

A comparative Analysis of Global Health Care Facilities: WASH Services Access Analysis

Under the guidance of Prof. Haewoon Kwak

INFO-I 590: Data Visualization
Fall 24

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Introduction:

This project aims to analyze global disparities in access to Water, Sanitation, and Hygiene (WASH) services in healthcare facilities. Using available data from the SDG framework, we plan to identify gaps and highlight areas that need policy interventions to improve healthcare quality and equity.

Motivation:

Healthcare plays a vital role in improving quality of life and promoting public well-being. The availability of WASH services is crucial for preventing infections, ensuring people safety and high-quality care. By visualizing the disparities, this project seeks to offer insights that can support efforts toward achieving equitable healthcare access.

Relevant Work & Gap Analysis

WHO & UNICEF established a global database on water, sanitation, hygiene, waste management, and environmental cleaning in health care facilities (2019)

WHO & UNICEF provided visuals summarizing the data, but these charts can be improved.

Suggested improvements include:

- Adding studies on service variations between urban and rural populations.
- Incorporating time-based comparisons, such as analyzing the impact of COVID-19 on these facilities.
- Including regional comparisons to enhance the analysis.

IHME Visualization:

<https://vizhub.healthdata.org/lbd/wash>



Preliminary WASH data Summary by WHO & UNICEF

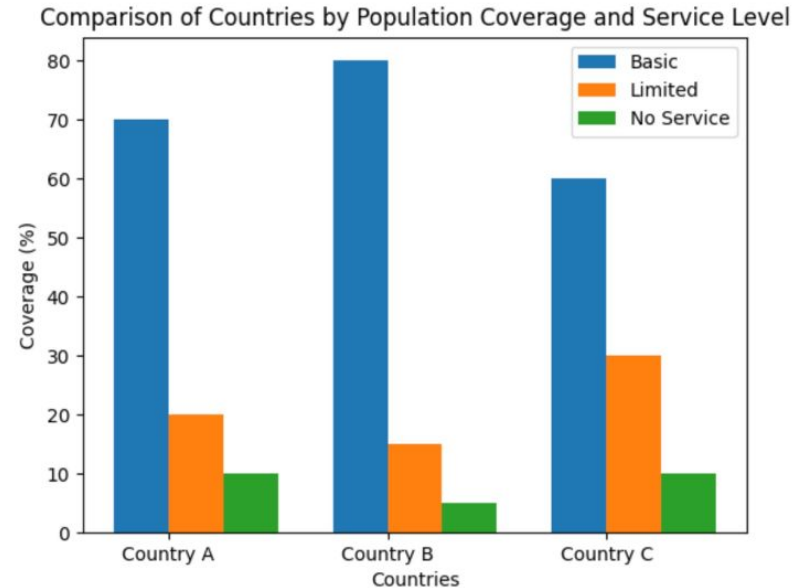
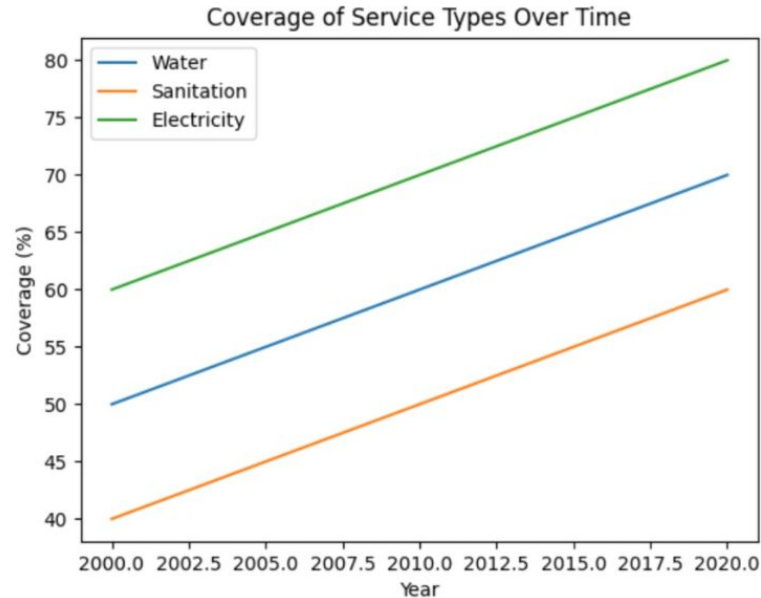
Data & Methods

- The dataset contains the following columns:
 - **ISO3**: country codes (**String**)
 - **Country**: country names (**String/ Categorical**)
 - **Residence/Facility Type**: government, rural, urban, hospital, non-hospital, non-government, total (**String/ Categorical**)
 - **Service Type**: water, sanitation, hygiene, environmental cleaning healthcare waste (**String/ Categorical**)
 - **Year**: year of the data collection (**DateTime.year**)
 - **Coverage**: percentage of coverage of WASH service types (**Numeric**)
 - **Population**: population of the country (**Numeric**)
 - **Service level**: status of services available: limited service, no service, basic service (**String/ Categorical**)
- **Dimensions of the dataset**: 8 columns and 241,309,437,100+ rows. We worked on a subset of this dataset
- **Visualization methods and plan**: Python Data Visualization libraries to plot Bar charts, Line charts, Heatmaps, Pie/donut charts, Geospatial maps, Scatter plots, Box plots

