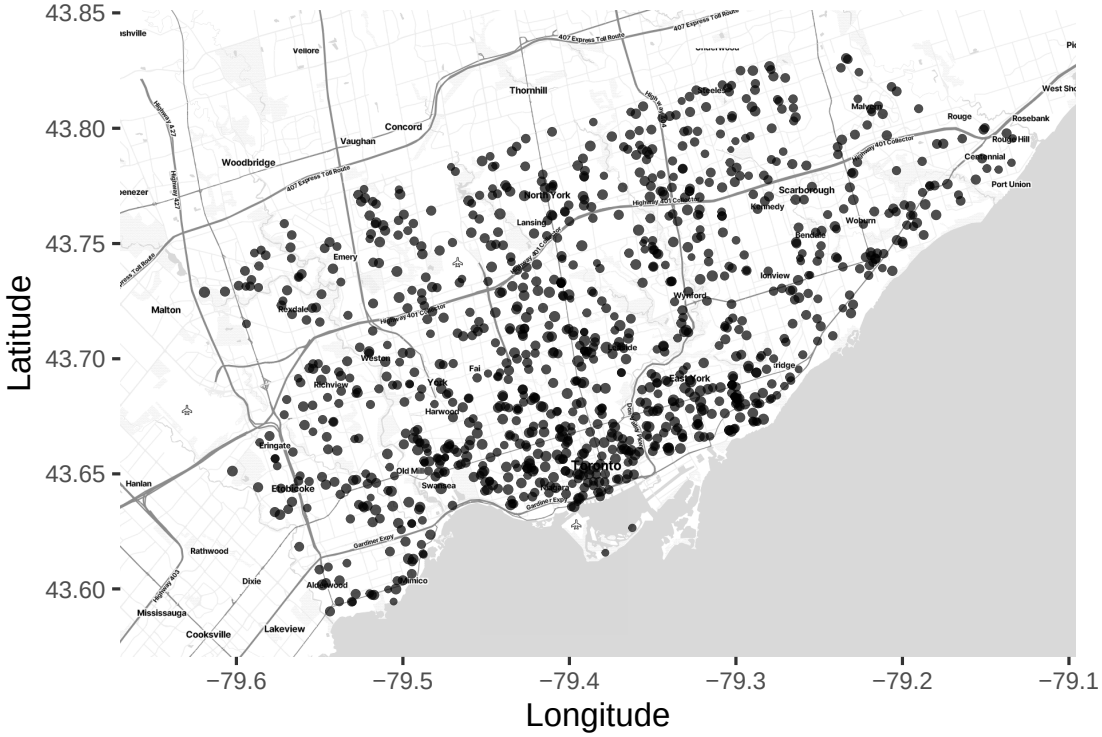


Figure 1: Map showing the loction of all licensed child care centres in Toronto

Figure 2 displays the total individual child care spaces found in each of Toronto's 25 wards. The wards with the fewest number of licensed child care spaces are Scarborough-Rouge Park with 1935 spaces, Etobicoke-North with 2094, and Scarborough North with 2104. The wards with the greatest number of child care spaces are Parkdale-High Park with 4632, Etobicoke-Lakeshore with 4937, and Toronto-Danforth with 5054.

