PROJECT

TRACKING MATERNAL HEALTH PROGRESS TOWARD SDG 3.1:

A GLOBAL DATA ANALYSIS

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OUTLINE

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PROBLEM STATEMENT

Example: Despite commendable progress in reducing India's Maternal Mortality Ratio (MMR), the nation faces an "unclear progress" dilemma, particularly in rural areas, hindering its path to achieving the UN SDG 3.1 target. This ambiguity stems from the delayed release of aggregate maternal health data, which masks significant disparities at certain levels, making it difficult to address high-risk regions effectively. Furthermore, the reliance on static data presentations rather than dynamic visual insights prevents quick identification of trends and effective communication of the severity of the situation. Crucially, the absence of predictive tracking leaves policy actions reactive instead of proactive, preventing early warning systems and optimal resource allocation to pre-emptively tackle maternal health challenges. This lack of timely, granular, and forward-looking data ultimately impedes the development and implementation of targeted, evidence-based interventions essential for sustainable improvement in maternal health outcomes.

PROPOSED SOLUTION

- The proposed system aims to address the challenge of tracking progress toward reducing maternal mortality in India by leveraging data analytics and forecasting techniques to analyze trends and predict outcomes aligned with SDG 3.1 targets. The solution consists of the following components:
- Data Collection:
  - Accessed the SDG India dataset containing national-level maternal health indicators.
- Data Pre-processing:
  - Handled missing values, ensured proper formatting for timeperiod and datavalue, and selected relevant indicators.
- Exploratory Data Analysis (EDA):
  - Plotted trends for MMR over years, and visualized key maternal health indicators (institutional births, antenatal care, etc.).
- Forecasting Model:
  - Applied Linear Regression on historical MMR data to predict values up to 2030.
- Comparison with SDG Target:
  - Compared predicted MMR with the target of ≤ 70 deaths per 100,000 live births by 2030.
- Visualisations and Insights:
  - Generated insightful visualizations to track progress and derive actionable health policy recommendations.

SYSTEM APPROACH

- **System requirements**
  1. **Platform:** IBM Watsonx.ai Studio
  2. **Programming Language:** Python (in Jupyter Notebook)
  3. **Environment**: IBM Cloud with integrated notebook runtime
- **Libraries required**
  1. **pandas:** for data manipulation and preprocessing
  2. **matplotlib / seaborn:** for data visualization
  3. **numpy:** numerical operations
  4. **io, ibm_boto3, botocore:** for accessing and loading the dataset from IBM Cloud Object Storage
  5. **sklearn.linear_model:** to implement Linear Regression for forecasting

