U.S. Metropolitan Healthcare Landscape Report – Power BI

Project overview:

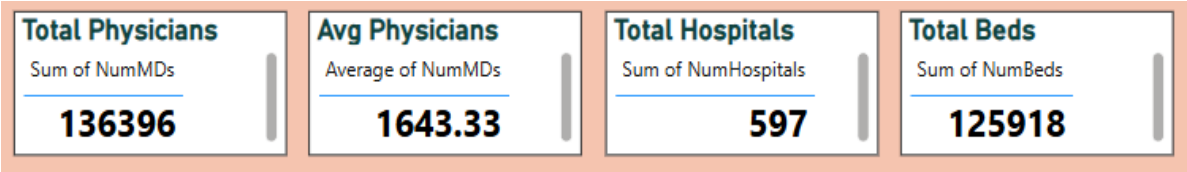
This project analyzes healthcare infrastructure and social security stress across 83 U.S. metropolitan areas using Power BI. It highlights resource gaps, elderly population growth, and risk patterns to support better planning and healthcare delivery.

Data preparation summary:

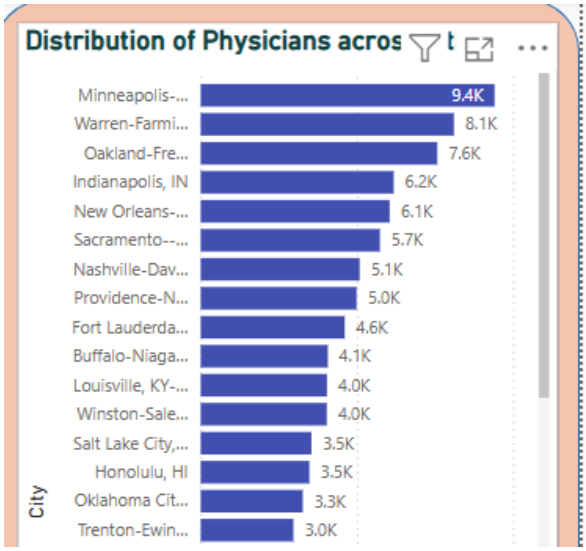
1. Made sure all the important columns were in the dataset.
2. Checked for missing or repeated values (none found).
3. Confirmed data types: City = Text, all other columns = Numbers.
4. Checked for errors: Ensured the number of doctors (NumMD), hospitals (NumHospital), and beds (NumBed) were not negative.

Data exploration and visualization summary:

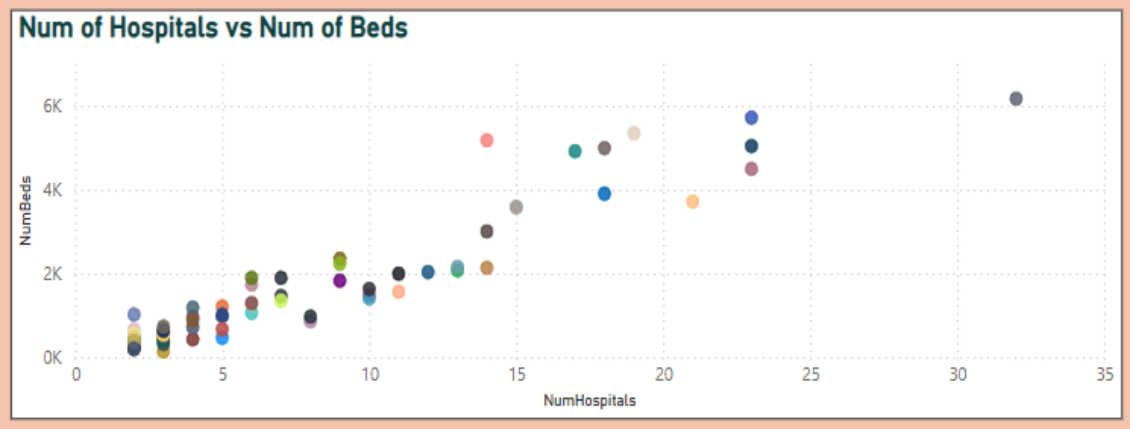
1. **Calculated basis statistics** – Total number of physicians, Average number of physicians, Total hospitals, Total beds



2. **Created basic visualization to understand the data**
   - **Bar Chart**: Shows how doctors are spread across different cities



- **Scatter Chart**: Shows the relationship between hospitals and beds.



- **Histogram**: Shows how many cities fall into different ranges of Social Security Recipients.

