

Data

The city of Toronto maintains a strong online database of city-specific information. To complete this assignment, I will reference three key databases from the city of Toronto and augment with data obtained from Foursquare. The main data sources are listed in Table 1.

Item	Description	Location
COVID-19 data for city of Toronto	Daily update of COVID-19 cases in Toronto broken down by neighbourhood in Excel and PDF formats	https://www.toronto.ca/home/covid-19/covid-19-latest-city-of-toronto-news/covid-19-status-of-cases-in-toronto/
City of Toronto neighbourhood profiles	Toronto census data in CSV format	https://open.toronto.ca/dataset/neighbourhood-profiles/
Toronto neighbourhood spatial information	Geojson file of 140 Toronto neighbourhoods	https://open.toronto.ca/dataset/neighbourhoods/
Foursquare queries	Query results of venue information for specific neighbourhoods	Results returned from Foursquare, converted to dataframe in Python

Table 1. Key data sources utilized in project.

COVID-19 infection data for Toronto is updated daily. The COVID-19 data I will employ was retrieved on January 15, 2021. The dataset consists of neighbourhood name and ID number, cumulate case count per neighbourhood, and cumulative infection rate per 100,000 people. An example is shown in Figure 1.

Neighbourhood ID	Neighbourhood Name	Rate per 100,000 people	Case Count
138	Eglinton East	3464.172813	789
47	Don Valley Village	1829.876899	495
38	Lansing-Westgate	1336.302895	216
9	Edenbridge-Humber Valley	2471.837786	384
44	Flemingdon Park	3720.421283	816
59	Danforth East York	1222.351572	210
129	Agincourt North	2109.02346	614
99	Mount Pleasant East	846.4977645	142
137	Woburn	3791.717304	2028
102	Forest Hill North	2045.915977	262
111	Rockcliffe-Smythe	3205.070574	713
130	Milliken	2009.634201	534
55	Thorncliffe Park	4368.012128	922
7	Willowridge-Martingrove-Richview	2735.150749	606

Figure 1. Sample of COVID-19 data for neighbourhoods in the city of Toronto.

The Toronto neighbourhood profile dataset is an extensive collection of demographic data collected as part of a 2016 census. This is the most recent census data available for the city. One assumption of the project is that demographic trends have not changed in a significant manner for Toronto neighbourhoods since

