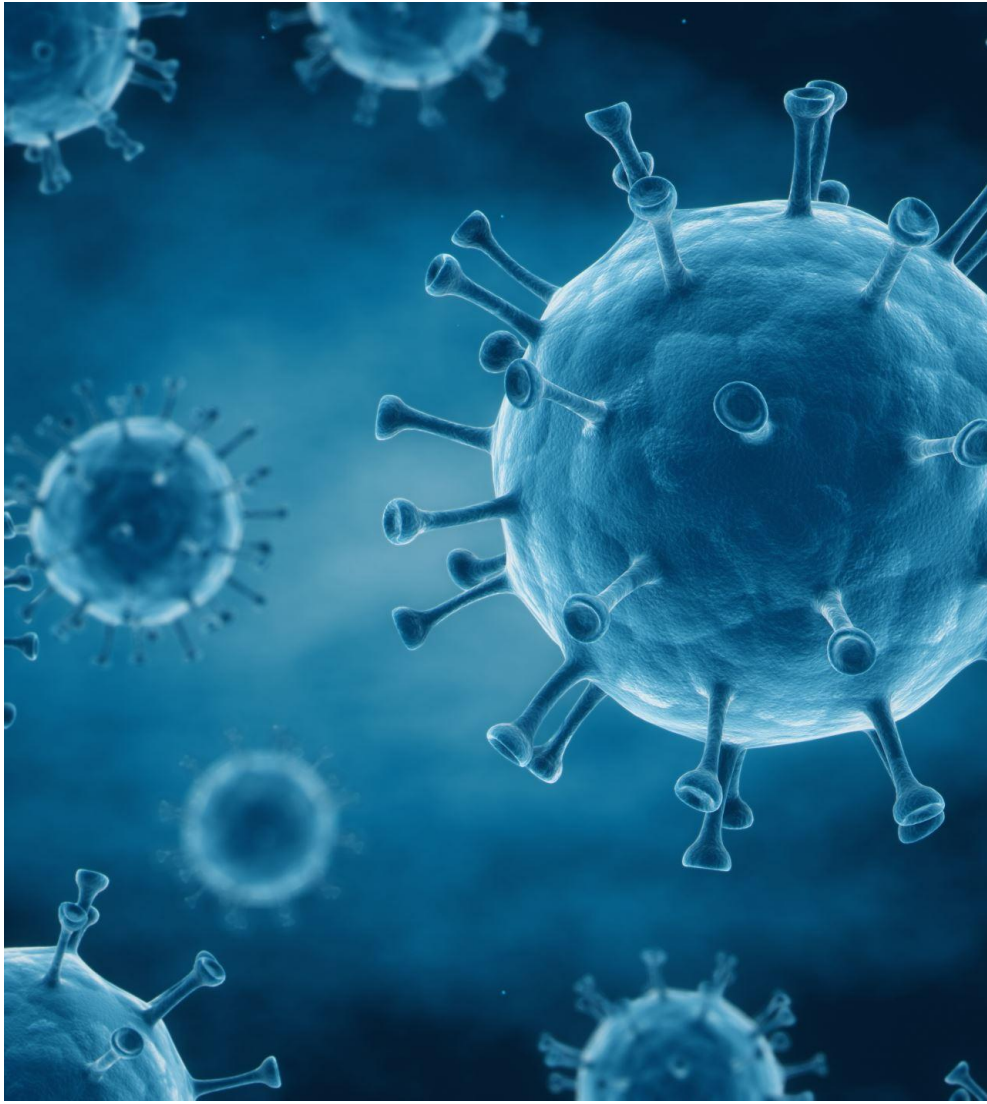


# COVID-19 Data Insights: A Visualization of Cases, Deaths, Vaccinations, and Testing Trends

## *Team Members and Roles:*

- **Shiva** – Data Cleaning & Testing Efficiency and Case Fatality Trends Analysis
- **Maruta** – Power BI Report Design & Regional Impact Analysis
- **Prajna** – Report Writing & Vaccine Effectiveness and Coverage Analysis
- **Neetika** – Storytelling & Presentation & Government Policies Impact Analysis
- **Sagar** – Hospital Strain Analysis



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# Project Overview



## Project Objective

- This project provides a data-driven visual analysis of COVID-19 trends, focusing on how the pandemic impacted different regions.



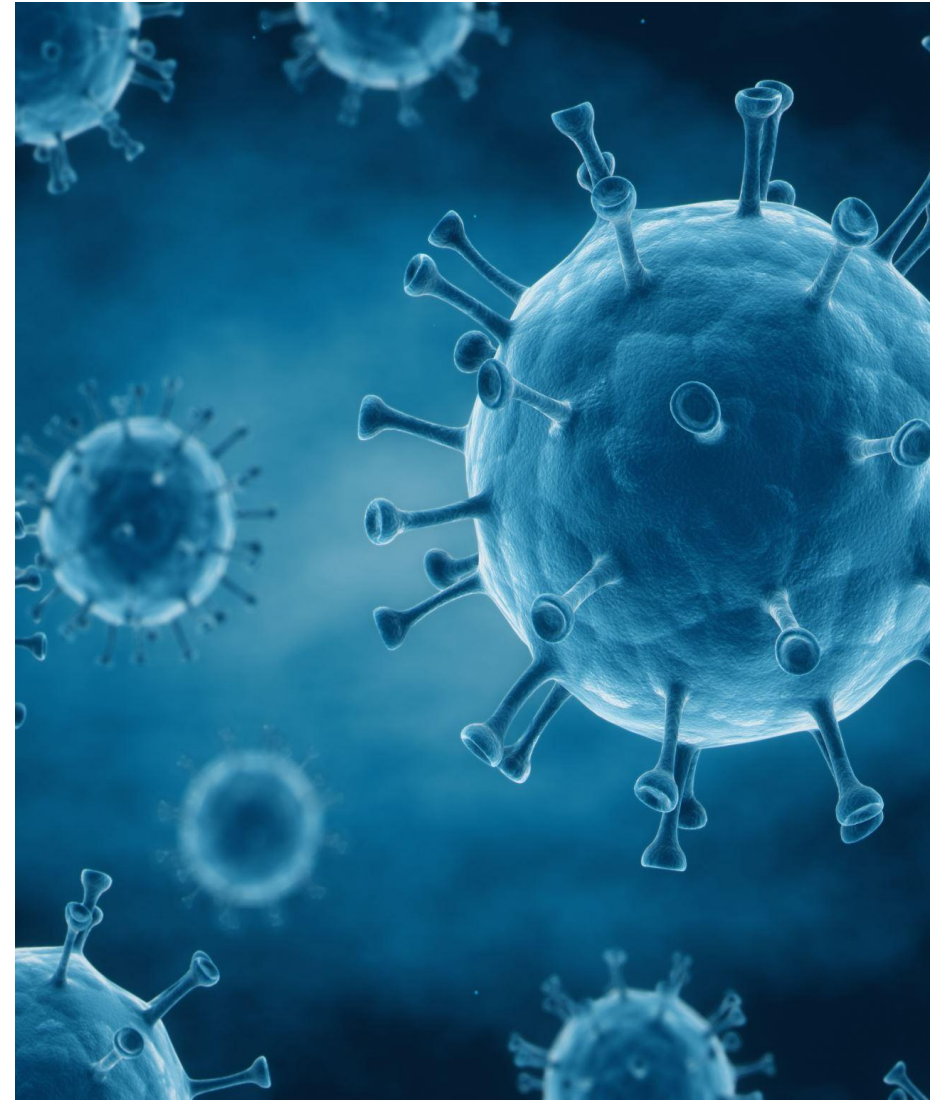
## Target Audience

- It enables Healthcare Researchers and Government Agencies to analyze long-term trends and derive actionable insights for future outbreak preparedness



## Project Deliverable

- The primary goal is to develop an interactive Power BI dashboard that visually explores COVID-19 trends in cases, deaths, vaccinations, and testing across different regions and time periods.