Data Visualizations Plan

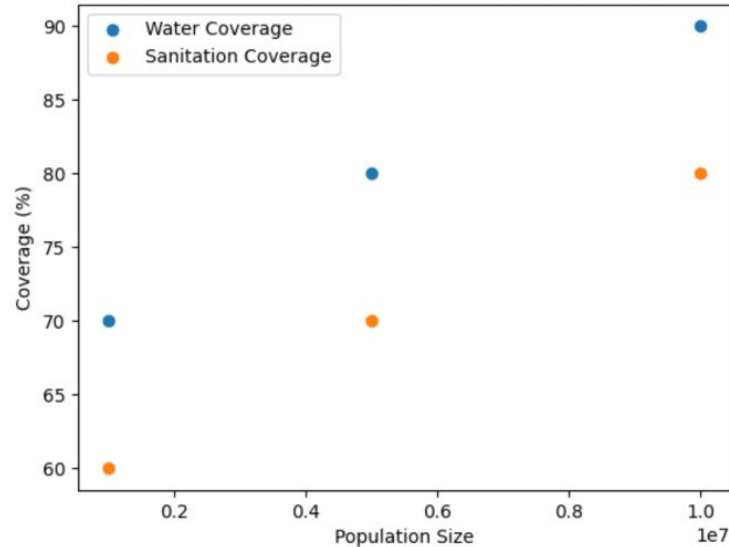
Q.How has the coverage of service types evolved over time for a country or globally?

Q. How do different countries compare in terms of the percentage of population covered by basic or limited and no service level for different service types?



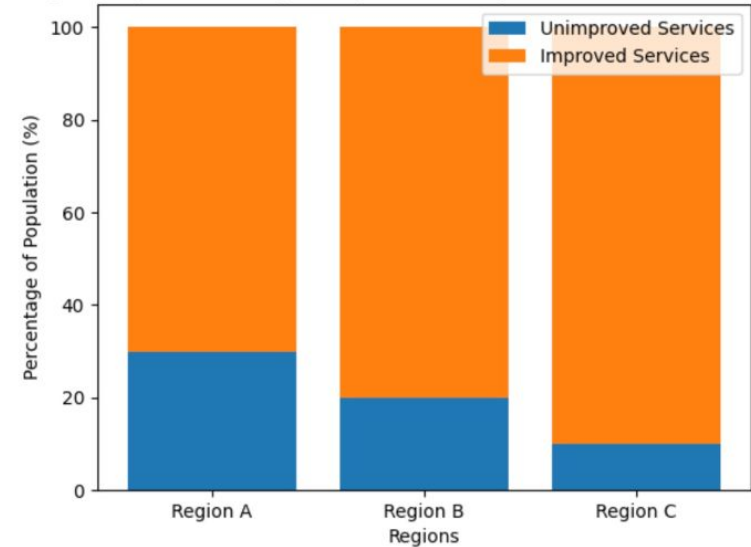
Q. Is there a correlation between the population size of a country or region and the percentage of coverage for different service types?

Correlation between Population Size and Coverage for Different Service Type



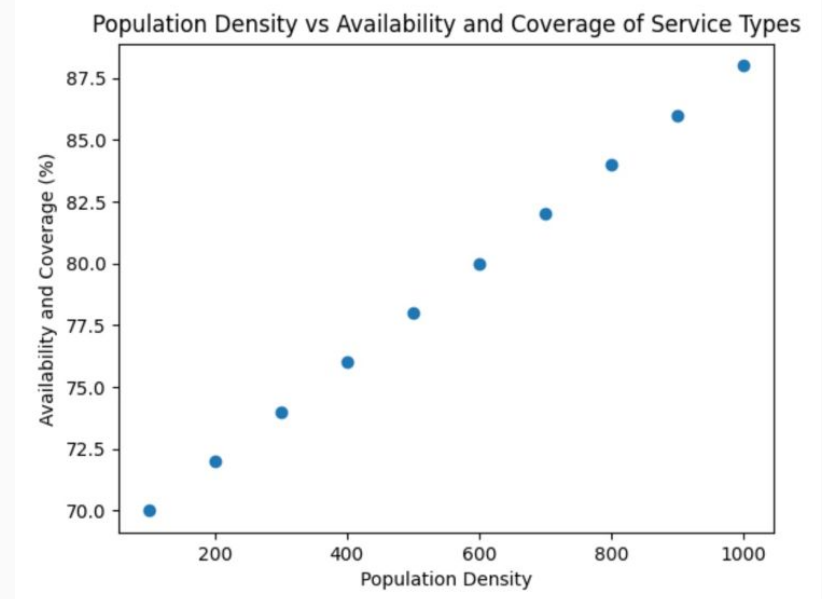
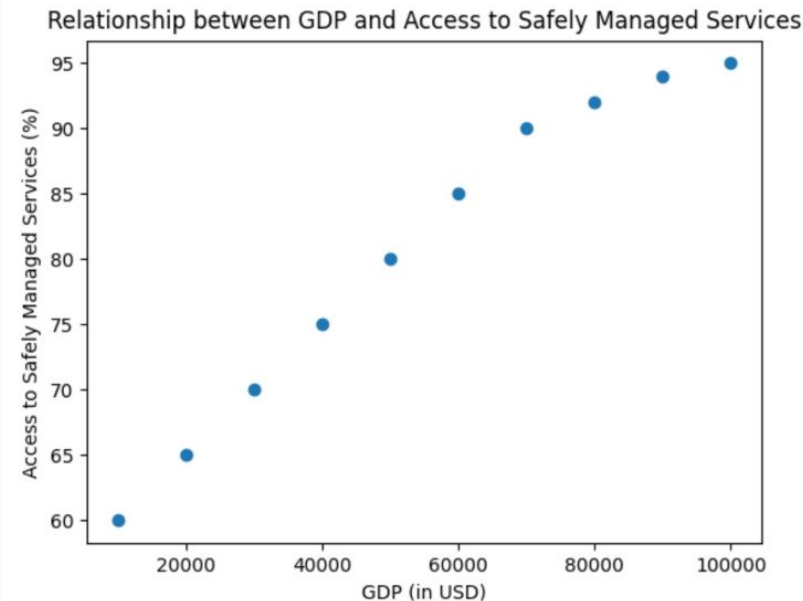
Q. What percentage of the population uses unimproved drinking water and sanitation services versus improved or safely managed services in different regions?