2016. An example of the dataset is shown in Figure 2. The dataset may be indexed by either Neighbourhood ID or name, which makes it possible to compare with the COVID-19 data. The data contains over 2000 demographic classifications, and not all will be considered in this study. Broad categories of classification include education level, household income, age and gender, housing density, mother tongue, method of transport to employment, and citizenship.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	
jd	Category	Topic	Data Source	Characteristic	City of Toronto	Agincourt Nc	Alderwood	Annex	Banbury-Dor	Bathurst	Bay Street	Bayview	Bayview	Ward	Bedford	Park	Beechboro	Bendale	Birchcliffe	Black Creek
1	Neighbourhood	Neighbourhood Information	City of Toronto Neighbourhood Number	129	128	20	95	42	34	76	52	49	39	112	127	122	124	121	123	125
2	Neighbourhood	Neighbourhood Information	City of Toronto TSN2020 Designation	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat	No Designat
3	Population	Population and dwellings	Census Profil Population, 2	2,731,571	29,113	23,757	12,054	30,526	27,695	15,873	25,797	21,396	13,154	23,236	6,577	29,960	22,291	21,737	21,737	21,737
4	Population	Population and dwellings	Census Profil Population, 2	2,615,060	30,279	21,988	11,904	29,177	26,918	15,434	19,348	17,671	13,530	23,185	6,488	27,876	21,856	22,057	21,856	22,057
5	Population	Population and dwellings	Census Profil Population C	4,506	-3,906	8,006	1,306	4,606	2,906	2,806	33,306	21,106	-2,806	0,206	1,406	7,506	2,006	-1,506	7,506	2,006
6	Population	Population and dwellings	Census Profil Total private	1,179,057	9,371	8,535	4,732	18,109	12,473	6,418	18,436	10,111	4,895	9,052	2,796	11,293	9,637	7,671	9,637	7,671
7	Population	Population and dwellings	Census Profil Private dwell	1,112,929	9,120	8,136	4,616	15,934	12,124	6,089	15,074	9,532	4,698	8,607	2,650	10,766	9,158	7,324	9,158	7,324
8	Population	Population and dwellings	Census Profil Population d	4,334	3,929	3,034	2,435	10,863	2,775	3,377	14,097	4,195	3,240	4,209	3,614	4,011	3,765	6,282	3,765	6,282
9	Population	Population and dwellings	Census Profil Land area in	630.2	7.41	7.83	4.95	2.81	9.98	4.7	1.83	5.1	4.06	5.52	1.82	7.47	5.92	3.46	5.92	3.46
10	Population	Age characteristics	Census Profil Children (0-1)	398,135	3,840	3,075	1,760	2,360	3,605	2,325	1,695	2,415	1,515	4,555	1,120	4,550	3,345	4,600	3,345	4,600
11	Population	Age characteristics	Census Profil Youth (15-24)	340,270	3,705	3,360	1,235	3,750	2,730	1,940	6,860	2,505	1,635	3,210	855	4,605	2,440	3,290	2,440	3,290
12	Population	Age characteristics	Census Profil Working Age	1,229,555	11,305	9,965	5,220	15,040	10,810	6,655	13,065	10,310	4,490	8,410	2,750	12,050	9,075	8,525	9,075	8,525
13	Population	Age characteristics	Census Profil Pre-retireme	336,670	4,230	3,265	1,825	3,480	3,555	2,030	1,760	2,540	1,825	3,075	885	3,535	3,520	2,425	3,535	2,425
14	Population	Age characteristics	Census Profil Seniors (65+)	426,945	6,045	4,105	2,015	5,510	6,975	2,940	2,420	3,615	3,685	3,980	965	5,250	3,910	2,870	3,910	2,870
15	Population	Age characteristics	Census Profil Older Senior	66,000	925	555	320	1,040	1,440	710	330	610	740	660	145	900	630	370	630	370
16	Population	Age characteristics	Census Profil Male: 0 to 4	69,895	660	575	360	445	570	435	470	455	205	675	180	770	570	745	570	745
17	Population	Age characteristics	Census Profil Male: 05 to 14	69,350	695	540	270	365	660	355	230	395	260	795	195	790	580	800	580	800
18	Population	Age characteristics	Census Profil Male: 15 to 19	64,945	660	480	225	325	675	415	130	410	320	880	170	775	535	785	535	785
19	Population	Age characteristics	Census Profil Male: 20 to 24	74,240	840	780	285	465	715	490	585	520	385	880	210	955	585	765	585	765
20	Population	Age characteristics	Census Profil Male: 25 to 29	97,415	1015	1000	355	1215	700	530	2485	735	445	765	215	1370	650	840	650	840
21	Population	Age characteristics	Census Profil Male: 30 to 34	113,905	1015	1045	355	2080	645	465	2115	1075	405	405	225	1135	530	725	530	725
22	Population	Age characteristics	Census Profil Male: 35 to 39	108,895	835	820	410	1610	735	485	1695	1040	285	450	200	995	600	635	600	635
23	Population	Age characteristics	Census Profil Male: 40 to 44	94,070	680	625	455	1055	735	580	1010	805	230	590	205	835	675	580	675	580
24	Population	Age characteristics	Census Profil Male: 45 to 49	86,535	760	610	420	835	815	435	560	685	310	665	170	840	740	585	740	585
25	Population	Age characteristics	Census Profil Male: 50 to 54	90,860	890	760	440	850	1010	535	500	605	390	760	225	950	835	660	835	660
26	Population	Age characteristics	Census Profil Male: 55 to 59	98,735	1160	970	515	920	1110	605	540	620	430	845	220	1010	1020	680	1020	680
27	Population	Age characteristics	Census Profil Male: 60 to 64	98,145	1040	840	540	840	1040	540	540	475	540	795	210	945	915	845	915	845
28	Population	Age characteristics	Census Profil Male: 65 to 69	72,270	925	710	390	755	730	385	375	555	375	670	230	765	810	465	765	465