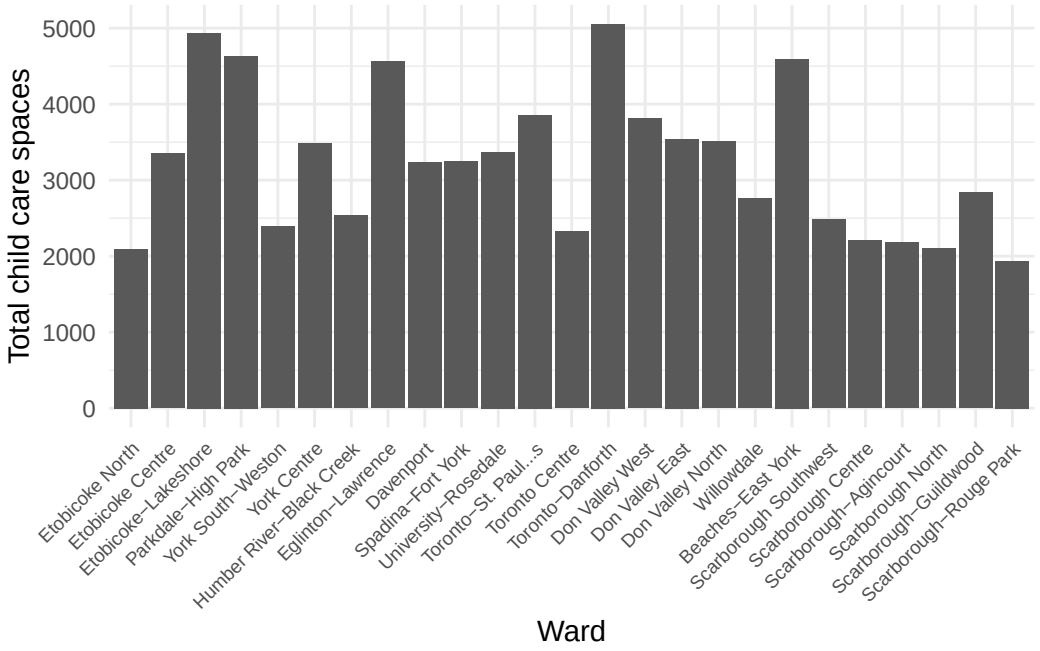


Figure 2: Total Number of Licensed Child-Care Spaces in Toronto by Ward

2.2 Toronto Ward Profiles

The "Ward Profiles (25-Ward Model)" data set is provided to Open Data Toronto (Gelfand (2022)) by Toronto City Planning (Toronto City Planning 2024). The data sets of interest in this paper found through this resource are the "2023-WardProfiles-2011-2021-CensusData" data set which is used to determine demographic information related to each ward, and the "25-WardNames-Numbers" data set that is used to code names to ward numbers in this paper (Toronto City Planning 2024). Variables isolated from the 2021 Canada Census include ward number, population, number of children under 15, average yearly household income, number of households where English is spoken most often, population identifying as racialized. Table 2 shows the first six entries in the cleaned data set.

Table 2: Sample of the First Six Entries in the Cleaned Toronto Ward Data

Ward	Total Population	Children Under 15	Average Household Income	English Spoken Most Often in Household	Population Identifying as Racialized
1	115120	18500	95200	67360	90130
2	117200	17300	146600	85330	37210
3	139915	18460	127200	105230	48675
4	104715	15015	127200	85720	30445
5	115675	18465	88700	76075	67120
6	107355	15555	107500	63260	56405

Figure 3 displays the total number of children under the age of 15 in each ward. Age range was selected to represent the child care age ranges found on the Government of Ontario's child care rules website (Ontario 2023). The wards with the fewest number of children are University-Rosedale with 8980, Spadina-Fort York with 9270, and Toronto Centre with 9310. The wards with the greatest number of children are Beaches-East York with 18685, Humber River-Black Creek with 18770, and Eglinton-Lawrence with 19115.

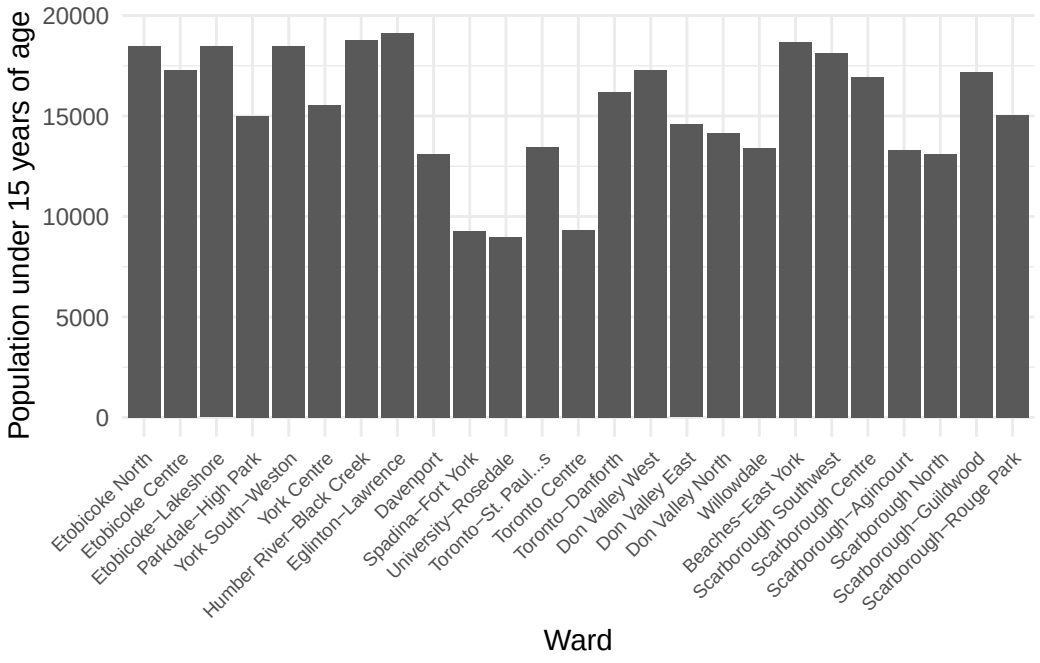


Figure 3: Population Under 15 Years of Age in Each of Toronto's 25 Wards

Figure 4 shows the average yearly household income in each of Toronto's 25 wards. The wards with the lowest average income in Toronto are Humber River-Black Creek with $85700, York

South-Weston with $88700, and Toronto Centre with $89400. Toronto's wards with the highest average income are University-Rosedale with $174800, Eglinton-Lawrence with $176400, and Don Valley West with $224800.

