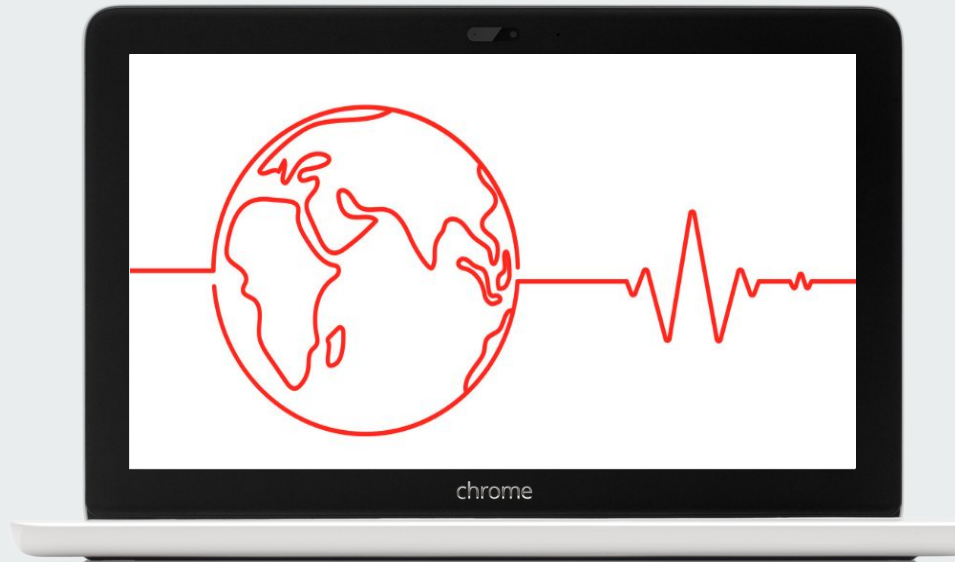




# Analysis of Overall Healthcare Worldwide

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Julius Nwojo, Shiqi Liu





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# The Big Question?

Based on comprehensive analysis of general health data, which areas of the world are in greatest need of assistance or aid from the World Health Organization (WHO) and other organizations, and which countries demonstrate exemplary health outcomes and practices that can serve as valuable lessons for global health improvement efforts?

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# Table of Content

- Data Cleaning and Preparation
- Life Expectancy vs. :
  - Gross Domestic Product (GDP)
  - Urban/Rural Population ratio
  - Mortality Rates
  - Immunization Rates
- Geomap with Hospital Counts
- Conclusion

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# Where did we get this data?

- Kaggle
- World Health Organization (WHO)
- World Development Indicator (WDI)
- Google Developers
- Mortality Rates, Average  
Immunization Rates, GDP, Life  
Expectancy, Urban vs. Rural  
Population %, Medical Doctor  
Numbers, Latitude/Longitude