# Research Methodology



Defining Problem  
Statement



Data Tools



Data Collection



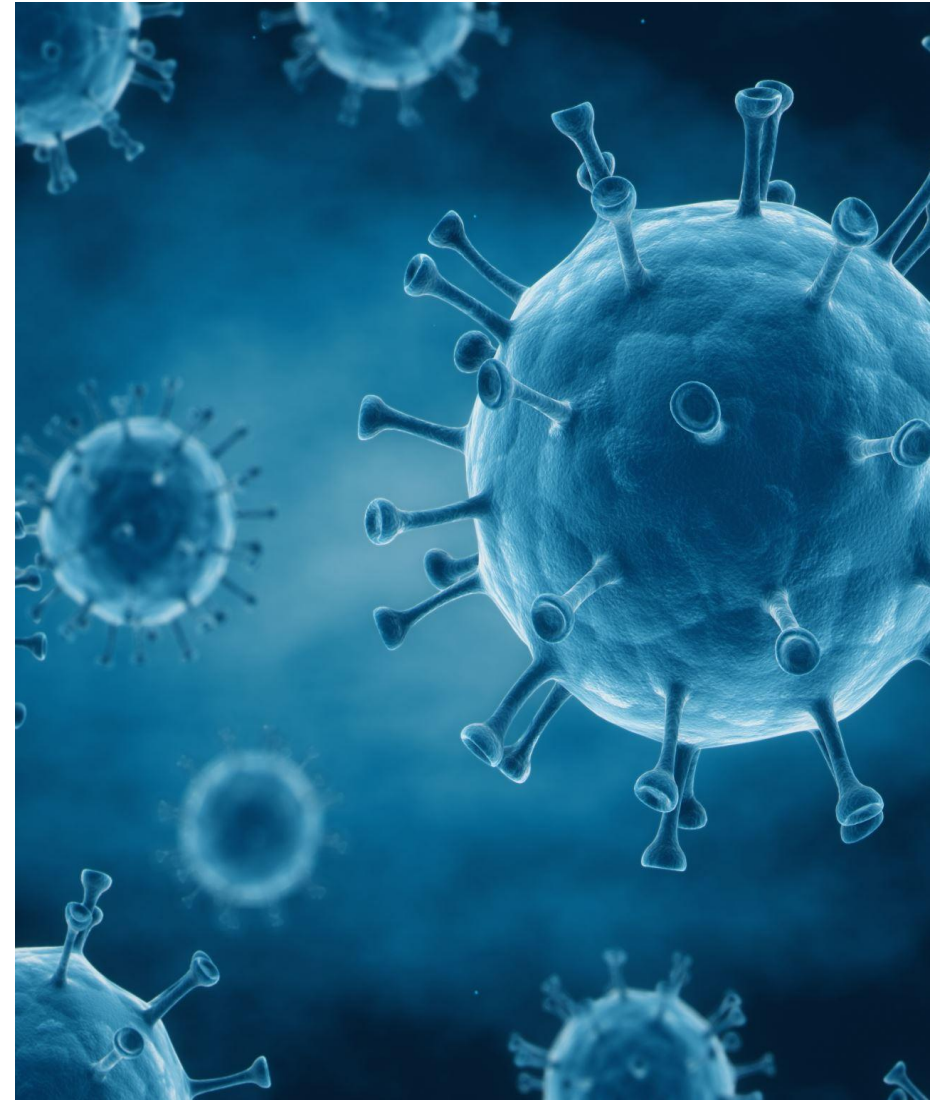
Data Cleaning &  
Preparation



Data Analysis



Data Visualization



# Problem Statement

To analyze global COVID-19 trends from 2020 to 2024, focusing on cases, deaths, vaccinations, and testing, and assess how government policies impacted outcomes.



## Regional Impact Analysis

- The COVID-19 pandemic affected regions differently, making it essential to analyze these disparities.



## Testing Efficiency and Case Fatality Trends Analysis

- Understanding patterns from past outbreaks can provide valuable insights to enhance future crisis response and preparedness strategies.



## Vaccine Effectiveness and Coverage Analysis

- There is a need to evaluate the effectiveness of vaccinations and public health measures in reducing transmission and mortality rates.