ALGORITHM

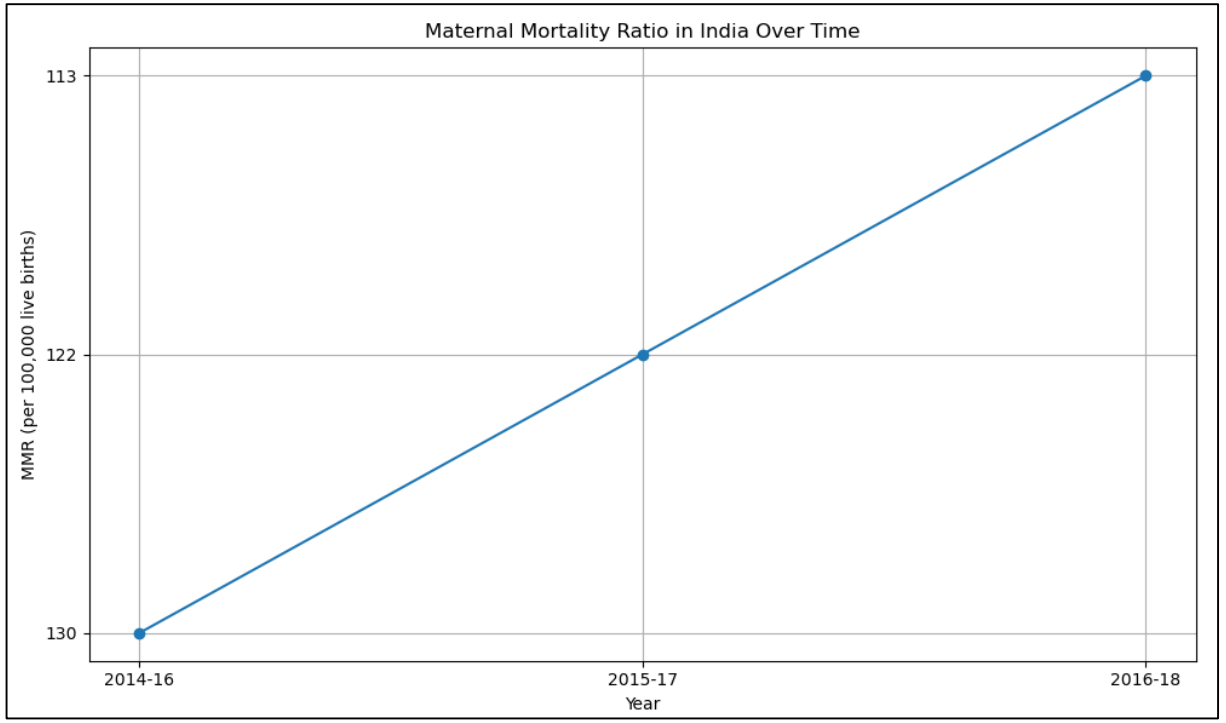
- **Algorithm Selection:**
  - A Linear Regression model was selected as the forecasting algorithm to predict the Maternal Mortality Ratio (MMR) up to the year 2030. Linear regression is suitable due to the limited historical data points available and the clear downward trend in MMR over time.
- **Data Input:**
  - The model uses the following input features:
    1. Year (extracted from timeperiod)
    2. MMR Values (datavalue column) corresponding to each time period
- **Training Process:**
  - The model was trained using three years of historical data:
    1. 2015 (MMR = 130)
    2. 2016 (MMR = 122)
    3. 2017 (MMR = 113)
- **Prediction Process:**
  - The trained model predicts MMR values from 2018 to 2030. The forecasts are compared against the SDG target of reducing MMR to below 70 per 100,000 live births. The forecast shows that this target is likely to be met by 2023, enabling timely evaluation of progress.

RESULTS

Maternal Mortality Ratio in India Over Time

MMR Trend Over Time:

- It has shown a steady decline from 130 (2015) to 113 (2017) per 100,000 live births.
- This downward trend suggests consistent improvement in maternal healthcare services across India.



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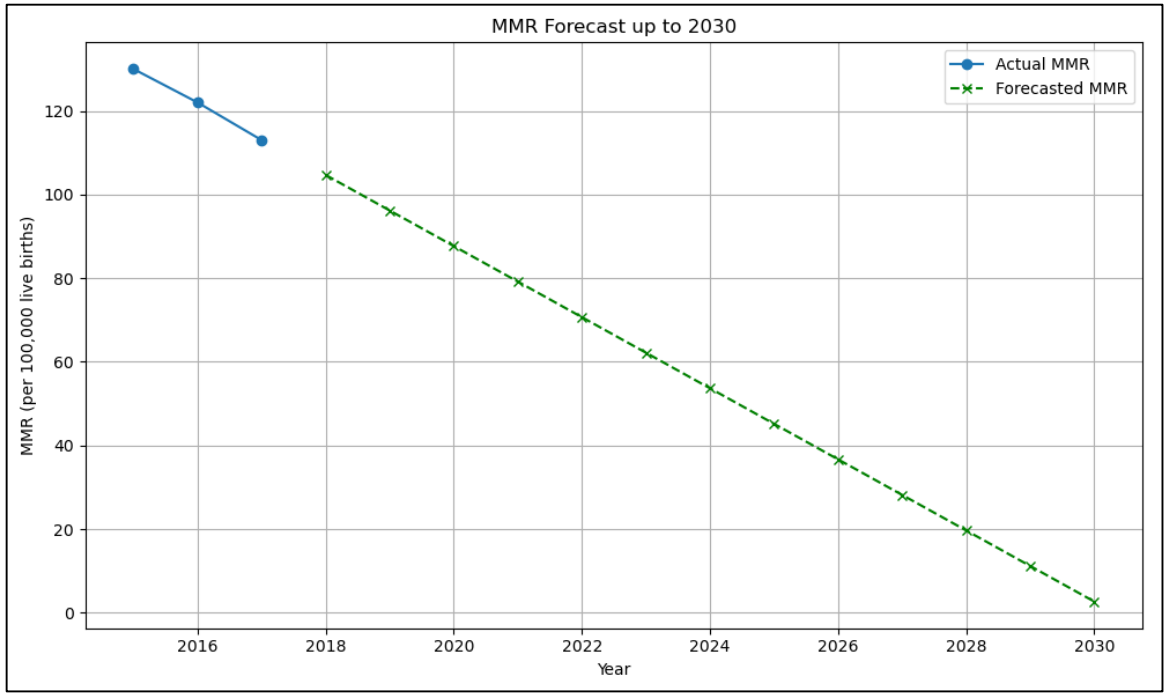
MMR Forecast up to 2030