DAX calculation :

```
RecipientsRange = IF(MetroHealth83[NumMedicare]>= 10000 &&
MetroHealth83[NumMedicare] <= 30000, "10000-
30000",IF(MetroHealth83[NumMedicare]>= 30001 &&
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MetroHealth83[NumMedicare] <= 270000, "240001-
270000",IF(MetroHealth83[NumMedicare]>= 270001 &&
MetroHealth83[NumMedicare] <= 300000, "270001-300000","300001-
340000")))))))))
```
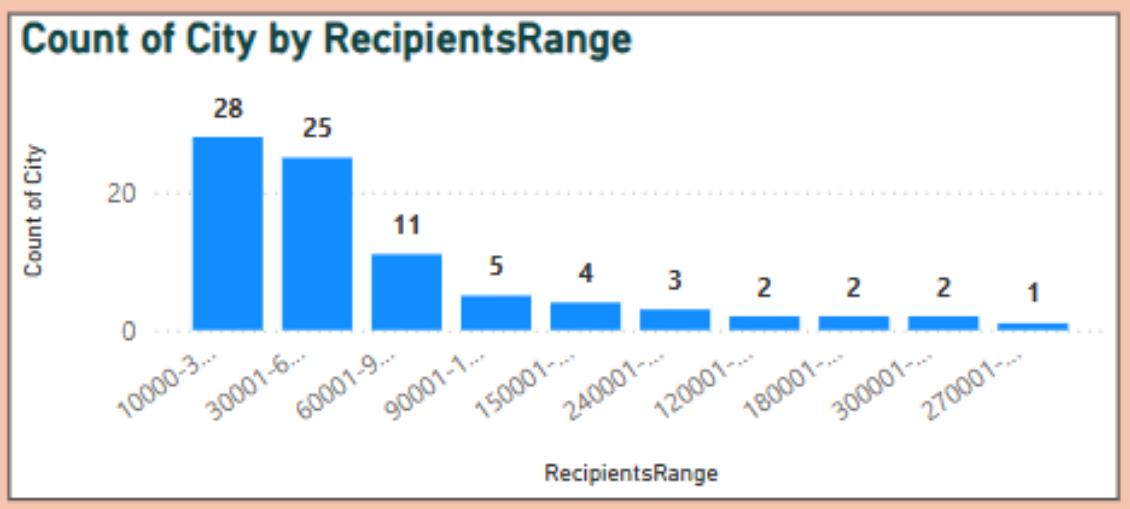



3. **Analyzed Healthcare Risk Areas**
   - Cities with **high Medicare rates** but **low physician rates** may need more doctors.

Cities that have high MedicareRate and low RateMDs - Need more Physicians

RateMDS vs MedicareRate

City	Sum of RateMDs	Sum of MedicareRate
Scranton--Wilkes-Barre, PA	254	20855
Altoona, PA	267	19634
Lewiston, ID-WA	245	19411
Florence-Muscle Shoals, AL	193	18923
Lakeland, FL	187	18324
Decatur, IL	257	18124
Pueblo, CO	279	17424
Springfield, OH	166	17066
Battle Creek, MI	184	16539
Fort Smith, AR-OK	179	16146
Myrtle Beach-Conway-North Myrtle Beach, SC	199	16031
Spartanburg, SC	234	15891
Kankakee-Bradley, IL	174	15636
Beaumont-Port Arthur, TX	185	15193
Total	**3003**	**245197**

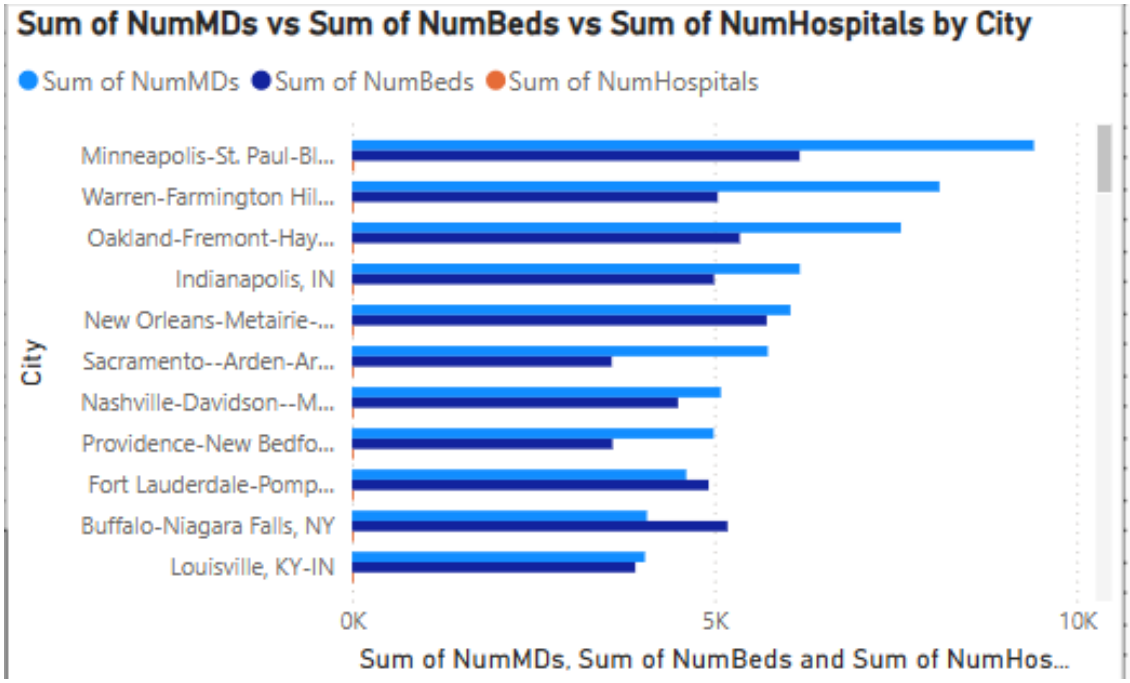
- Cities with **many hospitals** but **fewer beds** may need more hospital beds.

