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The Canadian Well-Being Index
Quantifying the Standard of Living in Canada

September 2019

EXECUTIVE SUMMARY

Canada is regarded as one of the best countries to live in the world. The Canadian National Census is conducted every five years, most recently in 2016. One product of the census is the Canadian Well-Being Index (CWBI), which measures the standard of living in Canadian communities based on four indexes: education, housing, income, and labour. The four indexes are averaged to generate the Overall Well-Being Index.

The purpose of this report is to dig deeper into communities that score poorly on the Overall Well-Being Index. This information is not only valuable to politicians at all government levels managing resource-allocation, but to each individual living in the country.

A thorough analysis of the CWBI data yielded the following results, ranked in order of importance:

1. **Indigenous communities are at a disadvantage:**

    Indigenous communities experience a 26% lower standard of living than the rest of Canada.

2. **Strength in numbers:**

    When the population of a community exceeds 2,500, it generally results in a high standard of living.

3. **Nationwide education can be improved:**

    Education still remains the driving force behind a high standard of living, despite being the lowest scoring index in the country.

Canada is a great place to live for more than 90% of the population. However, despite years of social programs, grants, and economic initiatives - a major gap in standard of living still exists in the country. The Indigenous population in Canada is still experiencing a drastically reduced quality of life. Although there is no single-solution to this social and economic problem, the idea of creating critical population mass (>2,500) within the Indigenous communities could be a step towards achieving a higher quality of life.

INTRODUCTION

Canada is a vast, unexplored country. Compared to many developed nations, Canada ranks as one of the least densely populated in the world. Understandably, resource-allocation across its 37 million citizens remains a challenge. With a handful of major city centers receiving most of the attention, there are thousands of smaller communities spread across the country where access to a first world standard of living still remains a challenge. In 2016 the Canadian government released the Canadian Well-Being Index, which ranks each community based on an overall score relating to education, housing, income, and access to work. In this report, we will use this dataset and take a closer look at those communities in need.

Problem Statement

The purpose of this report is to understand why certain communities in Canada rank low on the Canadian Well-Being Index (CWBI). Further, we will explore ideas on how we can improve fair and equitable distribution of resources to these communities.

Target Audience

Every citizen in Canada is a stakeholder in this report, and has the right to know how their standard of living compares to the remainder of the population.

Primary Target

Politicians from all levels of government are the primary target of this report. Specifically, politicians who manage the allocation of resources to the citizens of Canada.

These resources include access to schools, social services, and equal opportunity employment. From a federal level, politicians will mainly be interested in high-level trends seen across the country. On a provincial level, politicians will be more interested in gaining a better understanding of parts of their province that they don't work with on a day to day basis. Out of sight, out of mind - as you will. This report may help them determine funding levels being allocated to each region of the province. From a municipal level, local politicians can use the findings in this report to champion their agendas to the community. They will be empowered with the data specific to their community, and will be able to benchmark themselves against the nationwide standards.

Secondary Target

The citizens of Canada are the secondary target of this report. Each one of us wants to know how our community ranks against the rest of the country. Further, it may give us better insight into understanding why other communities across the nation act and behave as they do. Overall, we are democratizing the data and handing over the power to the communities to seek further insights.

DATA OVERVIEW

Data Sources

The work included in this report is based on data from the Canadian Well-Being Index (referred to as the CWBI) from 2016, as well as current location data from Foursquare. The CWBI is publicly available data shared by the Canadian government in CSV format. The CWBI coincides with the census, with the next round of data gathering slated for 2021. It ranks every community in Canada based on four indexes, which are then averaged to generate the overall Well-Being Index.

1. Education
2. Housing
3. Employment
4. Income

Foursquare is the second tool that was leveraged for the analysis. Using the Foursquare API, we were able to retrieve information relating to the types of services provided within each community. Paired with the community's CWBI, Foursquare allows us to take a deeper dive into the driving force behind the community's overall ranking. For example, identifying a lack of schools in a particular region may be the driving force behind an overall poor index rating for education.

Data Wrangling

Limited data wrangling was required to bring the CWBI to an analysis-friendly condition. Overall, the data was already refined to the essentials - community name, census boundary ID, population, community type, and index results. Ideally, the dataset would have included additional attribute information from the 2016 census, such as contributing data to the calculation of each index. For the scope of this report, no additional census data was merged into the dataset.

Data Refinement - Stage 1

Approximately 30% of the communities in the dataset were missing one or more index rating. Instead of replacing these missing values with the nationwide mean (not appropriate in this case), the decision was made to drop any community with missing index data. This adjustment reduced the number of total communities in our dataset from 5,162 to 3,680. Based on the overall size of the resulting dataset, we are still confident that we are tapping into a large enough subset of the Canadian population.