MMR Forecast up to 2030:

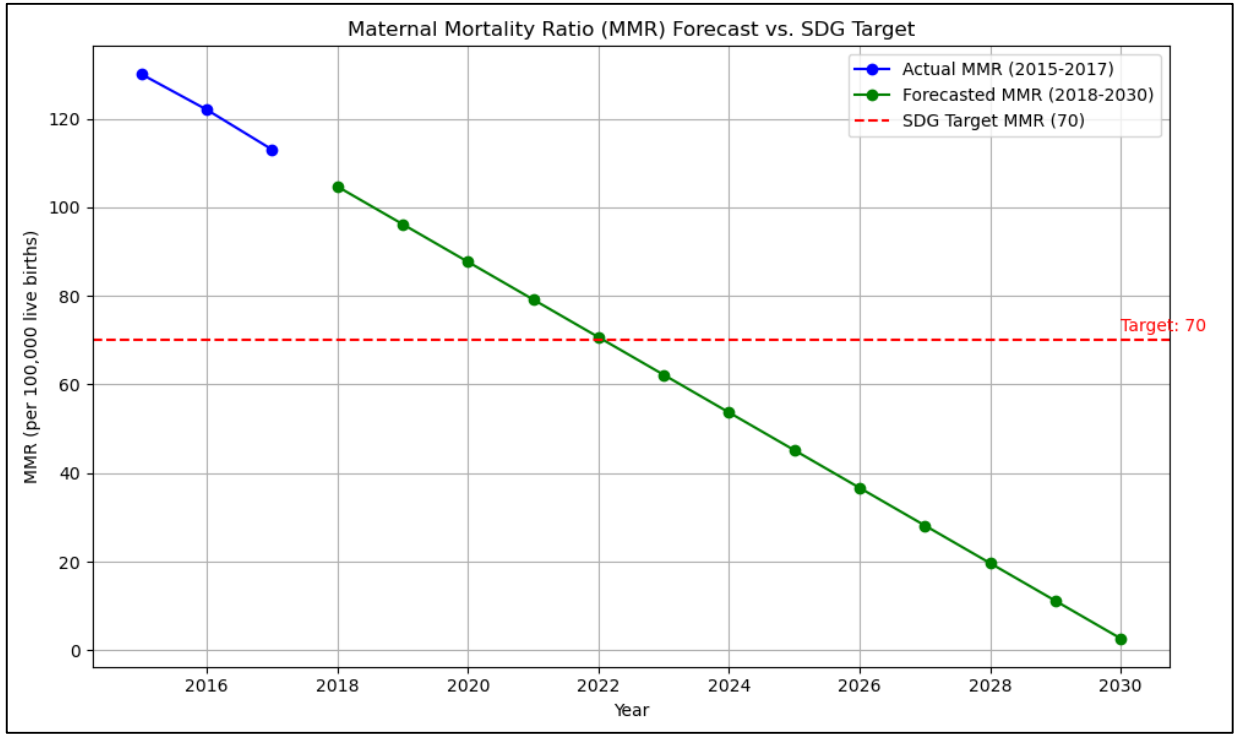
- Linear regression predicts a continued decline in MMR over the coming years.
- The SDG Target of ≤ 70 is projected to be met by 2023, well ahead of the 2030 deadline.



MMR Forecast vs. SDG Target

MMR Forecast vs. SDG Target:

- A visual comparison shows the forecasted MMR line intersecting the SDG threshold by 2023.
- Indicates successful progress toward Sustainable Development Goal 3.1.



