Household Food Insecurity and the Immigrant Population of Metro Vancouver

Introduction and Research Questions:

The problem that we are trying to research through our project is that of Household Food Insecurity through identifying Food Deserts in Metro Vancouver, and how the overall population as well as, specifically, the immigrant population is affected by it.

Household Food Insecurity in Canada is defined to be limited access to safe, nutritious and healthy foods at a household level (Tarasuk, 2016) while food deserts are defined as residential spaces whose population do not have easy access to affordable, good quality groceries (Holmes *et al.*, 2019), so we can note that the two often go hand in hand.

Households in Canada are also classified on a scale of:

1. Food secure
2. Marginally Food Insecure
3. Moderately Food Insecure
4. Severely Food Insecure

with regard to food insecurity. (Holmes *et al.*, 2019)

With the growing rates of food insecurity across Canada, this is a problem that we need to address now, more than ever- a 2012 Canada-wide study found that 12.6% of Canadian households were grappling with household food insecurity (Tarasuk, 2016) , while the same study done in 2021 revealed that rates had gone up to 15.9% (Tarasuk *et al.*, 2022), which is alarming news. Through our study, we want to identify the areas that would benefit the most from food security initiatives.

In addition to this, there is also data suggesting the financial hardships that immigrants often go through when they move to a different country (Lightman *et al.*, 2018), and we wanted to find out whether food deserts in Metro Vancouver are more likely to have a higher population or not, and if this data suggests that we need more food security programs to help immigrants specifically.

For our purposes, since we wanted to study the area of Metro Vancouver, we chose to do an analysis of the census subdivisions of Vancouver, Surrey, as well as Richmond since these are the subdivisions with the highest immigrant populations in Metro Vancouver, according to a survey done by Statistics Canada in 2021.

So, the research questions that we aim to answer with our paper are:

1. What areas, if any, of Vancouver should the government focus on with respect to food security initiatives in the future?
2. How is the immigrant population of Vancouver affected by food deserts?
3. Is it affected disproportionately with respect to the general population?

Data:

Dataset name	Data Type: Vector, raster, or tabular	Key Attributes: What features/phenomena does this dataset represent?	Source
Household Population by Total Immigrants and Place of Birth	Vector	This dataset represents the spread of immigrant households across Vancouver	Simply Analytics
Household Population by Total Immigrants and Place of Birth	Vector	This dataset represents the spread of immigrant households across Richmond	Simply Analytics
Household Population by Total Immigrants and Place of Birth	Vector	This dataset represents the spread of immigrant households across Surrey	Simply Analytics
Median Household Incomes in Vancouver	Vector	This dataset represents the spread of median incomes of households across Vancouver	Simply Analytics
Median Household Incomes in Richmond	Vector	This dataset represents the spread of median incomes of households across Richmond	Simply Analytics
Total Basic Population of Vancouver	Vector	This dataset represents the spread of total population across Vancouver	Simply Analytics

Total Basic Population of Richmond	Vector	This dataset represents the spread of total population across Richmond	Simply Analytics
Total Basic Population of Surrey	Vector	This dataset represents the spread of total population across Surrey	Simply Analytics
Grocery Business Licences in Metro Vancouver	Vector	All licensed businesses in the Metro Vancouver, including Grocery stores and their locations	Simply Analytics

Limitations of Data:

According to the definition of a Grocery store, as per Statistics Canada, we took all stores with a prefix of NCAIS as “44511”. This includes convenience stores under the definition, although they do not always carry a wide amount of groceries.

Methods:
First, to identify a food desert, we wanted to identify areas which were both:

1. low income and
2. did not have easy access to grocery stores

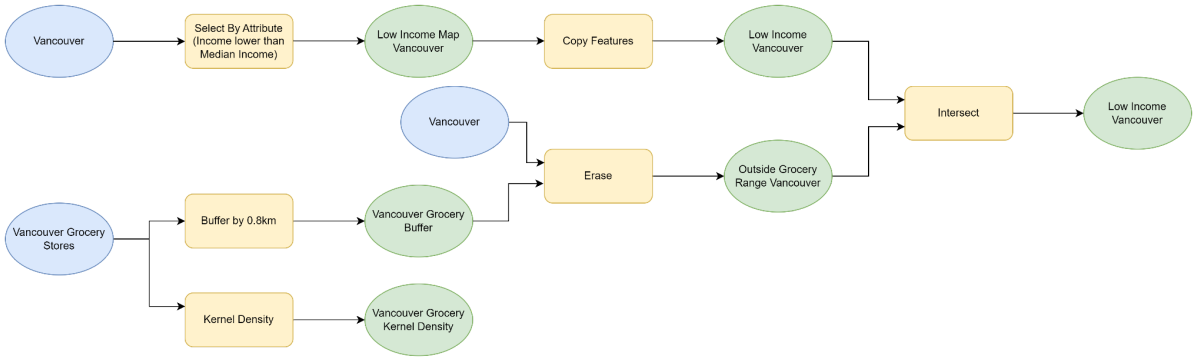
According to Statistics Canada, a low income area is defined as one where the income is less than the median income of the subdivision. To find low income areas in each subdivision, we chose census tracts with the Median Income less than the Median Income of the subdivision as a whole.

Additionally, we identified a ten minute walking distance to be a reasonable distance for easy access to a grocery store, which translates to about 0.8km. So areas out of this range were classified as "not having easy access to stores".