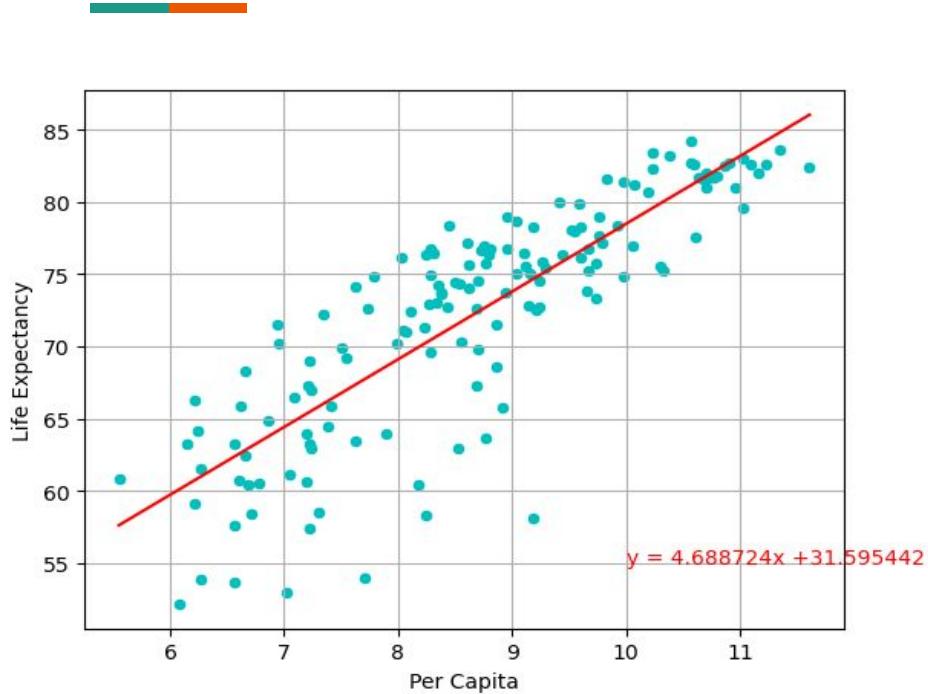


# Data Cleaning and Preparation

## Data Limitation

- Years: 2015 to 2019.
- COVID-19 Mortality Rates Analysis: 2019 to 2021.
- Countries that did not have Life Expectancy and Immunization Rates for all analyzed years were excluded from the analysis:
  - Curacao,
  - Greenland,
  - Sint Maarten (Dutch part).
- Life Expectancy for the entire population was calculated as weighted average between Male Life Expectancy and Female Life Expectancy.
- Countries that did not have Male/Female ratio to calculate Life Expectancy for the entire population were assigned 50%:
  - Czech Republic,
  - Turkey.
- 95 countries (63.33%) did not have complete 'Year' information the data was averaged out by years.
- The average of the HepB3, DPT, and Measles Vaccine was taken to analyze the overall immunization rates.
- Data frame that contains information by country with averaged information across the analyzed years has 246 countries.
- For the number of Medical Doctors, 60.98% of the countries were filtered out from the original data set because of the missing values, bringing dataset to the size of 150 countries.

## GDP Per Capita vs. Life Expectancy

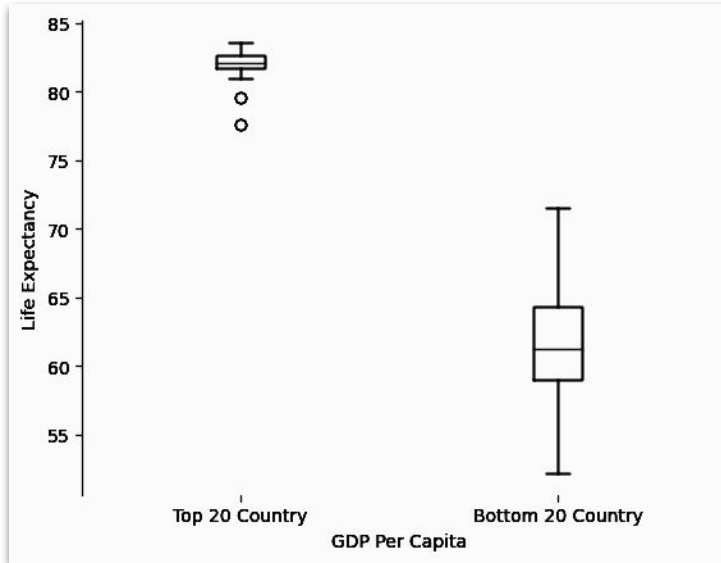


There is a **strong positive** correlation between GDP Per Capita and Life Expectancy