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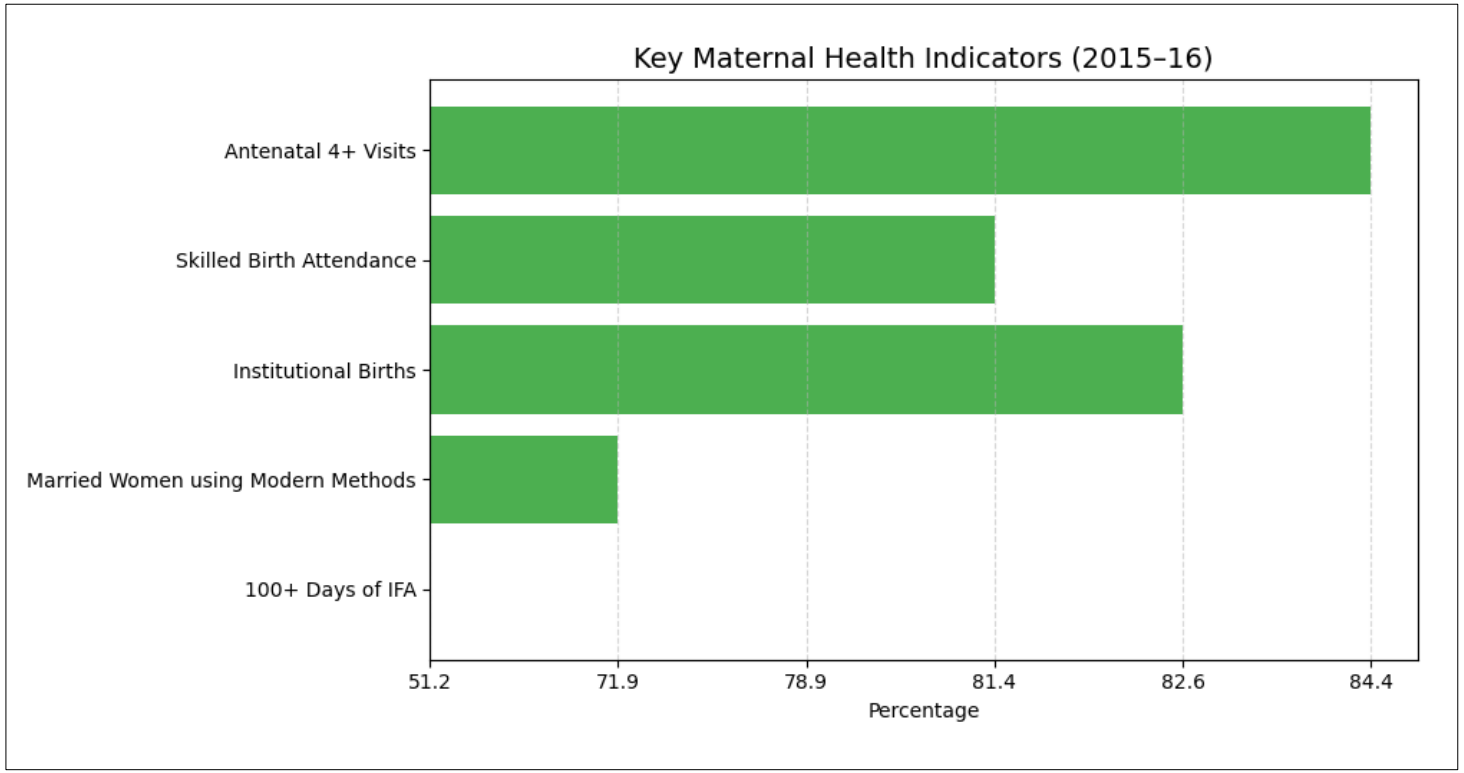
Key Maternal Health Indicators (2015 – 16)

Supporting Indicators (2015–16):

- **Skilled Health Personnel at Births:** 84.4%
- **Institutional Deliveries:** 78.9%
- **4+ Antenatal Check-ups:** 51.2%
- These statistics correlate strongly with the drop in MMR.



