HOW TO READ THE MAPS

This document explains the most common thematic (statistical) types of maps available on the Ontario Community Health Profiles Partnership (OCHPP) website www.ontariohealthprofiles.ca

Note: Some of the map types are no longer available on the main part of our website, but can be found in the 'Data Archives' or in 'Related Projects' sections.

Map Types:

Choropleth (shaded) maps

Choropleth maps are the most common statistical maps on OCHPP. Choropleth maps are typically used to depict rate or ratio variables. They are not suitable for displaying counts or frequencies.

Classification methods

Values of the depicted variable, which are usually captured within standard statistical or geographical areas, are first sorted from the lowest to the highest, and then divided into several categories or groups using one of several standard or custom classification methods.

The majority of choropleth maps on the OCHPP site use the Jenks Natural Breaks classification method, which reduces the variance within classes and maximizes the variance between classes. With the right data distribution and a correct number of classes picked this method produces fairly natural groupings of similar values making it very desirable for depicting true data patterns across the study area.

Another common classification method groups data into quintiles, with each quintile containing more or less the same number of geographic units. This method is particularly suitable for data with uniform distribution patterns, or for attributes that are grouped into quintiles prior to the mapping stage.

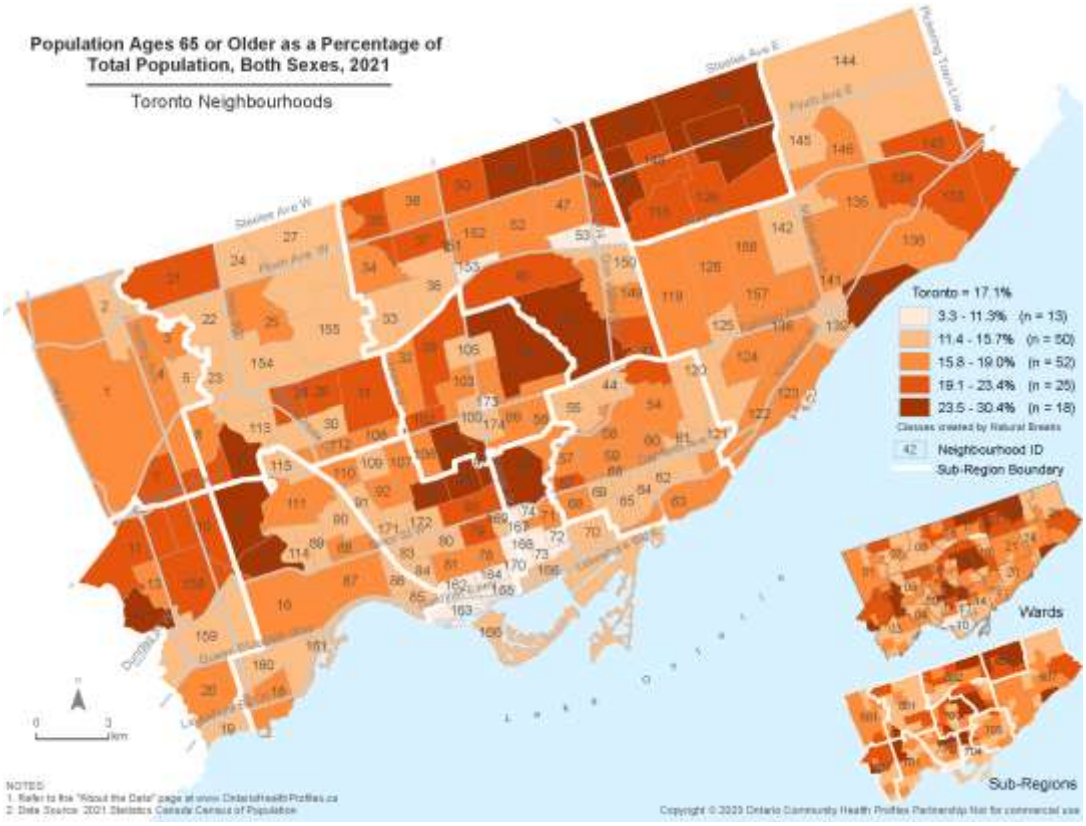
Some maps utilize custom classification methods to better reflect data distribution or a specific character of the depicted variable.