Cities that have high number of Hospitals and low number of Beds - Need more Beds

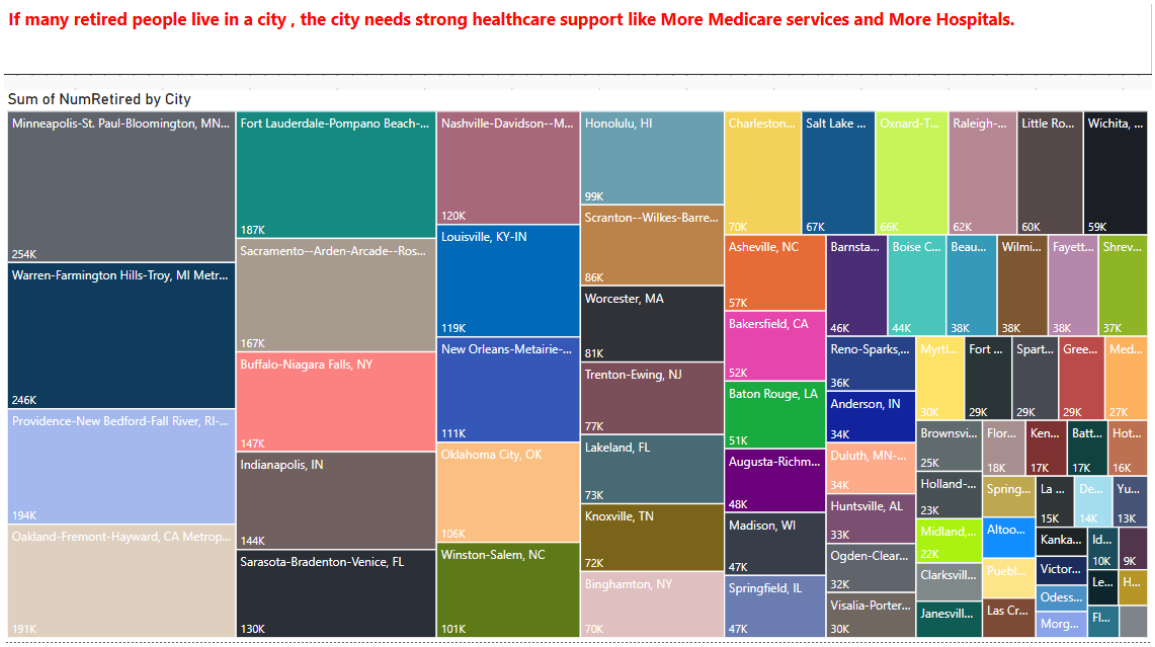
NumBeds vs NumHospitals

City	Sum of NumHospitals	Sum of NumBeds
Bakersfield, CA	10	1498
Beaumont-Port Arthur, TX	10	1412
Duluth, MN-WI	11	1567
Worcester, MA	10	1634
Total	**41**	**6111**

- Some cities have big **gaps in resources.**



- Tree map - Cities with more **retired people** need better healthcare support.

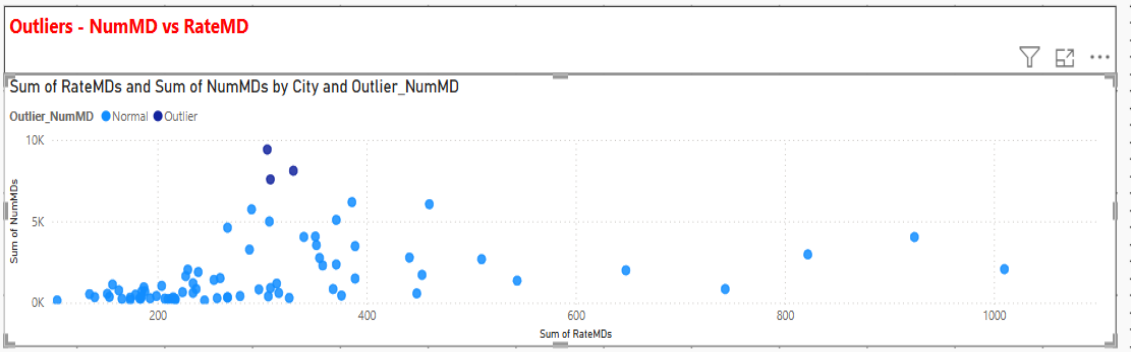


4. **Outlier Analysis**:

- A city with many physicians but low physicians' rate may be an underserved population

Z score calculation :

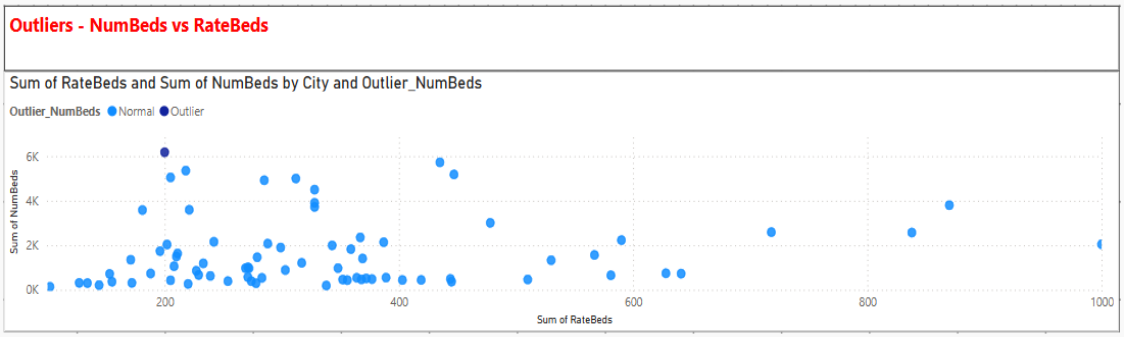
```
Z_Score_NumMDs = (MetroHealth83[NumMDs]-
AVERAGE(MetroHealth83[NumMDs]))/STDEV.P(MetroHealth83[NumMDs])
```



- A city with many beds but low bed rate may be an underserved bed

  Z score calculation:

```
Z_Score_NumBeds = ((MetroHealth83[NumBeds])-
AVERAGE(MetroHealth83[NumBeds]))/STDEV.P(MetroHealth83[NumBeds])
```