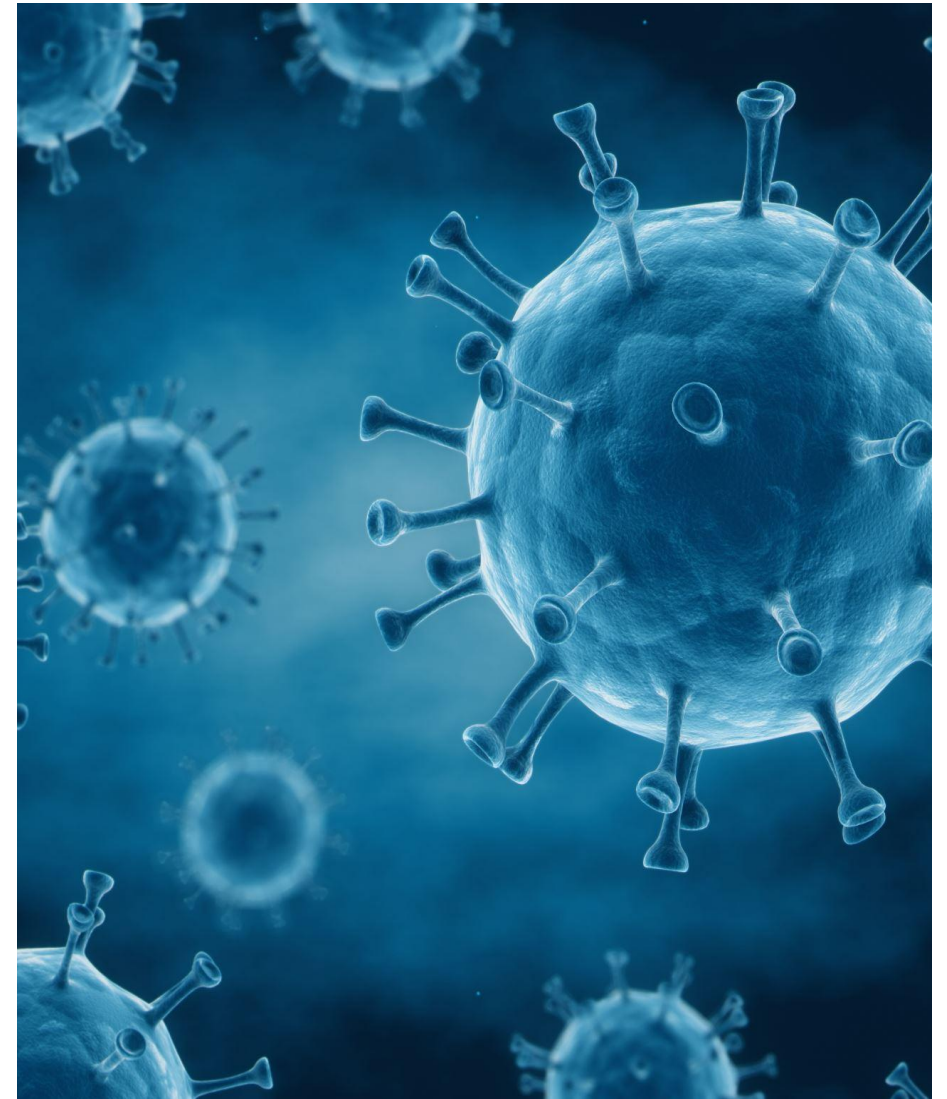
## Government Policies Impact Analysis

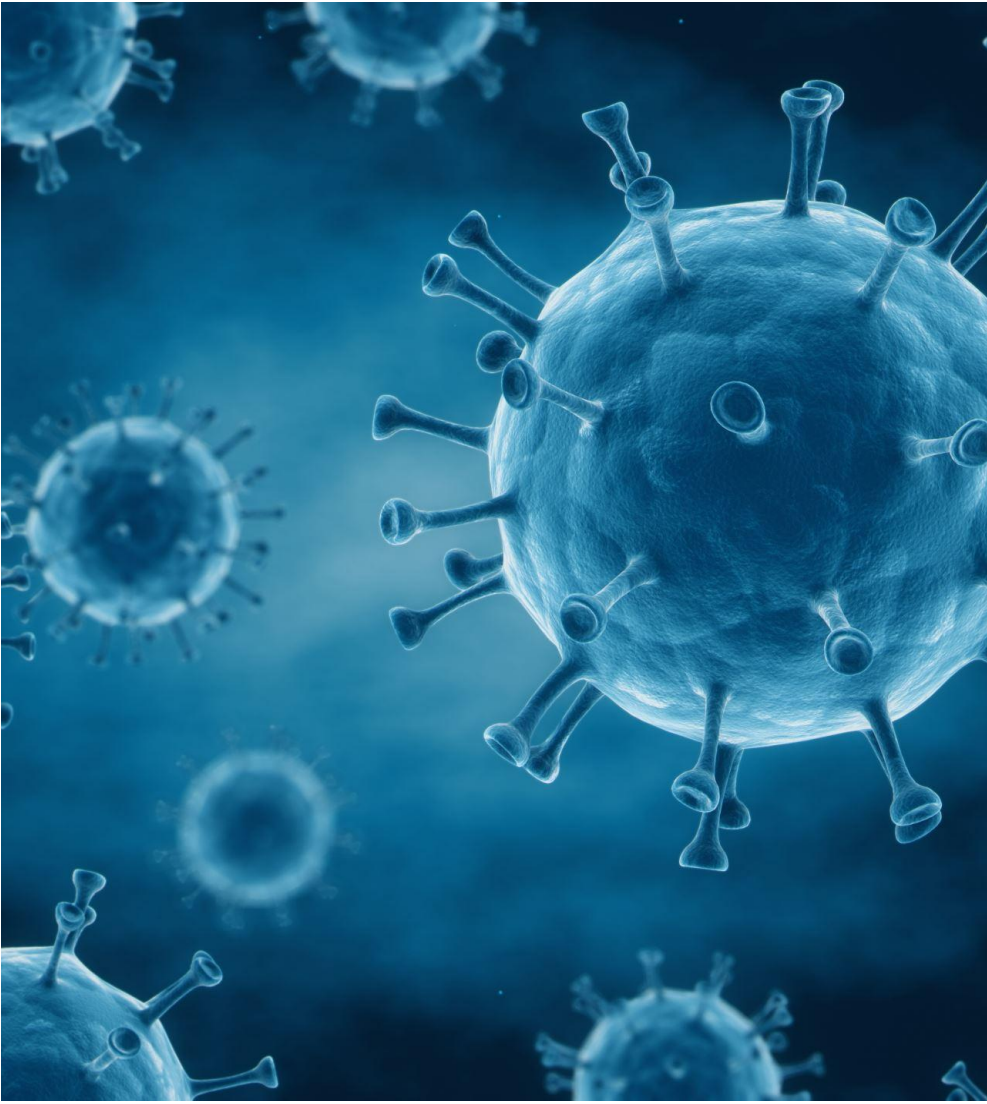
- The influence of lockdowns and government-imposed restrictions on virus transmission needs to be assessed to determine their role in controlling the pandemic.



## Hospital Strain Analysis

- Analyzing hospital strain during the COVID-19 pandemic is essential to identify system vulnerabilities and improve preparedness for future health crises.





# Data Analysis Toolkit

Tools such as MS Excel and Power BI ensured a seamless workflow from raw data to impactful visual storytelling

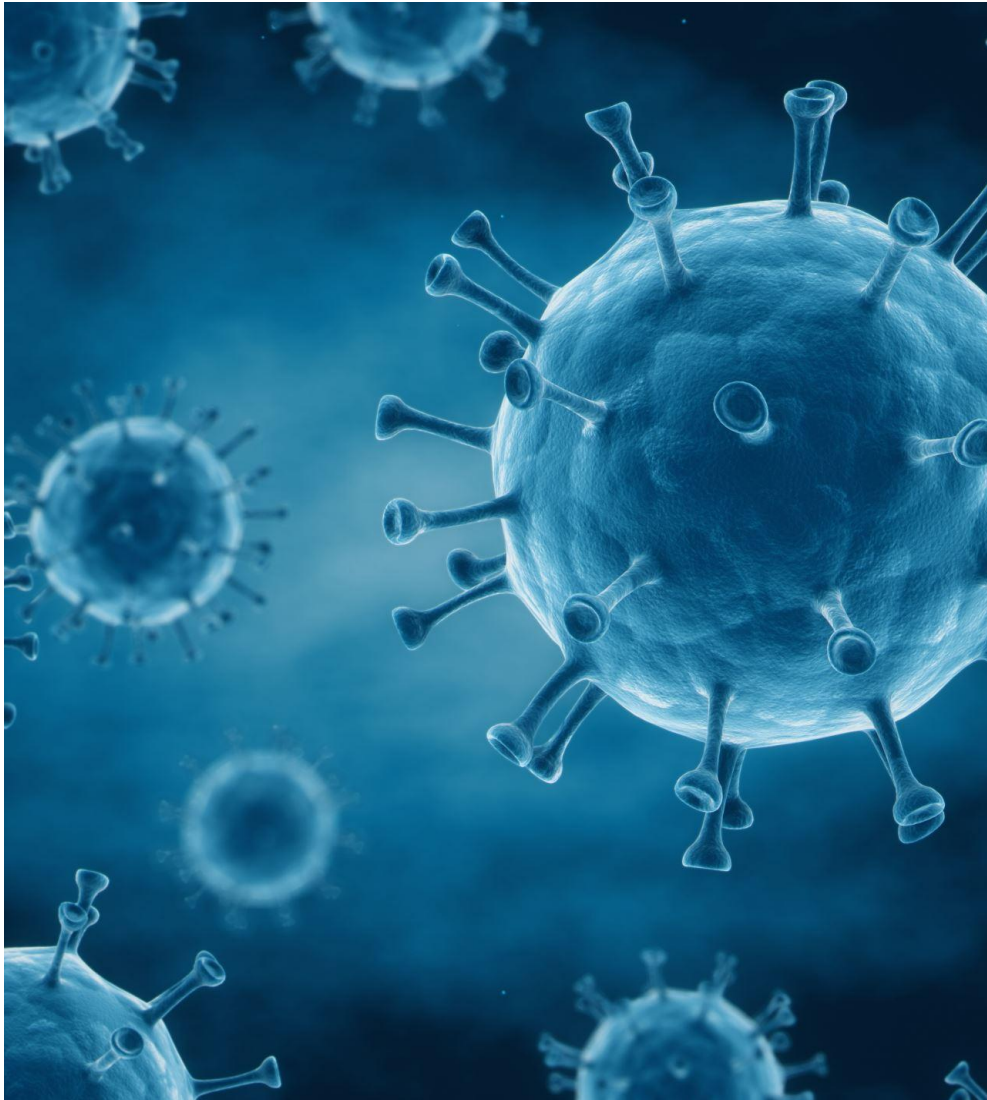
## MS Excel

- Used for initial data cleaning and inspection
- Handled missing values and formatted columns before importing into Power BI

## Power BI

- Helped prepare calculated fields
- Enabled filtering by country, date, and other variables for dynamic exploration
- Used to analyze trends and visualize data through interactive dashboards





# Data Collection

## Source

- |                               |                             |
|-------------------------------|-----------------------------|
| 1) Compact COVID-19 Dataset   | 1) Our World in Data (OWID) |
| 2) Latitude & Longitude       | 2) Kaggle                   |
| 3) GDP and Population Density | 3) World Bank               |