For more information on classification methods please visit
https://www.spatialanalysisonline.com/HTML/index.html
https://gisgeography.com/choropleth-maps-data-classification/
https://en.wikipedia.org/wiki/Jenks_natural_breaks_optimization

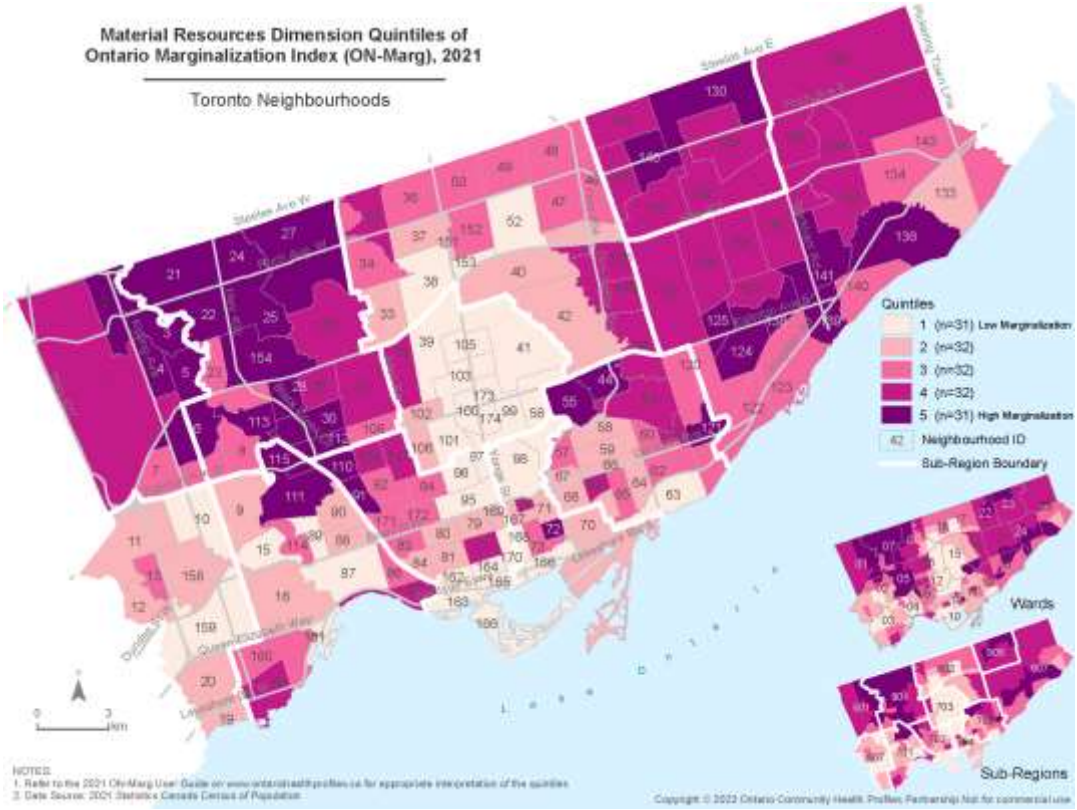
Colours

Each data class is depicted with a specific saturation of a colour, with higher values usually shown by darker colours. In some cases, a gradient between two colours is used, especially when the low values of the variable may be perceived as negative, while higher values may reflect a more positive outcome.