Correlation coefficient = 0.84  
R square = 0.70

# GDP Per Capita vs. Life Expectancy

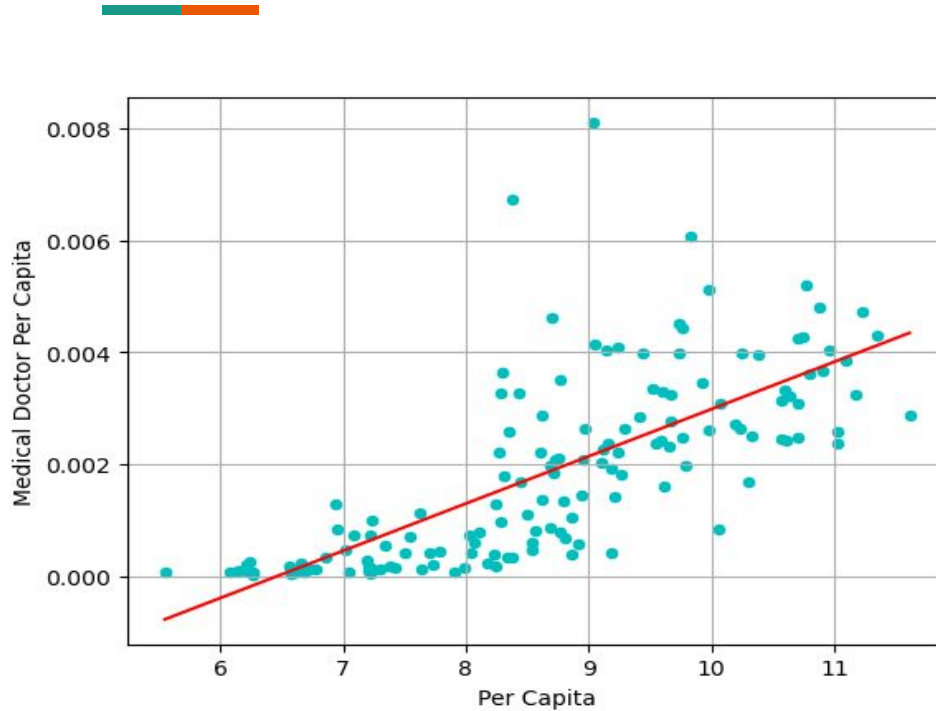
-Top 20 GDP Per Capita Countries vs. Bottom 20



Average Life Expectancy of Top 20 GDP countries : 82

Average Life Expectancy of Bottom 20 GDP countries : 62

## GDP Per Capita vs. No.of Doctors Per Capita



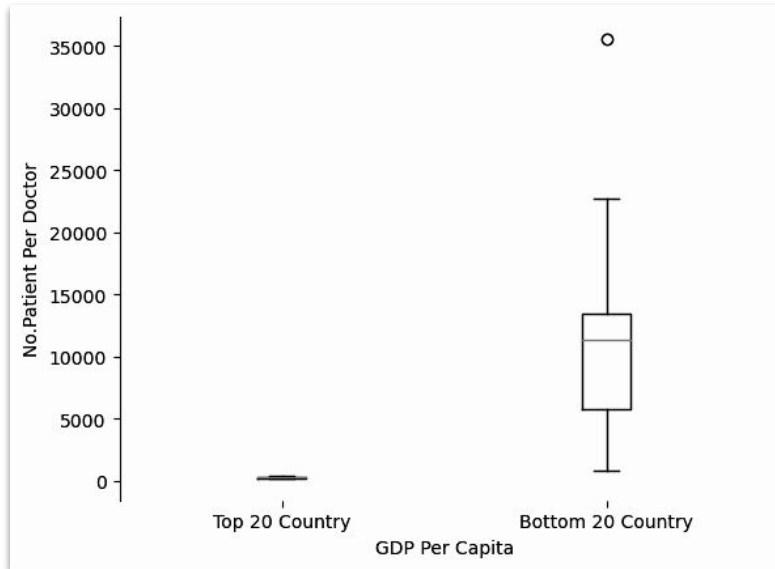
There is a **moderate** correlation between GDP Per Capita and Medical Doctors Per Capita