29	Population	Age characteristics	Census Profil Male: 70 to 74	60,360	925	630	300	780	715	380	295	475	405	560	120	650	640	380	640	380
30	Population	Age characteristics	Census Profil Male: 75 to 79	42,320	590	425	205	640	570	225	285	345	315	400	125	495	420	285	420	285
31	Population	Age characteristics	Census Profil Male: 80 to 84	32,730	490	350	155	485	505	200	200	265	310	270	65	435	240	245	240	245
32	Population	Age characteristics	Census Profil Male: 85 to 89	62,165	595	475	255	355	600	330	105	350	270	820	180	765	575	730	575	730
33	Population	Age characteristics	Census Profil Male: 90 to 94	25,670	380	240	105	335	435	165	150	230	255	250	90	355	200	175	200	175
34	Population	Age characteristics	Census Profil Male: 95 to 99	15,665	210	155	65	230	340	110	80	150	165	145	25	230	125	95	125	95
35	Population	Age characteristics	Census Profil Male: 100 to 104	6,185	100	45	35	80	175	80	35	75	55	60	10	80	55	40	55	40
36	Population	Age characteristics	Census Profil Male: 105 to 109	1,280	25	20	10	25	20	20	0	10	20	15	0	10	25	5	25	5
37	Population	Age characteristics	Census Profil Male: 110 to 114	125	0	0	0	5	5	5	0	0	0	0	0	0	10	5	0	0
38	Population	Age characteristics	Census Profil Female: 0 to 4	66,105	620	530	320	480	500	400	500	405	185	605	190	735	510	755	510	755
39	Population	Age characteristics	Census Profil Female: 05 to 14	65,680	620	495	325	400	600	365	235	405	265	780	200	710	570	785	570	785
40	Population	Age characteristics	Census Profil Female: 15 to 19	61,285	965	690	290	550	660	405	790	615	365	840	205	900	555	820	555	820
41	Population	Age characteristics	Census Profil Female: 20 to 24	97,330	975	895	310	1520	650	510	3005	815	435	725	225	1385	635	860	635	860
42	Population	Age characteristics	Census Profil Female: 25 to 29	119,040	1005	975	350	2265	745	480	2440	1145	410	475	235	1155	555	845	555	845
43	Population	Age characteristics	Census Profil Female: 30 to 34	115,675	935	835	430	1675	860	575	1645	1170	285	645	240	1130	635	805	635	805
44	Population	Age characteristics	Census Profil Female: 35 to 39	102,240	775	715	450	1040	895	615	815	860	785	260	925	715	730	715	730	
45	Population	Age characteristics	Census Profil Female: 40 to 44	95,860	910	745	445	915	975	575	530	760	385	835	225	945	870	735	870	735
46	Population	Age characteristics	Census Profil Female: 45 to 49	100,065	1060	885	430	855	1170	650	555	780	535	985	270	1030	895	780	895	780
47	Population	Age characteristics	Census Profil Female: 50 to 54	103,670	1290	975	515	935	1115	630	665	750	520	985	280	1090	1045	795	1045	795
48	Population	Age characteristics	Census Profil Female: 55 to 59	94,660	1165	915	485	915	1005	605	500	715	525	885	250	990	990	730	990	730
49	Population	Age characteristics	Census Profil Female: 60 to 64	81,600	1070	795	400	940	895	470	425	660	475	730	185	830	810	610	810	610
50	Population	Age characteristics	Census Profil Female: 65 to 69	70,180	985	690	325	950	955	415	445	585	520	660	155	795	690	470	690	470
51	Population	Age characteristics	Census Profil Female: 70 to 74	51,285	690	450	210	700	790	275	320	440	400	505	110	580	450	355	450	355
52	Population	Age characteristics	Census Profil Female: 75 to 79	43,430	575	405	180	565	730	280	250	355	400	390	90	545	345	330	345	330
53	Population	Age characteristics	Census Profil Female: 80 to 84	34,965	485	350	210	425	650	285	170	315	330	305	60	500	290	235	290	235
54	Population	Age characteristics	Census Profil Female: 85 to 89	25,135	350	205	130	345	615	265	135	230	265	260	45	350	250	130	250	130
55	Population	Age characteristics	Census Profil Female: 90 to 94	13,500	160	100	70	260	360	165	50	115	180	140	60	155	140	80	140	80
56	Population	Age characteristics	Census Profil Female: 95 to 99	3,475	60	20	5	90	105	45	5	25	35	0	65	40	15	0	15	0
57	Population	Age characteristics	Census Profil Female: 100 to 104	650	10	0	5	25	20	10	0	0	10	10	0	10	5	15	10	15
58	Families, hoi	Household and dwelling characteristics	Census Profil Occupied pri	1,112,930	9125	8135	4620	15935	12125	6080	15075	9535	4700	8610	2655	10765	9205	7320	9205	7320
59	Families, hoi	Household and dwelling characteristics	Census Profil Single-det	269,675	3345	2790	2840	645	3485	2105	5	2025	1565	4820	665	3870	4900	680	4900	680
60	Families, hoi	Household and dwelling characteristics	Census Profil Apartment	493,275	2120	3145	255	8165	6270	2055	14800	5900	1775	1995	665	4850	945	4065	945	4065
61	Families, hoi	Household and dwelling characteristics	Census Profil Other attac	349,880	3645	2200	1525	7125	2370	1925	280	1610	1365	1790	1325	2040	3325	2585	3325	2585
62	Families, hoi	Household and dwelling characteristics	Census Profil Semi-det	71,225	805	330	545	1185	285	165	0	120	495	45	80	290	425	660	425	660
63	Families, hoi	Household and dwelling characteristics	Census Profil Row house	61,630	1440	515	85	595	740	45	15	880	200	65	15	325	40	1140	40	1140
64	Families, hoi	Household and dwelling characteristics	Census Profil Apartment	48,540	645	595	330	455	40	640	0	75	100	315	90	1075	880	155	880	155
65	Families, hoi	Household and dwelling characteristics	Census Profil Other sing	165,610	735	610	560	47												