Here bright color indicates cities with high percentage and high Medicare rate

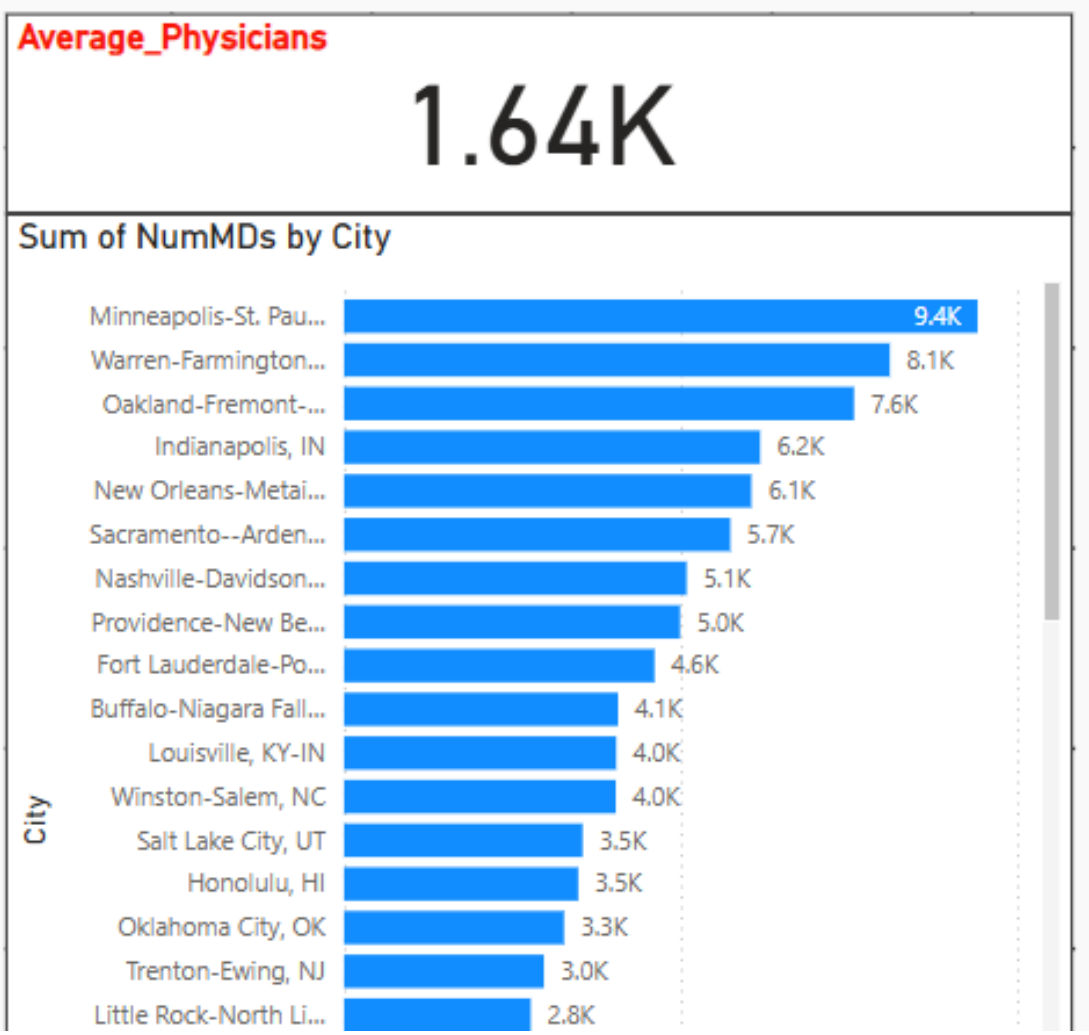
Bright color indicates cities with high percentage and high Medicare Rate

City	Sum of PctChangeMedicare	Sum of SSBChange	Sum of MedicareRate
Altoona, PA	0.60	3.80	19634
Anderson, IN	2.20	2.20	34816
Asheville, NC	5.10	5.10	19970
Augusta-Richmond County, GA-SC	5.70	5.90	13173
Bakersfield, CA	6.40	6.40	11029
Barnstable Town, MA	2.60	2.30	25149
Baton Rouge, LA	5.70	5.80	11178
Battle Creek, MI	2.40	3.30	16539
Beaumont-Port Arthur, TX	1.40	2.40	15193
Total	**376.10**	**372.30**	**1220013**

Data analysis and feature engineering

1. **Univariate Analysis**:

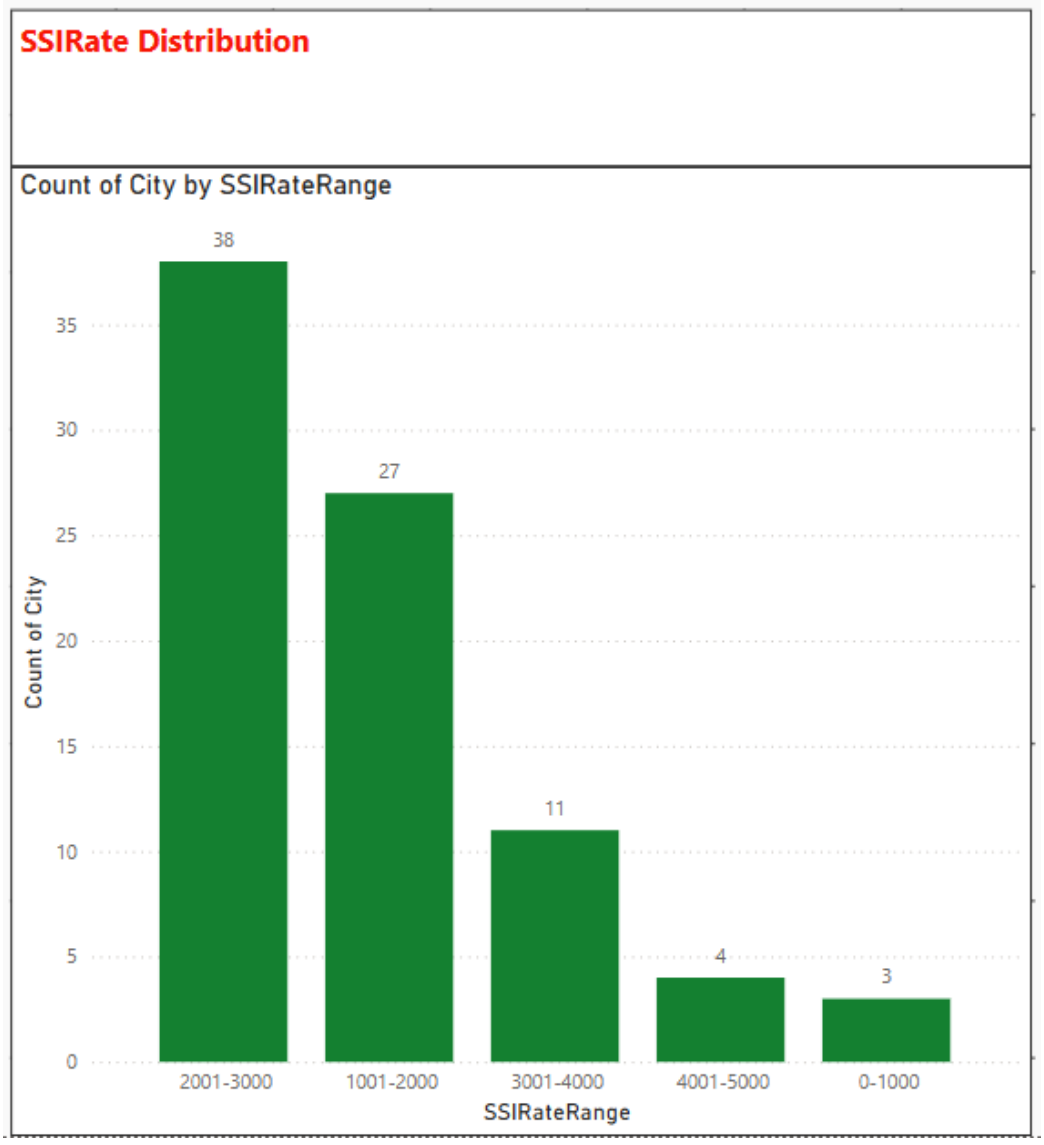
   - Distribution of physicians across cities



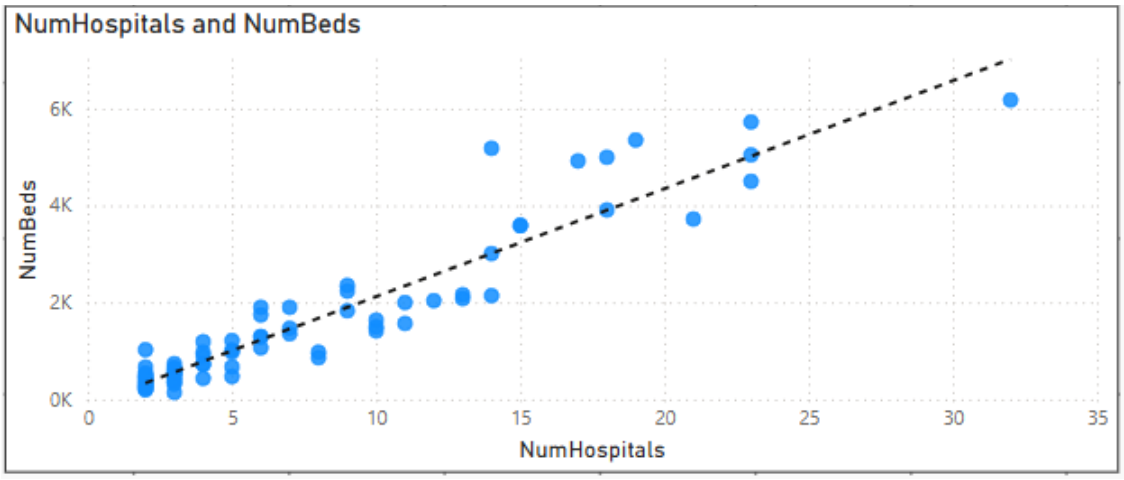
- SSI distribution by count of cities

Dax Calculation :

