



Guide to Health Neighbourhoods: Methodological Notes

Durham Region Health Department

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Methodological Notes

Geocoding Data into Health Neighbourhoods

Data from the 2016 census were provided as a custom geography through the Community Data Group, which the Regional Municipality of Durham accesses as a member of the Durham Consortium.

Data from the Better Outcomes Registry and Network (BORN) were directly categorized into Health Neighbourhood from Dissemination Area (DA).

Data based on postal code were categorized into Health Neighbourhood using the 2017 Postal Code ^{OM} Conversion File (PCCF) from Statistics Canada, obtained through the Community Data Program. The PCCF first assigns postal codes to a specific DA and then the DA is used to assign the Health Neighbourhood. Some postal codes do not fit precisely into one DA. If the postal code was missing or did not link to a DA, manual coding was used to try and assign Neighbourhood based on other available geographic information (e.g., address, coordinates). Cases which could not be linked to a DA were excluded from Neighbourhood analysis, however, this was minimal (less than 5%).

Data based on geographic coordinates, such as the ambulance call data, were assigned to Health Neighbourhoods using ArcGIS and an in-house geocoding program developed by the Region of Durham GIS Services. All geocoding was performed by the Region of Durham GIS Services in Corporate Services- Information Technology.

Tables 2 to 5 provide lists of Neighbourhoods indicators and the method used to assign Neighbourhood.

Data Based on Residence

All Neighbourhood data were analyzed based on place of residence, not the location where the event occurred. The only exception was ambulance call data, which were geocoded to the pickup location of the patient and not the patient's address. Durham Region residents who visited an emergency department or were hospitalized at any Ontario facility were captured and coded by their place of residence. Events that occurred outside of Ontario were excluded.

Indicator Mapping – Quintiles and Impact on Health

Indicator maps are available on the durham.ca/neighbourhoods web page through the Map Viewer and Health Neighbourhoods interactive dashboards.

Quintiles

For each indicator, Neighbourhoods were ranked from the lowest to the highest indicator values and divided into quintiles, with Quintile 1 having the Neighbourhoods with the lowest values and Quintile 5 having the highest. However, if a Neighbourhood

had a value that was not releasable due to small numbers, it was excluded from the quintiles.

For indicators where the number of cases/events was available and relevant, the quintiles were formed in such a way that there was approximately an equal number of cases/events in each quintile (approximately 20%). Based on this method, the number of Neighbourhoods in each quintile was unequal if the number of cases/events were not evenly distributed across Neighbourhoods. Indicators based on data from the Census, the Better Outcomes Registry and Network (BORN), and the Early Development Instrument (EDI), as well as crude and age-specific rates were divided into quintiles based on this method.

For the remaining indicators, the Neighbourhoods were sorted by indicator value and divided equally into quintiles. This resulted in approximately 10 Neighbourhoods per quintile. However, since Neighbourhoods with the same value were grouped together, some quintiles may have had greater or fewer than 10 Neighbourhoods. Indicators based on survey data, child immunization data, paramedic or police services data, and age- and/or sex-standardized rates were divided into quintiles using this method.

Tables 2 to 5 provide lists of Neighbourhoods indicators and the method used to divide them into quintiles, either based on an even number of Neighbourhoods or an even count of events/cases.

Impact on Health

Each indicator has a unique impact on health, in terms of both direction and magnitude. For clarity, four categories were used for classifying the health impact of each indicator based on the impact on health:

1. No impact on health: increases and higher values would not change the health of the population

This category includes indicators which may be associated with health in some way but increasing the prevalence or rate of the indicator in a population would not improve or worsen health.

Maps of these indicators show Neighbourhoods with the lowest values in light yellow and those with the highest values in dark red.

2. Impact on health is complex: increases and higher values could be better or worse for health

This category includes indicators that are associated with health, but it is difficult to determine their impact on health. Increasing the prevalence or rate in a population may improve or worsen health, but the impact often differs based on other factors, such as social structure, support and economic status.

Maps of these indicators show Neighbourhoods with the lowest values in light yellow and those with the highest values in dark red.

3. Increases and higher values are worse for health

This category includes indicators where higher values are associated with worse health.

Maps of these indicators show Neighbourhoods with the lowest values in light yellow and the highest values in dark red.

4. Increases and higher values are better for health

This category includes indicators where higher values are associated with better health.