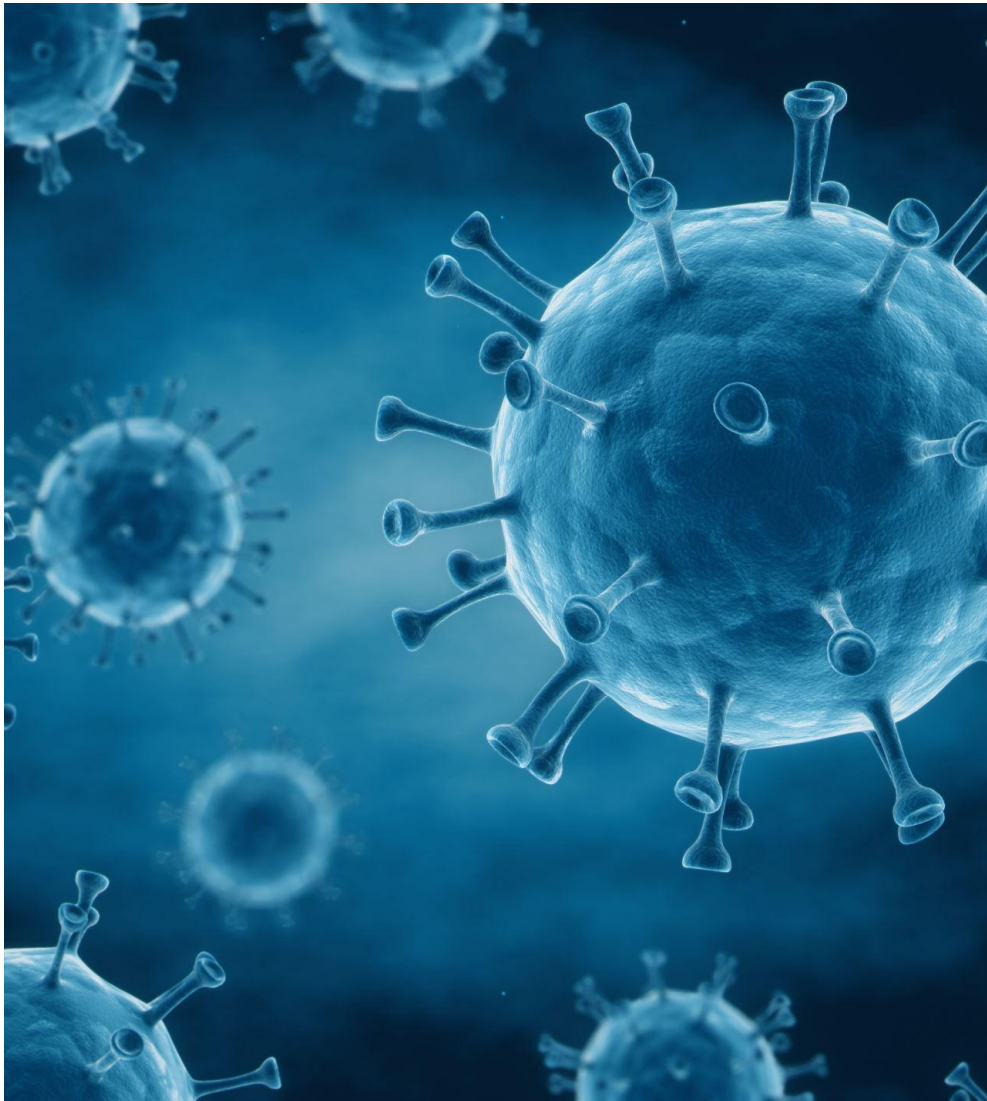
## Data Coverage

Global, with country-wise breakdowns from Year 2020 to 2024

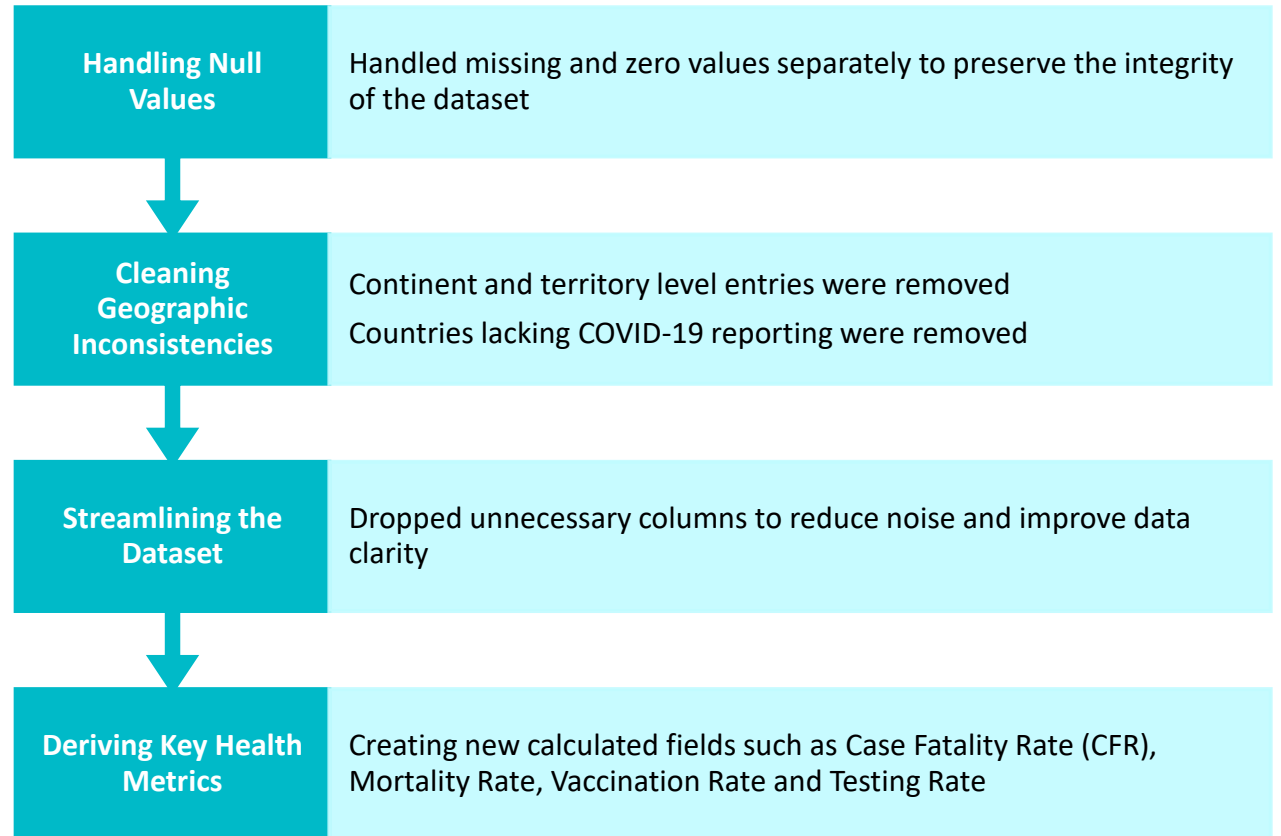


## Data Collection

Imported multiple CSV files from various sources and established relationship in Power BI using Country as primary key