Feature Selection

Given the clean condition of the original CWBI dataset, feature selection was a relatively straightforward process. In total, seven features were selected to perform the analysis:

1. Total Population
2. Community Type
3. Education Index
4. Housing Index
5. Labour Index
6. Income Index
7. Overall Well-Being Index (CWBI)

As defined in the original dataset, the CWBI is simply the average of the four unique index ratings.

METHODOLOGY

We will employ data science techniques to build on our knowledge of the Well-Being Index and overall standard of living in each community across Canada.

First, we will explore the data. Through data visualization and basic statistical analysis, we can quickly bring ourselves up to speed on the dataset. Understanding how each index is correlated, how population affects well-being, and the impact of being in an indigenous community will set the stage for refining the dataset to capture only those communities of interest.

Next, we will use the k-means clustering algorithm to group communities into four distinct groups. All features will be considered during the clustering process. This process will allow us to compare and contrast two specific subsets of the data. In short, understanding both ends of the CWBI spectrum.

Finally, we will map our clusters of interest and sample a subset of each in preparation to use the Foursquare API. This API will retrieve information relating to the services provided in each community. From there, we can build an in-depth profile of each community and start to draw conclusions on the driving factors behind communities that rank both highly and poorly on the CWBI.

Data Visualization

Three data visualization techniques were selected to gain a quick understanding of the CWBI data:

1. **Boxplot**

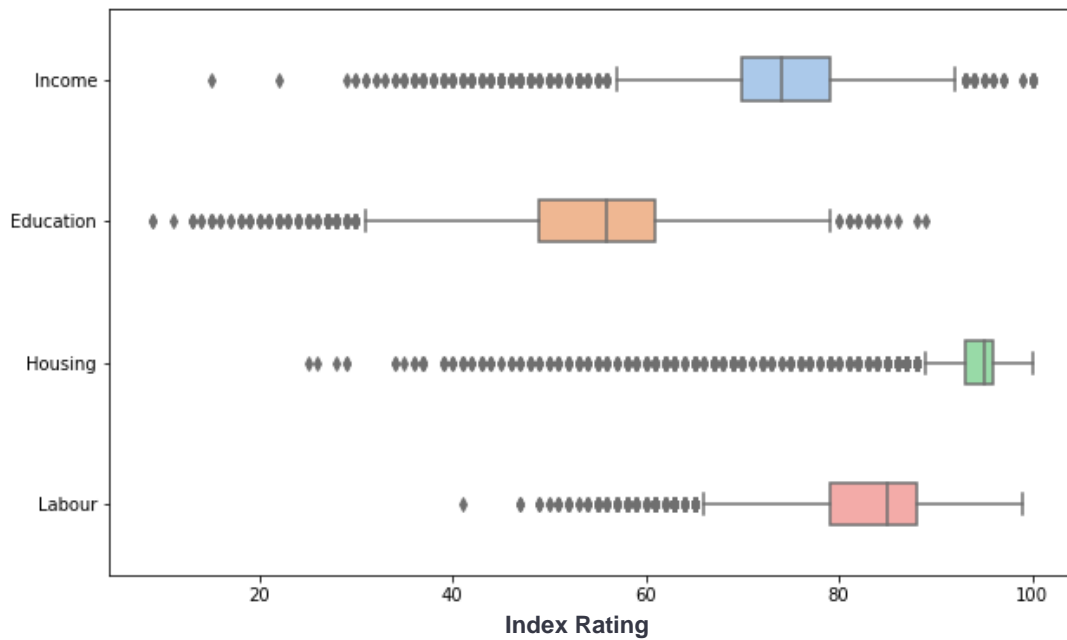   Summarize the statistical distribution of the four indexes.

2. **Scatterplots**

    Highlight the role education plays in other indexes.

3. **JointGrid**

    Display all feature relationships, highlighting Indigenous communities and clustering results.

Boxplot Visualization - Distribution of the Four Unique Well-Being Indexes

Takeaways:

- The education index is lagging relative to all other indexes - this needs to be investigated further as education can be seen as the building block to a high standard of living.