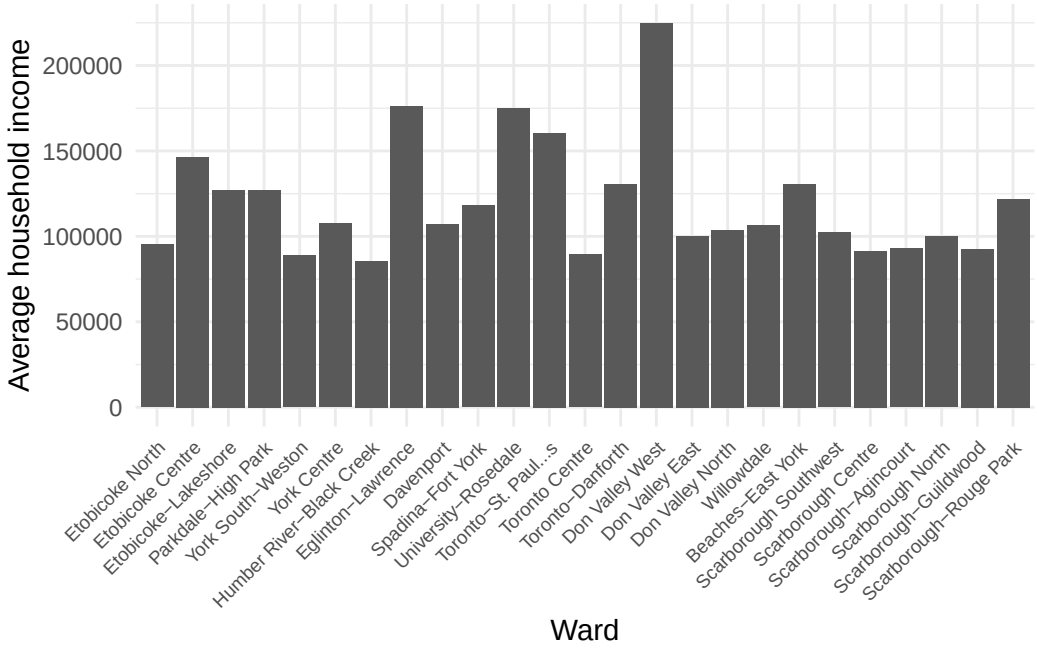


Figure 4: Average Household Income in Each of Toronto's 25 Wards

Figure 5 shows the proportion of the population in each of Toronto's 25 wards that speaks English most often in their households. The wards with the lowest proportion of English speaking households in Toronto are Humber River-Black Creek with 41%, York South-Weston with 43%, and Toronto Centre with 48%. Toronto's wards with the highest proportion of English speaking households are Toronto-Danforth with 81%, Beaches-East York with 81%, and Park Dale-High Park with 82%.

Figure 6 shows the proportion of the population in each of Toronto's 25 wards that identifies as racialized. The wards with the lowest proportion of racialized population in Toronto are Parkdale-High Park with 29%, Etobicoke Centre with 32%, and Davenport with 34%. Toronto's wards with the highest proportion of racialized population are Etobicoke-North 78%, Scarborough-Agincourt with 82%, and Scarborough-North with 92%.

3 Model

The goal of this paper's modelling strategy is to investigate the effects that average household income, proportion of racialized population, and proportion of English-speaking households