Maps of these indicators show Neighbourhoods with the highest values in light yellow and the lowest values in dark red.

For the positive and negative indicators, the simplest overall message is that the dark red areas on maps highlight Neighbourhoods with poorer health behaviours or outcomes.

Determining Highs and Lows

In addition to assigning Neighbourhoods to quintiles, they were also classified as higher, lower, or similar as compared to Durham Region. For socio-demographic indicators, "Lower" refers to at least 20% lower than the Durham Region rate and "Higher" refers to at least 20% higher. The 20% value was chosen arbitrarily but has been used by other organizations such as the City of Toronto. For indicators under the categories of child health, general health, and health behaviours & risks, "Lower" or "Higher" means that the 95% confidence intervals do not overlap and that the rates are significantly different from Durham Region. "Similar" means that the Neighbourhood is similar to Durham Region as a whole for that indicator. When Ontario data were available, Durham Region and Health Neighbourhoods were compared to Ontario in the same way.

We colour coded the words "Lower" or "Higher" as blue, green or red in indicator summaries and neighbourhood profiles to show how the indicator relates to health for ease of reading when there is a significant difference. Indicators with no impact on health or where the impact on health is complex have "Lower" and "Higher" shown in blue. Indicators with higher values that are worse for health have "Higher" shown in red and "Lower" shown in green. Indicators with higher values that are better for health have "Higher" shown in green and "Lower" shown in red.

Calculation of Confidence Intervals

Rates for many indicators have 95% confidence intervals provided. Confidence intervals indicate the amount of variability and precision of an estimate and whether rates are significantly different. An estimate with wide confidence intervals is less precise, possibly because it is based on a smaller number of cases or a small population or, in the case of survey data, based on a small number of people sampled.

For events such as infectious diseases or teen pregnancies that are based on complete counts, confidence intervals are useful because there may be relatively few events that occur in a given year, particularly at the Neighbourhood level. When the number of events is low and there is a small probability of such an event occurring, there are more random fluctuations within the time period. Rates are unstable from year to year. Grouping multiple years reduces this random fluctuation. Confidence intervals help to quantify how unstable the rates are by indicating that 95% of the time the "true" estimate will be within the range of the 95% confidence interval.

Confidence intervals for estimates from the Rapid Risk Factor Surveillance System were calculated using survey commands in STATA. Life expectancy confidence intervals were calculated in Excel using the Chiang II method of calculation.

We calculated all other confidence intervals, except for the Early Development Instrument (EDI) indicators, in Excel using a method outlined by Fleiss for proportions close to zero or one.

The formula for this calculation is:

- 95% Lower Confidence Interval=
$$\frac{((2 \cdot n \cdot p + 1.96 \cdot 1.96 - 1) - 1.96 \cdot \sqrt{(1.96 \cdot 1.96 - (2 + 1/n) + 4 \cdot p \cdot (n \cdot q + 1))})}{2 \cdot (n + 1.96 \cdot 1.96)}$$
- 95% Upper Confidence Interval=
$$\frac{((2 \cdot n \cdot p + 1.96 \cdot 1.96 + 1) + 1.96 \cdot \sqrt{(1.96 \cdot 1.96 + (2 - 1/n) + 4 \cdot p \cdot (n \cdot q - 1))})}{2 \cdot (n + 1.96 \cdot 1.96)}$$
- where p = numerator/denominator, $q = 1 - p$, n = denominator

The six EDI indicators used critical difference to determine if Neighbourhoods were significantly different from Durham Region or Durham Region from Ontario, and if the percentage of vulnerable children changed significantly between 2012, 2015 and 2018. We used the procedures developed by the Human Early Learning Partnership (HELP) through the University of British Columbia. A detailed explanation of the process can be found on the [Understanding Critical Difference](#) page of the HELP website. Essentially, the HELP method used modelling techniques to estimate the degree of uncertainty for each of the six EDI measures by testing different sources of measurement error, including neighbourhood size and teacher-related error. Vulnerability rates for large populations are more precise than for smaller populations; the critical difference value decreases as the total number of SK children increases. The equations for each EDI measure were then entered Excel and used to calculate the critical differences for Durham Region Neighbourhoods. The critical difference method is more specific and precise than a general calculation of statistical significance.