Correlation coefficient = 0.73  
R squared = 0.52



## GDP Per Capita vs. No. of patients Per Doctor

-Top 20 GDP Per Capita Countries vs. Bottom 20



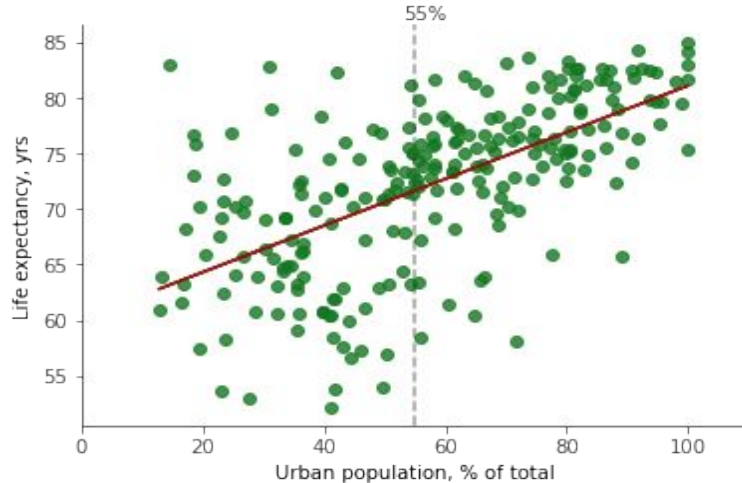
Average Patients per Doctor of Top 20 GDP Per Capita Countries: **295**

Average Patients Per Doctor of Bottom 20 GDP Per Capita Countries: **11462**

There is over **3800%** in difference

# Life Expectancy vs. Urban Population ratio

Countries Life Expectancy vs. Urban/Rural Population Ratio



There is **positive** correlation between Life Expectancy and Urban Population ratio.

The degree of correlation is **moderate**\*.

Countries with Urban Population ratio **lower than 55%** have **lower** Life Expectancy than countries with urban population **55% or higher**.\*\*

The statement is true for the analyzed dataset with 95% confidence level.

\* Correlation analysis:  
Pearson's R = 0.62

Linear regression analysis:  
 $y = 0.21 * x + 60.14$   
 $R^2 = 0.38$

\*\* Statistical evidence:

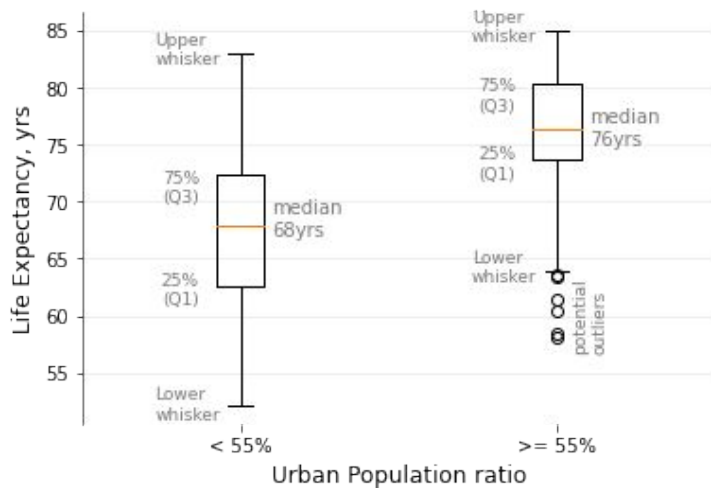
Independent samples t-test was conducted:  
**p-value  $\approx 0$ .**  
 $H_0$  can be rejected at 5% error  
( $H_0$ =Life Expectancy for countries with Urban population < 55% is no different than Life Expectancy for countries with Urban population  $\geq 55\%$ ).

Assumptions:

1. Data is normally distributed
2. Data is independent
3. Data is homogenous (The standard deviations are roughly equal)

# Life Expectancy vs. Urban Population ratio

Distribution of Life Expectancy for the countries with Urban Population lower than 55% and higher than 55%



