HOW TO READ THE MAPS

- Single Variable Maps -

1. Rate Ratio Maps [RR]

Rate ratio (RR) maps depict rates of a variable (e.g. "Premature Mortality per 100,000") divided by the overall city of Toronto rate of the same variable. 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 city 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 colour shade on the map, where shades of blue indicate areas with more favourable rates than the City and shades of red 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 neighbourhood rate is statistically significantly different from the city rate. The difference is tested at 95% probability. Neighbourhoods with rates that meet this significance level and that are higher that the Toronto rate are indicated by the letter 'H'. Neighbourhoods with rates significantly lower than the Toronto rate are indicated by the letter 'L'.

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

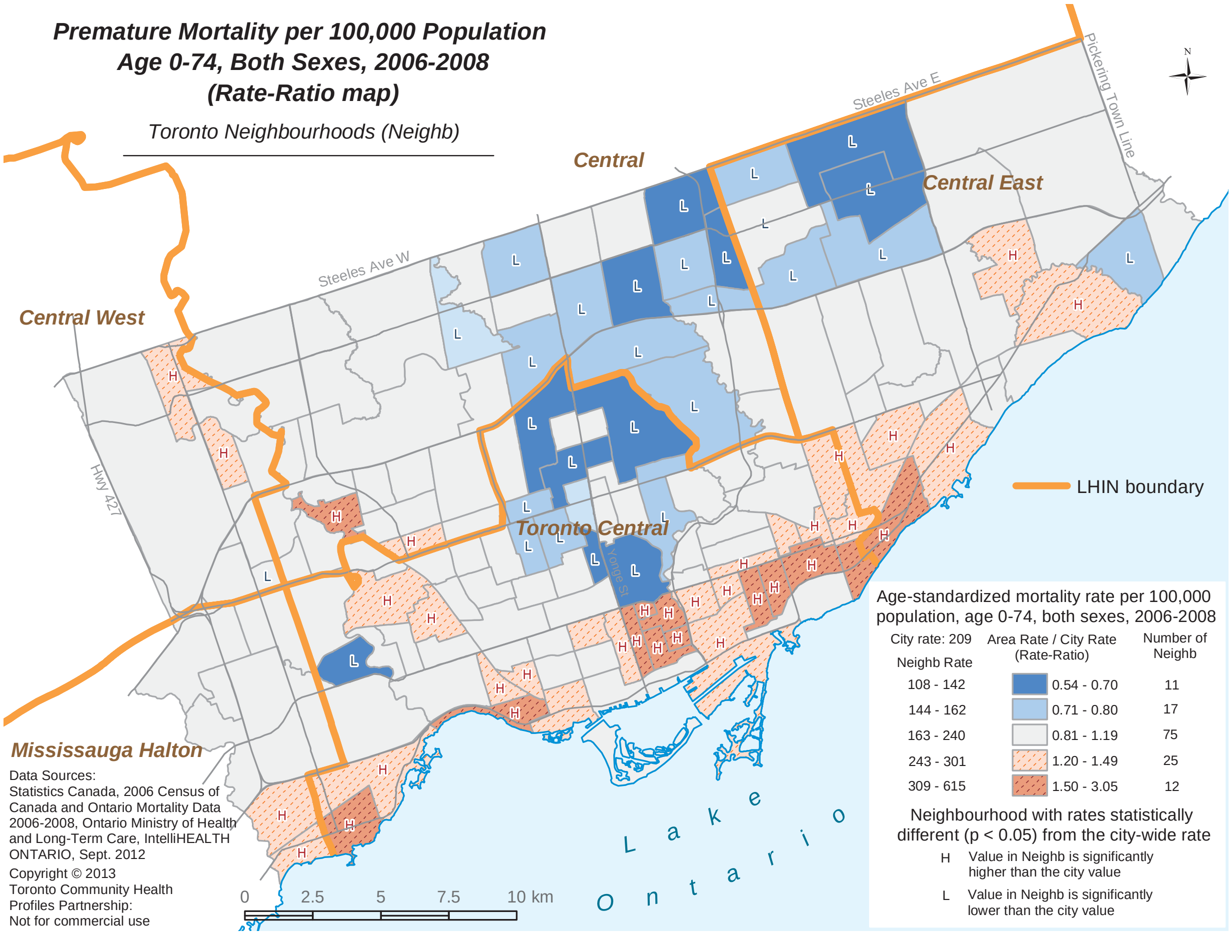
- <u>Advantages</u>: rate ratio maps clearly show which local areas (e.g. neighbourhoods) have higher, and which areas have lower rates than the city overall. The difference in rate values for these neighbourhoods and the overall city rate is also tested statistically.
- <u>Disadvantages</u>: Rate-ratio 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.

