Death Registrations May Indicate a Discreptency Between Expected and Reported Data During the COVID-19 Pandemic*

An Analysis of Death Registrations from 2016-2020

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The COVID-19 pandemic marked a significant shift in Canadian mortality rates in the year 2020. Using death registry data from three civic centres in the greater Toronto are from 2016 to 2020, we demonstrate that even data from a considerably reliable source may become distorted

1 Introduction

Canadian death registry statistics offer a useful tool in helping better our healthcare system as by monitoring trends in public health such as infectious diseases, suicide, and unintentional injuries they help the healthcare sector provide better services and resources, like screening and prevention programs (Statistics Canada 2022b). However, maintaining this data may not always be done accurately which could cause confusion over our understanding of Canadian demography and health.

In this paper we look at death registry statistics from three civic centres in the greater Toronto area, Etobicoke, Scarborough and North York between 2016 and 2020. From this data, we find that the death licenses provided by these centres during the first year of the COVID-19 pandemic (2020), are much lower than in previous years (Open Data Toronto 2023). This is significant as Canada experienced an increase of 7.7% in deaths in 2020 (Statistics Canada 2022a), and 5.2% more deaths than would typically be expected when taking into account Canada's aging population (Statistics Canada 2021). We reason that this discrepancy in expected data versus reported data could be the result of strain and complications put onto record-keeping during this time similarly to what was seen in early 2019 with long delays in

*Code and data are available at: https://github.com/cthierst/death_registry_analysis.git.

the distribution of death, birth and marriage certificates due to high online demand (Jeffords 2019). Future work could look specifically at how strains on data reporting centres during the COVID-19 pandemic influenced data.

This paper will begin with an overview of its data management, source and cleaning. Next we will briefly overview the drop off in trend from previous years in death registrations to begin our discussion. Next we will consider the relationship between death licenses provided at each civic centre over the period of 2016 to 2020, to better understand how the year 2020 differed from past years. Next, we discuss in more detail, death licenses provided by each civic centre to determine a possible cause for the uncharacteristic decline of death licenses in 2020. We will then compare the mean number of deaths from each civic centre to further gauge how these centres relate to rates of death registrations. Finally, we will consider the limitations of the data, including biases.

2 Data

2.1 Data Management

This paper utilizes the R statistical programming language (R Core Team 2020), along with several packages. These packages are, tidyverse (Wickham et al. 2019), janitor (Firke 2021), here (Müller 2020) and dplyr (Wickham et al. 2022). The data being analyzed comes from Open Data Toronto and it is imported using the opendatatoronto package (Gelfand 2022). All figures have been created using ggplot2 (Wickham 2016) and the tables have been created with knitr (Xie 2023) and kableExtra (Zhu 2021), packages. The color styles in the graphs were created by using the RColorBrewer (Neuwirth 2022) package and any graph combinations were made using the Patchwork (Pedersen 2022) package.

2.2 Data Source and Cleaning

The data comes from death registrations which are entered into the Registry Services Tracking System (RSTS) by Registry Services staff who are located at three of the civic centres, Etobicoke, North York and Scarborough (Open Data Toronto 2023). It's creation supports the Vital Statistics Act, a Provincial legislation (Open Data Toronto 2023) which involve the collection of deaths, marriages, stillbirths, and live births (Statistics Canada 2022b). This data set is updated monthly (Open Data Toronto 2023). The variables from this data set represent the civic centres; "Etobicoke", "North York", and "Scarborough", number of death licenses registered in the month, place of death; "Outside City Limits" or "Toronto", and time period by month and year in which the death was registered (Open Data Toronto 2023).

