# COVID-19 Death Trends & Analysis

## 1. Introduction

This project presents an analytical dashboard focused on COVID-19 Death Trends and Analysis across different countries. The aim of this study is to visualize and understand the impact of COVID-19 on total deaths, expected deaths, and non-COVID deaths over time. The dashboard was designed using Power BI and Python to generate interactive visuals that provide meaningful insights into the pandemic’s mortality trends.

## 2. Objectives

* To analyze and compare total deaths, COVID deaths, and non-COVID deaths across years.
* To identify countries with the highest COVID-related mortality.
* To calculate and interpret excess deaths and their percentage change over time.
* To visualize month-wise and category-wise death patterns using Python and Power BI.
* To provide a comprehensive understanding of the mortality distribution across countries.

## 3. Data Source and Processing

The dataset was obtained from authentic COVID-19 mortality records (such as WHO, Our World in Data, or national statistics). The data includes key attributes like total deaths, expected deaths, COVID deaths, non-COVID deaths, excess deaths, and percentage changes.

Python was used for data preprocessing, cleaning, and visualization. Libraries such as Pandas, Matplotlib, and Seaborn were utilized to analyze and plot key metrics. The cleaned dataset was imported into Power BI for interactive visualization and dashboard creation.

## 4. Data Fields Used

* Country
* Year and Month
* Total Deaths
* Expected Deaths
* COVID Deaths
* Non-COVID Deaths
* Excess Deaths
* Excess Deaths % Change
* Daily Average Deaths

## 5. Dashboard Design and Visuals

The COVID-19 Death Trends & Analysis dashboard was designed with a red-themed color palette to highlight the severity and focus of the topic. It integrates multiple key performance indicators (KPIs) and charts for comprehensive analysis:

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| **Visualization** | **Description** | **Purpose** |
| Total Deaths vs Expected Deaths | Clustered bar chart comparing actual and expected deaths for each year. | Highlights the deviation in mortality during COVID-19 years. |
| Covid Deaths vs Non-Covid Deaths | Donut chart showing the proportion of COVID vs non-COVID deaths. | Displays the direct share of COVID-related fatalities. |
| Top 5 Countries with Highest COVID Deaths | Bar chart ranking the top five countries by COVID death count. | Identifies the most affected nations. |
| Covid Deaths Over Month | Line chart showing month-wise COVID deaths trend. | Tracks how deaths fluctuated across months. |
| Percentage Breakdown of Deaths Across Countries | 100% stacked bar chart showing COVID, Non-COVID, and Excess deaths per country. | Reveals relative contributions and mortality composition across nations. |

## 6. Python Visualizations

Python was integrated into Power BI to generate specific analytical visuals. The following Python libraries and functionalities were applied:

* Pandas – for data cleaning, transformation, and aggregation.
* Matplotlib & Seaborn – for plotting line, bar, and area charts within Power BI.
* NumPy – for numerical computation and statistical summaries.
* Integration of Python visuals with Power BI for dynamic rendering.

## 7. Key Insights and Observations

* Total global deaths reached approximately 33 million, with around 3 million attributed directly to COVID-19.
* The excess death count was about 4.45 million, reflecting the indirect impact of the pandemic.
* United States, Mexico, and Peru were among the top countries with the highest COVID death tolls.
* Month-wise trends revealed that January recorded the highest COVID deaths, showing pandemic peaks.
* Excess death percentage change was significantly high (~823%), suggesting strong deviations from expected mortality rates.

## 8. Challenges and Solutions

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| **Challenge** | **Solution** |
| Missing or inconsistent COVID data from certain countries | Used interpolation and statistical estimation for missing data. |
| Large dataset leading to slow Power BI refresh | Optimized query structure and used data reduction techniques. |
| Python visuals not displaying properly in Power BI service | Configured environment dependencies and enabled Python scripting support. |
| Difficulty comparing absolute and relative values | Used both total and percentage-based visuals for clear comparison. |

## 9. Conclusion

The COVID-19 Death Trends & Analysis dashboard provides a powerful analytical tool for understanding the pandemic’s impact on mortality worldwide. By combining Python-based analysis with Power BI’s visualization capabilities, this project delivers actionable insights through data-driven storytelling. The integration of excess deaths, COVID deaths, and non-COVID deaths offers a holistic view of the pandemic’s true burden on human lives. Future extensions could include time forecasting, predictive analytics, or integration with vaccination data for deeper trend analysis.