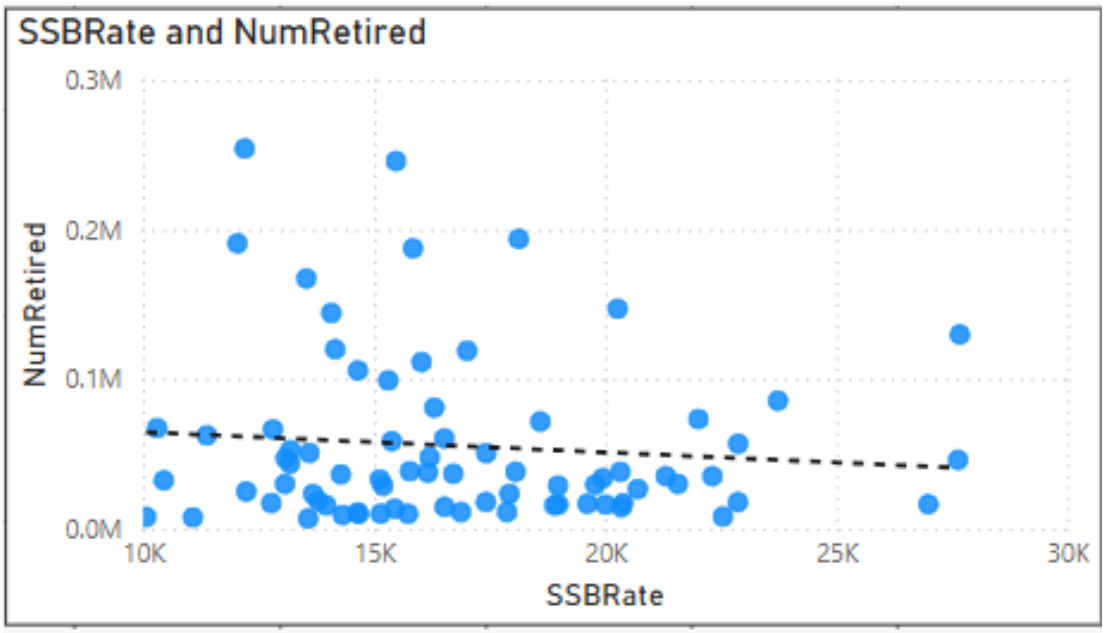
```
SSIRateRange = IF(MetroHealth83[SSIRate]>0 && MetroHealth83[SSIRate]<= 1000,"0-1000",IF(MetroHealth83[SSIRate]>1000 && MetroHealth83[SSIRate]<= 2000,"1001-2000",IF(MetroHealth83[SSIRate]>2000 && MetroHealth83[SSIRate]<= 3000,"2001-3000",IF(MetroHealth83[SSIRate]>3000 && MetroHealth83[SSIRate]<= 4000,"3001-4000","4001-5000"
```



2. **Bivariate analysis** – Checked the connection between two values.
    - **Hospitals vs Beds** – More hospitals should usually mean more beds



- **Social Security Rate vs Retired Population** – Checked if benefits match retired population size.



Feature engineering – Created new values to get more insight, because raw data may not tell the full story.

- Beds per hospitals - `BedsPerHospital = MetroHealth83[NumBeds]/MetroHealth83[NumHospitals]`

- Doctors per hospitals - `DoctorsPerHospital = MetroHealth83[NumMDs]/MetroHealth83[NumHospitals]`

- Beds per doctors - `BedsPerDoctors = MetroHealth83[NumBeds]/MetroHealth83[NumMDs]`

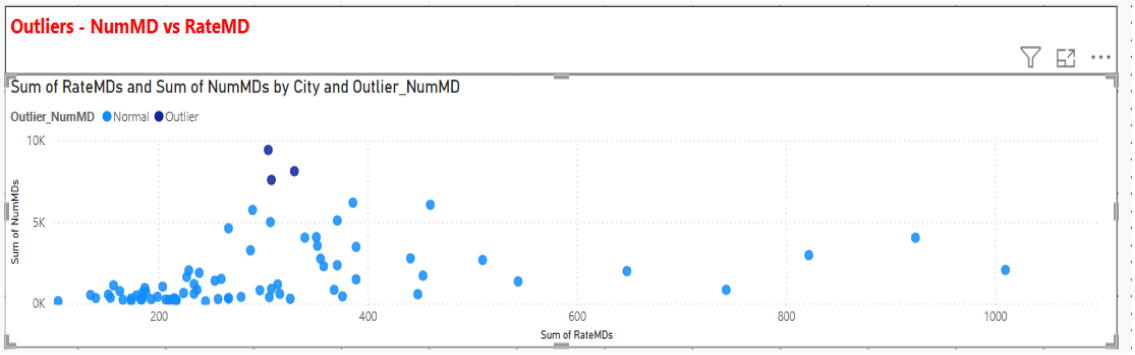
- Retired people per hospital - `RetiredPerHospital = MetroHealth83[NumRetired]/MetroHealth83[NumHospitals]`

- Medicare to SSB Ratio - `MedicareToSSBRatio = MetroHealth83[NumMedicare]/MetroHealth83[SSBNum]`

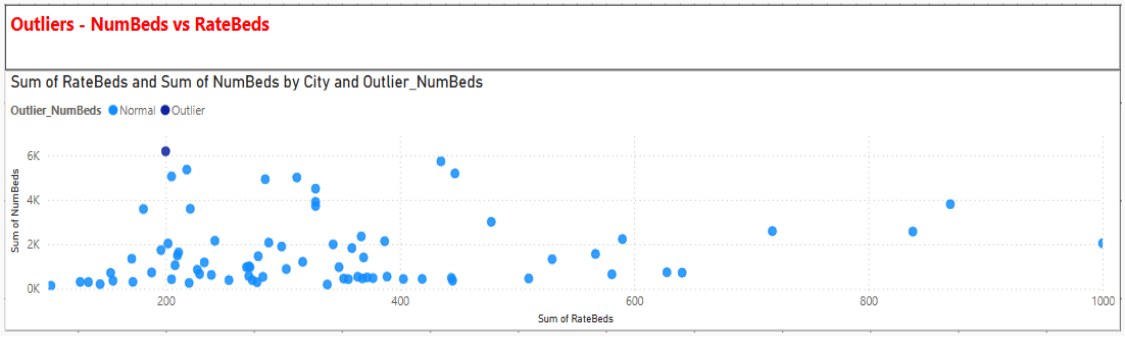
- Resource efficiency - `ResourceEfficiency = (MetroHealth83[NumBeds]+MetroHealth83[NumMDs])/(MetroHealth83[SSBNum]+MetroHealth83[NumRetired])`