Non-Releasable Estimates

In some cases, an estimate was not released because the number of cases was too small. The threshold depends on the data source but usually if the numerator is less than five or the denominator less than 30, the estimate is suppressed and marked as “Not Releasable”. This practice protects confidentiality and ensures a minimum standard in terms of the precision of estimates. The one exception were the EDI indicators, which were not suppressed if the numerator was less than five.

For estimates from the Rapid Risk Factor Surveillance System (RRFSS) and the Infant Feeding Surveillance System (IFSS), the coefficient of variation was also used to assess whether an estimate had sufficient precision to be released. The coefficient of variation expresses the standard error of an estimate as a percentage of the estimate itself. The higher the coefficient of variation, the larger the variability and the less precise the estimate. If the coefficient of variation was between 16.5 per cent and 33.3 per cent, the estimate was identified with an Asterix, in order to state it should be used with caution. Estimates with a coefficient of variation greater than 33.3 per cent were not releasable.

Municipality Rates and Counts

Counts for municipalities are equal to the sum of the Neighbourhood counts, which may result in municipal counts and rates that are inconsistent with other Health Department reports. This inconsistency is due to the exclusion of cases with missing or incorrect postal codes that could not be assigned to a Health Neighbourhood.

Age Differences across Neighbourhoods

Age is an important determinant of health. Certain health problems are more prevalent among specific age groups, which means that Neighbourhoods may have higher rates of a health problem simply because they have a higher proportion of people in that age group. Sometimes age standardization is used so that different geographical areas can be compared even though they may have different age structures in their populations. Age-standardization, using the direct method, was done for the following indicators: breast cancer screening rates and Pap test screening rates. Age- and sex-standardization, using the direct method, was done for the following indicators: disease prevalence (diabetes, lung disease, asthma), diabetes incidence, cancer screening, doctors visits and Emergency Department visits for mental health and addictions, and residence ambulance calls.

The remaining indicators were not standardized by age or sex due to the difficulty in obtaining population counts by sex and age group, as well as methodological issues with small populations. Instead, age-specific rates were used where possible, with restrictions to the age group with the highest incidence. For example, chlamydia rates were presented for females aged 15 to 24 years. In this case, limiting data to this specific population allowed for a better comparison across Neighbourhoods.

Use of Census Population Counts for Denominators

For some indicators (e.g., injury, teen pregnancy rate), the 2011 and 2016 Census population was used as the denominator for indicator calculation. Population counts by DA or Health Neighbourhood were only available from the Census. As a result, rates were calculated for years that straddle the Census year, e.g., 2010-2011-2012 or 2015-2016-2017 combined. These may not be the most current years of data available. Neighbourhoods that experience rapid population growth may have indicators that are under-estimated or overestimated if the numerator is far away from the Census year.

Some indicators, such as residence ambulance calls, used population counts by Health Neighbourhood from the Registered persons Database (RPDB) as the denominator for indicator calculation. The RPDB is a population-based register maintained by the Ministry of Health and the Ministry of Long-Term Care to manage services funded under the Ontario Health Insurance Plan (OHIP). Inaccuracies in the RPDB data have been documented, but the estimates appeared reasonable when census numbers and population growth were considered.

Multiple Testing

Each Neighbourhood and municipality were compared with Durham Region for all indicators. Many comparisons were made using 95% confidence intervals. This means one out of 20 (5%) comparisons may be statistically significant simply due to chance alone. Therefore, it is important to examine overall patterns and understand the context of the indicators and the Neighbourhoods rather than look at a specific rate in isolation.

Complex Nature of Health

Health Neighbourhoods provides a wide range of demographic and health indicators for Durham Region residents that cover the lifespan from birth to death. Many indicators are inter-related. All are complex. Some limited information is provided within the indicator summaries to highlight how certain factors can affect health, but casual conclusions cannot be made from Neighbourhoods data.

It is also important to note that it is not possible to make inferences at an individual level based on Neighbourhoods data. Indicators simply represent an average value/outcome for a population. Although individuals from the same Neighbourhood are more likely to be similar to one-another compared to individuals from a different Neighbourhood, Neighbourhoods are not perfectly homogenous with regards to demographics, health behaviours or outcomes. For example, an individual may live in a Neighbourhood with a low median household income and a high prevalence of diabetes, but they may have a very high household income and not be diabetic. Similarly, an individual may live in a very wealthy Neighbourhood, but may experience poverty.