- The housing index ranks highly and has a tight distribution - access to housing is likely not a widespread issue in Canada.
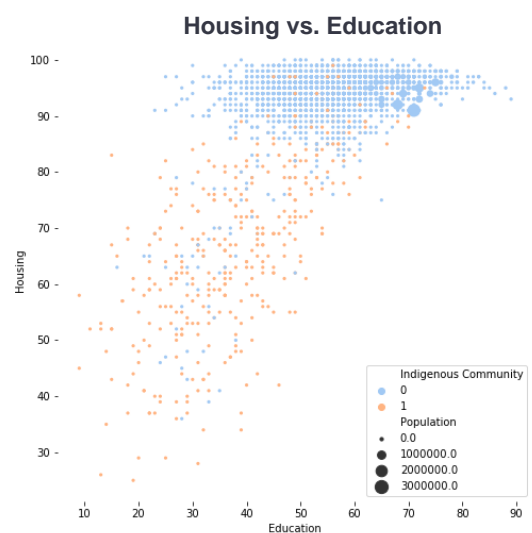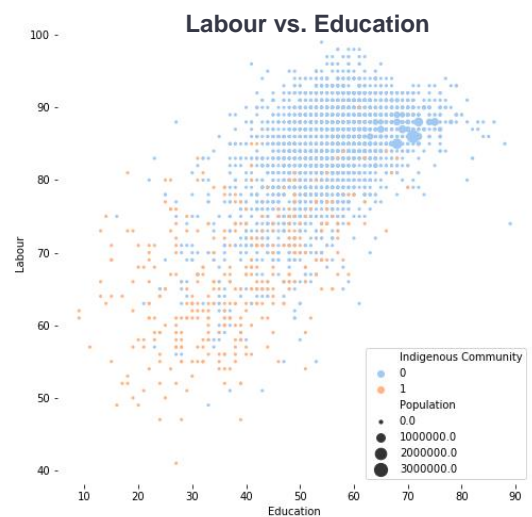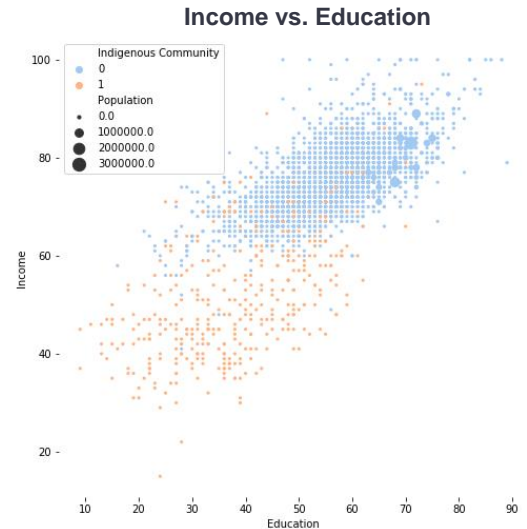
Scatterplot Visualizations - Impact of Education on Income, Labour, and Housing
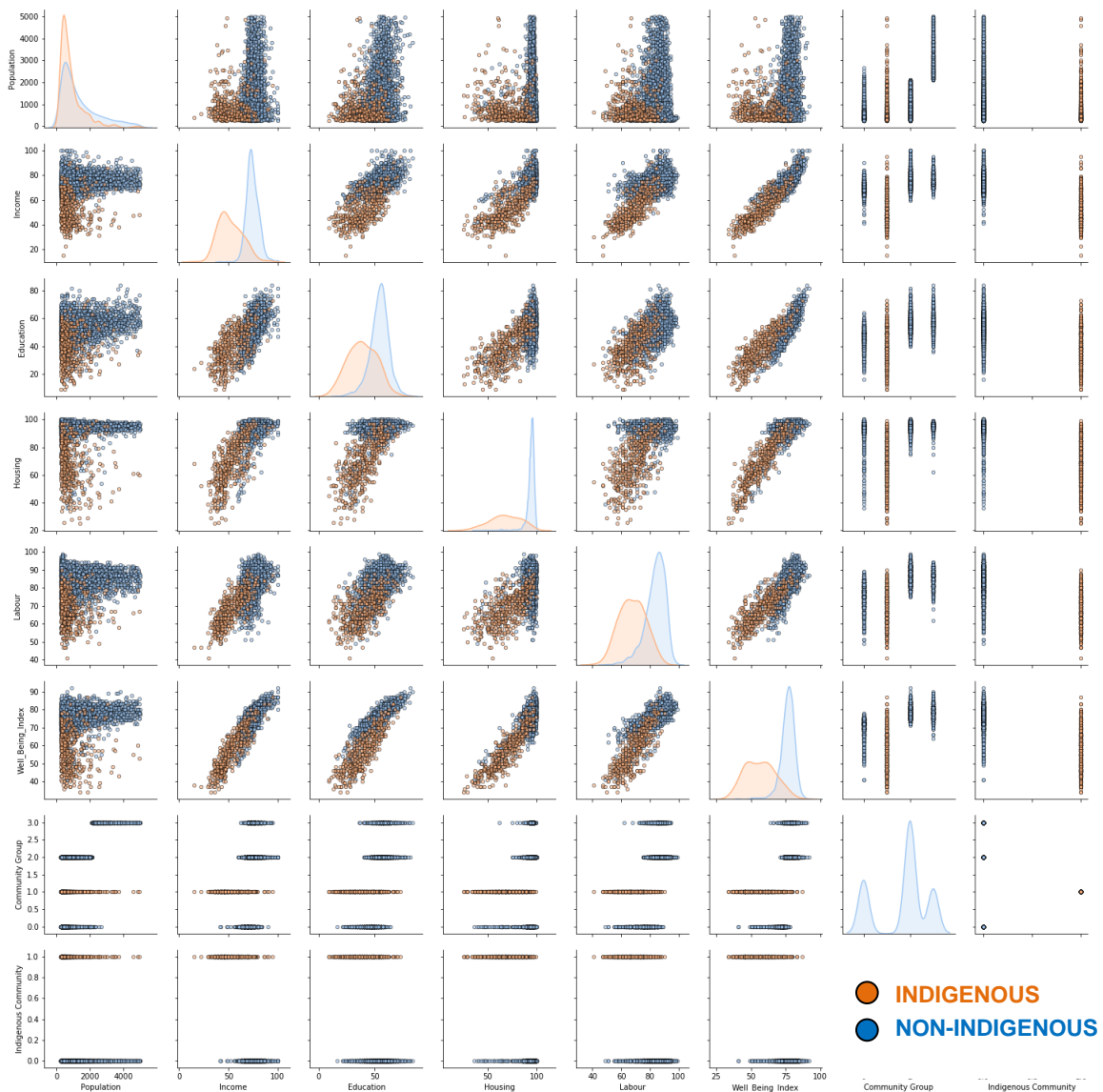
Takeaways:

- Education is linearly related to both income and labour - this is expected, as better education should unlock stable work with decent pay.

- Education is non-linearly related to housing - we saw a hint of this in the boxplot from before, regardless of your education in Canada it appears that access to housing is sufficiently provided.

- Indigenous communities represent almost exclusively the poorly educated and low income communities in Canada.

- Major city centers (i.e. large population communities) are well educated with a high level of income.

Data Refinement - Stage 2

It is clear that we need to take a closer look at the Indigenous communities in Canada, as they rank at the bottom of all indexes. Further, we will exclude communities with a population above 5,000 in our go-forward analysis. These city centers score highly across all indexes and are not the focus of our analysis. This adjustment reduces the number of total communities in our dataset from 3,680 to 2,967.

Income vs. Education

Labour vs. Education

Housing vs. Education

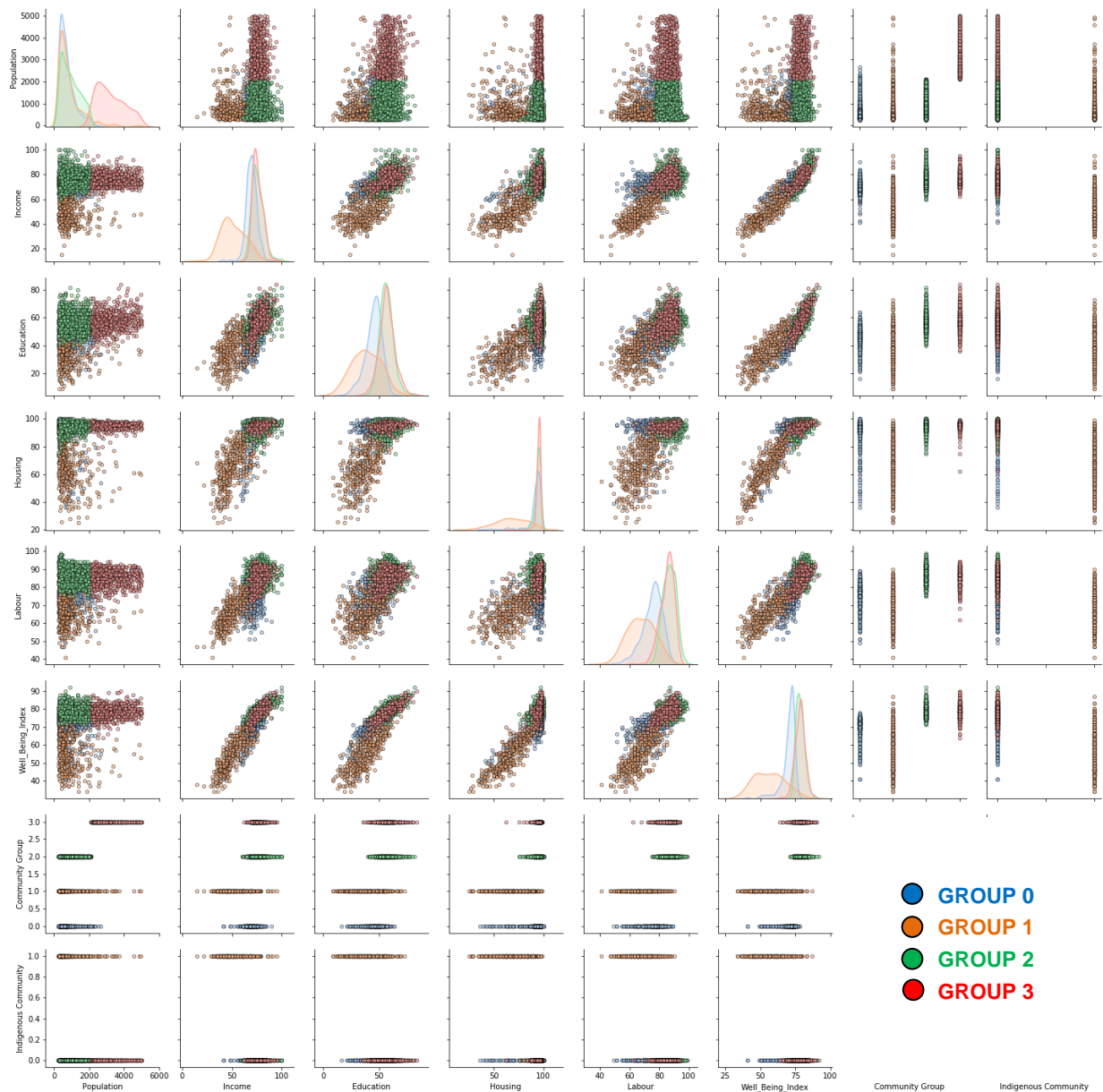**JointGrid Visualization** - Indigenous vs. Non-Indigenous Communities