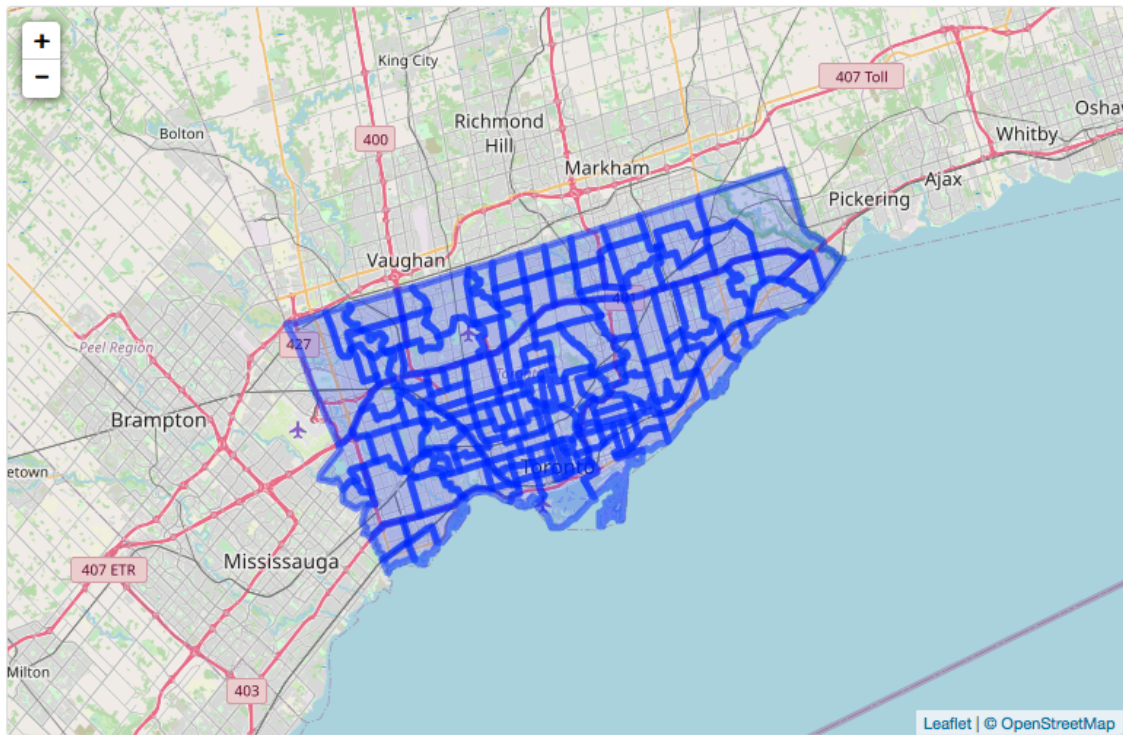


Figure 3. Map view of Geojson file used in this study.

Once I identify neighbourhoods of high or low rates of COVID-19 infection, I will run queries in Foursquare to understand the types and abundances of venues in each neighbourhood. Figure 4 is a sample of a Foursquare result converted to a data frame for analysis.

[62] :

	Cluster Labels	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue
0	1	Black Creek	Home Service	Hotel	Fast Food Restaurant	Intersection	Electronics Store	Coffee Shop	Italian Restaurant
1	1	Forest Hill South	Pizza Place	Trail	Gift Shop	Intersection	Israeli Restaurant	Coffee Shop	Korean Restaurant
2	4	Humbermede	Golf Course	Furniture / Home Store	Coffee Shop	Department Store	Dance Studio	Gastropub	Food & Drink Shop
3	3	Maple Leaf	Park	Trail	Convenience Store	Furniture / Home Store	Food & Drink Shop	Fish & Chips Shop	Fast Food Restaurant
4	0	Mount Olive-Silverstone-Jamestown	Park	Baseball Field	Caribbean Restaurant	Trail	Dance Studio	Furniture / Home Store	Food & Drink Shop
5	1	Rosedale-Moore Park	Coffee Shop	Fish & Chips Shop	Breakfast Spot	Pizza Place	Fast Food Restaurant	Intersection	Trail
6	1	Runnymede-Bloor West Village	Asian Restaurant	Café	Food & Drink Shop	Diner	Market	Coffee Shop	Sushi Restaurant
7	1	The Beaches	Fast Food Restaurant	Italian Restaurant	Ice Cream Shop	Burrito Place	Liquor Store	Food & Drink Shop	Fish & Chips Shop
8	2	Thistletown-Beaumont Heights	Convenience Store	Home Service	Construction & Landscaping	Dance Studio	Furniture / Home Store	Food & Drink Shop	Fish & Chips Shop
9	1	Woodbine Corridor	Fast Food Restaurant	Italian Restaurant	Ice Cream Shop	Burrito Place	Liquor Store	Food & Drink Shop	Fish & Chips Shop

Figure 4. Example of data frame created from Foursquare data query.