68  
years

Average Life Expectancy for  
the countries with Urban  
Population < 55%\*

76  
years

Average Life Expectancy for  
the countries with Urban  
Population >= 55%\*\*

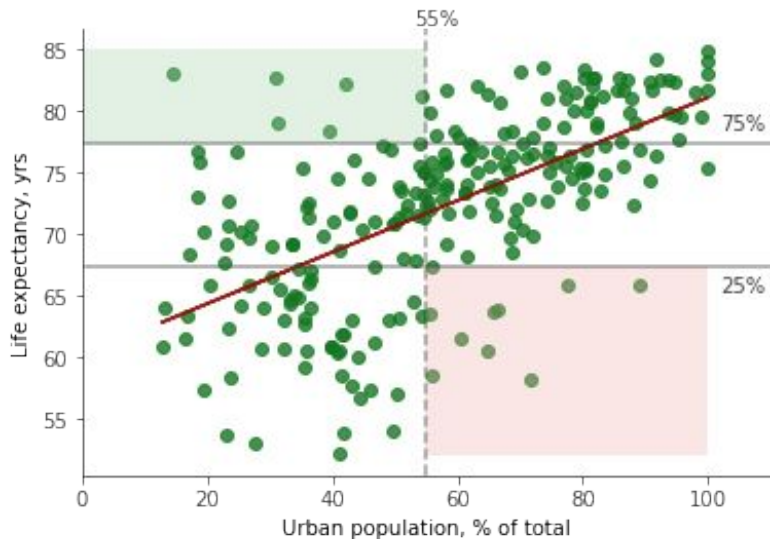
Upper whisker - upper boundary before points are considered outliers.  
Lower whisker - lower boundary before points are considered outliers.

\* Median is calculated for the population of 111 countries.

\*\* Median is calculated for the population of 135 countries.

# Life Expectancy vs. Urban Population ratio

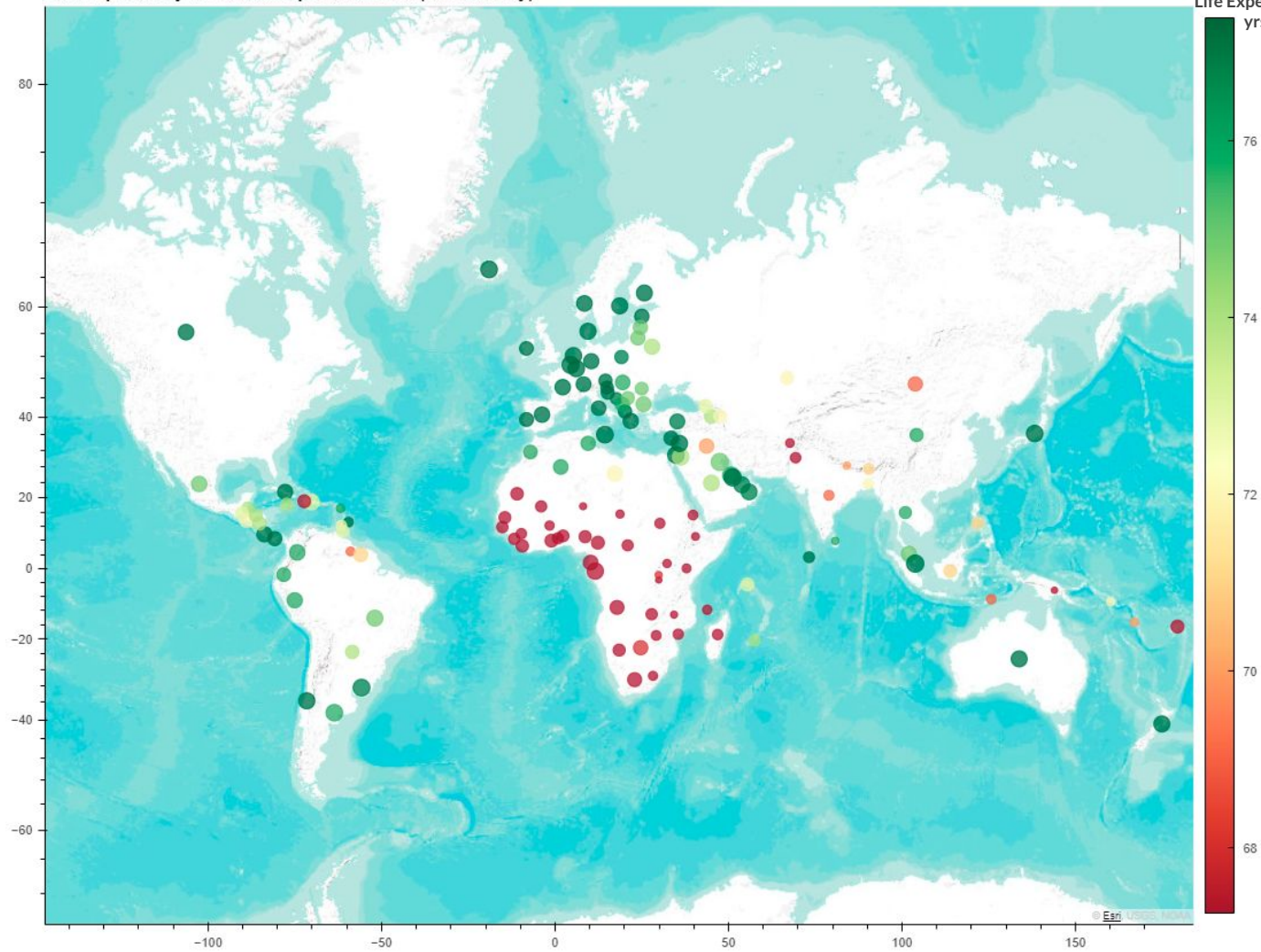
Countries Life Expectancy vs. Urban/Rural Population Ratio