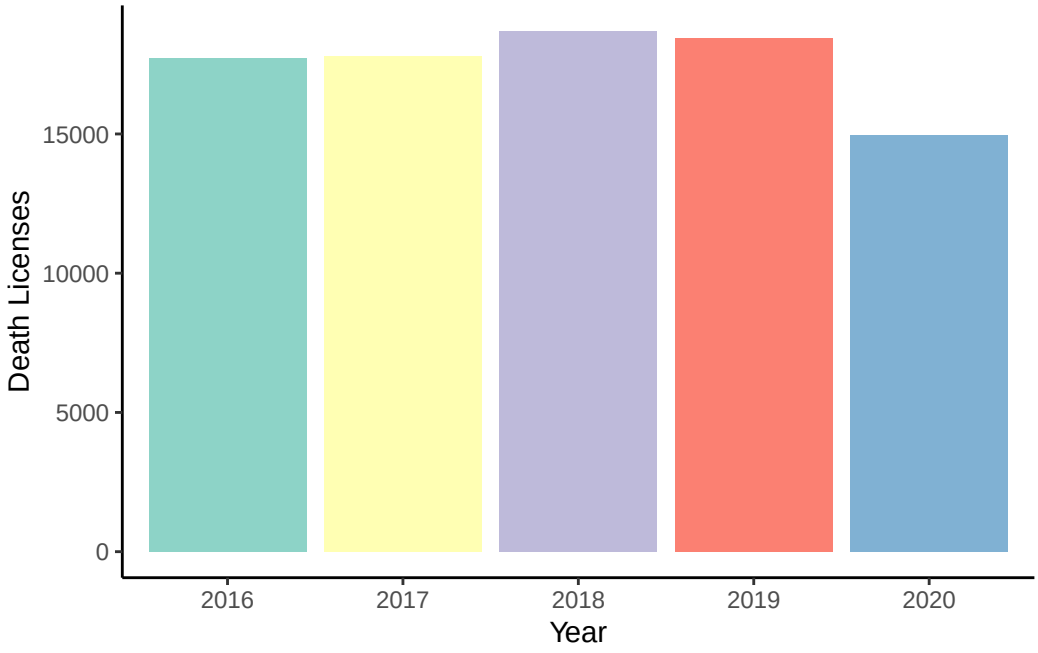
To properly analyze this data for the purposes of this paper certain data was removed including, all data for the years 2011-2015 and 2021-2023. This was done to ensure that the data set

being worked with had sufficient and consistent data to draw from without being too broad in scope. Additionally, rows from the civic centre variable labelled "Toronto" were removed as death registrations at this location were especially low and its data input, sporadic. Finally, the variable for place of death was not included in the analysis of this data as it was not relevant to its narrative.

2.3 Data Analysis

The province of Ontario represents a large portion of deaths in Canada, taking on an estimated 37% of Canadian mortality from 2016-2020 (Statistics Canada n.d.). It is also estimated that on average, that just over 100 thousand people have died each year in Ontario between 2016 and 2020 (Statistics Canada n.d.). We may suggest then, that Toronto makes up a large portion of this mortality rate, as it makes up approximately 44% of the Ontarian population (Statistics Canada n.d.). Additionally, Canada has an aging population, meaning that it's mortality rate is expected to rise every year although it rose exponentially due to the COVID-19 pandemic (Statistics Canada 2022a). Therefore, we may suspect that the COVID-19 pandemic would increase the mortality rate significantly in Toronto as Canada saw an increase of 7.7% in deaths in 2020 (Statistics Canada 2022a).

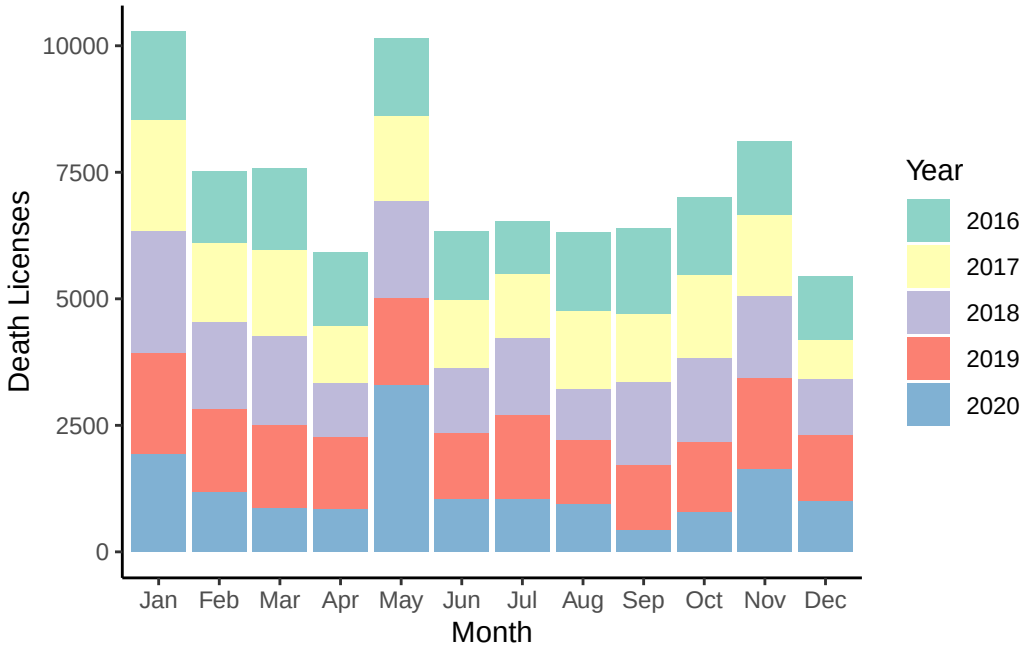
Figure 1: Death Licenses Provided by All Civic Centres Yearly From 2016-2020



When looking at Figure 1, however, we can see that from 2016 to 2018 to there was an increase in death licenses registered, as expected, followed by a slight drop in 2019. This drop in 2019

may be indicative of a backlog from Ontario's Vital Statistics in early 2019 which was cited as having delays of over three months, waiting for death, birth and marriage certificates (Jeffords 2019). What is most important in Figure 1 is that when looking at the "2020" bar in Figure 1, we can see that the death licenses registered drops significantly in comparison to any of the previous 4 months.