Example of a choropleth map, natural breaks classification



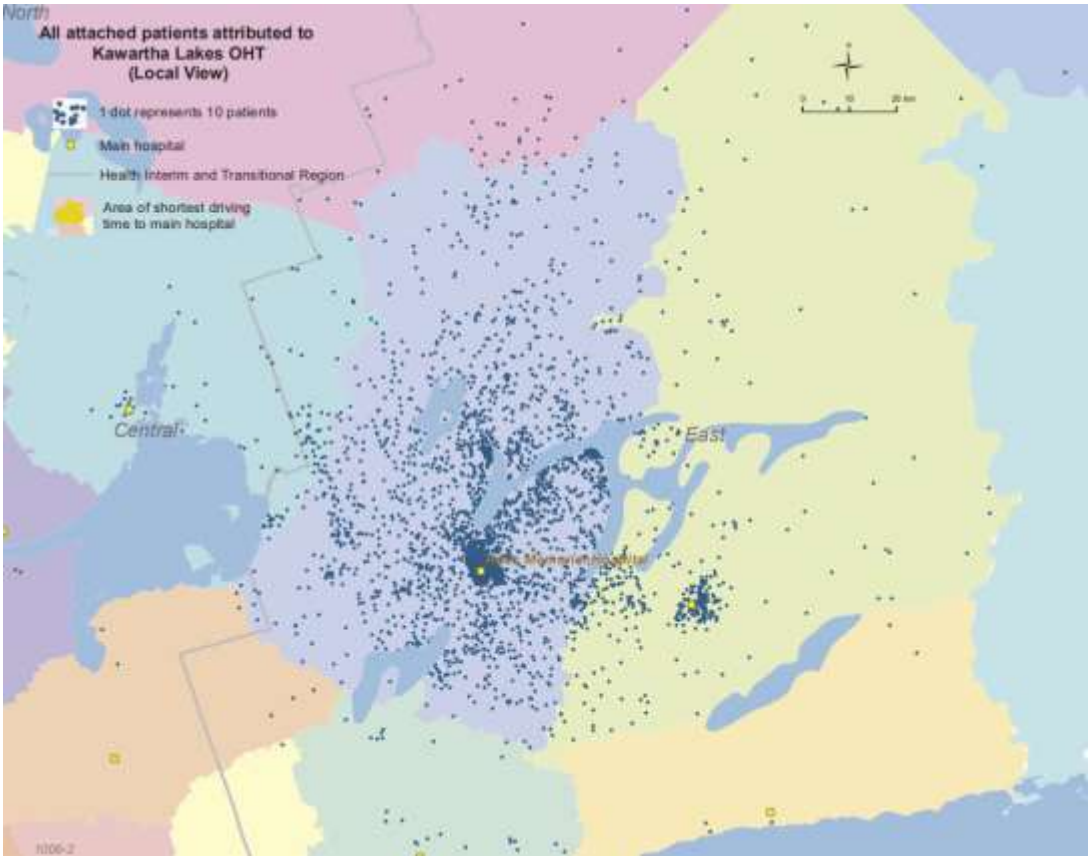
Example of a choropleth map, quintiles classification



Dot Density maps

Dot density maps are typically used to show the count or frequency of specific attributes, such as the total number of residents or patients, within a given area. To create this type of map, counts of a given attribute are calculated for a pre-defined area, such as a neighbourhood or local area, and dots are placed randomly within their boundaries. The higher the density of dots the more cases of the attribute occurring in a given area. One dot can represent one case of the mapped attribute but usually data values require use of higher values, e.g. 1 dot represents 10, 50, 100, 1000 or more cases. On the sample map shown below each dot represents 10 patients. Patients are summed within Dissemination Areas (DA), and each dot represents a group of 10 patients which are placed randomly within DA boundaries; for clarity in the map below, the DA boundaries are not shown. It is important to remember that if areas on the map are very different in size, but have similar counts of the mapped attribute, the smaller areas may appear to have a higher concentrations of cases even though the absolute number of cases is similar. This is because the same number of dots will be placed closer together within smaller areas than within larger areas.