<u>Example:</u>

Overall city rate: 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

Rate Ratio Map Example



2. Rate Maps

These choropleth (shaded) maps show age-standardized rates by neighbourhood so that you can compare neighbourhoods with each other. We map age-standardized rates instead of crude rates so that you can identify differences between neighbourhoods that are not simply due to differences in the underlying age composition of the people living in those neighbourhoods. These kinds of maps are portrayed on our website using two classification methods: natural breaks and population-weighted quintiles. These methods are described further below.

2A. 'Natural breaks' [NB] (Jenks optimization algorithm) **– this method divides data values into classes bounding peaks and valleys in the data distribution. This method searches for the 'natural' clusters of data values, which is particularly useful for identifying 'the best' and 'the worst' performing regions within the study area.**

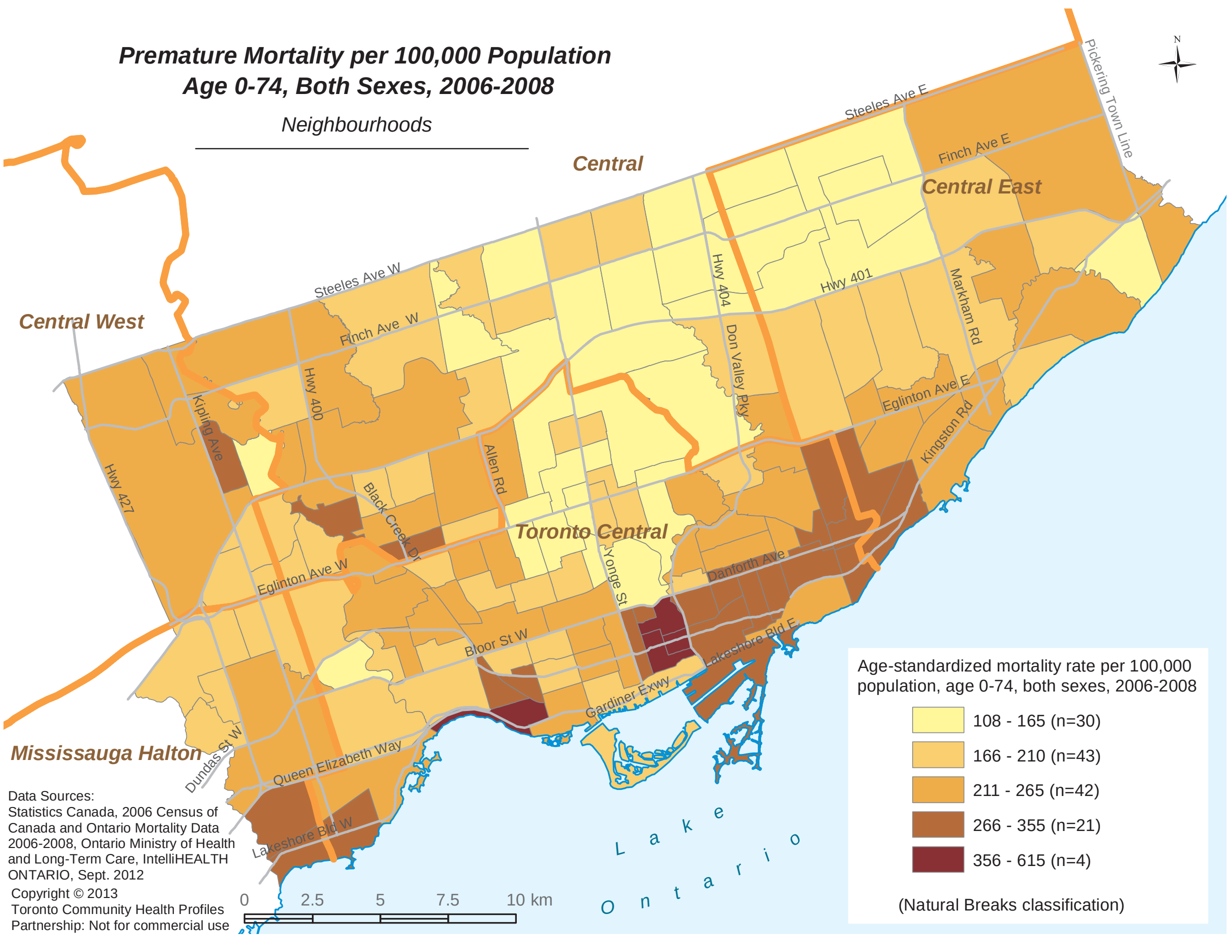
This classification method optimizes groupings so that there is the *minimum* possible standard deviations between values *within* a data class, and the *maximum* possible standard deviations *between* each data class. It thus aims to minimize variation within data classes and maximize variation between them.