Table 1: List of socio-demographic indicators, methods used to assign Neighbourhood and quintiles, and impact on health

#	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
1	Population	Population growth rate	Custom geography	Neighbourhood	No impact
2	Population	Population density	Custom geography	Neighbourhood	No impact
3	Population	Population aged 0 to 14	Custom geography	Count	Complex
4	Population	Population aged 0 to 4	Custom geography	Count	Complex
5	Population	Population aged 5 to 9	Custom geography	Count	Complex
6	Population	Population aged 10 to 14	Custom geography	Count	Complex
7	Population	Population aged 15 to 19	Custom geography	Count	Complex
8	Population	Population aged 20 to 24	Custom geography	Count	Complex
9	Population	Population aged 25 to 29	Custom geography	Count	Complex
10	Population	Population aged 30 to 39	Custom geography	Count	Complex
11	Population	Population aged 40 to 49	Custom geography	Count	Complex
12	Population	Population aged 50 to 59	Custom geography	Count	Complex
13	Population	Population aged 60 to 64	Custom geography	Count	Complex
14	Population	Population aged 65+	Custom geography	Count	Complex

#	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
15	Demographics	Female lone-parent families	Custom geography	Count	Worse
16	Demographics	Seniors living alone	Custom geography	Count	Complex
17	Demographics	Aboriginal population	Custom geography	Count	Complex
18	Demographics	Visible minorities	Custom geography	Count	Complex
19	Demographics	Foreign-born population	Custom geography	Count	Complex
20	Demographics	Recent newcomers	Custom geography	Count	Complex
21	Demographics	Non-English speakers	Custom geography	Count	Complex
22	Demographics	Home language not English	Custom geography	Count	Complex
23	Socio-economic status	Median income	Custom geography	Neighbourhood	Better
24	Socio-economic status	Low income	Custom geography	Count	Worse
25	Socio-economic status	Children in low-income households	Custom geography	Count	Worse
26	Socio-economic status	Seniors in low-income households	Custom geography	Count	Worse
27	Socio-economic status	Postsecondary education	Custom geography	Count	Better

#	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
28	Socio-economic status	Unemployment	Custom geography	Count	Worse
29	Housing	Movers	Custom geography	Count	Complex
30	Housing	Renters	Custom geography	Count	No impact
31	Housing	Shelter costs	Custom geography	Count	Worse
32	Housing	Not suitable housing	Custom geography	Count	Worse
33	Housing	Major dwelling repairs	Custom geography	Count	Worse

Table 2: List of child health indicators, methods used to assign Neighbourhood and quintiles, and impact on health,

#	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
34	Births	Live birth rate	Dissemination area	Count	No impact
35	Births	Teen pregnancy rate	Dissemination area	Count	Worse
36	Births	Births to young mothers	Dissemination area	Count	Worse
37	Births	Births to older mothers	Dissemination area	Count	Complex
38	Births	Preterm births	Dissemination area	Count	Worse
39	Births	Small-for-gestational age (SGA)	Dissemination area	Count	Worse
40	Births	Large-for-gestational age (LGA)	Dissemination area	Count	Worse
41	ACE-like risk factors	Maternal mental illness	Postal code	Count	Worse
42	ACE-like risk factors	Maternal smoking or substance use	Postal code	Count	Worse
43	ACE-like risk factors	One or more ACE-like risk factors	Postal code	Count	Worse
44	Breastfeeding	Early breastfeeding	Dissemination area	Neighbourhood	Better

#	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
45	Breastfeeding	Early exclusive breastfeeding	Dissemination area	Neighbourhood	Better
46	Breastfeeding	Breastfeeding for 6 months or more	Dissemination area	Neighbourhood	Better
47	Well-baby visits	18-month well-baby visit	Postal code	Neighbourhood	Better
48	School readiness	Physical health and well-being	Postal code	Count	Worse
49	School readiness	Social competence	Postal code	Count	Worse
50	School readiness	Emotional maturity	Postal code	Count	Worse
51	School readiness	Language and cognitive development	Postal code	Count	Worse
52	School readiness	Communication skills and general knowledge	Postal code	Count	Worse
53	School readiness	Vulnerable in one or more EDI domains	Postal code	Count	Worse

Table 3: List of General Health Indicators, methods used to assign Neighbourhood and quintiles, and impact on health,