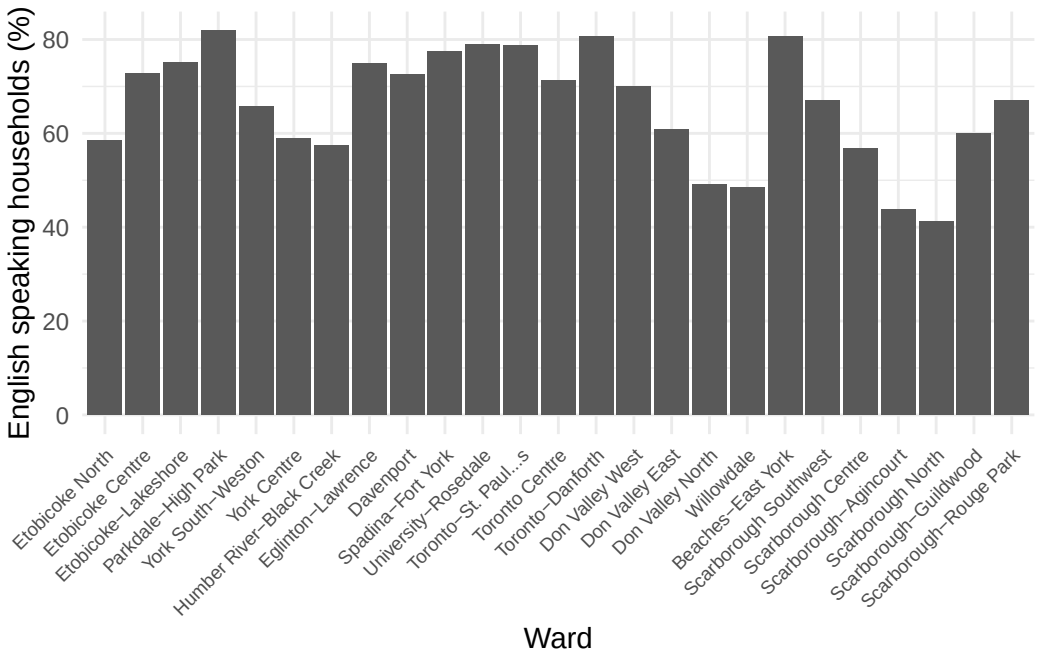


Figure 5: Proportion of the Population in Each of Toronto's 25 Wards That Speak English Most Often at Home

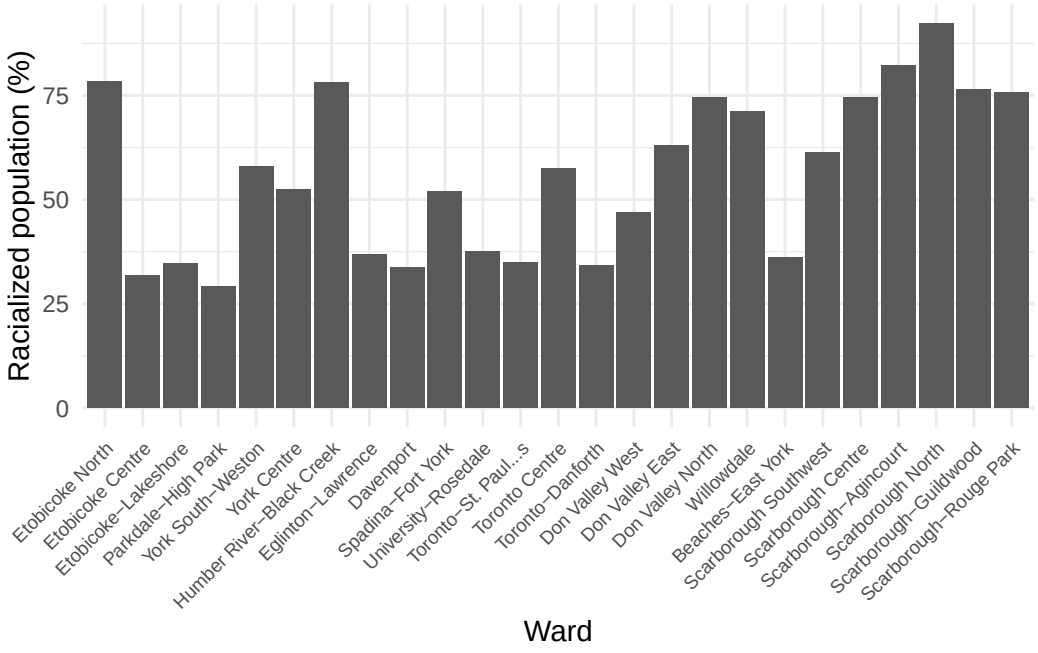


Figure 6: Proportion of the Population in Each of Toronto's 25 Wards Identify as Racialized

have on the number of children per existing child care space in each of Toronto's 25 wards.

Here we briefly describe the Bayesian analysis model used to investigate… Background details and diagnostics are included in Appendix B.

3.1 Model set-up

Define y_i as the number of children per child care space in a ward. Then β_i is the average household income in the ward, γ_i is the proportion of English speaking households in the ward, and θ_i is the proportion of the ward's population identifying as racialized.

$$y_i|\mu_i, \sigma \sim \text{Normal}(\mu_i, \sigma) \tag{1}$$
$$\mu_i = \beta_i + \gamma_i + \theta_i \tag{2}$$
$$\alpha \sim \text{Normal}(0, 2.5) \tag{3}$$
$$\beta \sim \text{Normal}(0, 2.5) \tag{4}$$
$$\gamma \sim \text{Normal}(0, 2.5) \tag{5}$$
$$\theta \sim \text{Normal}(0, 2.5) \tag{6}$$
$$\sigma \sim \text{Exponential}(1) \tag{7}$$

We run the model in R (R Core Team 2023) using the `rstanarm` package of Goodrich et al. (2022). We use the default priors from `rstanarm`.

3.1.1 Model justification

We expect a negative relationship between average household income and the number of children per child care space by ward. In particular…

We can use maths by including latex between dollar signs, for instance θ.

4 Results

Our results are summarized in Table 3.