Percentage of Population Using Unimproved vs Improved Services in Different Regions

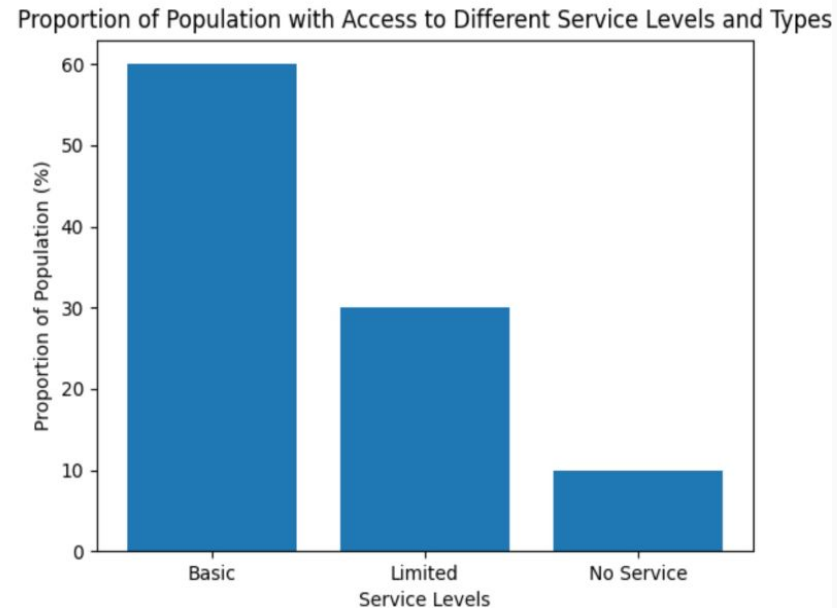
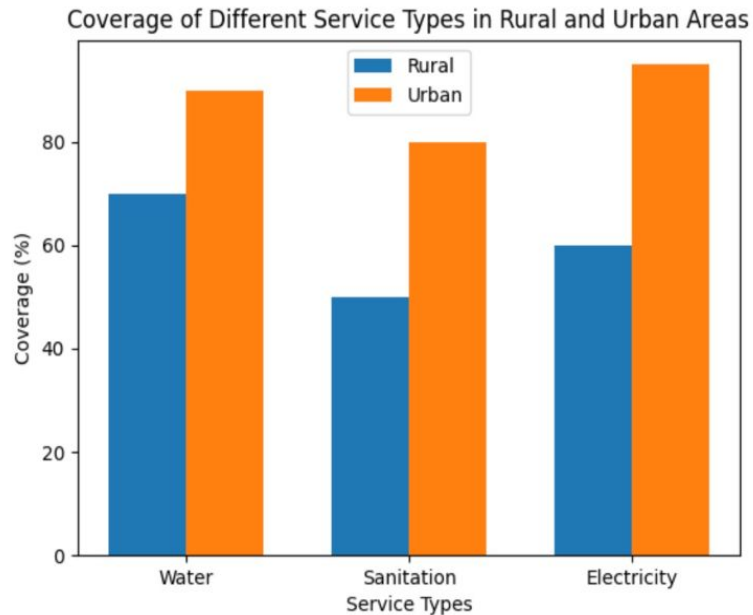


Q.What is the relationship between a country's GDP and its access to safely managed drinking water and sanitation services?

Q. How does population density correlate with the availability and coverage of service types in different countries?



Q: Is there any positive/negative correlation between population size and coverage? what is the overall correlation by each service type?

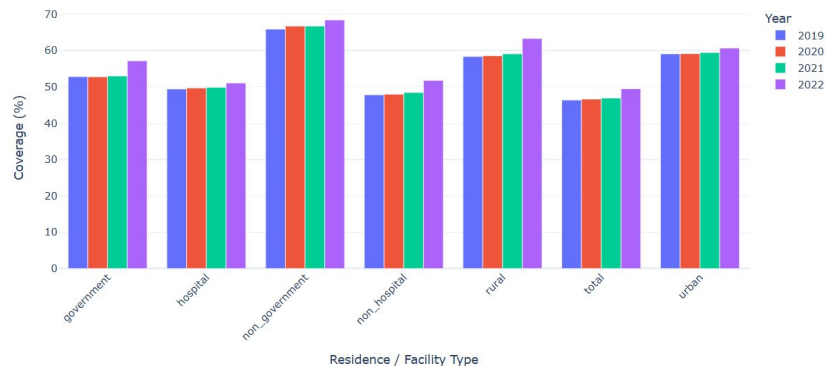


Final Data Visualizations & Insights

Q: How does the coverage of different service types differ between rural and urban areas within a country?