Example of a dot density map



Other map types not available on the main page of the OCHPP website

*These map types can be found in the 'Data Archives' or 'Related Projects' section of OCHPP

Rate-Ratio Maps

When mapped, rate ratios (RR) are a comparison of the rates for a variable (e.g. "Premature Mortality per 100,000") in two different geographic areas. OCHPP has created this type of map to depict how the rate of a variable in each Toronto neighbourhood (numerator) compares to the rate for the City of Toronto overall (denominator). This type of map shows how the rate of the mapped variable in each neighbourhood *compares to the overall Toronto rate*. Values less than 1 indicate that the rate in the neighbourhood is lower than the Toronto rate, whereas values greater than 1 indicate that the neighbourhood rate is higher than the Cty rate. The interpretation of the rate ratio is quite straightforward. For example, a RR of 1.8 indicates that the neighbourhood rate is 80% higher than the City rate; a RR of 0.8 indicates the neighbourhood rate is 20% (i.e. (1.0 - 0.8 = 0.2) x 100%) lower than the City rate. Rate ratio values typically range between 0 and 3, but values higher than 3 can also occur. Rate-ratio values are depicted as a choropleth map, where variations of blue indicate areas with more favourable rates than the City and of the darkness of the red colour indicates areas with less favourable rates.

In addition to the rate ratio values indicated by a choropleth colour shade, this type of map shows whether the difference in neighbourhood rate, when compared to the City rate, is statistically significant. The difference is tested at 95% probability. Neighbourhoods with rates that meet this significance level and that are higher than the Toronto rate are indicated by the letter 'H'. Neighbourhoods with rates that are lower than the Toronto rate and which are statistically significant, are indicated by the letter 'L'.

Actual variable rate ranges for each rate-ratio class are also shown on the map legend.

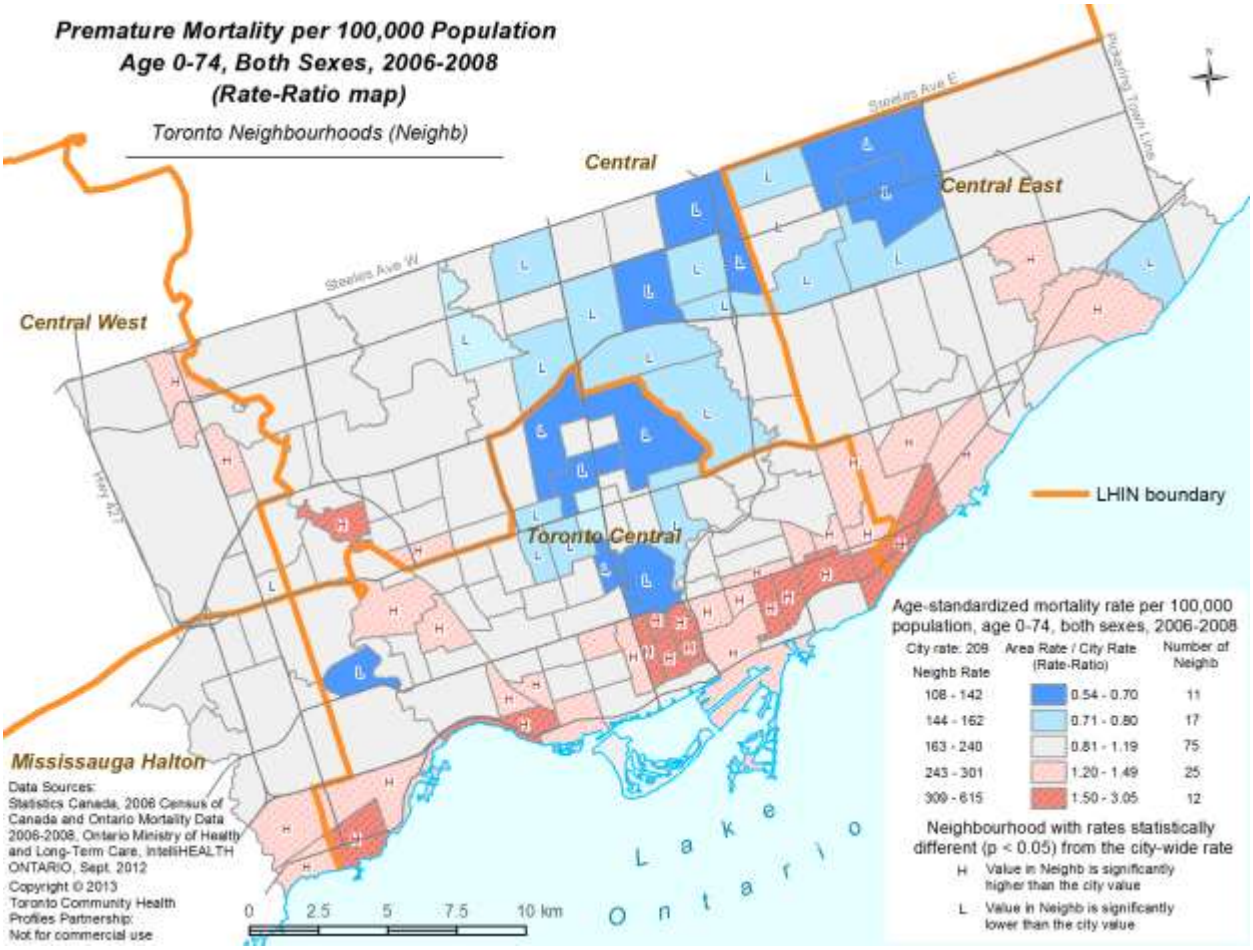
- Advantages: rate-ratio maps clearly show which local areas (e.g. neighbourhoods) have higher, and which have lower rates than the City overall. The difference in rate values for these neighbourhoods and the overall City rate is also tested statistically.
- Disadvantages: Rate-ratio maps may be harder to interpret than simple rate maps. For many variables, rate values in the specific areas do not differ substantially from the overall City rate. As a consequence, a large proportion of areas may fall into the middle 'similar-to-the-city-rate' category shown in grey.