- Advantages: neighbourhoods with more similar values are displayed as the same class and colour, and neighbourhoods that vary greatly from each other are assigned to different classes and colours.

- Disadvantages: highly skewed variables may result in few neighbourhoods being assigned to the top and bottom classes. This method produces unique classes for each variable, so different maps cannot be easily compared to each other.

- Example:
  - All data values: 0, 0, 1, 1, 1, 2, 6, 6, 8, 13, 14, 14, 15, 24, 25, 26, 27, 28, 29, 94
  - Classes with data ranges: 1) 0-2, 2) 6-8, 3) 13-15, 4) 24-29, 5) 94

Natural Breaks Map Example



2B. ‘Population-weighted quintiles’ [PWQ] **– this method 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.**

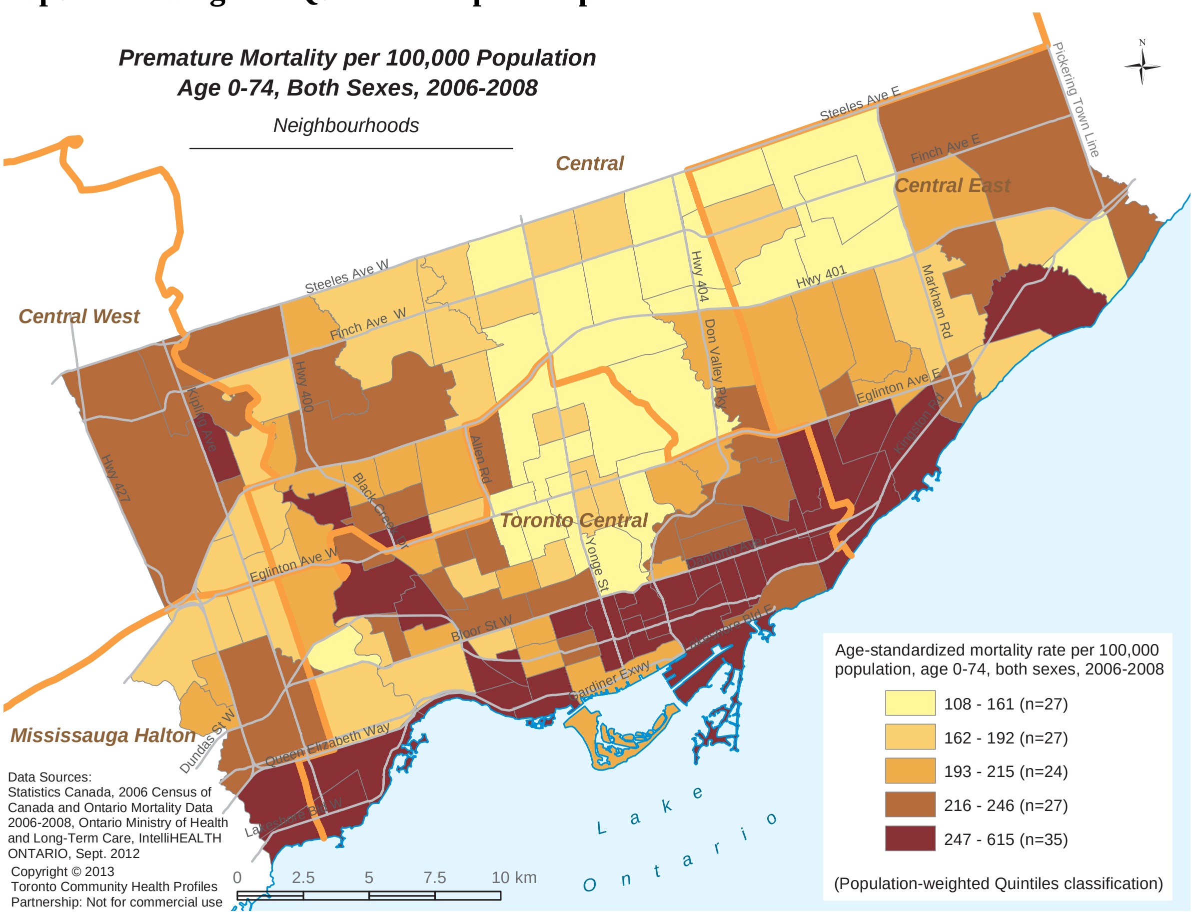
This classification method sorts neighbourhoods by the variable to be mapped and then divides neighbourhoods into 5 classes with roughly *equal populations* in each class.

- 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:
  - All data values: 0, 0, 1, 1, 1, 2, 6, 6, 8, 13, 14, 14, 15, 24, 25, 26, 27, 28, 29, 94
  - Classes with data ranges: 1) 0-1, 2) 2-8, 3) 13-14, 4) 14-26, 5) 27-94