Global Analysis

Coverage of Residence / Facility Type by Year (with Differences from Preceding Years)



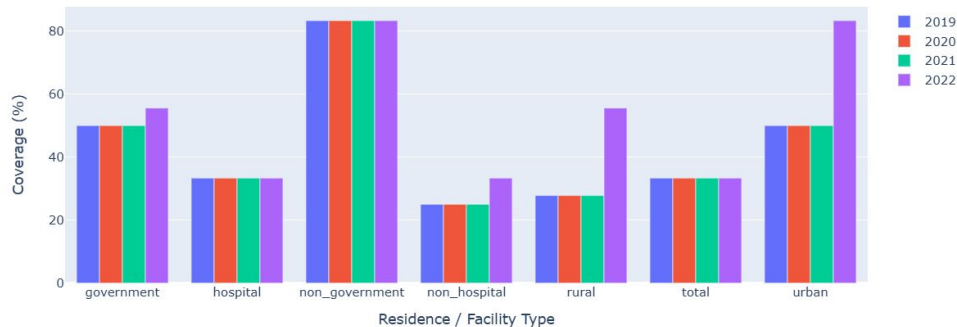
Country Wise Analysis

Coverage of Residence / Facility Type by Year

Ghana

× 2019 × 2020 × 2021

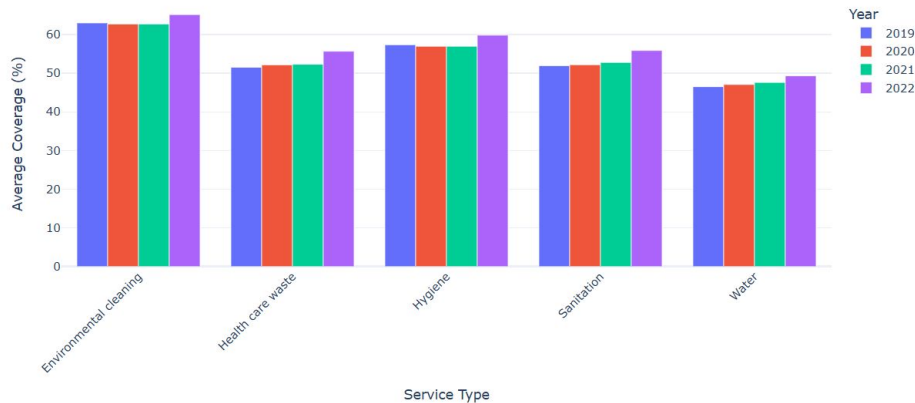
Coverage for Ghana (2019, 2020, 2021, 2022)



Q: How has the coverage of service types evolved over time for a country or globally?

Global Analysis

Global Average Coverage of Service Types by Year (with Differences from Preceding Years)



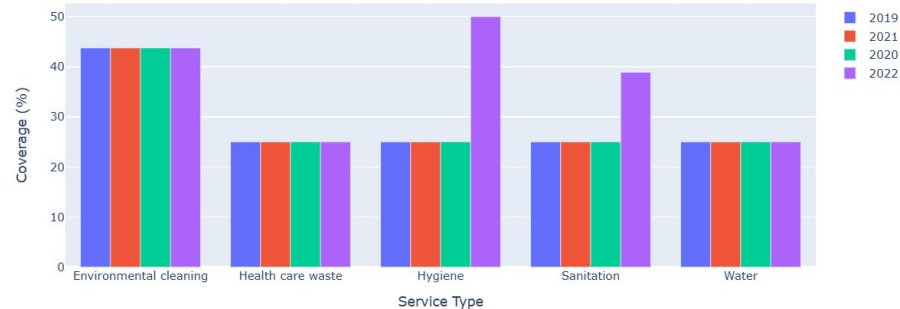
Country Wise Analysis

Coverage of Service Types by Year

Bangladesh

× 2019 × 2021 × 2020 × 2022

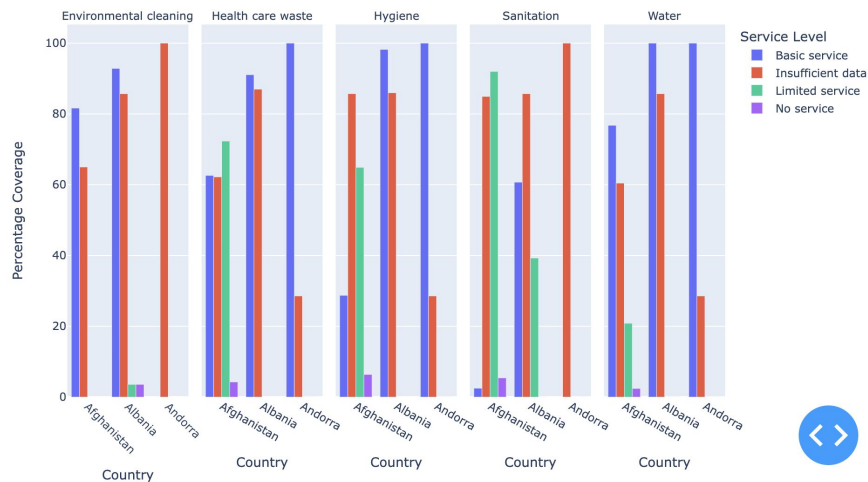
Coverage for Bangladesh (2019, 2021, 2020, 2022)



Q: How do different countries compare in terms of the percentage of population covered by basic or limited and no service level for different service types?

Analysis of selected countries

Population Coverage by Service Levels for 2021



Geographical Visualization



Q: What is the geographic distribution of coverage for a specific service in a specific year?

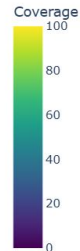
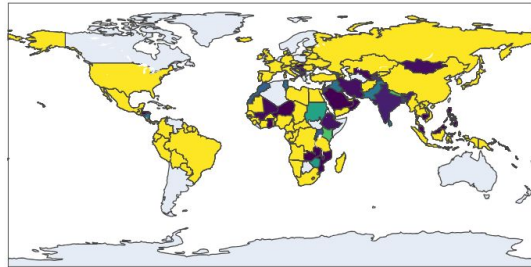
What is the geographic distribution of coverage for a facility/ residence type in a specific year?