Takeaways:

- Indigenous communities rank at the bottom of every index.

- There are a select number of Indigenous communities that rank highly compared to their peers - this could be a potential avenue of investigation to evaluate how they are achieving these high rankings.

- If the population of your community is over 2,500 people, it's almost guaranteed that you will have a moderately high standard of living. Said differently, there are few communities with more than 2,500 people that have a Well-Being Index below 70. Interestingly, there are very few Indigenous communities with populations exceeding 2,500.

Clustering

The next step of our analysis is to employ the k-means clustering algorithm to bin the communities into four groups. After clustering, the 2,967 communities can be visualized in the JointGrid below.

JointGrid Visualization – Canadian Communities with < 5,000 People

GROUP 0
GROUP 1
GROUP 2
GROUP 3

Based on the clustered JointGrid visualization, we can classify each group as follows:

Poor	○		
Moderate	○		
Good	○		

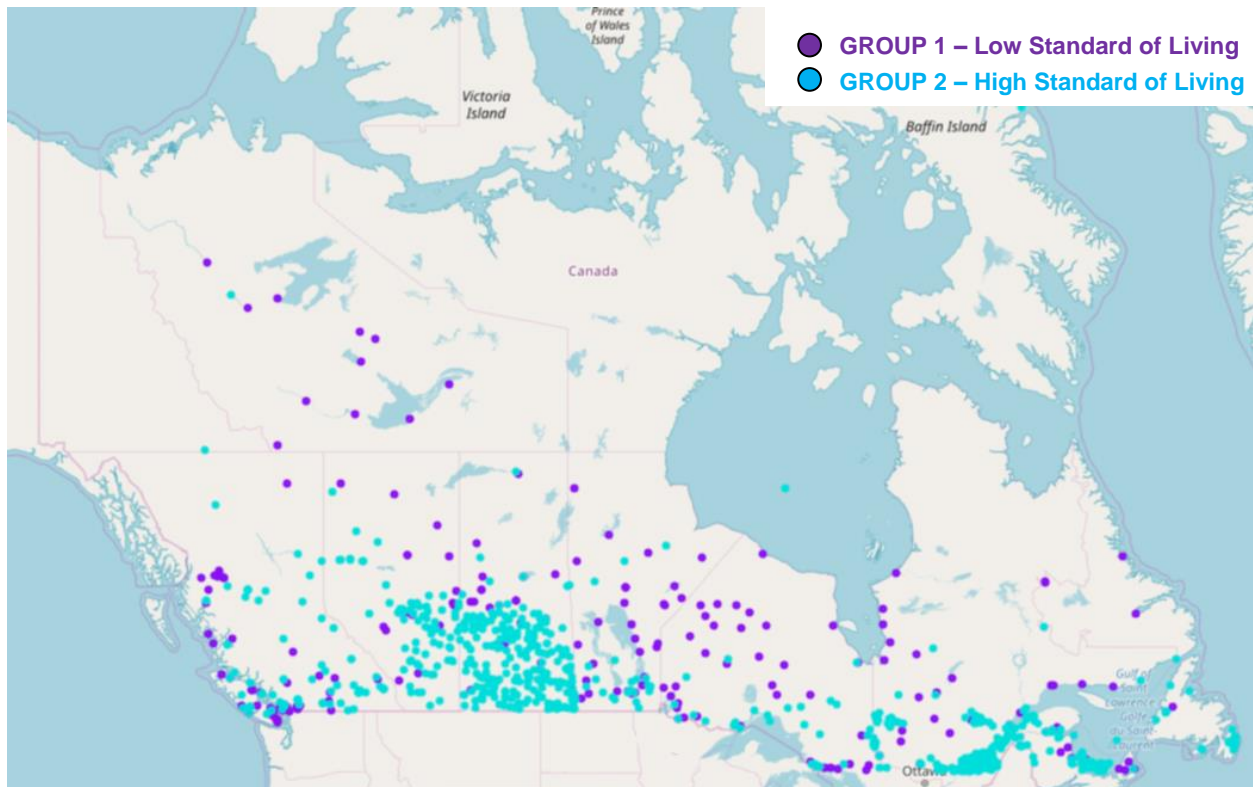| Group	Population	Education	Income	Housing	Labour
0	Small	○	○	○	○
1	Small	○	○	○	○
2	Small	○	○	○	○
3	Large	○	○	○	○