The methods that we took to identify the food deserts were:

- Projected our data about grocery stores in Vancouver, Richmond and Surrey into feature datasets as points and then onto our base map.
- We then got the Kernel Density, taking the Grocery Stores as input, with a radius of $800m^2$ and a Geodesic method, to see which areas have higher density of grocery stores in them.
- To find the areas that did not have easy access to grocery stores, we buffered them by 800m, and essentially subtracted this area by the rest, since this is the area easily accessible by grocery stores.
- Having acquired the datasets for the census tracts of the subdivisions with their Median Income and Immigrant Population as mentioned above, we then wanted to focus only on areas that are both low income *and* out of an 800m radius of a grocery store.
- We did this using the erase tool to clip out areas that were low income and fell outside the range of 800m from a grocery store. These are our food desert areas as described in our model.

Model:



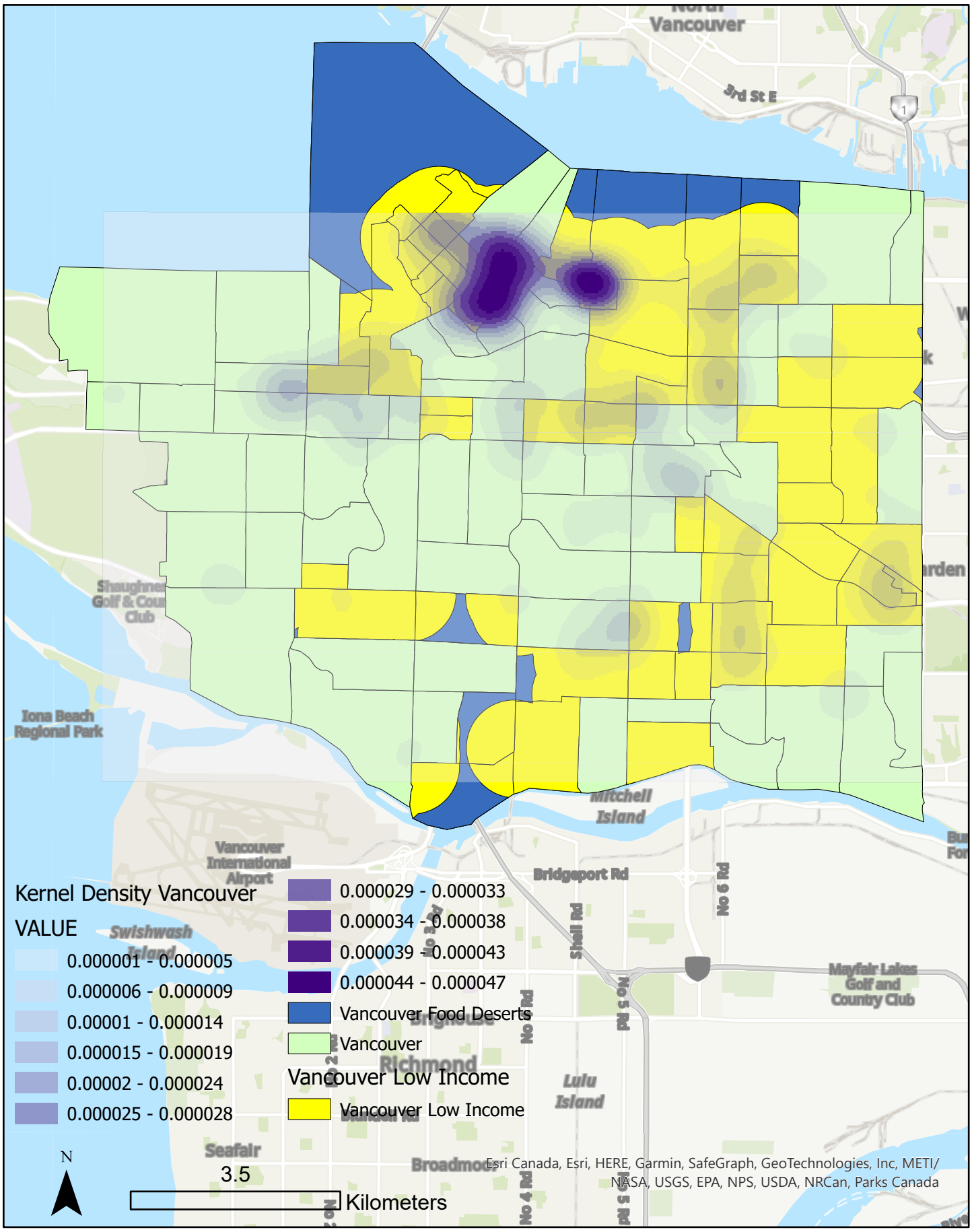
The same process was repeated for the subdivisions of Richmond and Surrey to identify the food deserts there; we did not show the flowcharts to avoid repetition.

To understand the impact that areas with high to moderate/marginal risk of food insecurity might have on immigrant populations, we tried to study whether immigrants are more likely to reside in such areas. In order to observe this, we created two scatterplots each for Vancouver, Surrey, and Richmond. One was between Median Household Income and Total population, while the other was between Median Household Income and Immigrant population. We then used the correlation coefficient to compare our results.