Coverage of Services

2019

Environmental cleaning

Coverage of Environmental cleaning in 2019

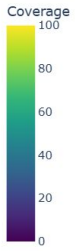
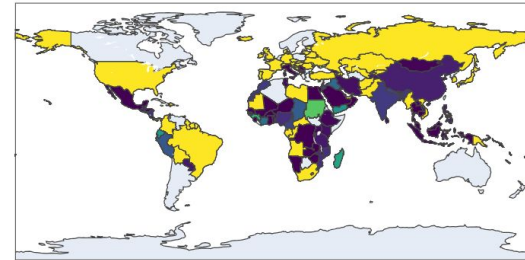


Coverage for Facility and Residence Type

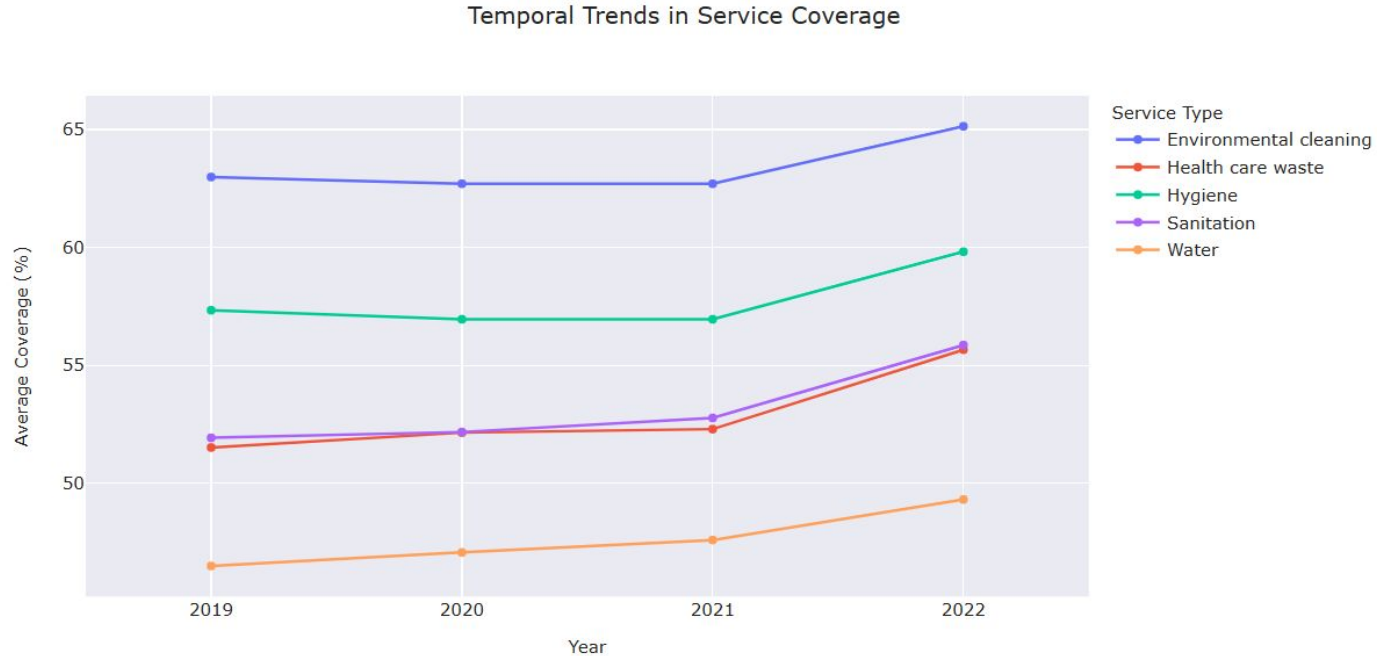
2019

government

Coverage for government in 2019



Q: What are the trends in service coverage across different service types over the years?



Q: What is the distribution of population for each Service Type?

Population Distribution by Service Types

Select a Country:

Afghanistan

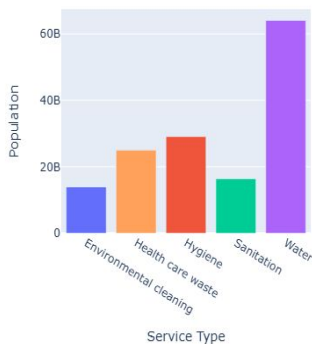
Select Year(s):

2020

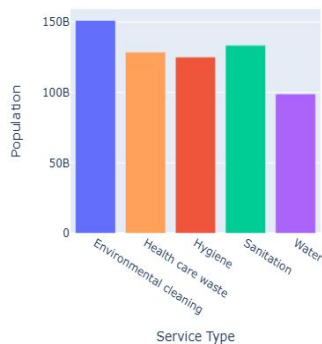
Select Residence / Facility Type:

hospital

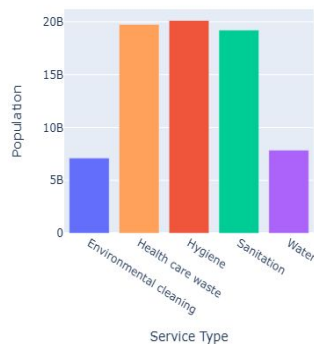
Population Distribution: Basic Service



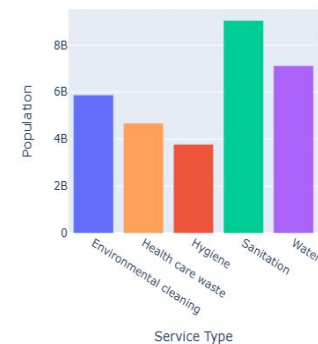
Population Distribution: Insufficient data Level