Country	Urban population	Life expectancy, yrs
Liechtenstein	14.3%	83
Channel Islands	30.9%	83
Barbados	31.2%	79
Maldives	39.4%	78
Faroe Islands	41.9%	82
Slovenia	54.3%	81

Country	Urban population	Life expectancy, yrs
Ghana	55.4%	63
Cameroon	55.8%	58
Gambia, The	60.6%	61
Angola	64.8%	60
South Africa	65.8%	63
Congo, Rep.	66.5%	64
Equatorial Guinea	71.6%	58
Djibouti	77.7%	66
Gabon	88.9%	66

Life Expectancy vs Urban Population ratio (141 country)



Life Expectancy,  
yrs

Urban population,  
%

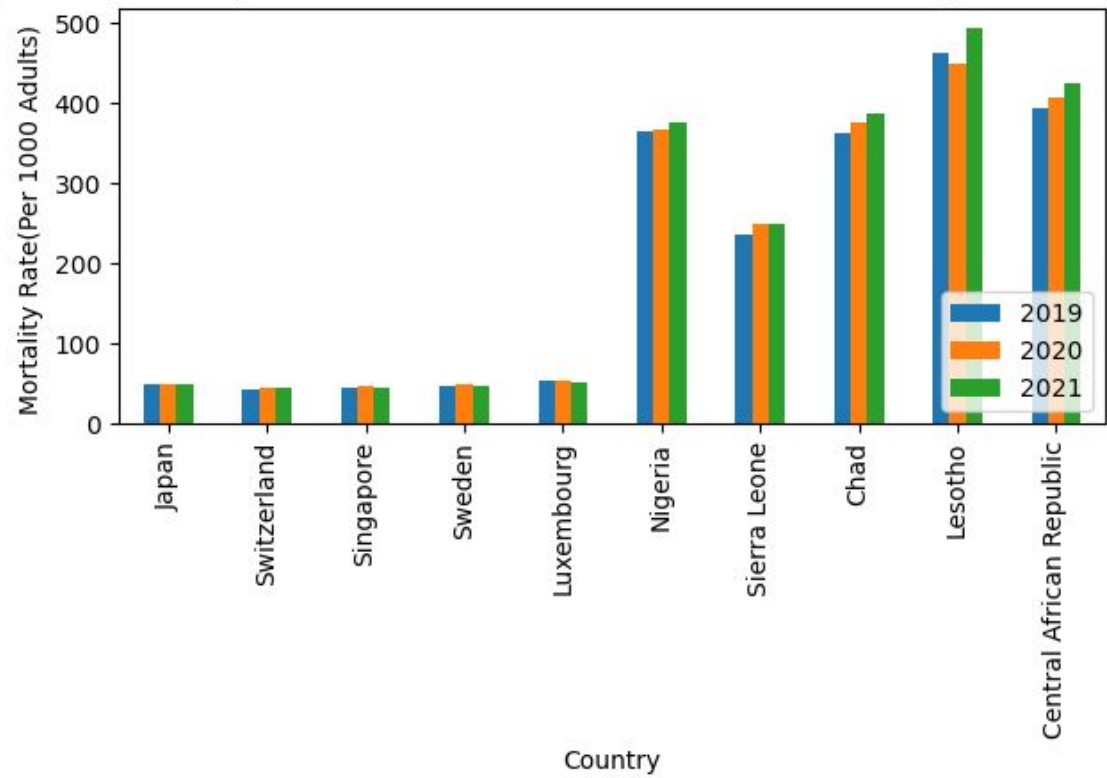


Other information available\*:



\* On the interactive map in respective Jupyter notebook.

Mortality Rates (Per 1000 adults) from 2019-2021 in the 5 Countries with the Highest and Lowest Life Expectancies