5 Discussion

5.1 First discussion point

The discussion is a chance to show off what you know and what you learnt from all this.

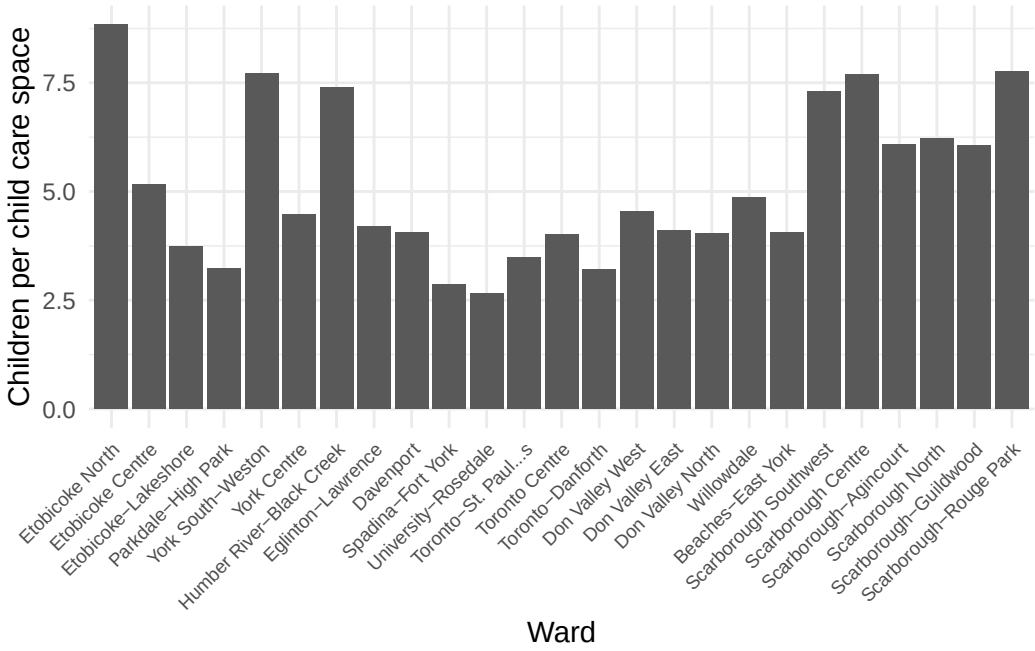


Figure 7: Number of Children for Every Existing Licensed Child Care Space in Each of Toronto's 25 Wards

