

# CSE161 Prog2

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## Abstract

Retirement can be an exciting time, but it's important to prepare. One way to prepare is to identify a retirement location that works for you. This paper, attempts to visualization a Numbeo data set to determine best retirement locations by a quality of life index. Important factors considered that were captured in this index were economics indicators like purchasing power, health factors, pollution, and entertainment factors. A D3 choropleth visualization was created to display quality of life for states and their contributing cities. It was found North Carolina held the best places to live with Raleigh being it's best city.

## 1 Introduction

Retirement is an important decision. In the United States the average age of retirement is 62 [7]. This number however is susceptible to economic changes with recessions forcing more people into early retirement. This was seen with the pandemic moving more and more people into retirement [4], thus making understanding retirees happiness increasingly salient.

There are several long term predictors of retiree happiness according to a study by Boston College [2]. The highest rated indicators include their overall savings and whether they had enough saved for retirement. The second rated factor was health. Thus in determining a place where one would like to retire, having these indicators considered will be important.

An article from *The Balance* describes important factors in determining a retirement location [6]. The most important of these are economics factors. These include the prices of homes, the income to home price ratio, and expenses like taxes. Some states exempt retirement income and thus these states fair better for these indicators. However, just because a state or city has lower taxes it doesn't necessarily mean it is cheaper to live there. Thus the cost of living should be taken into account as well, with the pricing of things like food and gas. Additionally, another important factor are the amenities afforded to retirees. While unlikely that a large nightlife scene will greatly influence retirees to move somewhere, having access to public spaces like parks and museums as well as movie theaters increase the appeal of these places.

Thus quality of life is a well suited indicator for retirement location and will be the used index in this paper. Quality of life is the standard happiness, health, and comfort experienced and will be a useful metric in this paper. According to *US News* the United States, where we focus on our retirement location, has the 20th highest quality of life index in the world [3]. To see more information about the world rankings see Jacob Low's paper on world retirement data.

## 2 Related Works

There are many academic papers discussing happiness in retirement with their research based in the United States. Most of these works focus by collecting data through surveys of retiree utility, important factors for retirees, and background information. For the sake of this paper however, collection of data in a large scale survey would not be possible in our timeline and thus we will be using data already collected by Numbeo, a crowd-sourced database for quality of life indicators.

### 3 Data set

Data was provided by Numbeo.com, a service that aims to provide a free database on global costs of living. The data is manually collected from official sources, using various sophisticated filters to reduce noise. For this specific application the Numbeo data set for North American cities was pulled containing 61 cities and 11 features.

Features of the data set are included rank, city name, and quality of life. Quality of life was composed from a linear combination of the remaining features which were in order: purchasing power index, safety index, health care index, cost of living index, cost of living index, property price to income ratio, traffic commute time, pollution index, and climate index. A higher index indicated more favorable outcomes for positive traits and lower numbers for negative ones. Negative factors include property price to income ratio, pollution index, cost of living index and traffic commute index. Positive factors were safety index, purchasing power index, health care index, and the climate index. Numbeo calculated their quality of life index then using this formula.

$$\text{Quality of Life} = 100 + \frac{\text{purchasingPowerInclRentIndex}}{2.5} - (\text{housePriceToIncomeRatio} * 1.0) - \frac{\text{costOfLivingIndex}}{10} + \frac{\text{safetyIndex}}{2.0} + \frac{\text{healthIndex}}{2.5} - \frac{\text{trafficTimeIndex}}{2.0} - \frac{\text{pollutionIndex} * 2.0}{3.0} + \frac{\text{climateIndex}}{3.0}$$

<https://wallethub.com/edu/most-fun-states/34665>

Another data set was pulled from WalletHub to determine the entertainment index for each location. WalletHub is a personal finance website dealing with decisions surrounding credit and savings. The entertainment index was included as research shows that access to amenities is important to the mentioned health and economics factors to retiree happiness. WalletHub's determination of their index was created by the total number of recreational activities including natural landscapes like parks. This was then normalized to reflect population of location. The index was created as an average for the state level.

### 4 Assumptions

Due to limitations of data, assumptions for state wide data in our visualization assume the average of the cities located within. Furthermore, a new quality of life index was calculated to include the entertainment index. In this new calculation the weight of the entertainment index was made same as the Numbeo climate index. This is because both were positive indicators, but most certainly not as important as major factors identified in research such as health and purchasing power.

## 5 Methodology

### 5.1 Data Cleaning

Data from the Numbeo site included all North American locations they had data for. Since the focus was the United States, entries from Canada and Mexico were removed. The final count of cities was 47 with 27 unique states. Two new columns were created called **Entertainment** and **Adjusted Quality of Life Index with Entertainment**. **Entertainment** contained the mapped values from the Wallethub dataset of the entertainment index for each city. **Adjusted Quality of Life Index with Entertainment** was then calculated using this formula:

$$\text{Quality of Life} = 100 + \frac{\text{purchasingPowerInclRentIndex}}{2.5} - (\text{housePriceToIncomeRatio} * 1.0) - \frac{\text{costOfLivingIndex}}{10} + \frac{\text{safetyIndex}}{2.0} + \frac{\text{healthIndex}}{2.5} - \frac{\text{trafficTimeIndex}}{2.0} - \frac{\text{pollutionIndex} * 2.0}{3.0} + \frac{\text{climateIndex}}{3.0} + \frac{\text{Entertainment}}{3.0}$$

The result was placed in a new data set called **Prog2\_state\_lvl\_adj\_entertainment.csv**. The sixe of the indexs are summarized in the barchart below:

Again a visualisation was created to show the max, min and mean quality of life index in this box and whiskper plot. This helps for our legend as we can see where the mian distribution of our quality of life is.