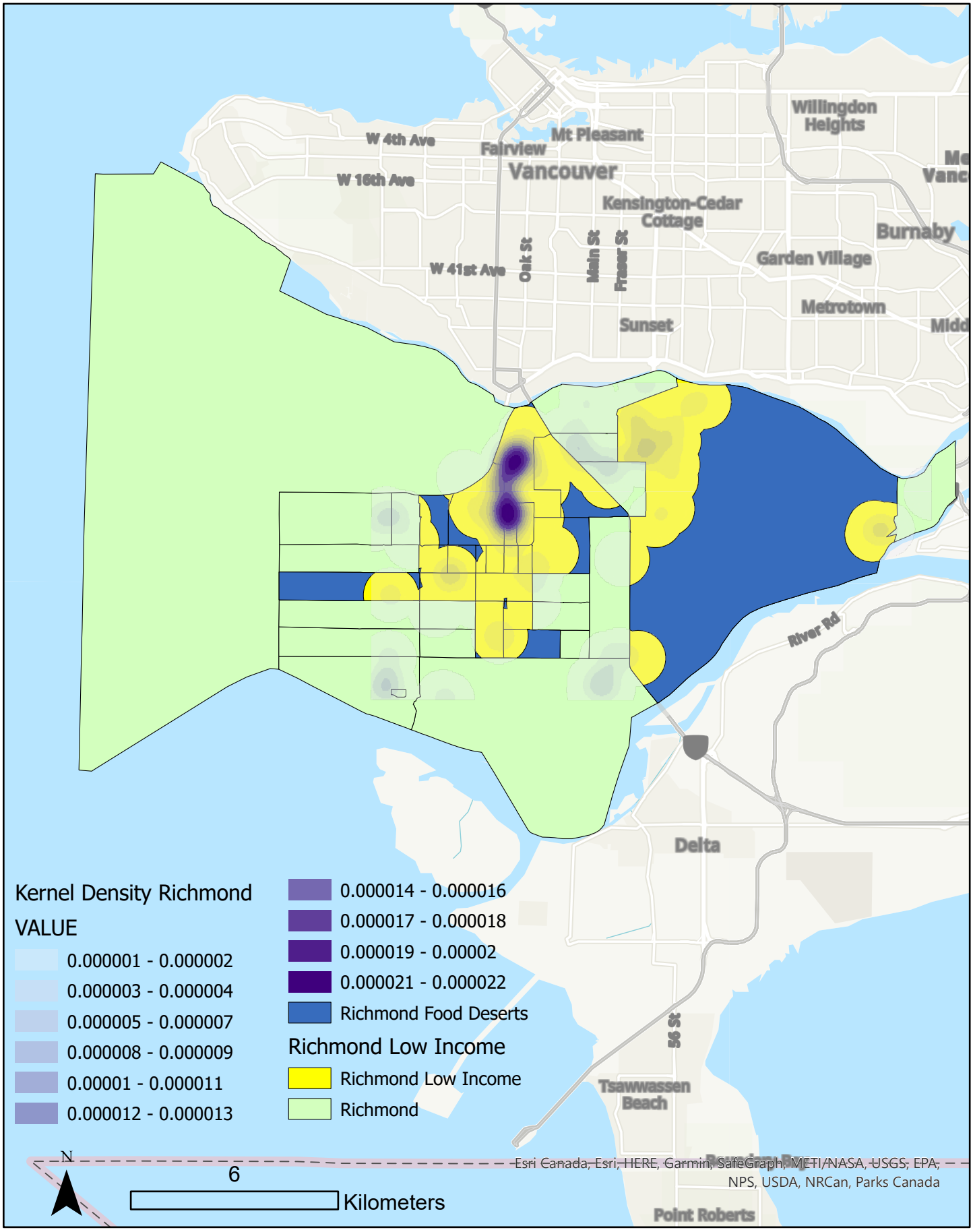
Results:

The distribution of low income areas and grocery stores is as follows for Vancouver, Richmond, and Surrey, in that order:

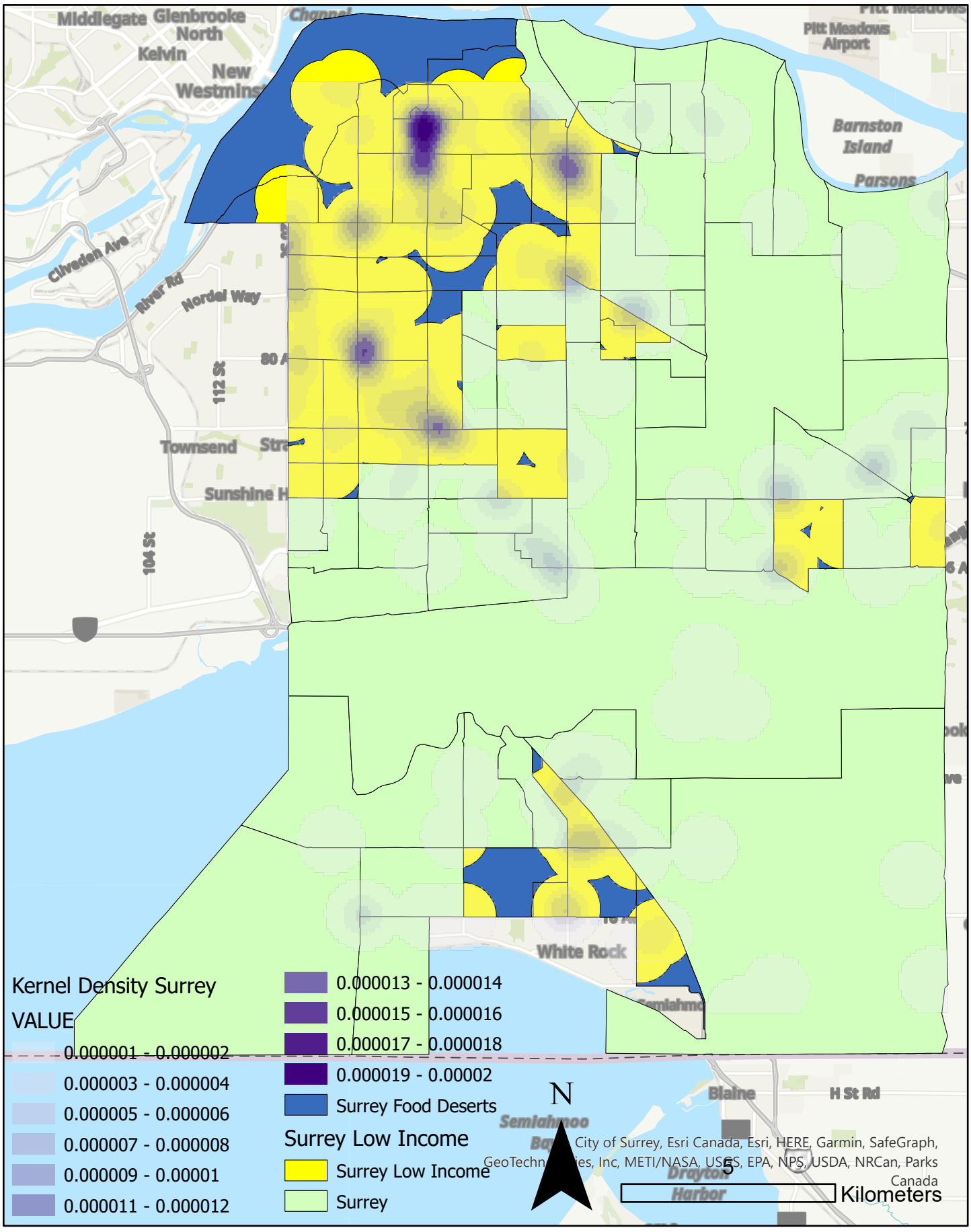
Vancouver - Food Insecurity Analysis



Richmond - Food Insecurity Analysis



Surrey - Food Insecurity Analysis



Analysis:
The areas that we identified in blue in the maps are the areas at *severe* risk of food insecurity, while the yellow areas are the low income areas; the green areas indicate food secure neighbourhoods.

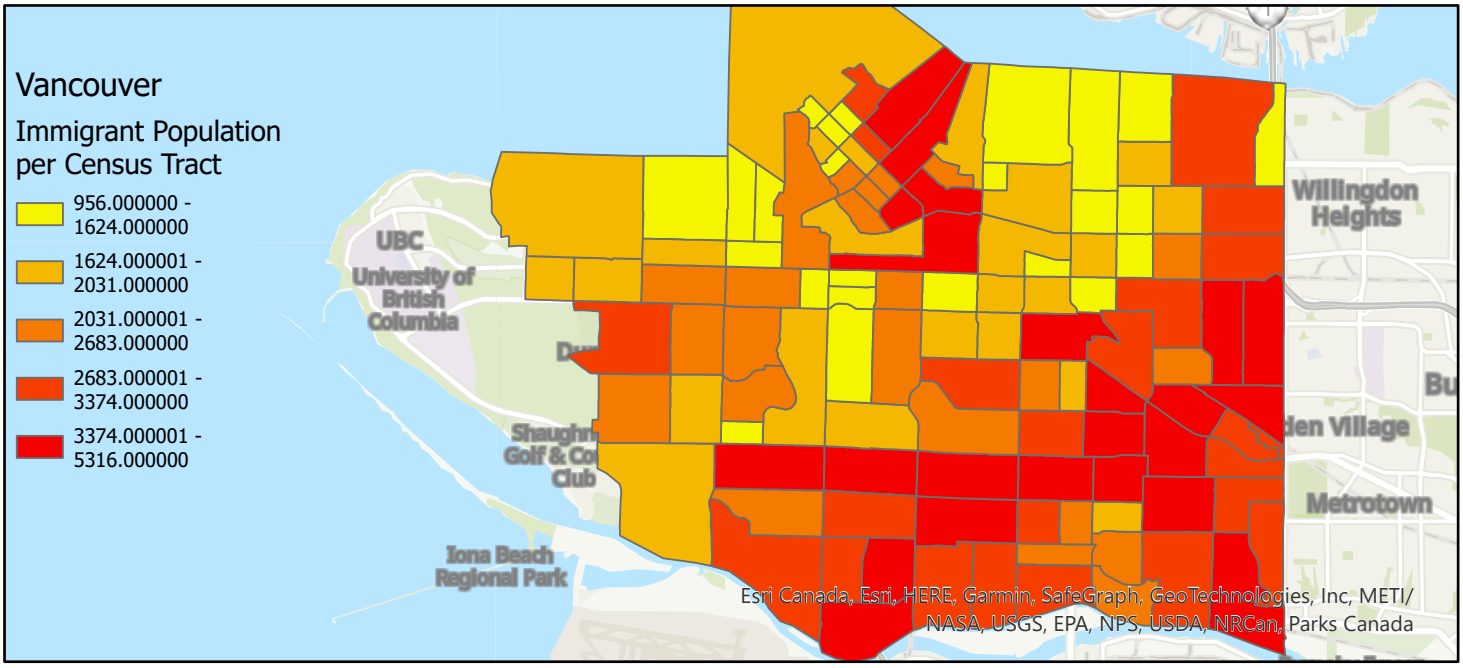
As we can see in all three subdivisions, some low income areas tend to have clusters or a high Kernel density of grocery stores fairly close to one another. These areas, despite being low income, are at *marginal*, or very low, risk of food insecurity and this is actually a positively contributing factor to grocery prices since with many grocery stores in the area, stores will often have competitive prices or deals to "out-do" each other.

On the other hand, low income areas with a low Kernel density of grocery stores in the area are more likely to have to deal with high food costs and since they only have one or two stores accessible to them in their neighbourhood, they will be at *moderate* risk of household food insecurity. These census tracts would benefit from some food security initiatives, but would not be as high on the priority list as compared to the areas severely at risk. These are the yellow areas on the map with a low density of grocery store locations on them.