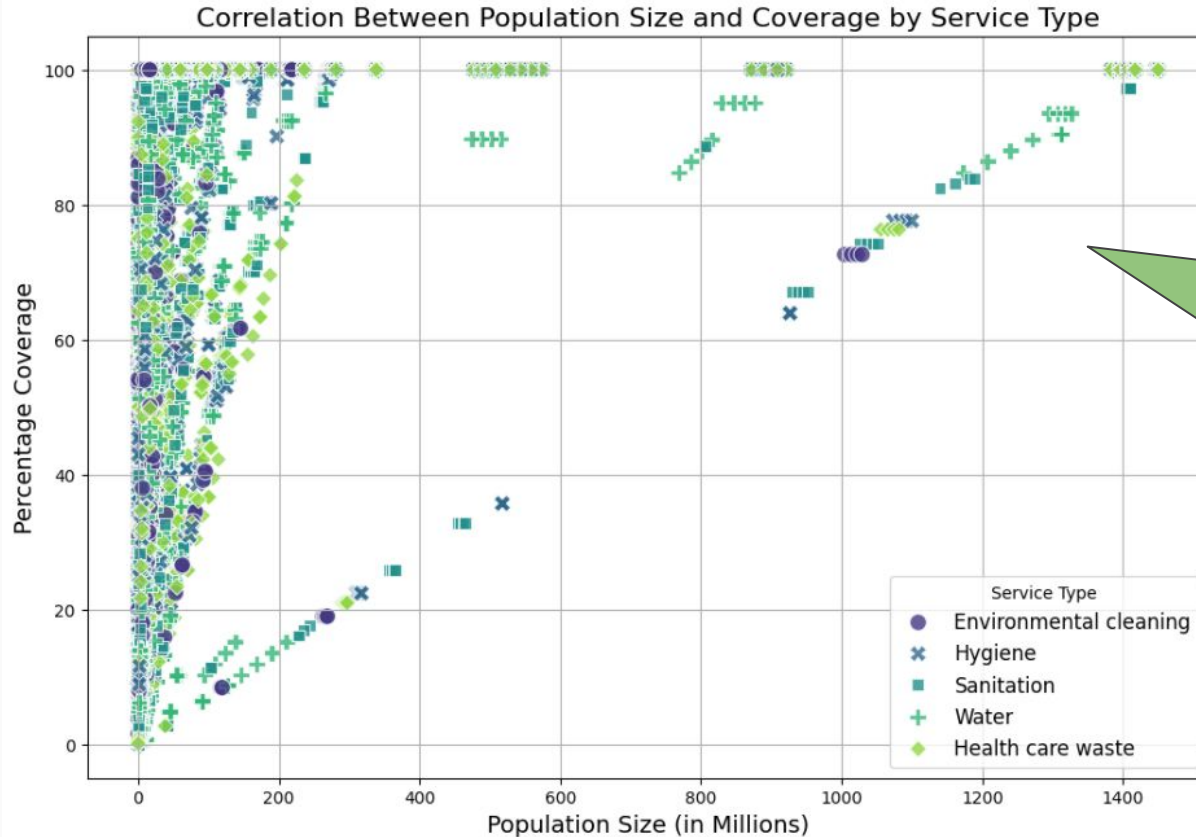
Population Distribution: Limited Service Level



Population Distribution: No Service Level

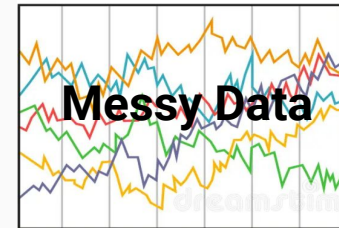


Question: Is there any correlation between population size and coverage? what is the overall correlation by each service type?