Example:

For health indicator X: Overall city rate is 40

Area Rate	20	24	34	39	43	45	47	50	55
Rate-Ratio	0.50	0.6	0.85	0.97	1.08	1.12	1.18	1.25	1.38
Class on the map	>=0.8	>=0.8	0.81-0.9	0.91-1.09	0.91-1.09	1.1-1.19	1.1-1.19	>=1.2	>=1.2

Example of a Rate-Ratio map



Choropleth map based on Population-weighted quintiles

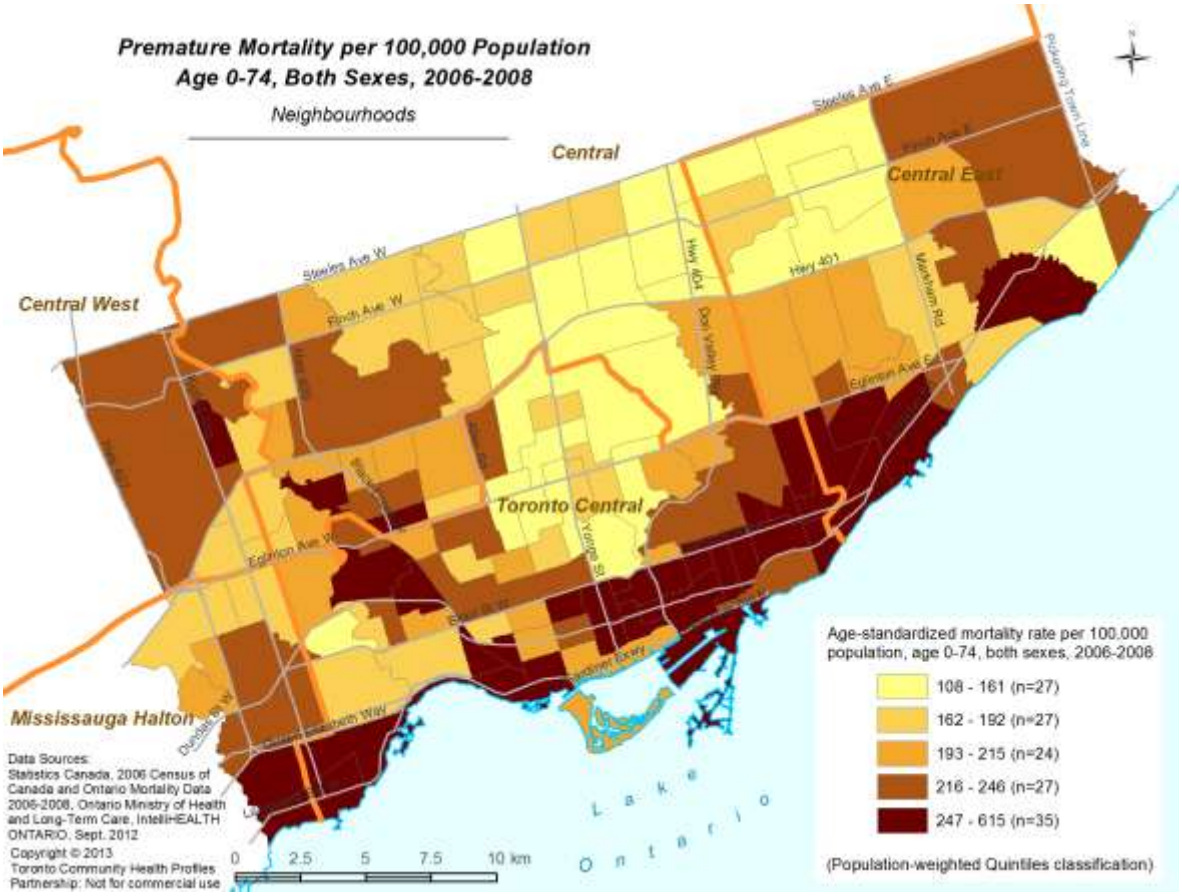
As described above for choropleth maps, the methods for producing choropleth maps based on population-weighted quintiles divides data into 5 classes with approximately the same population size. This classification may be particularly useful for policy-making where a focus is placed upon understanding the population distribution of health indicators or resources and for health equity analyses.

This classification method sorts neighbourhoods by the variable to be mapped and then divides neighbourhoods into 5 classes with roughly *equal populations* in each class.

- Advantages: the population of the study area is divided into similar-sized groups, so when looking at the lowest (or the highest) data class represented by a specific colour on the map one knows that approximately 20 percent of the total study population is in that class. This information may be useful for identifying similar size populations across various mapped attributes.

- Disadvantages: similar (or the same) data values may end up in different classes on the map, while quite dissimilar data values may end up in the same class.