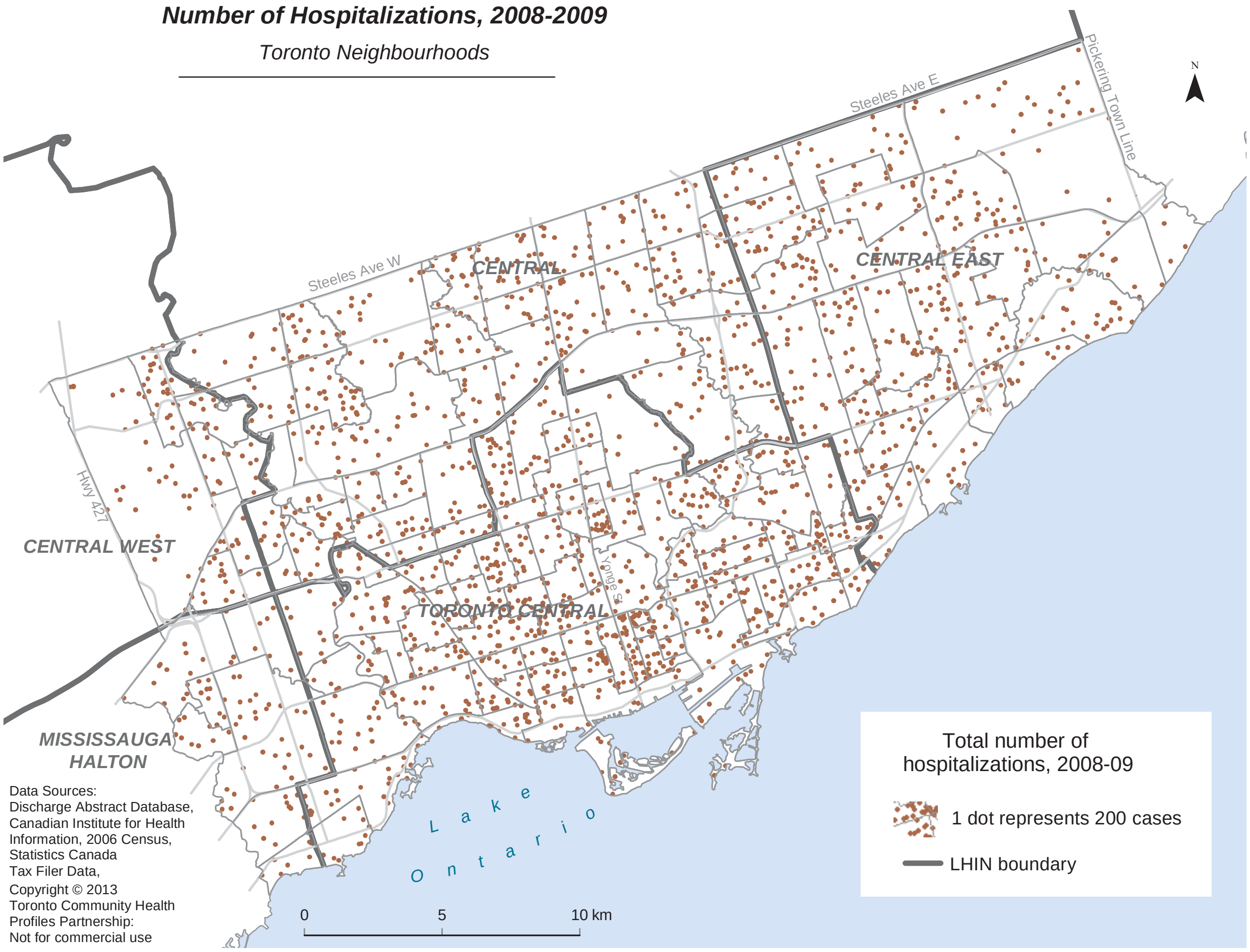
Population-weighted Quintiles Map Example



3. Dot Density Maps [DD]

Dot density maps are typically used to show the count or frequency of specific attributes, such as the total number of residents or total number of hospitalizations, within a given area. To create this map, counts of a given attribute are calculated for pre-defined areas, such as neighbourhoods, and dots are placed randomly within their boundaries. The higher the density of dots the more cases of the attribute occur in a given area. One dot can represent one case of the mapped attribute but usually cartographers choose higher values. For example, on the map below every dot represents 200 hospitalizations. On a map depicting the total number of residents in an area, one dot might represent 500 or 1,000 people. 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 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.