Data Refinement - Stage 3

The clustering results indicate that Group 1 (385 communities) and Group 2 (1,379 communities) represent both low and high ends of the well-being spectrum. Both Group 1 and 2 have small populations (< 2,000) and are well suited to be compared against one another. As a result, we will further refine our dataset to focus exclusively on Group 1 and 2. This adjustment reduces the number of total communities in our dataset from 2,967 to 1,764.

Mapping

To enhance our understanding of how the standard of living is distributed across Canada for communities with less than 2,000 people, the location coordinates of each community were retrieved to generate a high level map.
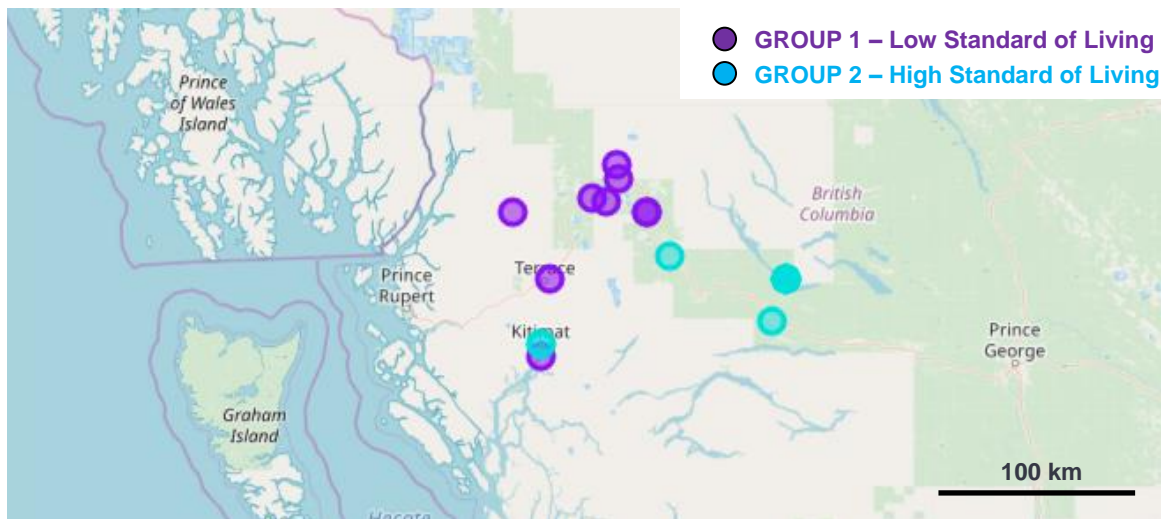
Canada - Standard of Living Distribution for Communities < 2,000 People

Takeaways:
- It's clear that there is no single province in Canada that is immune to communities with low standards of living. This disparity exists across the entire country.

- There are several areas in the country where a community with a high standard of living directly offsets a community with a low standard of living. Despite living in an identical landscape, one community is suffering and the other is not. This will be the focus of our next stage of analysis.