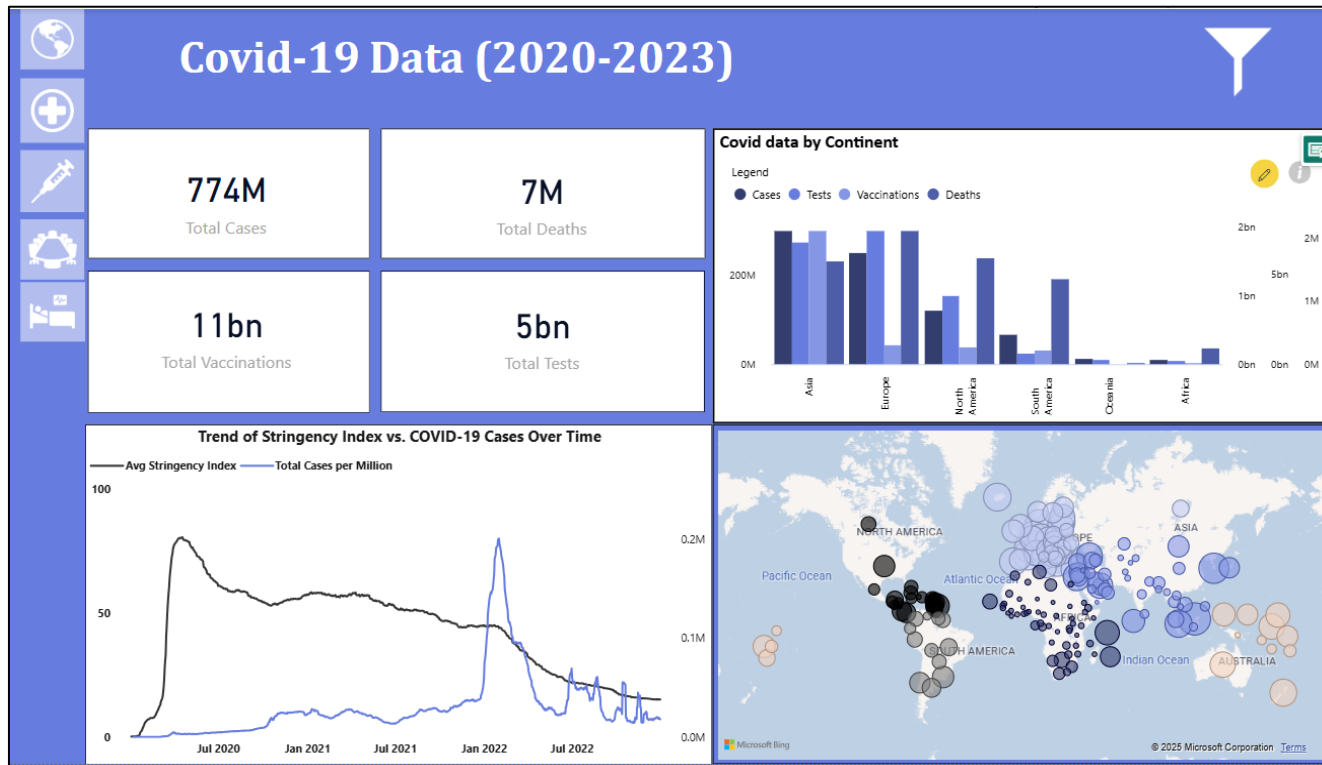


# Data Preparation





# Visual Analysis of COVID-19 Trends



## Continental Insights:

- Asia leads in total vaccinations and tests
- Europe and North America show high testing and death counts
- Africa shows low reported figures, possibly due to underreporting

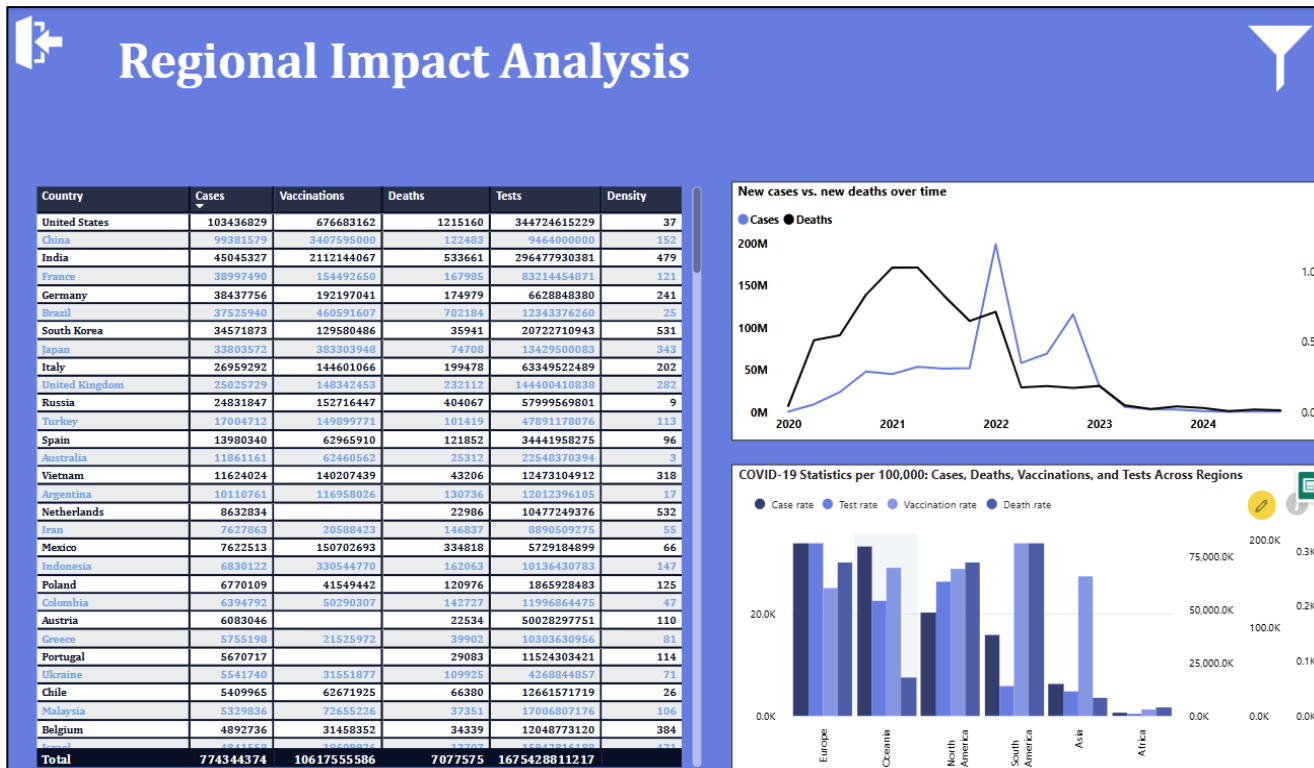
## Trend Analysis (Bottom Left Chart):

- As Stringency Index (lockdowns/restrictions) decreased, cases per million fluctuated
- Major spike in cases occurred post-2021, with declining policy strictness

## Geospatial Patterns (Bottom Right Map):

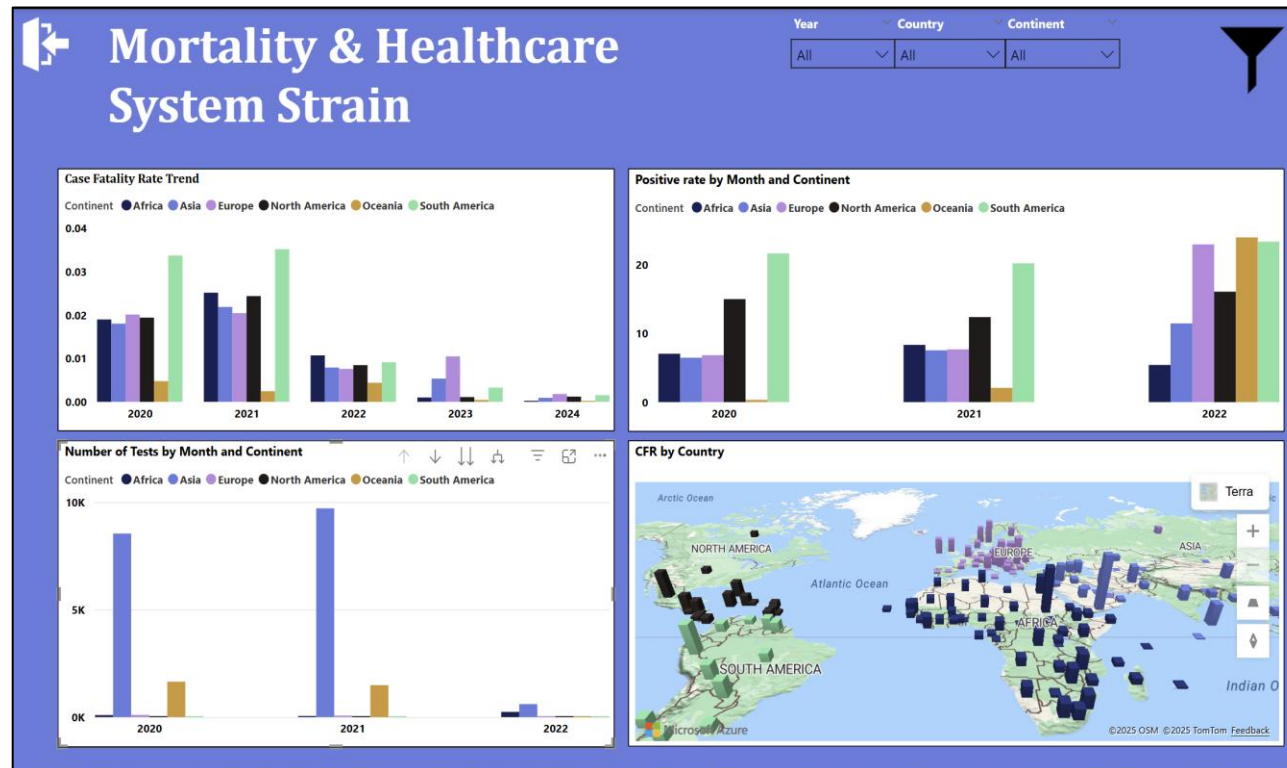
- Dense case clusters in Europe, North America, and South Asia
- Larger circles = higher case volume