Figure 2: Death Licenses Provided by Month from 2016-2020 at Three Toronto Civic Centres



when looking at Figure 2 we can see - death licenses provided by month and year from all three civic centres - highlights the spike in death licenses provided in May - this may indicate a spike in deaths near the beginning of COVID-19 pandemic, - ~need to find source to make this make sense~

Looking briefly at Figure 3 we can see a surprising drop in death licenses provided in 2020. ###### this is surprising as death rates are said to have increased during the pandemic, yet there is a signficant decline ###### why? explain...

Figure 3: Death Licenses Provided by Each Civic Centre Yearly and Monthly from 2016-2020

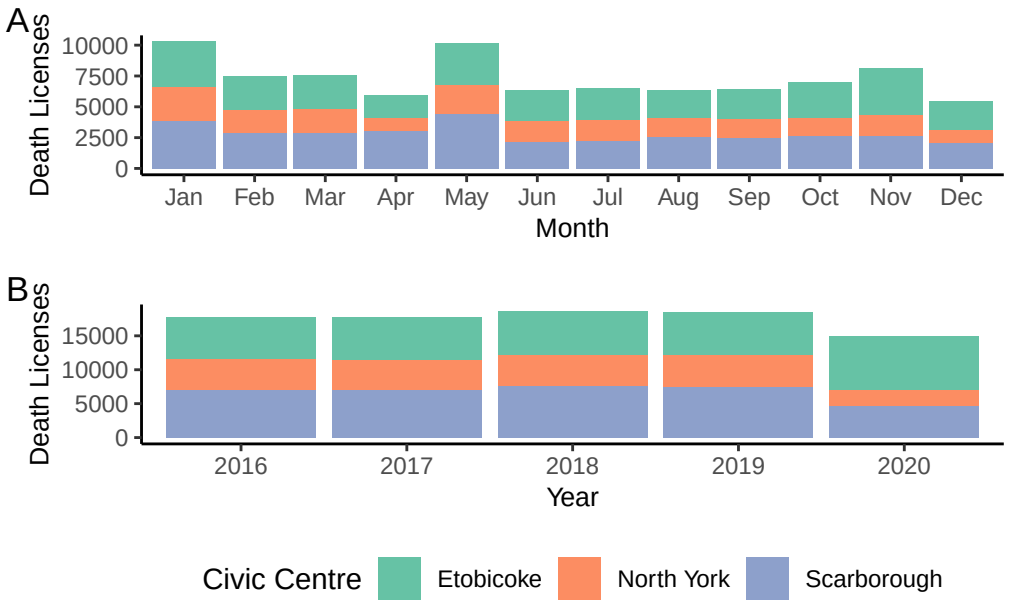


Table 1: Average Number of Deaths Per Month from 2016-2020 at Etobicoke Centre

	Average Number of Deaths				
Month	2016	2017	2018	2019	2020
Jan	342	360	372	346	358
Feb	264	276	275	259	250
Mar	275	281	285	269	237
Apr	236	209	211	237	273
May	315	320	329	320	403
Jun	236	238	235	253	196
Jul	223	250	263	275	235
Aug	241	239	211	230	210
Sep	248	225	251	236	185
Oct	281	275	275	278	226
Nov	348	351	340	356	280
Dec	229	209	233	228	217

Table 2: Average Number of Deaths Per Month from 2016-2020 at Scarborough Centre

	Average Number of Deaths				
Month	2016	2017	2018	2019	2020
Jan	350	366	376	371	359
Feb	266	269	272	289	262
Mar	275	281	273	284	244
Apr	273	262	261	268	299
May	382	396	409	382	419
Jun	214	214	201	206	223
Jul	253	248	263	253	274
Aug	275	279	252	271	288
Sep	252	243	244	236	195
Oct	256	264	258	244	226
Nov	246	256	265	261	301
Dec	214	184	199	203	272

Table 3: Average Number of Deaths Per Month from 2016-2020 at North York Centre

	Average Number of Deaths				
Month	2016	2017	2018	2019	2020
Jan	291	323	330	303	293
Feb	210	214	236	222	193
Mar	224	221	235	225	182
Apr	184	164	155	180	189
May	246	250	259	268	372
Jun	194	193	199	179	180
Jul	176	186	194	211	209
Aug	199	195	165	172	186
Sep	198	181	194	170	135
Oct	183	192	205	176	160
Nov	194	200	204	220	233
Dec	165	139	151	184	189

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