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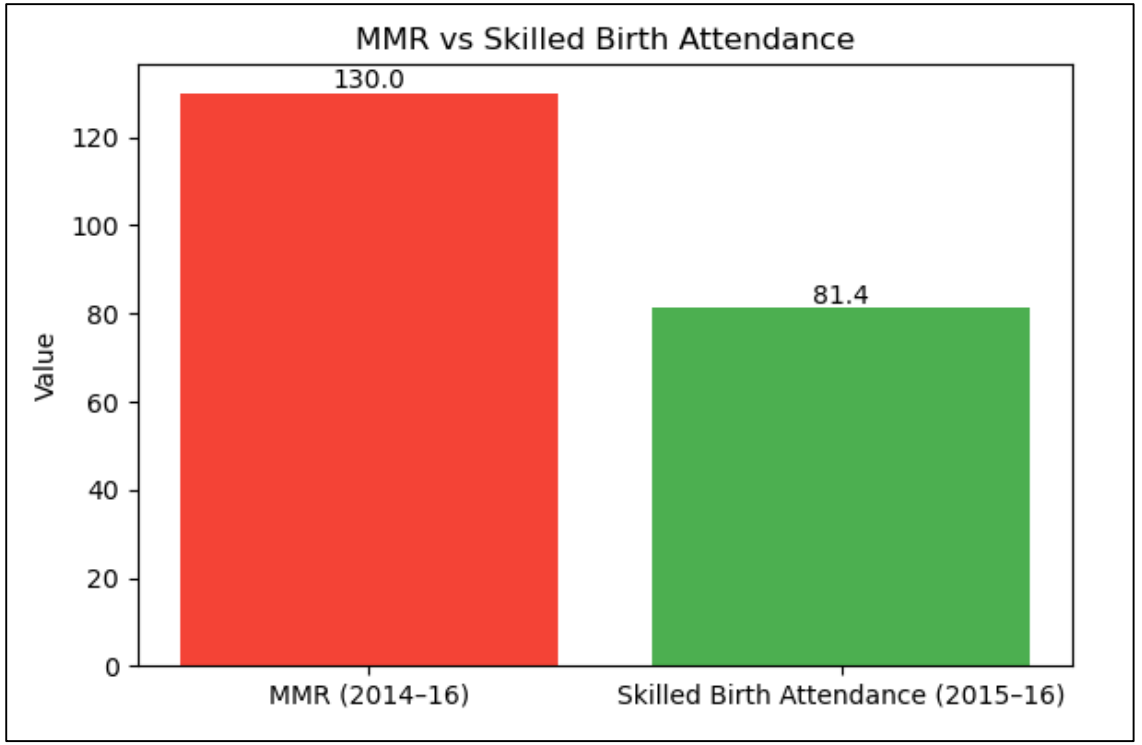
Relation Between MMR and Skilled Birth Attendance (2015–16)