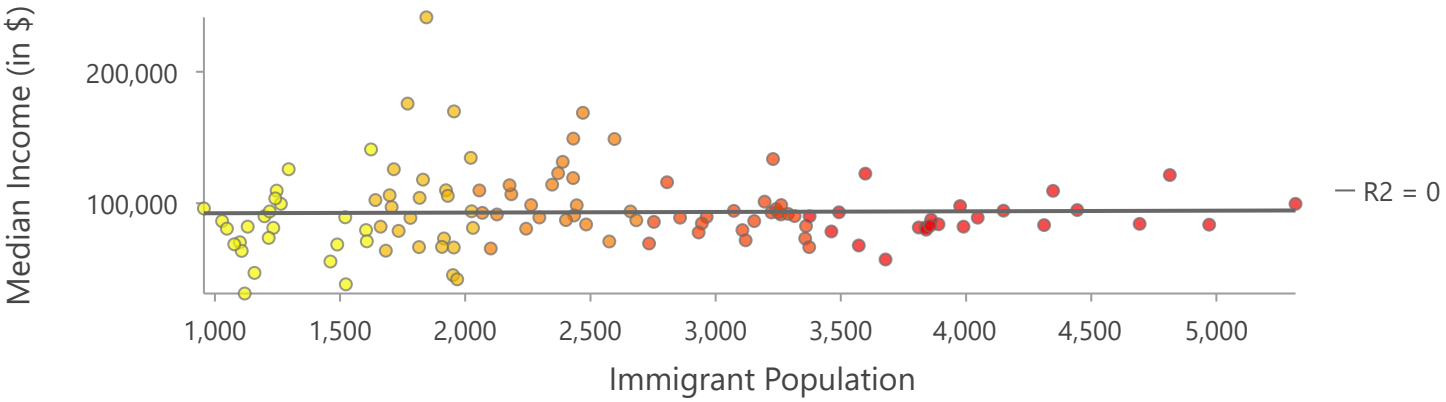
We found that Surrey, although it has more than twice the land area of Vancouver and a pretty comparable population, has only about a third of the grocery stores that Vancouver has. In addition to this, most grocery stores are concentrated into a single area, with people who live further away having to travel a considerable distance to reach a retail food store.

Immigrant Populations:
Since we are considering all three degrees of food insecurity, which are all correlated to the median household income, in order to see how immigrants are affected by Household Food Insecurity, we decided to showcase this divide with a scatter plot.