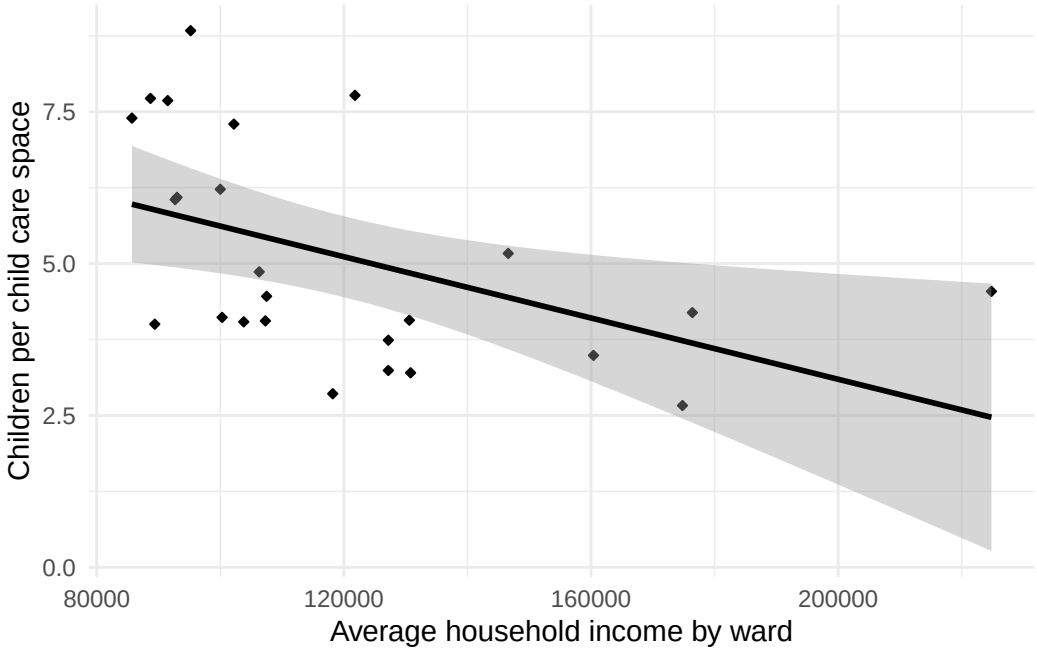


Figure 8: Relationship between income and child care spaces

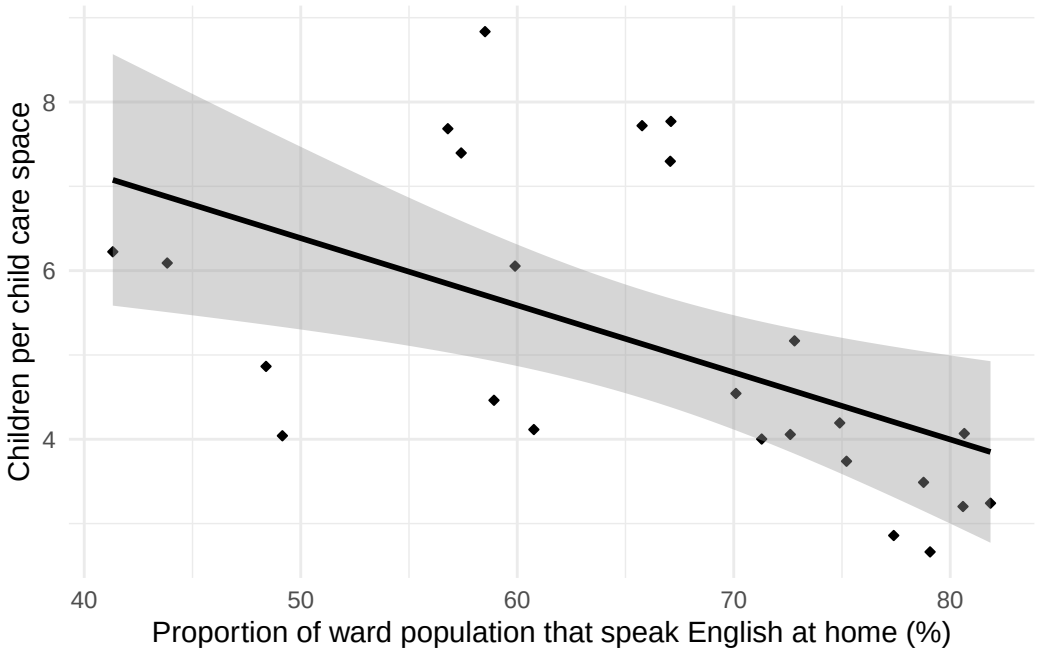


Figure 9: Relationship between language and child care spaces

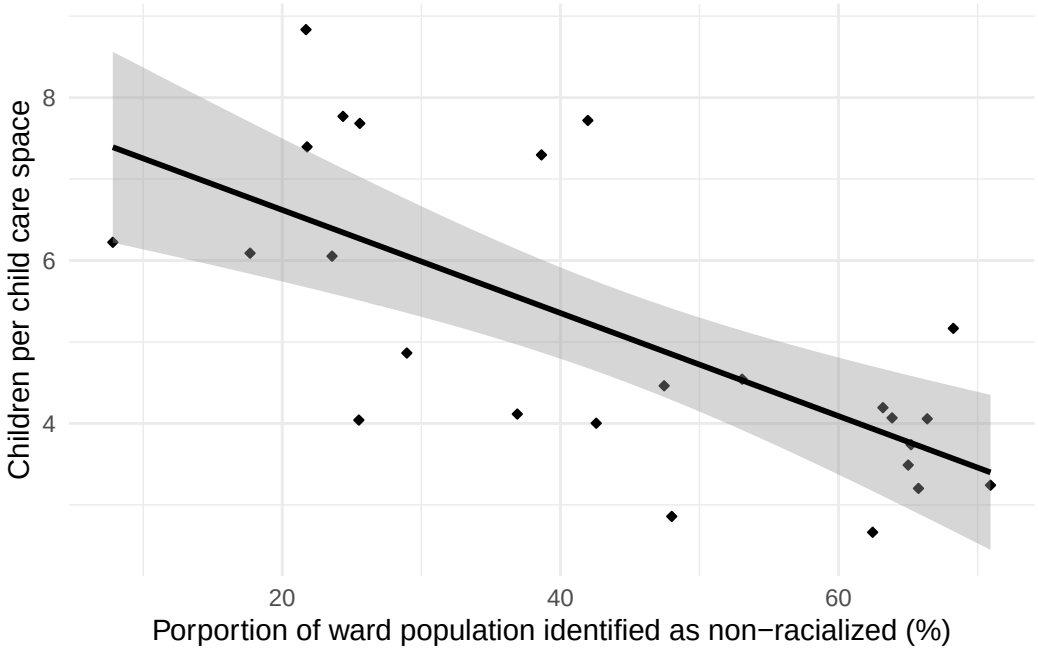


Figure 10: Relationship between non-racialized population by ward and child care spaces