# Regional Impact Analysis



- USA, Brazil, and India reported the highest total COVID-19 cases and deaths, highlighting the pandemic's severe impact on densely populated nations.
- China, India, and the USA led in global vaccination numbers.
- USA, India, and the UK conducted the highest number of tests, reflecting robust testing infrastructure.
- There is a sharp increase in cases in 2022 which unfortunately increased number of deaths.
- By 2024, both new cases and deaths declined significantly, indicating progress in pandemic control.
- Normalized data (per 100K population) shows Asia leads in vaccinations and has lower death and case rates.
- A higher vaccination rate correlates with improved COVID-19 outcomes

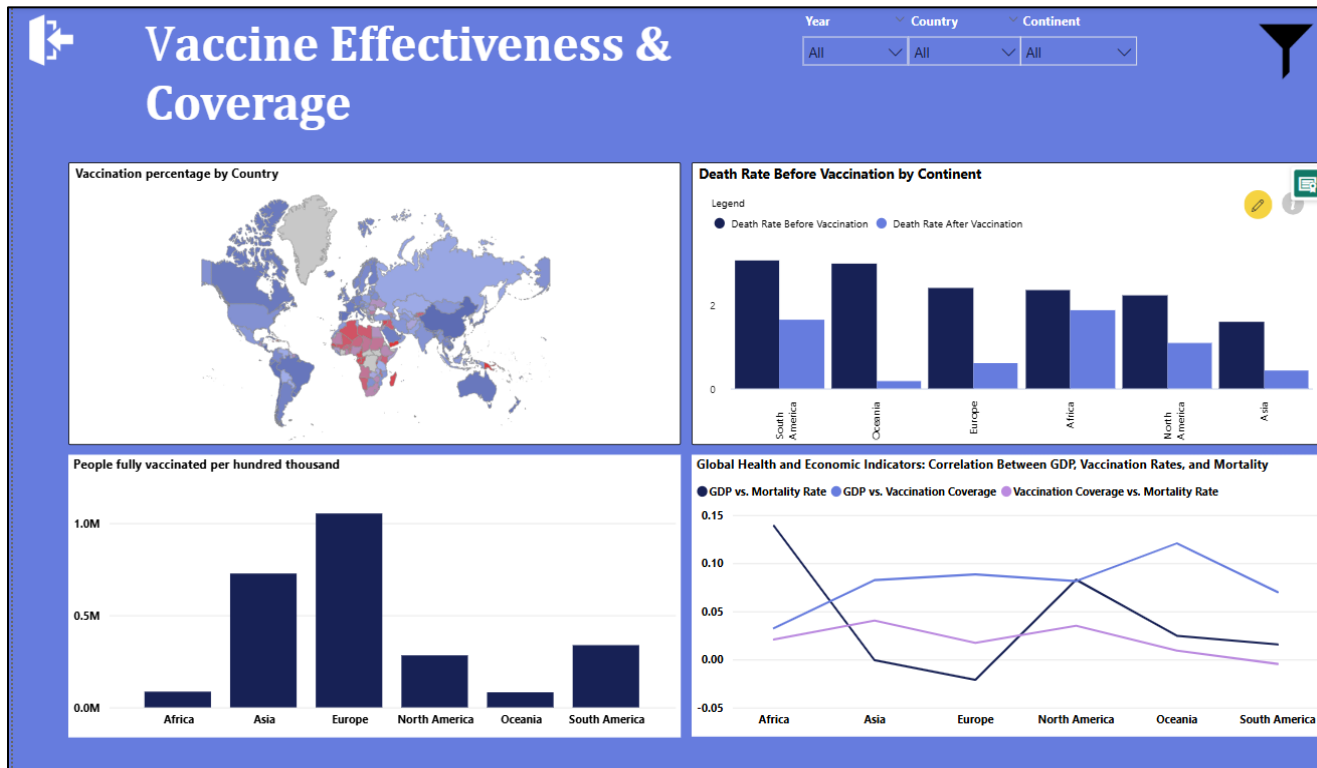
# Testing Efficiency & Case Fatality Trends Analysis



- In 2021, South America had the highest Case Fatality Rate (CFR), followed by Asia, North America and Europe, indicating significant pressure on healthcare systems.
- CFRs declined in 2022 and 2023, likely due to improved treatments and widespread vaccination efforts.
- Oceania and Asia saw a spike in tests per case in 2021, reflecting proactive efforts to curb the virus spread.
- Africa and South America had lower testing rates, which may have delayed early case detection and response.
- Early in the pandemic, South America, Europe, and North America showed high test positivity rates, suggesting widespread infection.
- Over time, increased testing and vaccination led to lower fatality rates and better control of the pandemic globally.

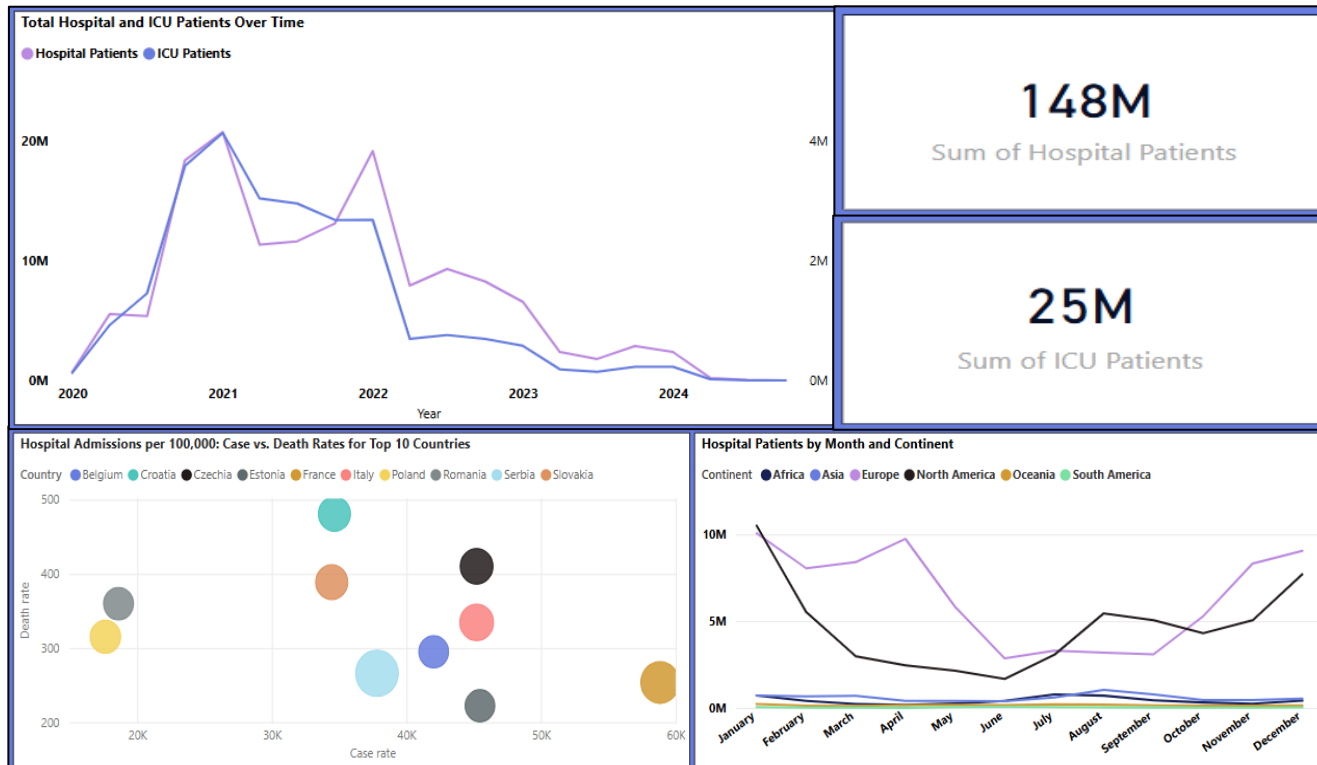


# Vaccine Effectiveness and Coverage Analysis



- High vaccination rates observed in North America, Europe, and parts of Asia.
- Africa and South America lag behind probably due to economic and logistical challenges.
- There is a strong correlation between GDP and vaccination coverage — wealthier nations have better access to vaccines.
- Mortality rates declined post-vaccination, especially in South America and Oceania.
- Disparities remain, highlighting the need for equitable vaccine distribution and stronger healthcare systems in low-income regions.
- Outliers identified:
  - Oceania (high GDP, lower-than-expected vaccination)
  - Cuba (low GDP, effective vaccination rollout)
  - Eastern Europe (high vaccine availability, high mortality, may be due to hesitancy)