3. Outlier detection

- Found cities that with unusual numbers of doctors compare to population

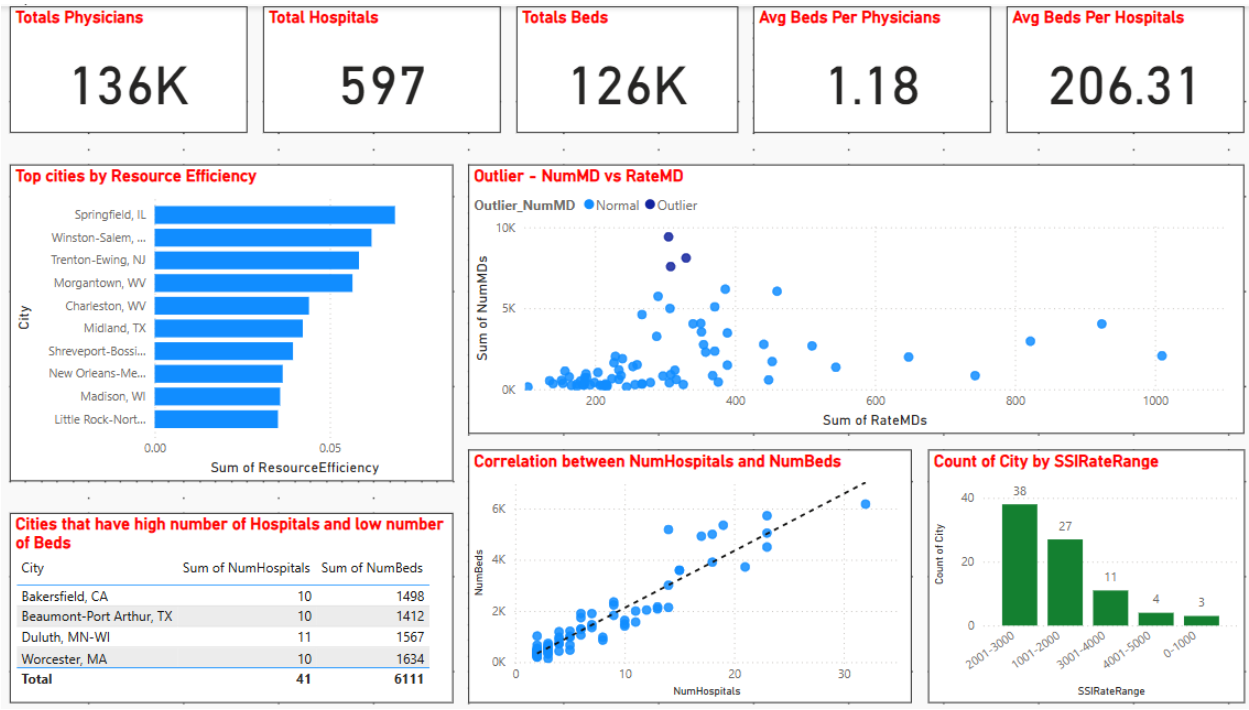


- Found cities that have too few or too many hospitals beds

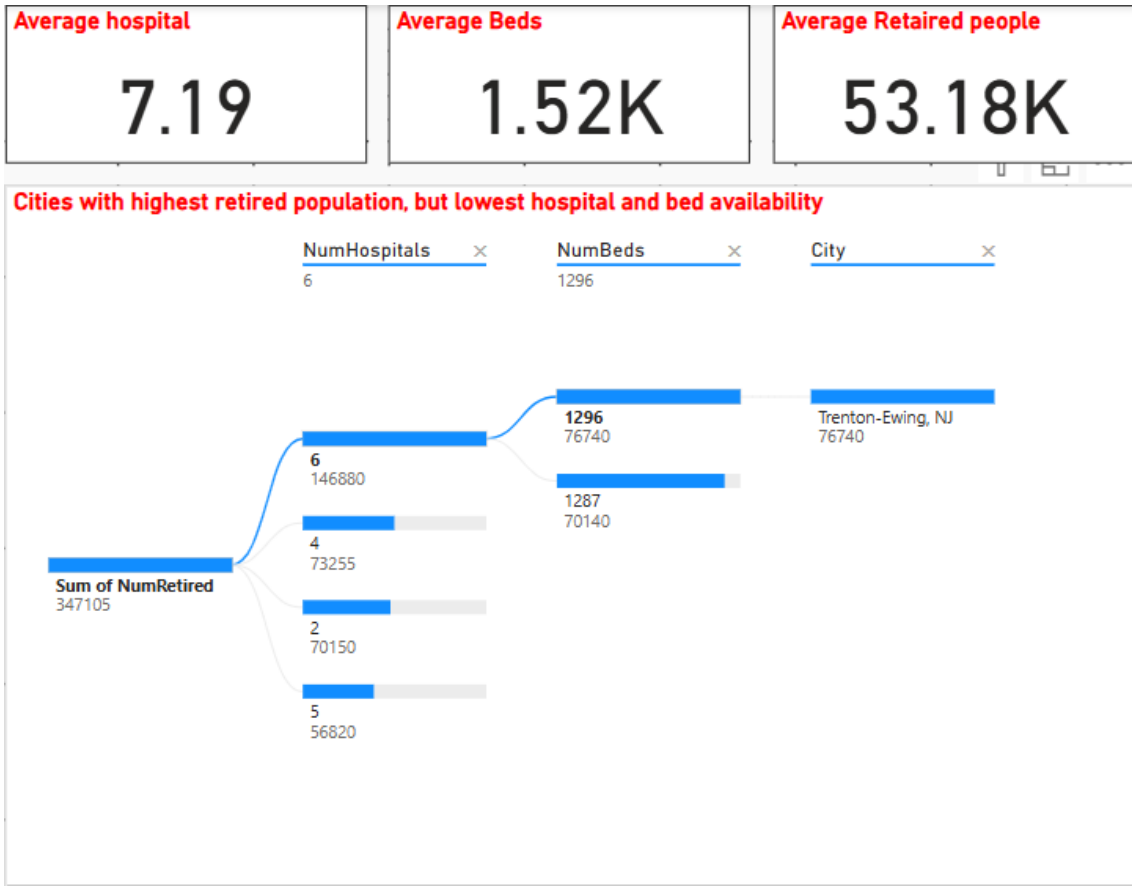


Reporting

1. **Summarized Key Insights**



2. **Complex patterns**
   - Some cities have **many retired people** but **not enough hospitals or beds.** Used **Decomposition Tree** to show these patterns clearly.



3. **Recommendations**

   - Hire more doctors in cities with a growing retired population.
   - Audit cities with extreme outliers for resource imbalance.
   - Invest more in healthcare where infrastructure is weak

Real world applications

1. This project can help solve real health problems

   Based on dataset, here some public health issues that can be addressed
   - **Resource Gaps** – Some cities don't have enough hospitals, beds, or doctors.
   - **Unequal Access** – In some cities, people may wait longer to get care

2. Data-driven recommendations

   - Expand hospital infrastructure in bed-scarce cities
   - Prioritize Medicare funding in fast-growing cities
   - Monitor outlier cities for inequality

Cities with low bed rate but high doctors rate

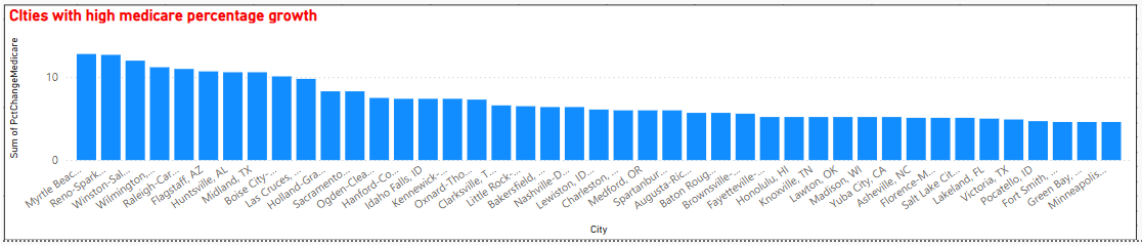
Average of RateBeds	Average of RateMDs
311.63	283.24

City	Sum of RateBeds	Sum of RateMDs
Barnstable Town, MA	134	368
Honolulu, HI	242	389
Madison, WI	279	510
Medford, OR	283	316
Minneapolis-St. Paul-Bloomington, MN-WI	200	305
Oakland-Fremont-Hayward, CA Metropolitan Division	218	308
Providence-New Bedford-Fall River, RI-MA	221	307
Reno-Sparks, NV	271	314
Sacramento--Arden-Arcade--Roseville, CA	181	290
Salt Lake City, UT	202	352
Sarasota-Bradenton-Venice, FL	299	371
Warren-Farmington Hills-Troy, MI Metropolitan Division	205	330
Wilmington, NC	303	308
Worcester, MA	211	355
Total	**3249**	**4823**

Cities with high bed rate but low doctors rate

Average of PctChangeMedicare