**Mortality Rates between 2019-2021 of countries with the highest and lowest life expectancies**



# Statistical Modelling: Independent T-Test with Life Expectancy and Average Immunization Rates

## Group 1 (Highest Life Expectancy Countries):

Average Immunization Rate: **94%**  
Median Immunization Rate: **96%**

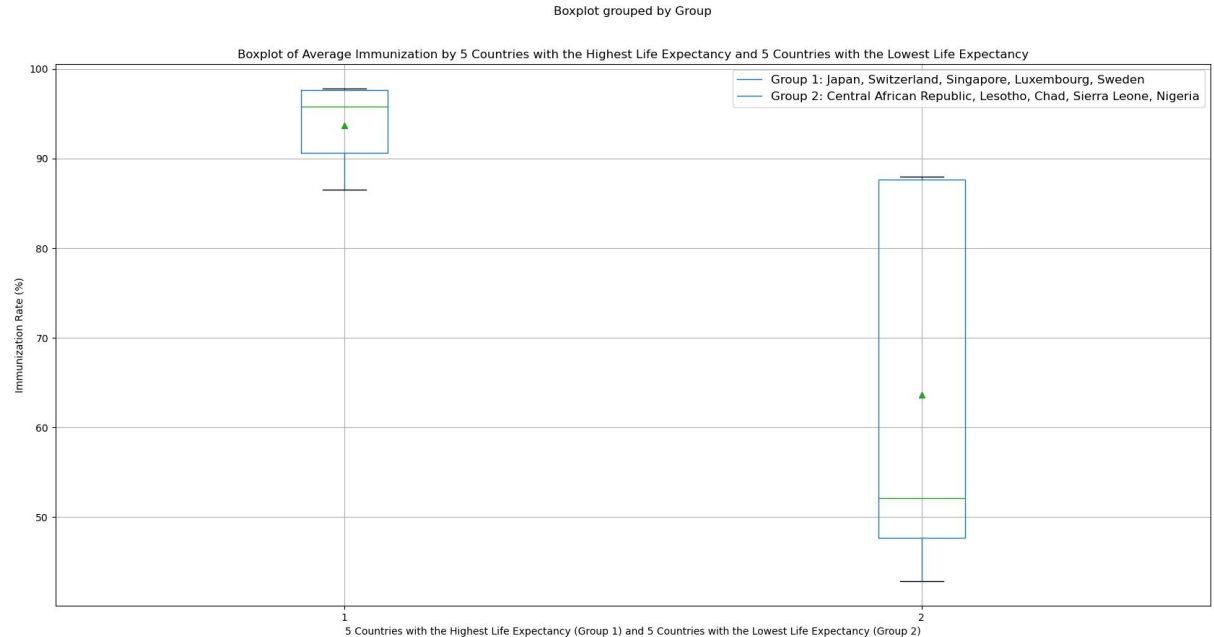
## Group 2 (Lower Life Expectancy Countries):

Average Immunization Rate: **64%**  
Median Immunization Rate: **52%**

There is **statistical evidence** to suggest that the average immunization rates of a country may affect the average life expectancy of the country.

(p-value= 0.038)

The statement is true for the analyzed dataset with 95% confidence level.