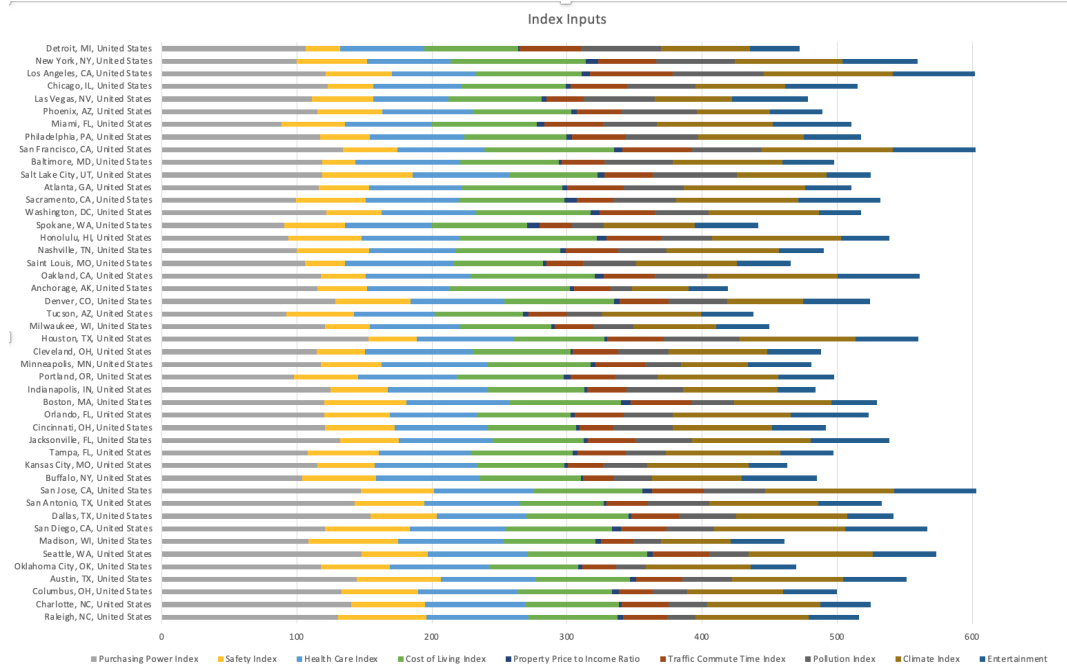


Figure 1: Input Index for each city

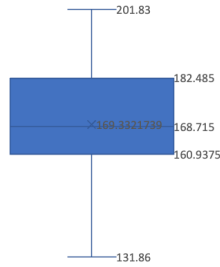


Figure 2: Box and Whisker of QoL

## 5.2 Data Visualization

A choropleth map of the United States showing intensity related to quality of life was selected as the infoVis model for this project. Choropleth map uses predefined areas, in this case states, to indicate properties about the specified locations using color. This representation was chosen due to the ability for users to easily identify locations where the average quality of life was higher for the state.

D3 was used to construct the visualization. This required the use of a geojson file of the united states as well as the latitude and longitudes of cities mentioned in **Prog2\_state\_lvl\_adj\_entertainment.csv**. This was collected from a tutorial that utilized the D3js website to implement a choropleth mapping [5]. In order to color the states, the average of the internal cities was used as the value. States with no city data were left gray to show the user that they were not included. The mapping also includes the cities used to create the choropleth mapping. The size of the city bubbles shows which cities had higher quality of life [1].

Another visualization consisted of creating a bar chart in order to quickly show users the ranking. Sometimes a the color of the choropleth map may be hard to interpret and thus a ranked bar allows users to use



## 7 Analysis

From our visualizations it is easy to see that some of the best cities to retire in are Raleigh, Charlotte, Colombia, Austin, and Oklahoma City. As seen in figure 1, Raleigh has a purchasing power index of 130, a health care index 75, and an entertainment index of 37. Not only this but it had smaller indexes for negative traits such as pollution and traffic. Furthermore, the best state to live in is North Carolina with the worst being New Jersey.

## 8 Limitations

Since the data set is crowd-sourced there is no guarantee that these results are accurate. Furthermore, not all the states are represented in the Numbeo data set making the visualizations incomplete. Due to the incomplete visualization it may be confusing for viewers to make their interpretations.

## 9 References

- [1] Basic US state map - D3. Popular Blocks. (n.d.). Retrieved June 1, 2022
- [2] Bender, Keith A., and Natalia A. Jivan. What Makes Retirees Happy - Boston College.
- [3] Best Countries to Live in the World — U.S. News Best Countries. <https://www.usnews.com/news/best-countries/rankings/quality-of-life>.
- [4] Fry, Richard. “Amid the Pandemic, a Rising Share of Older U.S. Adults Are Now Retired.” Pew Research Center, Pew Research Center, 4 Nov. 2021, <https://www.pewresearch.org/fact-tank/2021/11/04/amid-the-pandemic-a-rising-share-of-older-u-s-adults-are-now-retired/>.
- [5] Gómez, R. (n.d.). Choropleth Map: US states. geomap. Retrieved June 1, 2022, from <https://d3-geomap.github.io/map/choropleth/us-states/>
- [6] Phipps, Melissa. “Find out Where You Should Retire and What Factors to Consider.” The Balance, The Balance, 6 Apr. 2022, <https://www.thebalance.com/where-should-i-retire-2894254>.
- [7] Ramsey Solutions. “What Is the Average Retirement Age?” Ramsey Solutions, Ramsey Solutions, 28 Apr. 2022, <https://www.ramseysolutions.com/retirement/average-retirement-age>.