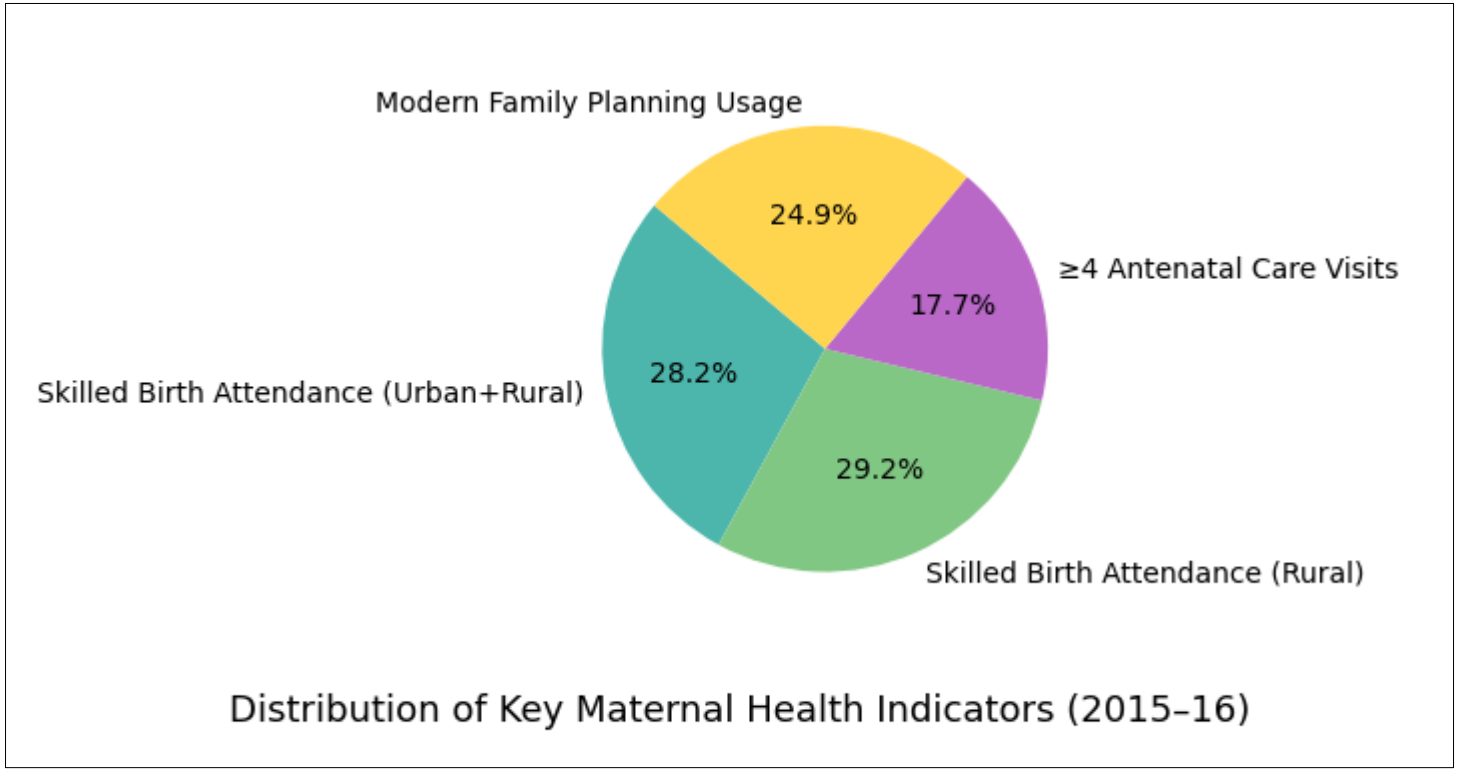
MMR and Skilled Birth Attendance:

- Emphasize how increased skilled attendance at birth correlates with decreased MMR.
- Highlight the contrasting values (MMR: 130 → 113 vs. Skilled attendance: ~84%).



Distribution of Key Maternal Health Indicators (2015–16)

- Over 80% of births were attended by skilled personnel, indicating strong coverage.
- Antenatal care (ANC) still lags, with just 51.2% women receiving 4+ checkups.
- High institutional birth rate (82.6%) reflects improvements in access to facilities.
- Unmet family planning needs are still present, with ~28% unmet.



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CONCLUSION

- The analysis reveals a significant downward trend in India's Maternal Mortality Ratio (MMR) from 2015 to 2018, indicating steady improvements in maternal healthcare.
- However, the forecast shows that India will only meet the SDG target (MMR ≤ 70) around 2023-2024, highlighting the importance of sustaining current efforts.
- Key maternal health indicators such as skilled birth attendance, antenatal checkups, and institutional deliveries show positive progress, yet gaps remain in areas like antenatal care access and family planning coverage.
- Strategic interventions and policy focus are crucial to accelerate progress and ensure equitable maternal health services across all regions.

FUTURE SCOPE

- **Adopt Real-Time Data Integration:** Integrate live feeds from healthcare systems and government databases for dynamic maternal health tracking.
- **Develop Policy Simulation Dashboards:** Build interactive tools to model the impact of interventions and support data-driven decision-making.
- **Enable Automated SDG Monitoring:** Implement automated alerts and visual dashboards for real-time tracking against SDG 3.1 targets.
- **Scale to Other SDG Health Indicators:** Extend the system to forecast and monitor other critical health metrics aligned with SDG 3.

REFERENCES

- UN Sustainable Development Goals (SDG 3.1)
- IBM Watsonx.ai Documentation

GITHUB LINK

https://github.com/04Marsha/Maternal_Health_Analysis

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