#	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
54	Health & longevity	Self-rated health	Postal code	Neighbourhood	Better
55	Health & longevity	Life expectancy in males	Postal code	Neighbourhood	Better
56	Health & longevity	Life expectancy in females	Postal code	Neighbourhood	Better
57	Health & longevity	Premature mortality in males	Dissemination area	Neighbourhood	Worse
58	Health & longevity	Premature mortality in females	Dissemination area	Neighbourhood	Worse
59	Mental health & addictions (MHA)	Self-rated mental health	Postal code	Neighbourhood	Better
60	Mental health & addictions (MHA)	MHA doctor visits, ages 0 to 24	Dissemination area	Neighbourhood	Complex
61	Mental health & addictions (MHA)	MHA emergency visits, ages 0 to 24	Dissemination area	Neighbourhood	Worse

#	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
62	Mental health & addictions (MHA)	Self-harm emergency visits, ages 10 to 24	Postal code	Count	Worse
63	Chronic diseases	Obesity	Postal code	Neighbourhood	Worse
64	Chronic diseases	Asthma emergency visits in children	Postal code	Count	Worse
65	Chronic diseases	Asthma prevalence in children	Dissemination area	Neighbourhood	Worse
66	Chronic diseases	Diabetes incidence	Dissemination area	Neighbourhood	Worse
67	Chronic diseases	Diabetes prevalence	Dissemination area	Neighbourhood	Worse
68	Chronic diseases	Hypertension prevalence	Dissemination area	Neighbourhood	Worse
69	Chronic diseases	Lung disease (COPD) prevalence	Dissemination area	Neighbourhood	Worse
70	Chronic diseases	Cardiovascular disease hospitalization	Postal code	Count	Worse
71	Infectious diseases	Chlamydia in young females	Postal code	Count	Worse

#	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
72	Infectious diseases	Enteric diseases	Postal code	Count	Worse
73	Infectious diseases	Hepatitis C	Postal code	Count	Worse
74	Infectious diseases	Tuberculosis	Postal code	Count	Worse
75	Injury	Sports injuries, ages 10 to 14	Postal code	Count	Worse
76	Injury	Assault, ages 10 to 24	Postal code	Count	Worse
77	Injury	Motor vehicle collisions, ages 15 to 24	Postal code	Count	Worse
78	Injury	Falls, ages 0 to 4	Postal code	Count	Worse
79	Injury	Falls, ages 65+	Postal code	Count	Worse

Table 4: List of Health Behaviour & Risks Indicators, methods used to assign Neighbourhood and quintiles, and impact on health #	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
80	Smoking	Smoking	Postal code	Neighbourhood	Worse
81	Immunization	School-required immunizations, ages 7 and 8	Postal code	Neighbourhood	Better
82	Immunization	School-required immunizations, ages 16 and 17	Postal code	Neighbourhood	Better
83	Immunization	Meningococcal disease immunization	Postal code	Neighbourhood	Better
84	Immunization	Hepatitis B immunization	Postal code	Neighbourhood	Better
85	Immunization	HPV immunization	Postal code	Neighbourhood	Better

Table 4: List of Health Behaviour & Risks Indicators, methods used to assign Neighbourhood and quintiles, and impact on health #	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
86	Cancer screening	Breast cancer screening (mammography)	Dissemination area	Neighbourhood	Better
87	Cancer screening	Cervical cancer screening (Pap tests)	Dissemination area	Neighbourhood	Better
88	Cancer screening	Overdue for colorectal cancer screening	Dissemination area	Neighbourhood	Worse
89	Ambulance	Residence ambulance calls	Coordinates	Neighbourhood	Worse
90	Ambulance	Residence ambulance calls in seniors	Coordinates	Neighbourhood	Worse
91	Ambulance	Non-urgent ambulance calls	Coordinates	Neighbourhood	Worse

Table 4: List of Health Behaviour & Risks Indicators, methods used to assign Neighbourhood and quintiles, and impact on health #	Sub-group	Indicator	Method: Neighbourhood Assignment	Method: Quintile Assignment	Impact on Health
92	Ambulance	Non-urgent ambulance calls in seniors	Coordinates	Neighbourhood	Worse
93	Police-reported incidents	Domestic incidents	Coordinates	Neighbourhood	Worse
94	Police-reported incidents	Domestic incidents with children present	Coordinates	Neighbourhood	Worse
95	Active travel	Walk or cycle trips to school, ages 11 to 17	FSA	Neighbourhood	Better
96	Active travel	Walk, cycle or transit to work, ages 18+	FSA	Neighbourhood	Better