Example of a population-weighted quintiles map

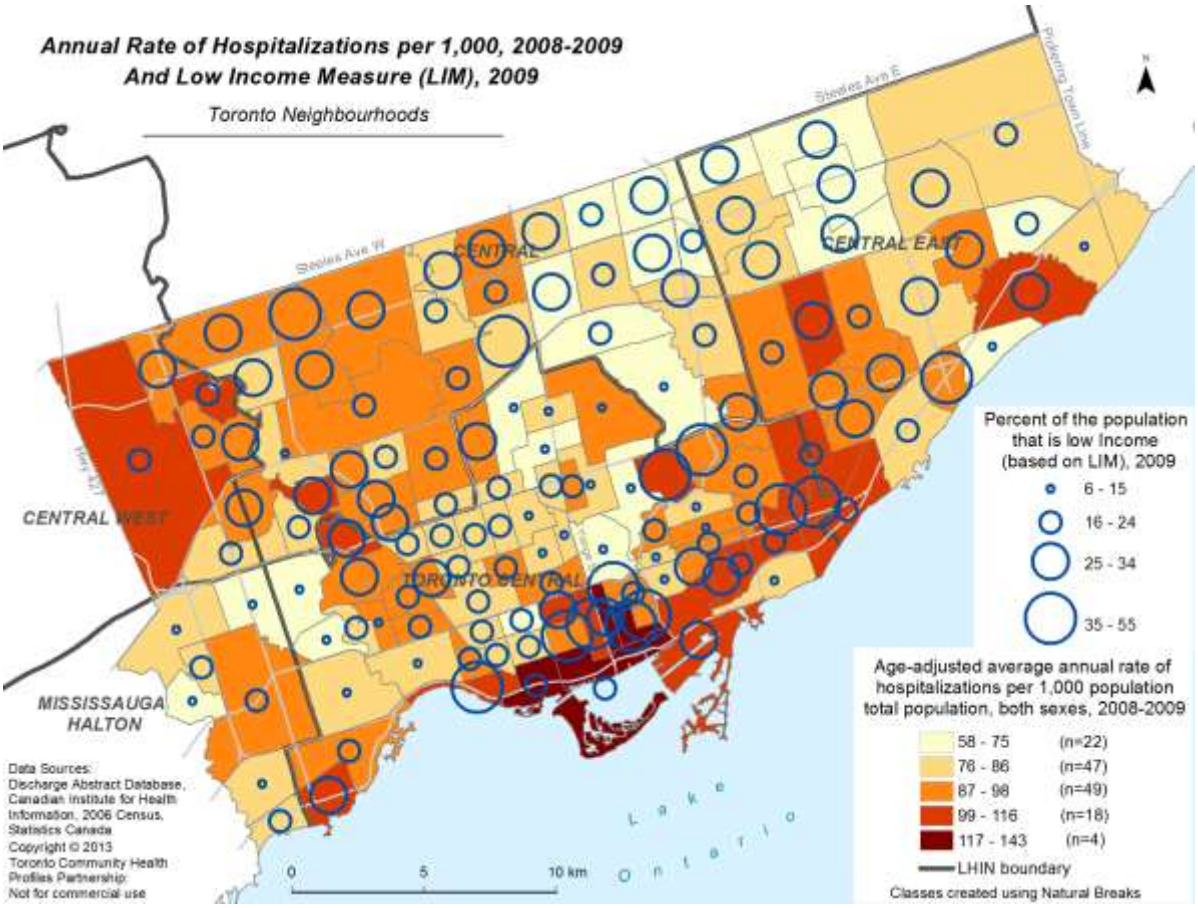


Overlay maps

Overlay maps are primarily created by showing two variables 'one on top of the other'. In order to ensure both layers are visible, one variable is usually mapped as a choropleth (shaded) layer, and the second variable is mapped as a proportional symbol layer (i.e. using different sized symbols to represent different values of an attribute) or dot density layer (i.e. using number of dots to represent the quantity of an attribute) placed on top of the choropleth layer.

The interpretation of an overlay map is fairly simple: darker colours of the choropleth layer, larger sizes of the proportional symbol layer, and greater concentrations in the dot density for polygons of similar area all correspond to higher values of variables. This allows the user to identify areas with high or low values of both variables for example, when mapping rates of hospitalization, we may see higher rates of hospitalizations (represented by a darker colour) along with a larger percentage of persons with low incomes (represented by larger circles).