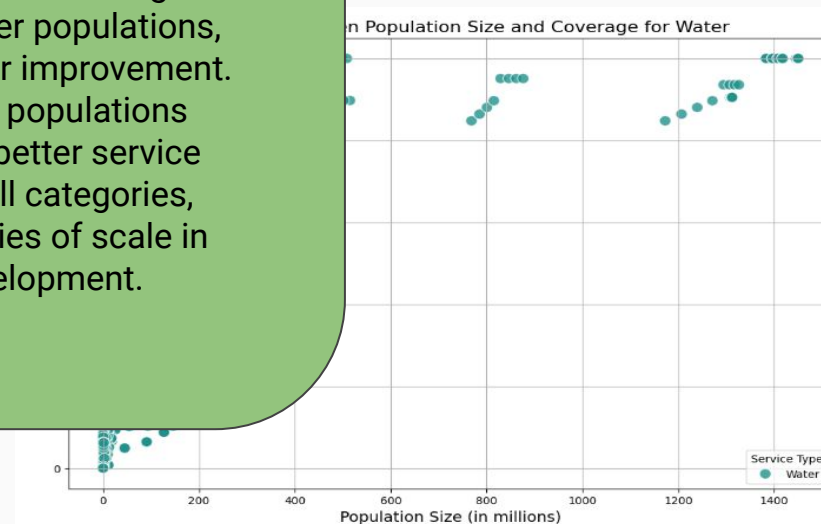
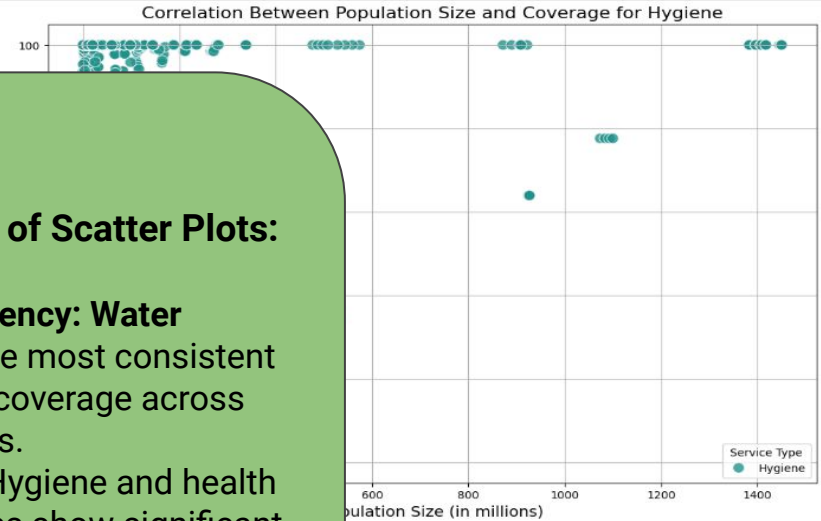
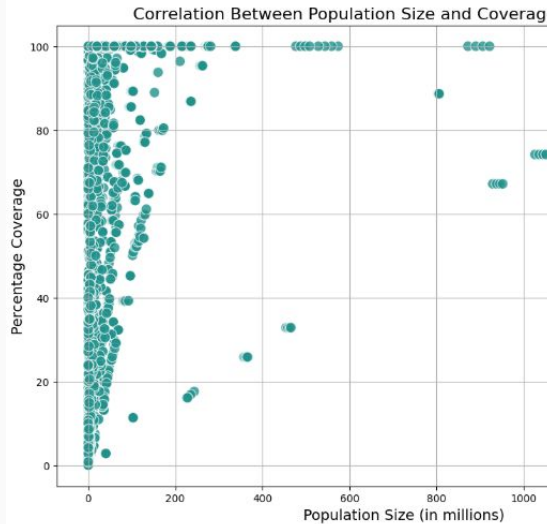
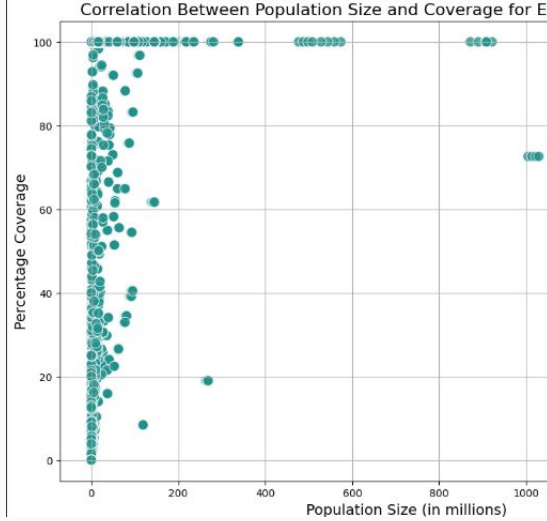
Correlation coefficient between Population and Coverage: 0.16

All correlations are positive, however they are weakly positive (ranging from 0.15 to 0.17), indicating a slight tendency for larger populations to have higher service coverage, but the relationship is not strong.

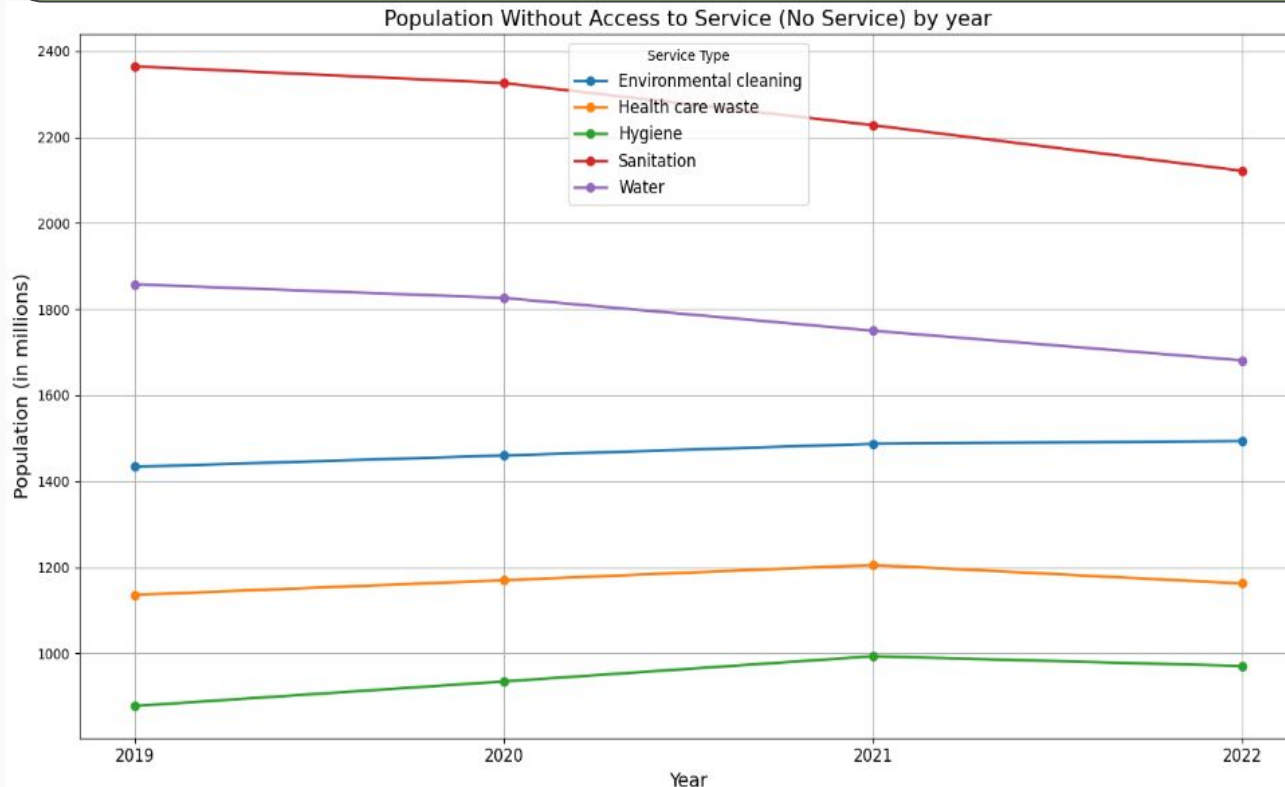


Comparative Analysis of Scatter Plots:

- **Strongest Consistency: Water services** exhibit the most consistent trend, with higher coverage across all population sizes.
- **Most Variability:** Hygiene and health care waste services show significant variability in smaller populations, indicating room for improvement.
- **Scalability:** Larger populations generally achieve better service coverage across all categories, reflecting economies of scale in infrastructure development.



Question: Has population under each service type has improved / deteriorated over time? What is the trend in overall population access to under each service level?



Insights:

Improved Services: Sanitation and water services show clear signs of improvement over time, with declining populations lacking access.

Stagnation: Environmental cleaning and health care waste management exhibit little to no change, highlighting areas needing greater focus.

Worsening Trend: Hygiene services show an increasing gap, potentially due to inadequate investment or growing challenges in certain regions

Q8: How does population density and GDP per capita correlate with the availability and coverage of service types in different countries?

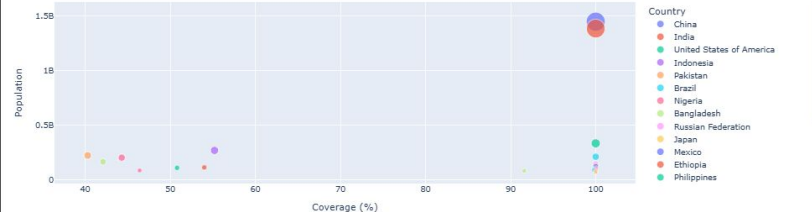
Population vs Coverage

Interactive Coverage Analysis

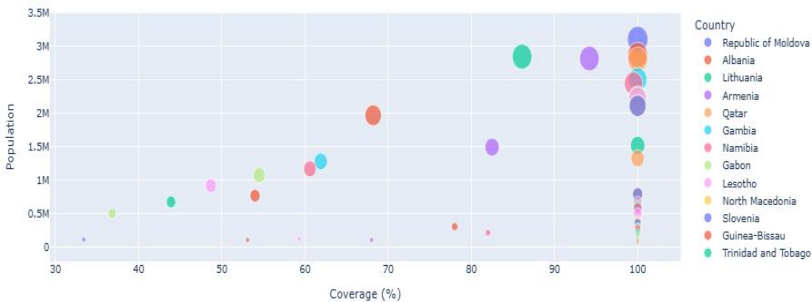
Health care waste

2019 2020 2021 2022

Top 20 Countries by Population for Health care waste in 2019



50 Countries with Least Population for Health care waste in 2019



GDP per capita vs Coverage

Interactive GDP vs. Coverage Analysis

Environmental cleaning

2021 2022

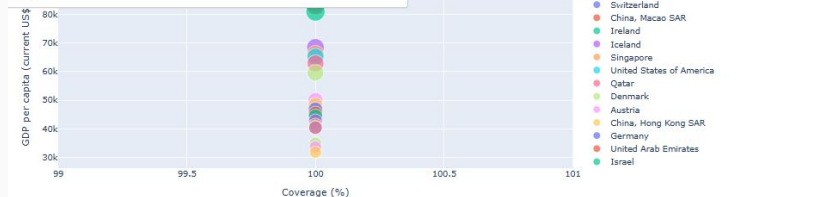
Environmental cleaning

Health care waste

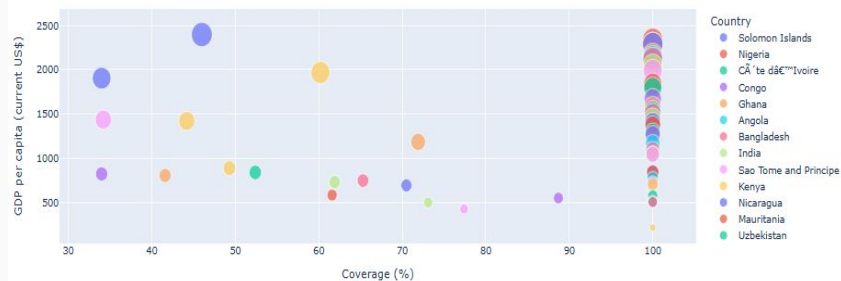
Hygiene

Sanitation

Water



50 Countries with Least GDP for Environmental cleaning in 2019



Conclusion

This project provides a comprehensive analysis of disparities in access to water, sanitation, and hygiene (WASH) services in healthcare facilities globally, aiming to identify gaps and inform policy interventions. The analysis of global disparities in access to WASH services in healthcare facilities highlights significant inequities between urban and rural areas, variations among service types, and the uneven progress of improvements over time. While water and sanitation services have shown notable advancements globally, hygiene and environmental cleaning services remain stagnant or exhibit worsening trends in some regions. The study underscores the influence of external factors like GDP, and the COVID-19 pandemic on service coverage, revealing systemic barriers that perpetuate inequalities. By leveraging detailed visualizations and correlations, this project provides actionable insights to guide policy interventions and resource allocation, emphasizing the need to prioritize investments in underserved areas to achieve sustainable healthcare equity.

Youtube URL

<https://www.youtube.com/watch?v=0xXnJoz72Lo>

Thank
You