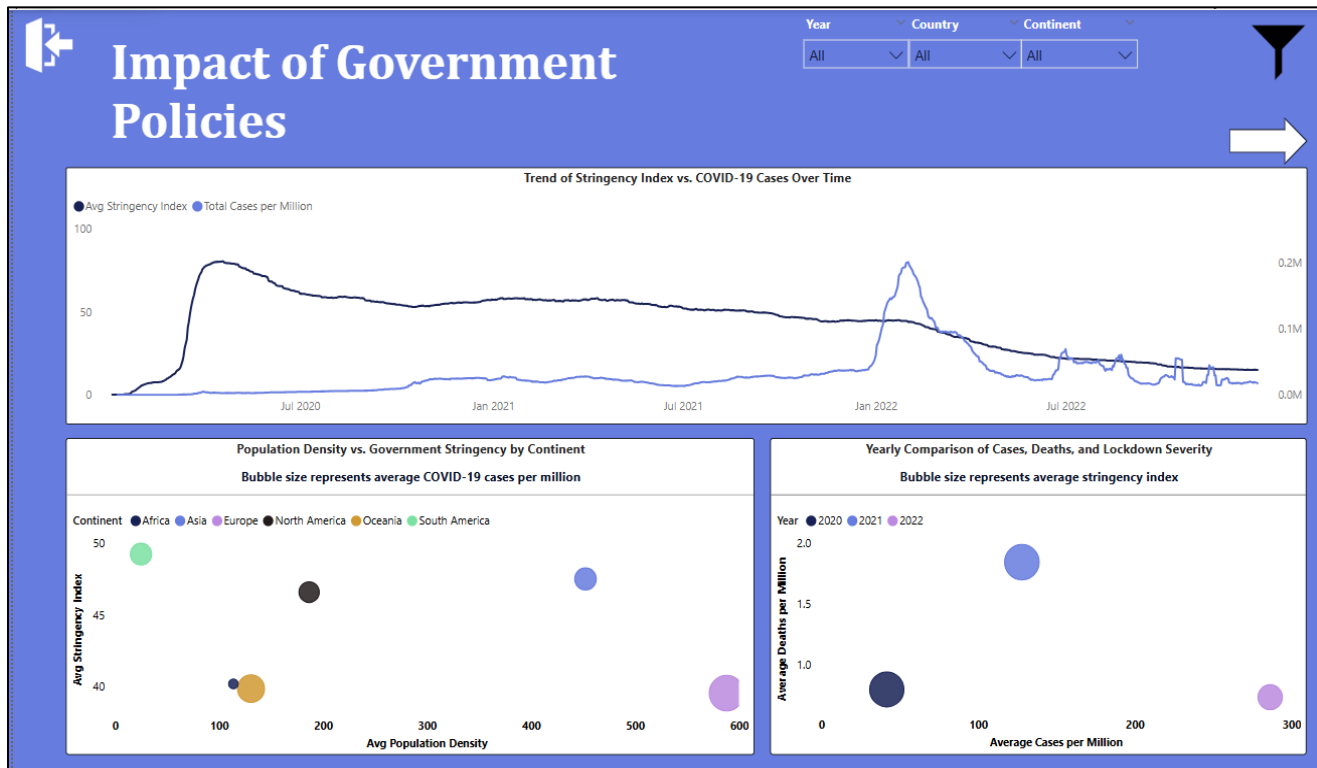
# Hospital Strain Analysis



- 148 million people hospitalized and 25 million admitted to ICUs for COVID over the past five years.
- Majority of hospital and ICU admissions occurred between 2020 and 2022.
- December and January had the highest monthly admission totals, aligning with seasonal flu trends.
- Some countries report zero hospitalization/ICU values, likely due to missing or unreported data.
- Europe had a peak in April, and North America in August — suggesting diverse transmission patterns.
- No strong correlation between hospital/ICU admission rates and death rates.
- Data suggests hospital strain does not directly predict mortality, highlighting the complexity of health system responses.

# Government Policies Impact Analysis(1)

*How Did Government Response Shift as Cases and Deaths Evolved?*



\*Note: Stringency Index is a composite score based on 9 government policies (e.g., school closures, travel bans, lockdowns). Please refer appendix.

- Government restrictions peaked in early 2020, helping keep case rates low; by 2022, restrictions dropped while cases surged.
- The lack of correlation between population density and stringency suggests that policy decisions were driven more by regional context than structural factors.
- Europe, despite higher density, did not always enforce the strictest policies compared to less dense regions like South America.
- Over time, there's a shift from high stringency with low cases (2020) to low stringency with high cases but lower deaths (2022).
- Policy impact appears stronger in early stages, while later outcomes reflect vaccine coverage and system adaptation.



# Government Policies Impact Analysis(2)

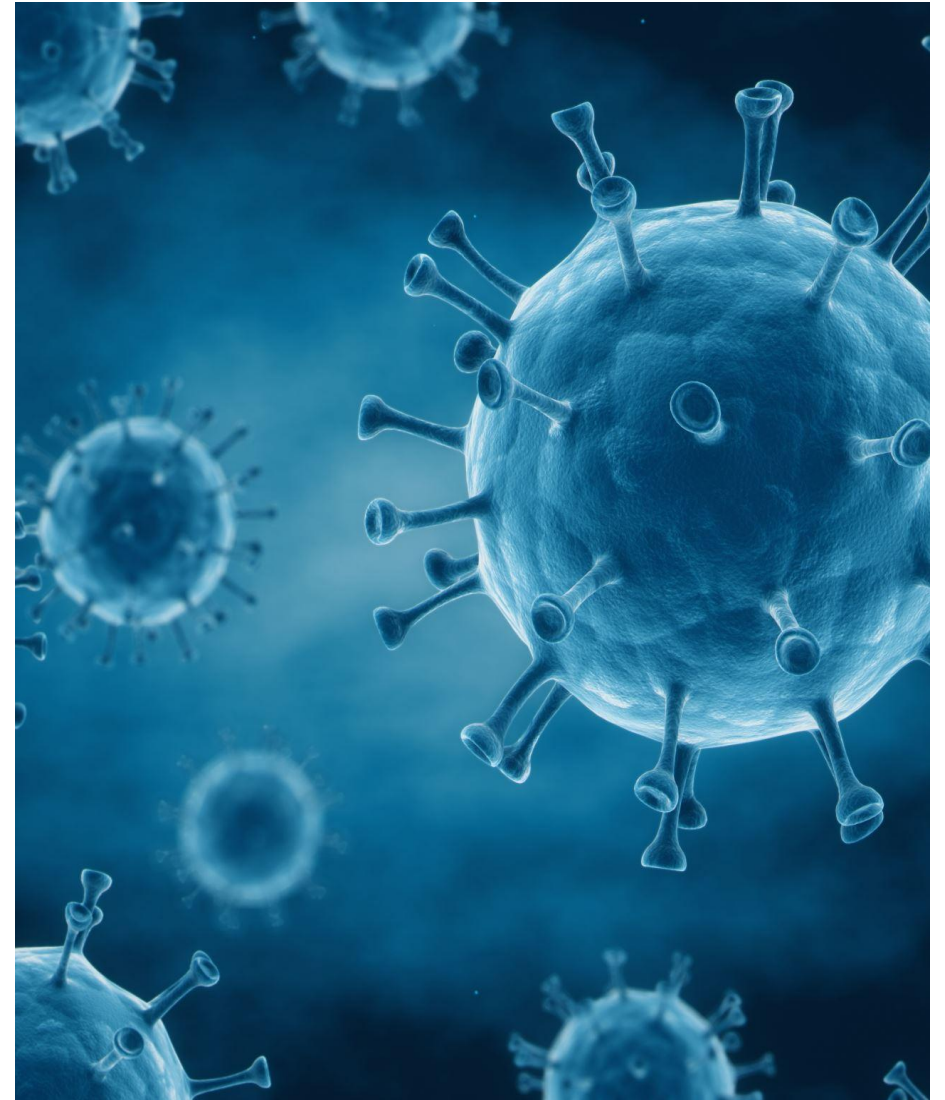
*How Did COVID-19 Policies Vary Across Continents and Density Levels Over Time?*