Example of an overlay map with two variables



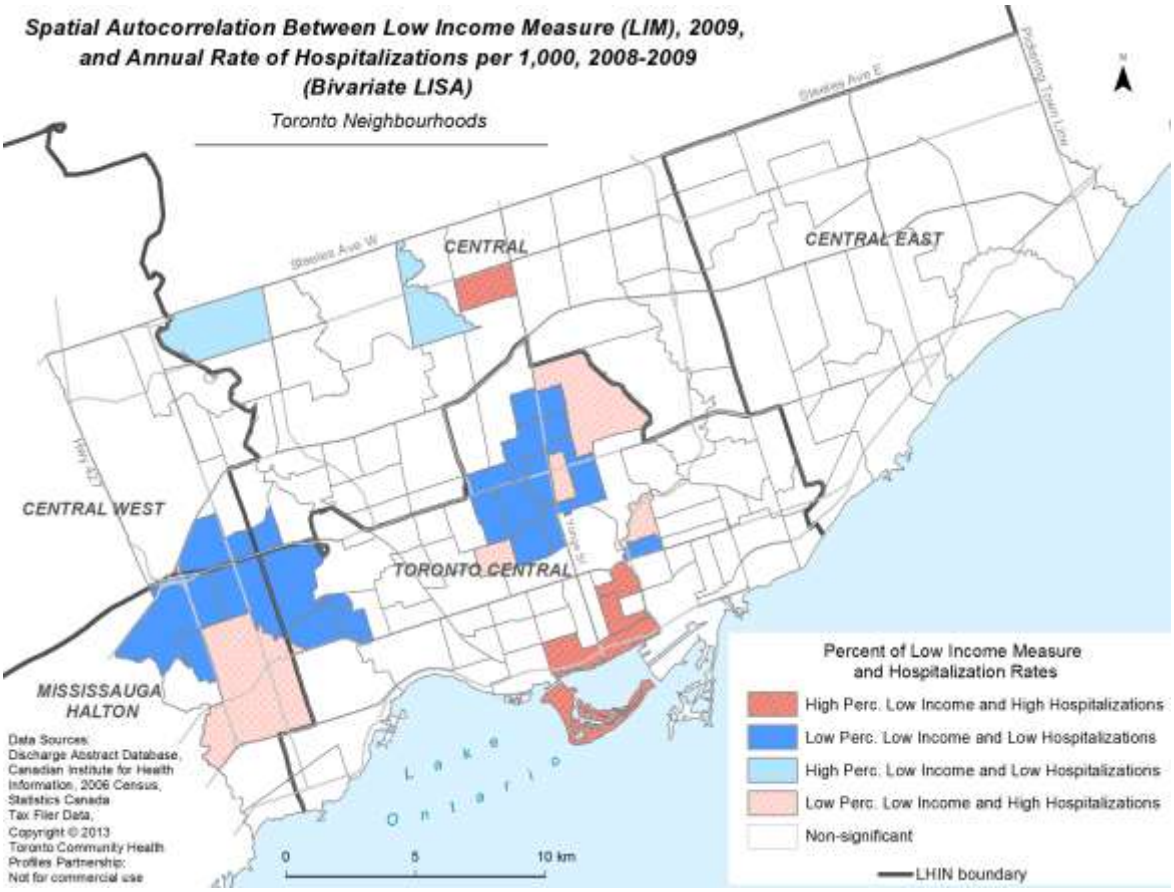
Local Indicator of Spatial Association (LISA) Maps

LISA is a spatial statistical analysis that helps to identify clusters of high and low values of two different variables (Anselin, 1995).

On a LISA map, the analysis results are depicted using colour shades to identify statistically significant clusters. LISA maps are more difficult to interpret than single-variable maps, but they help identify statistically significant clusters of high and low values of the mapped variables. They are often used to identify 'hotspots' of interest or concern, for example, an area with a disproportionately high rate of hospitalizations in combination with a large low income population.

To illustrate, in the map example below, the variables of low Income and hospitalization rates were analyzed together. The dark red areas indicate high percentages of low income populations combined with high rates of hospitalizations. Areas in dark blue are the opposite—low percentages of low income in combination with lower hospitalization rates. The light red and light blue areas represent the off-diagonal results. Areas without colour (shown in white) are where the LISA analysis results were not statistically significant, meaning that the probability of these outcomes is less than 95%.

Example of a LISA map



References:

Anselin, L. (April 1995). Local Indicators of Spatial Association—LISA. *Geographical Analysis*, *27*(2): 93-115.