Table 3: Explanatory models of flight time based on wing width and wing length

	First model
(Intercept)	6.22
	(2.25)
income	−1.15
	(2.30)
language	5.01
	(4.95)
nonracialized	−8.46
	(3.23)
Num.Obs.	25
R2	0.490
R2 Adj.	0.369
Log.Lik.	−42.131
ELPD	−45.8
ELPD s.e.	2.9
LOOIC	91.5
LOOIC s.e.	5.7
WAIC	91.2
RMSE	1.24

5.2 Second discussion point

5.3 Third discussion point

5.4 Weaknesses and next steps

Appendix

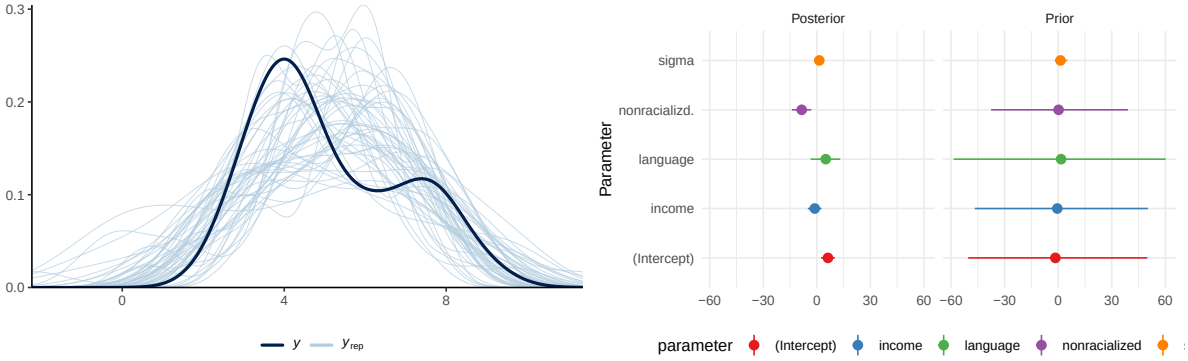
A Additional data details

B Model details

B.1 Posterior predictive check

In Figure 11a we implement a posterior predictive check. This shows...

In Figure 11b we compare the posterior with the prior. This shows...



(a) Posterior prediction check

(b) Comparing the posterior with the prior

Figure 11: Examining how the model fits, and is affected by, the data

B.2 Diagnostics

Figure 13a is a trace plot. It shows... This suggests...

Figure 13b is a Rhat plot. It shows... This suggests...

Figure 12 is a credibility interval plot

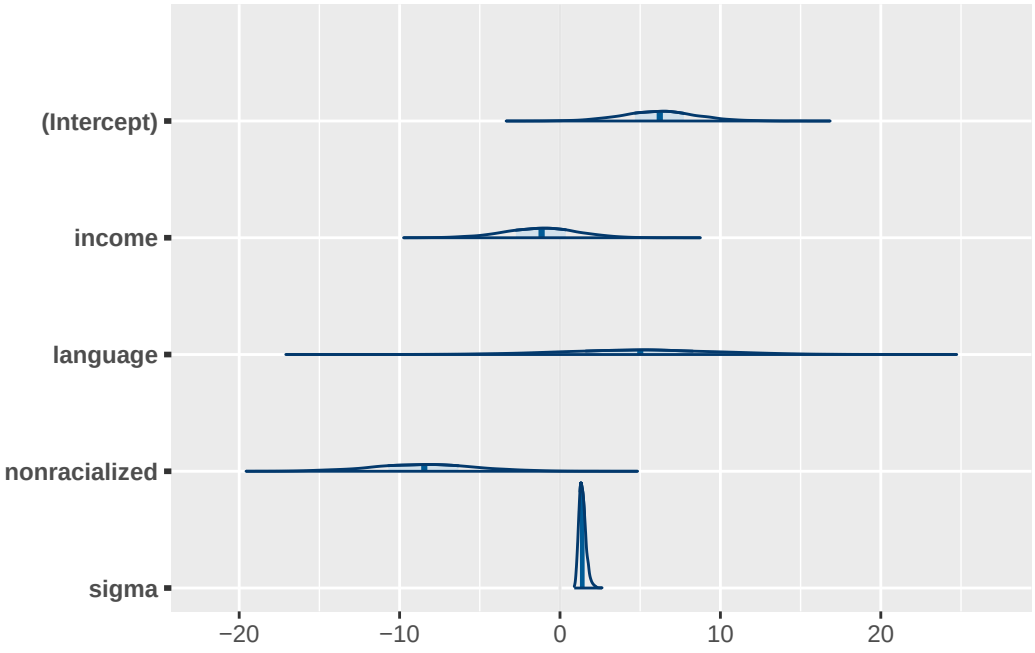
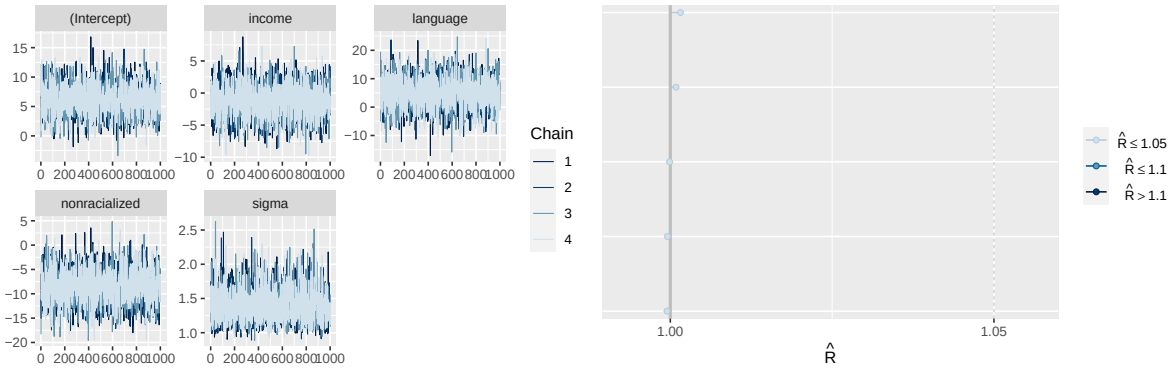