Comparing COVID-19 Burden and Lockdown Measures (2020–2022)						
Includes population density categories and highlights shifts in case rates and government restrictions over time						
Year	2020		2021		2022	
Continent	Avg Cases per Million	Avg Stringency	Avg Cases per Million	Avg Stringency	Avg Cases per Million	Avg Stringency
<b>Africa</b>						
Low Density	8	49	31	45	12	26
Medium Density	6	46	59	48	70	29
<b>Asia</b>						
High Density	29	52	107	49	931	30
Low Density	21	51	99	54	169	27
Medium Density	48	58	125	61	242	31
<b>Europe</b>						
High Density	48	51	289	39	821	21
Low Density	85	47	250	49	457	20
Medium Density	119	49	289	54	801	19
<b>North America</b>						
Low Density	63	54	140	56	202	26
Medium Density	10	59	129	59	173	27
<b>Oceania</b>						
Low Density	1	42	35	48	471	33
Medium Density	0	30	0	37	656	40
<b>South America</b>						
Low Density	54	62	154	61	182	25

- In 2020, most regions enforced high stringency with low case averages, especially in Asia and South America.
- 2021 showed rising cases with still elevated restrictions in many areas, continuing the cautious approach.
- In 2022, case rates were highest, but stringency dropped significantly across all continents, indicating a global policy shift.
- The table confirms no consistent correlation between density and policy strictness, reinforcing earlier visuals.
- This detailed view supports Slide 1's findings and highlights how policy response varied by region and year, not just population structure.

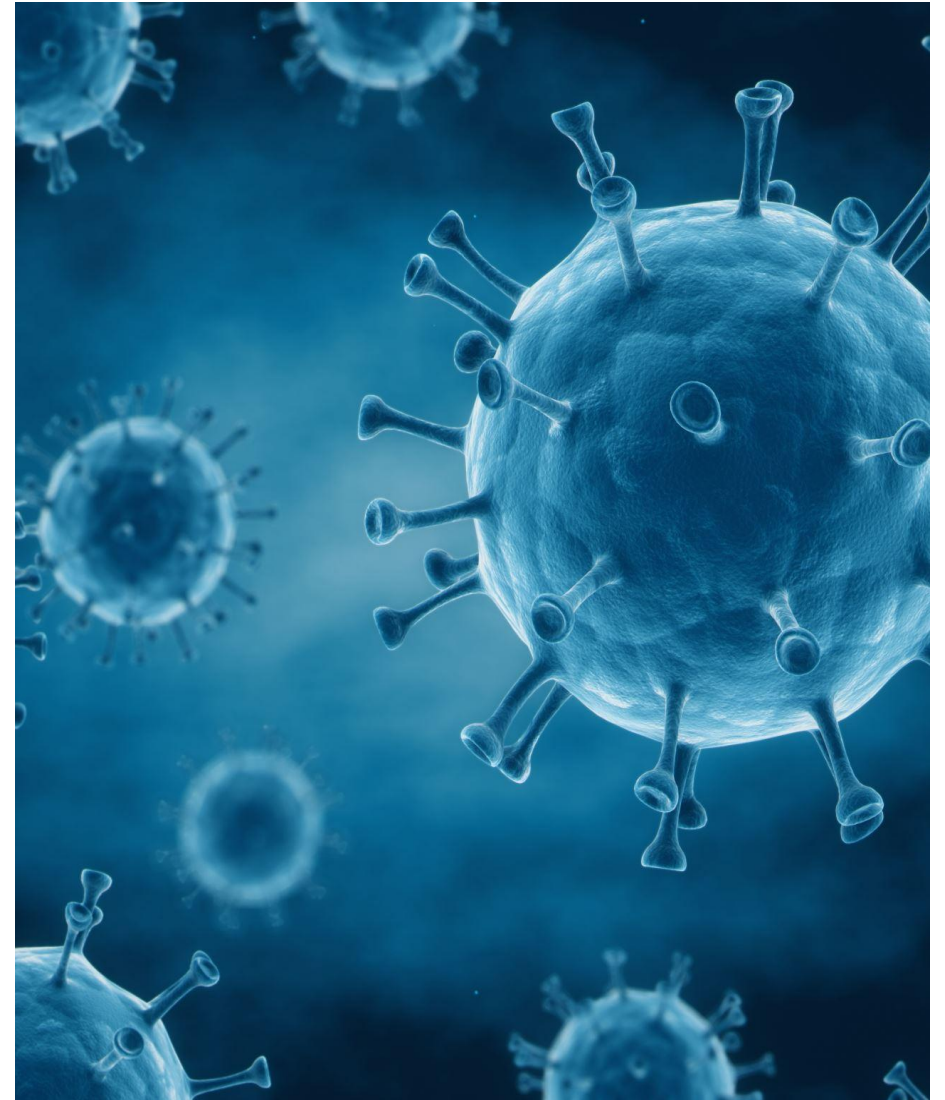
# Challenges & Limitations

- **Missing or Incomplete Data**
  - Some countries lacked consistent data
- **Aggregated vs. Country-Level Data**
  - Continent-level entries had to be removed to prevent double-counting or skewed analysis
- **Blank vs. Zero Values**
  - Needed to differentiate between missing values and actual zero values to avoid misinterpretation
- **Calculated Metrics Complexity**
  - Custom metrics like CFR, Tests per Case, and Positivity Rate required careful definitions and consistent formulas
- **Visual Comparison Challenges**
  - Countries with vastly different population sizes and testing policies made comparisons tricky; needed normalized metrics
- **Balancing Detail and Clarity**
  - Too many visuals risked overwhelming the audience; had to choose visuals that best conveyed insights



# Conclusion

- The Project revealed critical patterns in cases, testing, vaccinations, and fatality rates across countries and time.
- Regional trends reveal that higher vaccination rates, combined with strong public health responses, contribute to lower COVID-19 cases and deaths, though anomalies still warrant further investigation.
- Improved testing efforts and increased vaccinations have led to lower case fatality rates globally, though disparities in testing efficiency highlight ongoing challenges in early detection and healthcare access.
- While vaccinations have significantly reduced mortality rates globally, persistent regional disparities underscore the urgent need for equitable access, stronger healthcare systems, and global cooperation.
- Hospitalization and ICU trends during the COVID-19 pandemic varied significantly by region and season, with no clear correlation between admission rates and death outcomes across countries.
- Government policy stringency showed potential correlation with improved public health outcomes when enforced timely





# Appendix & References

- The Stringency Index measures the strictness of government policies on a scale of 0 to 100.
- It is based on 9 indicators, including school closures, travel restrictions, and stay-at-home orders.
- Developed by the Oxford COVID-19 Government Response Tracker (OxCGRT).
- Higher values indicate stricter public health measures.

Policy Area	Indicator	Examples
Education	School closures	Fully closed, partially open, or fully open
Workplace	Workplace closures	Recommendations vs. mandatory closures
Public Events	Cancellation of public events	Limits on gatherings, cultural/sporting bans
Public Transport	Restrictions on public transport	Closed, reduced service, or open
Stay-at-home	Stay-at-home requirements	Curfews, shelter-in-place, full lockdowns
Movement Control	Restrictions on internal movement	Intercity or interstate travel bans
International Travel	Restrictions on international travel	Entry bans, quarantine, visa suspensions
Gatherings	Limits on gatherings	Number of people allowed to gather
Public Info Campaigns	Public information campaigns	Government messaging, awareness efforts

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- <https://www.cdc.gov/ncird/whats-new/2024-2025respiratory-disease-season-outlook-october-update.html>
- <https://www.sciencenews.org/article/why-covid-notseasonal>



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**Thank you for your  
attention!**