Vancouver - Distribution of Immigrant Population

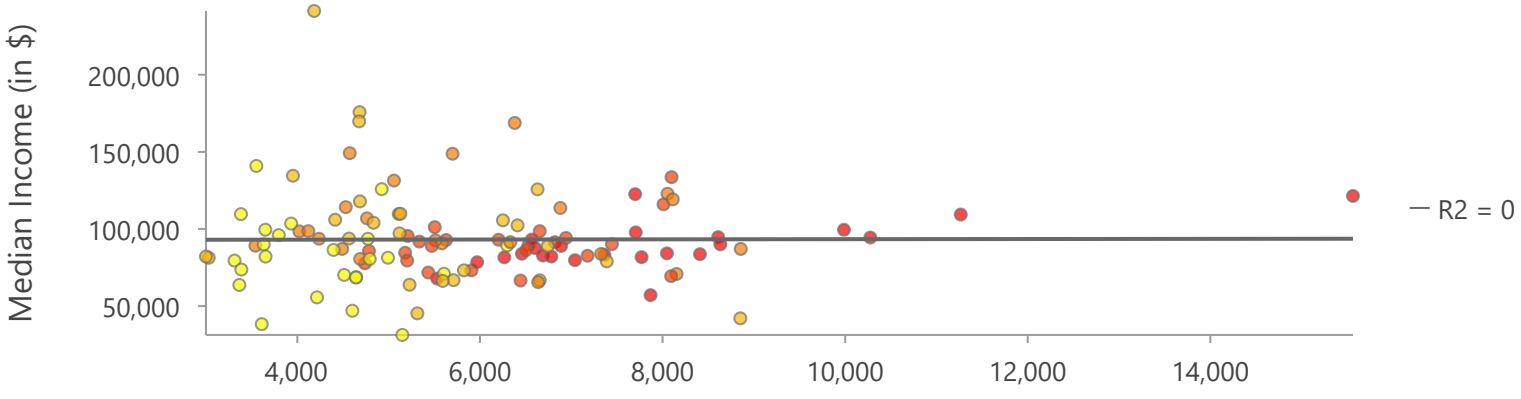


Relationship between Immigrant Population and Median Income



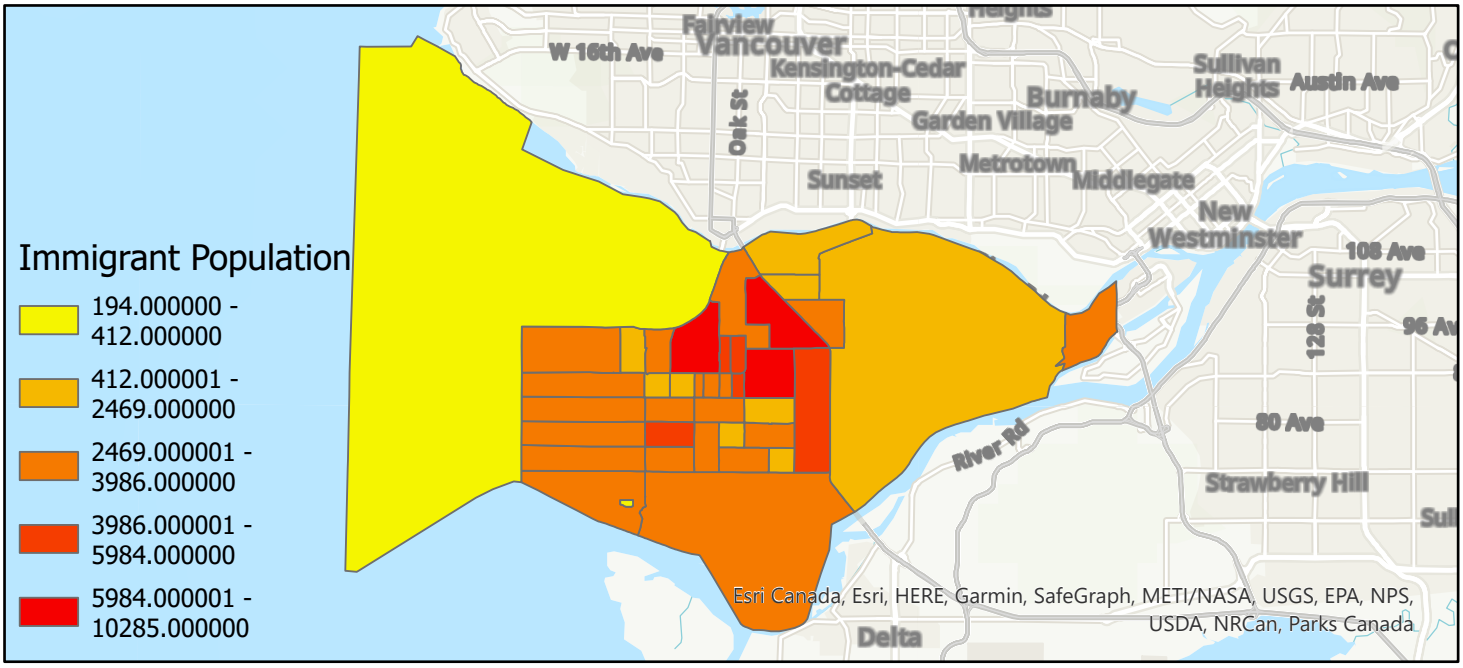
Immigrant population has little to no correlation with median income

Relationship between Total Population and Median Income

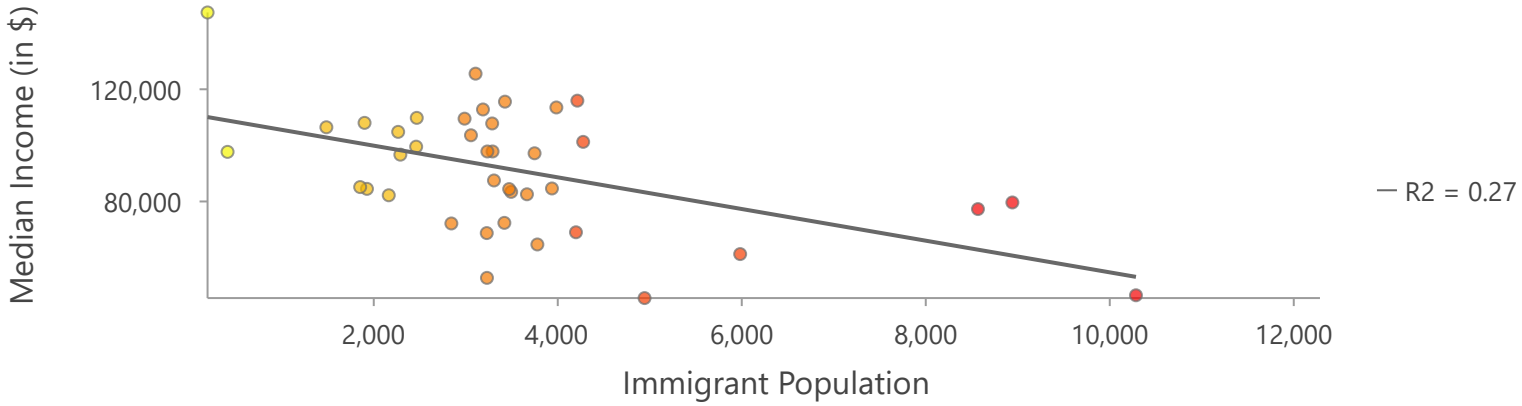


Total population has little to no correlation with median income

Richmond- Distribution of Immigrant Population

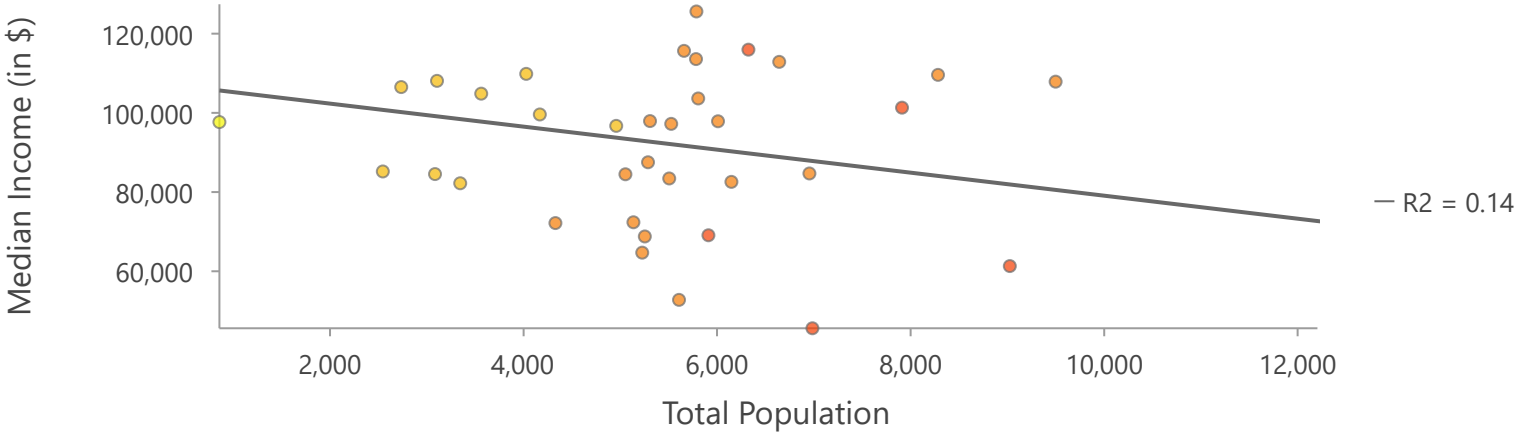


Relationship between Immigrant Population and Median Income



The two have a negative correlation: median income drops as immigrant population in an area rises