Figure 12: Checking the credibility of the model



(a) Trace plot

(b) Rhat plot

Figure 13: Checking the convergence of the MCMC algorithm

References

Alexander, Rohan. 2023. *Telling Stories with Data*. Chapman; Hall/CRC. https://tellingstorieswithdata.com.

Firke, Sam. 2023. *Janitor: Simple Tools for Examining and Cleaning Dirty Data*. https://CRAN.R-project.org/package=janitor.

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

Goodrich, Ben, Jonah Gabry, Imad Ali, and Sam Brilleman. 2022. "Rstanarm: Bayesian Applied Regression Modeling via Stan." https://mc-stan.org/rstanarm/.

Gunaseelan, Vinusha. 2021. "A New Normal for Child Care in Canada: Accessible, Affordable, Universal. Wellesley Institute."https://www.wellesleyinstitute.com/children-youth/a-new-normal-for-child-care-in-canada-affordable-accessible-universal/.

Kahle, David, and Hadley Wickham. 2013. "Ggmap: Spatial Visualization with Ggplot2." *The R Journal* 5 (1): 144–61. https://journal.r-project.org/archive/2013-1/kahle-wickham.pdf.

Müller, Kirill. 2020. *Here: A Simpler Way to Find Your Files*. https://CRAN.R-project.org/package=here.

Ontario, Government of. 2023. "Child Care Rules in Ontario." https://www.ontario.ca/page/child-care-rules-ontario.

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

Rhijn, Tricia van, Kathryn Underwood, Elaine Frankel, Donna S. Lero, Karen Spalding, Magdalena Janus, Martha Friendly, and Arlene Haché. 2021. "Role of Child Care in Creating Inclusive Communities and Access for All." *Canadian Public Policy* 47 (3): 399–409. https://doi.org/10.3138/cpp.2021-010.

Richard A. Becker, Original S code by, Allan R. Wilks. R version by Ray Brownrigg. Enhancements by Thomas P Minka, and Alex Deckmyn. 2023. *Maps: Draw Geographical Maps*. https://CRAN.R-project.org/package=maps.

Richardson, Neal, Ian Cook, Nic Crane, Dewey Dunnington, Romain François, Jonathan Keane, Dragoș Moldovan-Grünfeld, Jeroen Ooms, Jacob Wujciak-Jens, and Apache Arrow. 2023. *Arrow: Integration to 'Apache' 'Arrow'*. https://CRAN.R-project.org/package=arrow.

Toronto Children's Services. 2024. "Licensed Child Care Centres." https://open.toronto.ca/dataset/licensed-child-care-centres/.

Toronto, City of. 2017. "Torontos Licensed Child Care Growth Strategy." https://www.toronto.ca/wp-content/uploads/2022/11/9791-Torontos-Licensed-Child-Care-Growth-Strategy.pdf.

Toronto City Planning. 2024. "Ward Profiles (25-Ward Model)." https://open.toronto.ca/dataset/ward-profiles-25-ward-model/.

Underwood, Kathryn, and Elaine B Frankel. 2012. "The Developmental Systems Approach to Early Intervention in Canada." *Infants & Young Children* 25 (4): 286–96. https:

//doi.org/10.1097/IYC.0b013e3182673dfc.

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, Romain François, Lionel Henry, Kirill Müller, and Davis Vaughan. 2023. *Dplyr: A Grammar of Data Manipulation*. https://CRAN.R-project.org/package=dplyr.

Xie, Yihui. 2023. *Knitr: A General-Purpose Package for Dynamic Report Generation in r*. https://yihui.org/knitr/.