Central BC - Disparity in Standard of Living for Communities in Close Proximity

The area of Central British Columbia ('Central BC') was selected as the sample group for further analysis. Similar to many parts of Canada, Central BC has several communities with a low standard of living that directly offset communities enjoying a high standard of living. The next section of the report will explore possible reasons why this gap exists.

This type of analysis can be performed on any part of Canada, as we've already seen that no province is immune to localized disparity between communities.

Foursquare API

Understanding the amenities available in each community contributes to our understanding of the gap in standard of living that exists in Central BC. Using current location data supplied by the Foursquare API, the following approach was taken:

1. Define a search radius of 5km from each the community center
2. Send the search request to the Foursquare API
3. Return all available amenities within the 5km radius for each community

Foursquare Results

A total of 12 communities in Central BC were queried with the Foursquare API, returning a total of 58 amenities for the area. On average, 4.8 amenities are available per community. It is important to note what Foursquare defines as an amenity. Simply put, an amenity is a *venue* that a person can visit - a gas station, a restaurant, or even a public park. However, the total number of amenities available in a community is misleading. The quality of the amenities matters most. We will illustrate this in the following section by comparing two communities on either end of the spectrum: Witset and Burns Lake.

Witset vs. Burns Lake

Despite being only two hours apart by car on Highway 16, Witset (formerly Moricetown) and Burns Lake are two communities in Central BC whose citizens enjoy a stark contrast in standard of living. Witset, an Indigenous community with a population of 800 scores 59 points on the total Well-Being Index. Conversely, Burns Lake is a non-Indigenous community with a population of 1,800 that scores 30% higher on the combined index with 76 points. Given these two communities are both located close to the town of Smithers (pop 10,000) and have an identical geographical setting - how could one outscore the other by 30%? Although limited, access to amenities may help enhance our understanding.

Relevant amenities in **Witset**, as defined by Foursquare data:

● Witset Gas Bar & Convenience Store

Relevant amenities in **Burns Lake**, as defined by Foursquare data:

● Rexall Drugstore
● KFC
● Subway
● A&W

The Foursquare data shows that neither community has what most would consider community 'essentials' - a school, grocery store, clinic, community hall, or a fitness facility. So again, why does Burns Lake score 30% higher than Witset? The answer to this question will not be solved on Foursquare data alone. The data explored in this report illustrates that a major gap still exists in the overall well-being of the Canadian population.

RESULTS

The results from all three parts of the report (data visualization, mapping, Foursquare API) will be combined into a single results set then ranked based on importance.

1. **Indigenous communities rank at the bottom of every index**

   On a population basis, Indigenous communities represent 5% of Canada. This group of 1.7 million Canadians are spread out across 1,025 communities and several big cities coast to coast. Despite their relatively small population, the Indigenous people of Canada are critical to the country's cultural identity and have lived on Canadian land for generations.

   When evaluating the standard of living among the Indigenous population, it's clear that a gap exists between the Indigenous communities and the rest of Canada. Statistically speaking, one can project that if you are born into an Indigenous community in Canada you are automatically at a disadvantage. This disadvantage amounts to a standard of living that is 26% worse compared to being born into a non-Indigenous community. The figure below quantifies the gap Indigenous communities experience across the indexes.
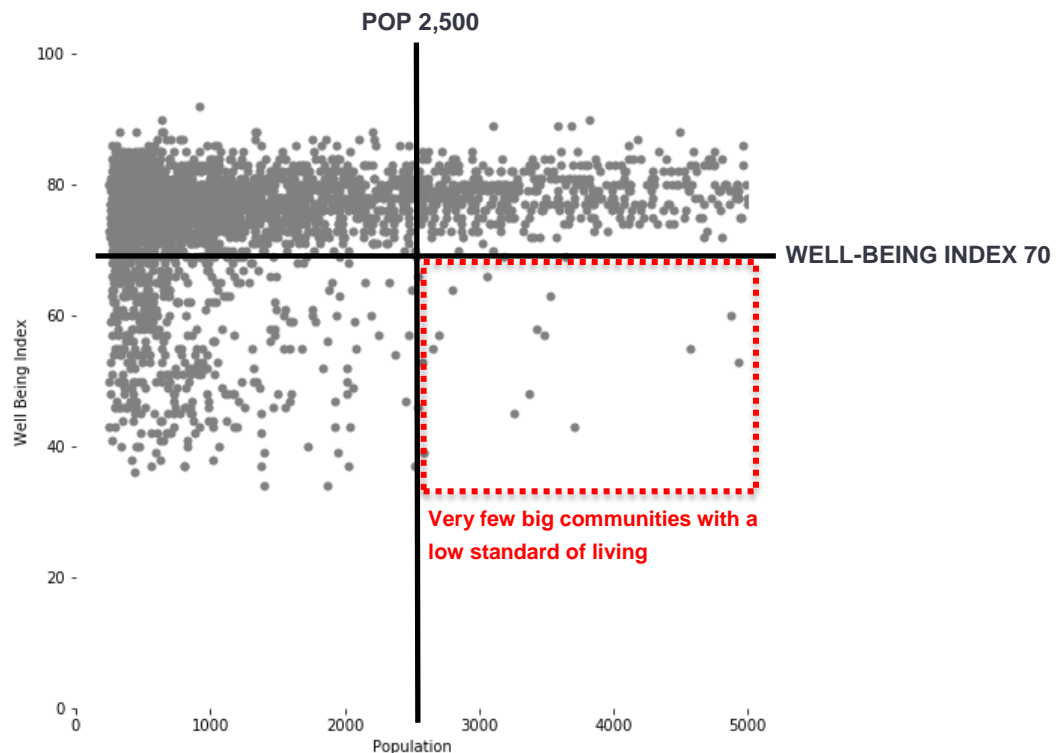
   Well-Being Index Comparison - Indigenous vs. Non-Indigenous Communities