### \* Assumptions:

1. Data is normally distributed
2. Data is independent
3. Data is homogenous (The standard deviations are roughly equal)



# Overall Analysis of Top 5 and Bottom 5 Countries based on life expectancy

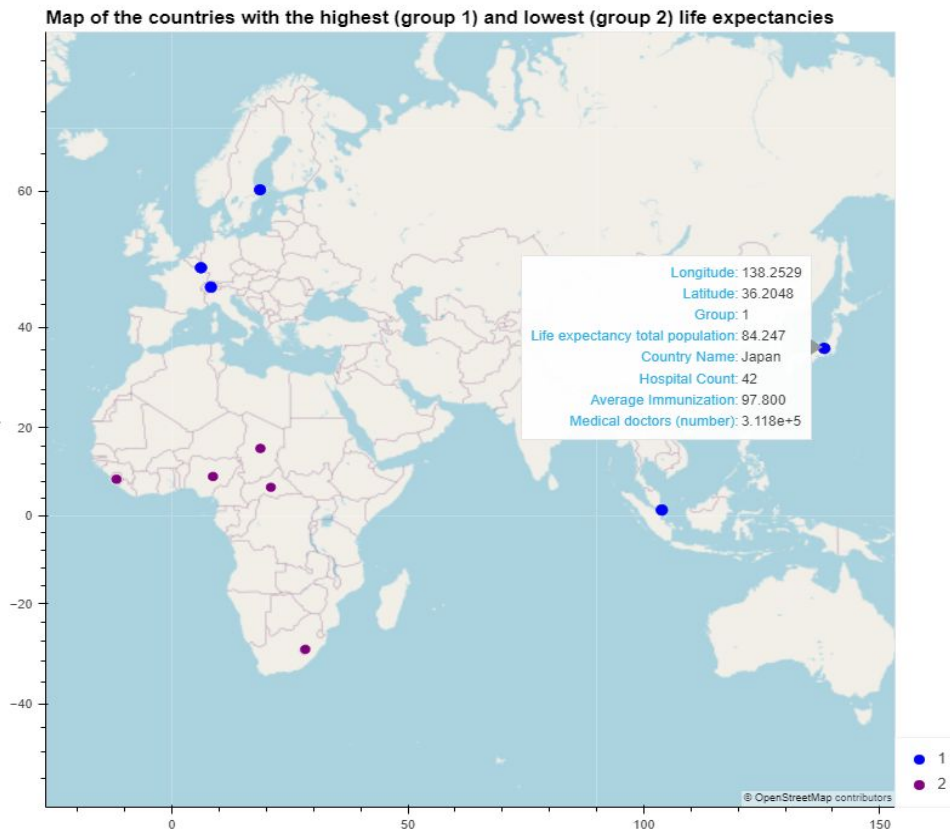


	Country Name	Hospital Count	Group
0	Japan	42	1
1	Switzerland	10	1
2	Singapore	133	1
3	Sweden	0	1
4	Luxembourg	15	1
5	Nigeria	0	2
6	Sierra Leone	14	2
7	Chad	0	2
8	Lesotho	4	2
9	Central African Republic	4	2

Hospital Count within a 500 km  
radius of the Capital City of each  
Country

**Group 1** = Highest Life Expectancy Countries

**Group 2** = Lowest Life Expectancy Countries



## Conclusion



- Countries in Africa may need more aid from the WHO.
- Overall, countries with a higher urban population generally have a higher life expectancy.
- There is statistically significance to show that countries with higher immunization rates, have a higher life expectancy.
- Generally speaking, countries with higher GDP per capita will anticipate to have a higher life expectancy as well as better medical resources(doctors) distributed.

Questions?

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# References

<https://data.worldbank.org/indicator/SP.DYN.AMRT.FE>

<https://data.worldbank.org/indicator/SP.DYN.AMRT.MA>

<https://www.kaggle.com/datasets/paultimothymooney/latitude-and-longitude-for-every-country-and-state>

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<https://www.kaggle.com/datasets/kiranshahi/life-expectancy-dataset?datasetId=1980580&sortBy=dateRun&tab=profile>

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