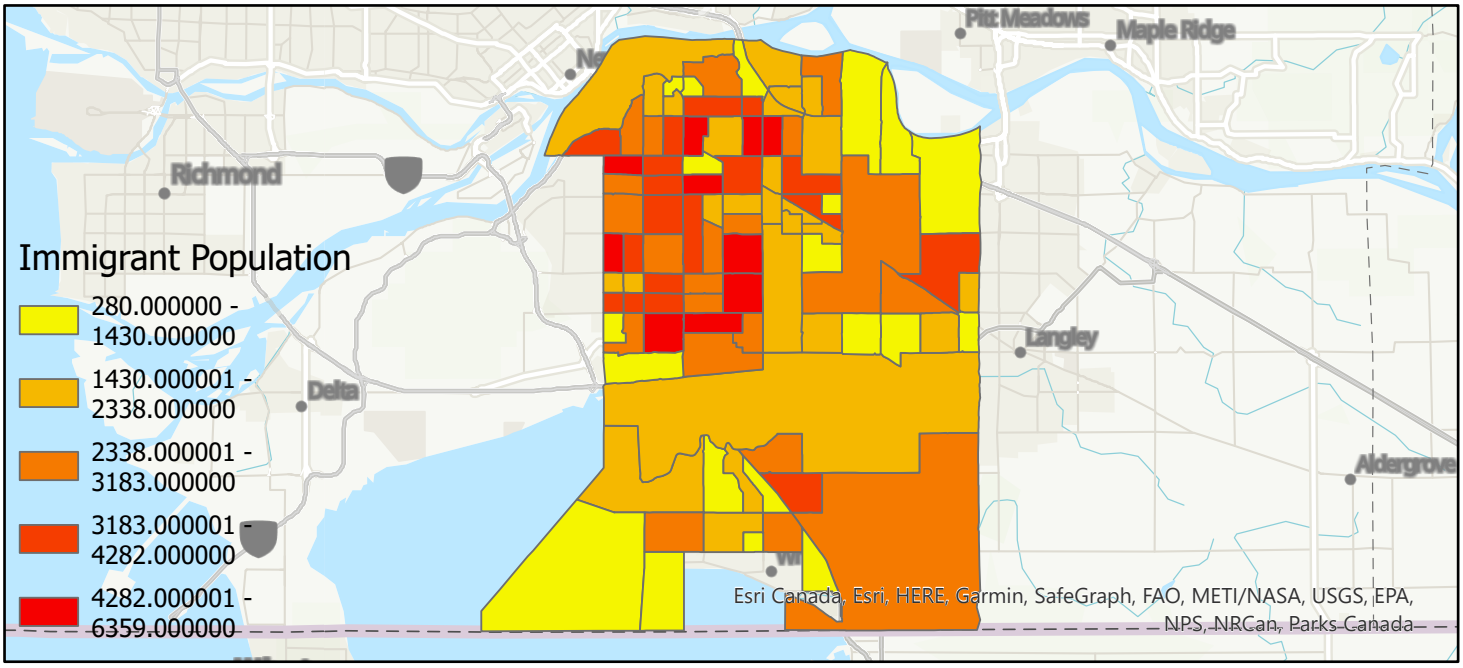
Relationship between Total Population and Median Income



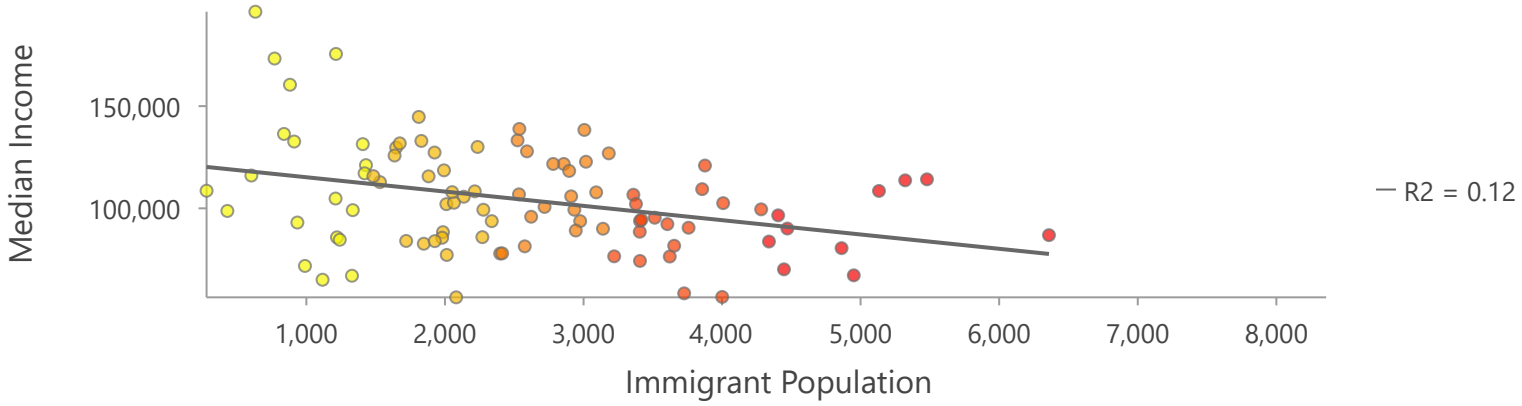
The two have a negative correlation: median income drops as total population in an area rises.