Dot Density Map Example



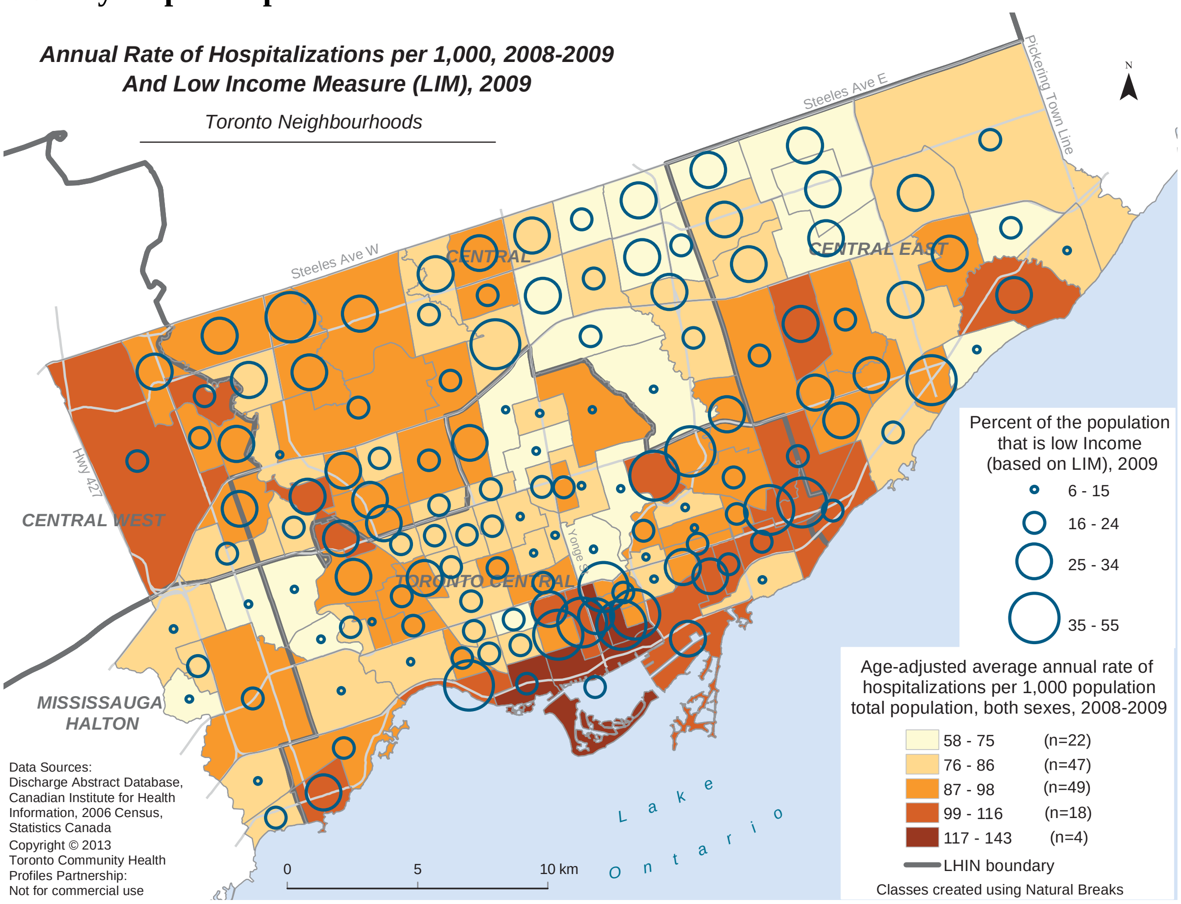
- Bivariate (two-variable) Maps -

Bivariate maps depict two attributes simultaneously. There are several ways this can be accomplished; the two most commonly used methods on our web site are overlay maps and statistical local indicator of spatial association ('LISA') maps.

<u>4. 'Overlay Maps' [OM]</u> are created by showing two variables 'one on top of the other'. In order to ensure both layers are visible, we usually map one variable as a choropleth (shaded) layer, and the second variable 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 (see example below).

The interpretation of the overlay map is fairly simple: darker shades of the choropleth layer, larger sizes of the proportional symbol layer, and greater concentrations in the dot density layer all correspond to higher values of variables. This allows the map user to identify areas with high or low values of both variables. In the example map below several areas including the downtown core have higher rates of hospitalizations (represented by the darker red shade) and larger percentages of low income people (represented by larger circles). Lightly-shaded neighbourhoods in central and west Toronto exhibit an opposite pattern, with low hospitalization rates and low percentages of low income people.