   Sample of 2,967 communities across Canada, excluding major city centers

Index Rating	Non-Indigenous	Indigenous	Variance
Education	54	39	-28%
Income	74	52	-30%
Housing	94	68	-27%
Labour	84	68	-19%
Total	**77**	**57**	**-26%**

2. Large community population results in higher standard of living

A relationship exists between the size of the community and its standard of living. The figure below suggests that a community with a minimum population of 2,500 enables a higher standard of living (Well-Being Index >70) compared to those communities with a population below 2,500. Said differently, there is demand created for certain services created once the community hits the 2,500 population mark. This makes sense - the higher the population, the better the community can support basic amenities such as a grocery store or a pharmacy.

3. Education paves the way for future success

Across both Indigenous and Non-Indigenous communities, education scores the lowest relative to all other indexes. This is a greater issue, but the takeaway here is that even in our modern age, Canada still has a long way to go in improving the education of its citizens.

Education is a key building block to a enjoying a high standard of living in life. Additionally, education lays the groundwork for a steady job, good income, and sufficient housing. Empowering a person with the simple skill to think for themselves sets the stage for a brighter future, for everybody

DISCUSSION

The original goal of this report was to dissect Canada's 2016 Well-Being Index in order to better understand the standard of living in Canada. For more than 90% of the population, things are just fine. Yes there could be improvements made to the education system, but in the grand scheme of things, the citizens of Canada are quite well off. Canada ranks in the top 5 of the OECD's Better Life Index for 2017, alongside Norway, Australia, Iceland, and Denmark.

However, as work progressed on this analysis a recurring theme emerged - the standard of living for the Indigenous population (1.7 million people) severely lags on all indexes. It is no secret that Indigenous populations have faced adversity dating back to the 16th century when the first Europeans landed on Canadian soil. What is surprising, is that even to this day, a major gap in well-being still exists. This means 26% poorer living standards for Indigenous communities compared to their non-Indigenous counterparts.

One has to ask - how is this still possible in 2019? This question dives into several socioeconomic factors that are beyond the scope of this report, but the point remains: not all Canadians enjoy a high standard of living. Have we preoccupied ourselves with trying to solve problems in other countries while ignoring those on Canadian soil? Let the citizens of Canada today be measured on what they will accomplish going forward, not what has existed in the past.

Based on the findings in this report, the idea of generating critical mass within Indigenous communities holds the best opportunity for improving overall living standards. The data demonstrates that a Well-Being Index of 70 can be achieved if a community reaches a population of 2,500. Achieving a 70-point score on the Well-Being Index constitutes a 23% improvement in well-being for today's Indigenous population.

With an average community population of 900, achieving critical mass amongst the Indigenous population would not necessarily be a straightforward process. Statistically, this would require two or three communities to band together as one. Culturally, logistically, and financially - this may not be possible. However, designating one community as a starting point for the future hub would be the initial step in generating critical mass.

CONCLUSION

Before any problem can be solved, it must be quantified. With an understanding of well-being metrics on a community-level, it's easy to benchmark the impact of different social, economic, and political initiatives as they are implemented across the nation.

As observed in the results from the 2016 Canadian Well-Being Index, a wide margin in standard of living still exists today. Despite Canada being ranked as one of the top countries in the world to live in, the Indigenous communities in Canada may not necessarily feel the same way.