4.53

City	Sum of RateBeds	Sum of RateMDs
Altoona, PA	368	267
Augusta-Richmond County, GA-SC	359	204
Battle Creek, MI	372	184
Beaumont-Port Arthur, TX	369	185
Decatur, IL	444	257
Florence-Muscle Shoals, AL	389	193
Fort Smith, AR-OK	348	179
Kankakee-Bradley, IL	419	174
Lawton, OK	403	213
Lewiston, ID-WA	338	245
Odessa, TX	356	207
Pocatello, ID	445	217
Pueblo, CO	364	279
Scranton--Wilkes-Barre, PA	387	254
Victoria, TX	581	217
Total	**6285**	**3535**



Project conclusion:

What was done

- Studied healthcare data from 83 cities.
- Focused on doctors, hospitals, retired population, and Medicare/SSB recipients.
- Found useful insights and gave recommendations for improvement.

Key findings

- **Doctor Shortage** in cities with many retired people.
- **Uneven Bed Availability** in different metro areas.
- **Fast Growth in Medicare** in some cities means more support is needed soon.
- **Outlier Cities** need special planning.

Tools and techniques used

- **Power BI** – For dashboards, finding outliers, and making visual reports.
- **Feature Engineering** – Created new values to understand the data better.
- **Visualizations** – Used bar charts, line charts, treemaps, cards, slicers, and more.

Significance of the project

- **Better Decisions** – Helps healthcare managers know where to send resources.
- **Easy to Understand** – Charts make the data simple, even for non-technical people.
- **Public Benefit** – Helps improve healthcare and support for elderly people.

Future steps

1. Use **updated data** – Current data is from 2000-2004
2. Add more **details** - Right now, data only includes total counts and rates — not age groups, income, or gender
3. Build **predictive models** - Helps forecast future shortages and plan preemptively
4. Expand the study to **state level** - Current scope is limited to 83 metro areas. Enables multi-tier decision-making — useful for governments and healthcare NGOs.