Overlay map example

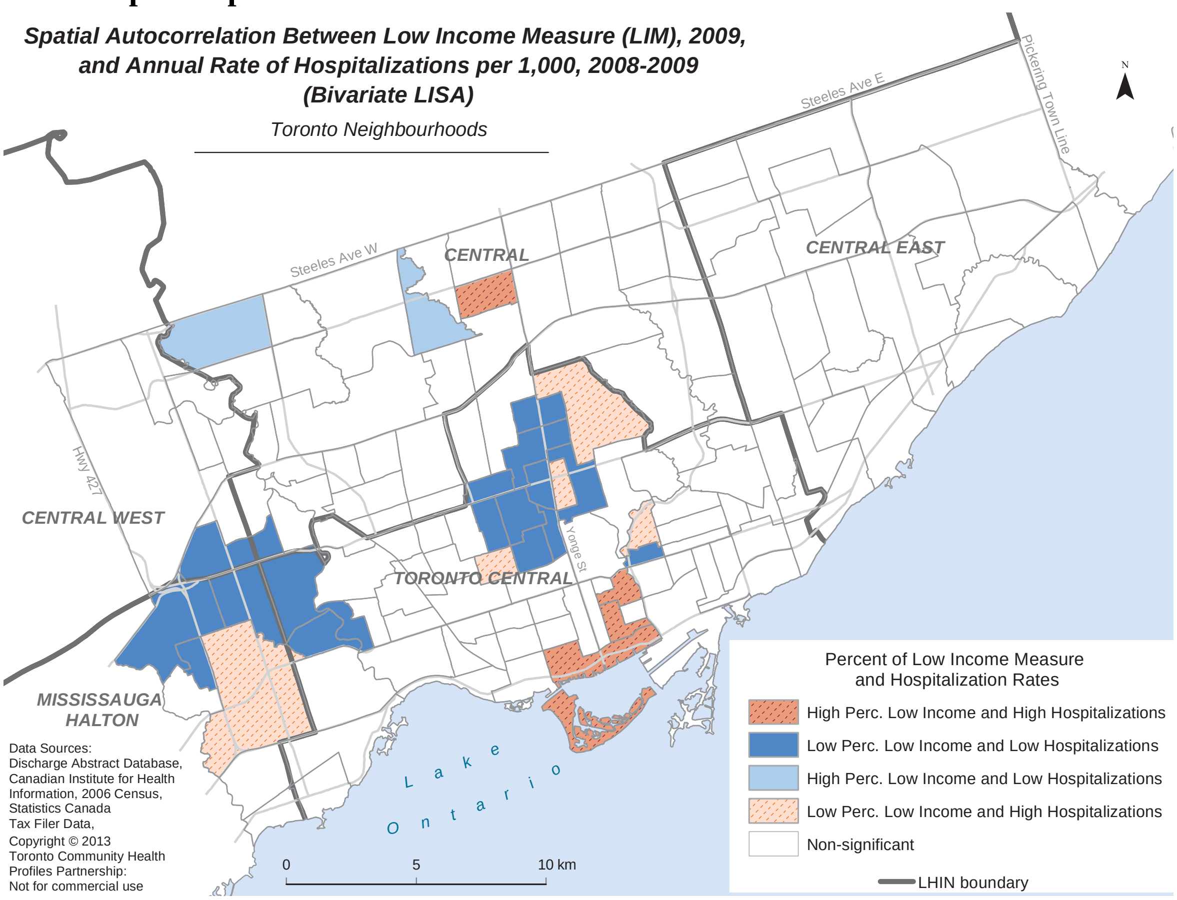


5. ‘Local Indicator of Spatial Association’ [LISA] is a spatial statistical analysis that helps to identify clusters of high and low values of two different variables (Anselin, 1995).

On a LISA map, the analysis results are depicted using colour shades to identify statistically significant clusters. In the map example below, Percent 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%.

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.

LISA map example



References:

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