Median income in areas of higher immigrant population has a steep decline as compared to median income in areas of total population.

Surrey- Distribution of Immigrant Population

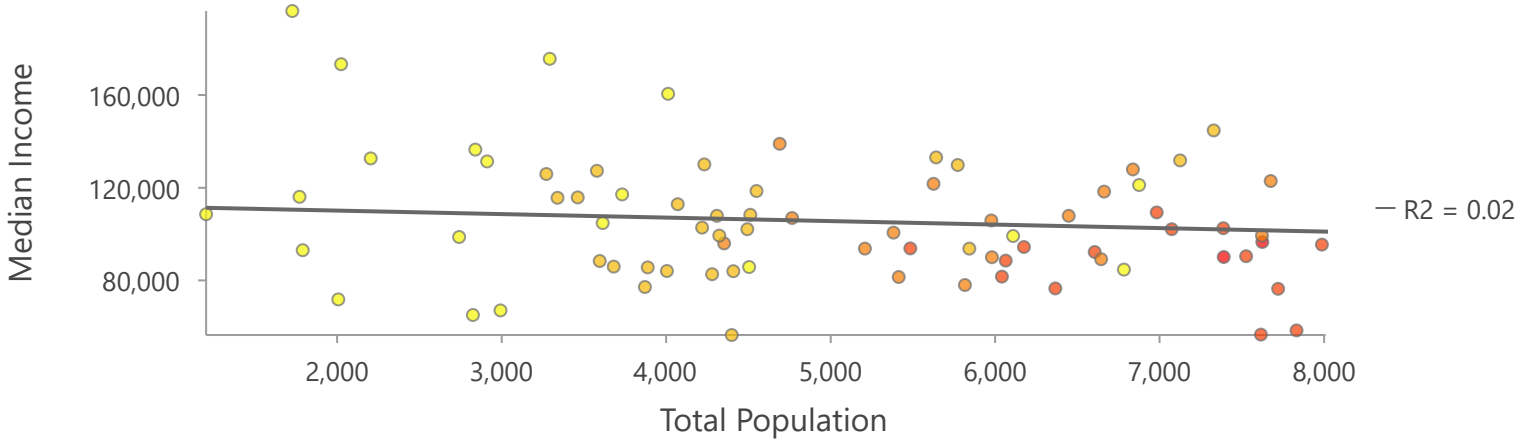


Relationship between Immigrant Population and Median Income



The two have a negative correlation: median income drops as immigrant population in an area rises

Relationship between Total Population and Median Income



Total population has almost no correlation with median income

Median income in areas of higher immigrant population has a steep decline while median income in areas of total population has almost no correlation

Analysis:

- We found that in Vancouver, neither high Immigrant population nor high total population have any correlation with median income. The correlation coefficient is zero in both cases.
- In Richmond, on the other hand Median income in areas of higher immigrant population has a steep decline as compared to median income in areas of higher total population.
  The correlation coefficient for Immigrant Population and lower Median Income was 0.27, and we can see from the slope that as immigrant population in an area increases, the lower median income decreases.
  The correlation coefficient for Total Population and lower Median Income was 0.14, and although we can see from the slope that as immigrant population in an area increases, the lower median income decreases, we can also observe that the rate at which it decreases is much lesser than the rate for the immigrant population.
  This shows a stronger correlation between the Immigrant Population of Richmond and Low Income, putting them at much higher risk of Household Food Insecurity.
- In Surrey, Median income in areas of higher immigrant population also has a steep decline compared to median income in areas of higher total population.
  The correlation coefficient for Immigrant Population and lower Median Income was 0.12, and we can see from the slope that as immigrant population in an area increases, the lower median income decreases.
  The correlation coefficient for Total Population and lower Median Income was 0.02, almost zero, implying almost no correlation between low income and higher rates of total population.
  This also shows a stronger correlation between the Immigrant Population of Richmond and Low Income, putting them at much higher risk of Household Food Insecurity.

Limitations:

- One of the limitations of our study is that we did not consider the average prices of groceries from each grocery store, and so there is no distinction in our project between low-cost, high-savings grocery stores as opposed to high-cost, low-savings stores.
  This is quite an important factor, since for a low income family, this severely limits the amount of food they are able to get from that store. Even if the store may be within a 0.8km radius from their home, its prices may be completely inaccessible to them, especially since Canada does not enforce a Maximum Retail Price on any grocery items.
- In our analysis of grocery store locations in Vancouver, we obtained the data by selecting all stores with active, unexpired grocery store licences. This data does not take into account farmers markets. We farmers markets would skew our data since they provide only a small subset of the food needed for a balanced diet, and usually only take place weekly or seasonally. However, one such location may be a main food source for a particular family.

Conclusion:

In conclusion, over the course of our analysis we found that there are not many *severely* food insecure areas in either of the three subdivisions of Vancouver, Richmond, or Surrey, but there are still a few that need to be paid urgent attention to. We saw those detailed in our maps above.

However, the number of *moderate* to *marginal* food insecure areas is fairly high, since most grocery stores seem to be densely packed in one or two urban centres of the subdivisions. So, these moderately food insecure areas tend to be residential or suburban in nature, which are often not very well connected by public transportation, or have a very high walkability index. These areas could be potential areas in Metro Vancouver for food security initiatives to be launched, since they would benefit from them.

Although we did not find any direct correlations between high immigrant population zones and severely food insecure areas, we did notice that a high immigrant population was correlated with a lower average income, not in Vancouver, but in both Richmond and Surrey. This puts immigrants at a higher risk of Household Food Insecurity when compared with the total populations of the areas mentioned above, and so, perhaps in those subdivisions there could be some food security initiatives launched towards lower income immigrant families.

References:

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