**Title:**

Maternal Health Risk Assessment

**Purpose:**

This project was done to provide healthcare professionals with a comprehensive tool to identify and manage health risks among pregnant individuals effectively.

**Project Background**

The SAA partnered with the Women's Rights Advocacy (WRA) NGO to drive impactful change in maternal healthcare through data-driven projects. As part of this collaboration, SAA was tasked with providing data-driven insights and resolving critical data-related challenges to enhance healthcare strategies. This project focused on analyzing vital health indicators—such as blood pressure, blood sugar, and other key metrics—for early-stage mothers (1–2 weeks postpartum) across a range of age groups, based on these health indicators, the column "Risk Level" assigns a mortality risk level—categorized as Low, Medium, or High—for each individual . By assessing these health indicators, the project aimed to deliver insights that could facilitate proactive and informed decision-making in maternal healthcare.

The data for this analysis was gathered meticulously from the Pediatrics departments of five underdeveloped hospitals in Southern Asia. These hospitals served diverse communities and were selected to provide a comprehensive view of maternal health trends across varying socioeconomic backgrounds. The SAA team collaborated closely with stakeholders and pediatric staff at each hospital, ensuring that raw health data was accurately collected and ethically managed. This close partnership enabled the SAA team to produce high-quality data insights while respecting patient confidentiality and adhering to healthcare standards.

Given the hospitals' limited access to advanced technological tools, SAA developed a custom dashboard in Microsoft Excel—a platform chosen for its ease of use and compatibility with the hospitals' existing infrastructure. The dashboard was designed to be intuitive and visually accessible, making it an ideal tool for healthcare professionals with varying levels of data expertise. This minimalistic yet powerful dashboard has since become a strategic asset, empowering healthcare providers to make data-driven decisions, enhance patient monitoring, and implement timely interventions for at-risk maternal populations.

**Objective**

The objective of this project was to create a robust, accessible dashboard that empowers healthcare professionals to make data-driven decisions for improving maternal health outcomes. By analyzing key health indicators—such as blood pressure and blood sugar levels—in early-stage mothers (1–2 weeks postpartum) across various age groups, the dashboard provides real-time insights crucial for timely intervention. It also enables trend analysis across different demographic groups, helping to identify patterns that may require targeted care. Moreover, the project aimed to bridge technological gaps by designing a user-friendly, Excel-based tool that aligns with the existing capabilities of under-resourced hospitals. Through these efforts, the dashboard strengthens collaborative healthcare efforts by presenting data in an interpretable format that fosters communication between pediatric staff and stakeholders, ultimately enhancing patient care and monitoring.

**Data Collection and Preparation**

The data for this analysis was gathered from the databases of five hospitals, focusing specifically on key health metrics of early-stage mothers. This raw data was initially exported in CSV format, allowing for in-depth exploration and analysis to uncover valuable insights. The dataset is structured to capture essential health indicators, including the age of each mother, with a range from 10 to 70 years. Key health metrics encompass systolic and diastolic blood pressure, which span from 70 to 160 mmHg and 49 to 100 mmHg, respectively. Blood sugar levels (BS) range from 6 to 19 mmol/L, while body temperature values lie between 98°F and 103°F. Additionally, heart rate data is recorded, covering values from 7 to 90 bpm. Each entry is also classified under a "Mortality Risk Level" indicator, which categorizes individuals into low, mid, or high-risk groups based on these metrics.

To ensure data integrity and reliability, several preprocessing steps were undertaken. These steps included filtering outliers, handling any missing values, and introducing a new column to categorize patients by "Age Group," with categories such as under 18, 18–24, 24–34, 34–44, 44–54, 54–64, and 65 and above. In Excel, conditional formatting was applied to highlight discrepancies, and necessary calculations were performed to derive more comprehensive insights. This transformation ensured a cleaner dataset and helped facilitate analysis.

To support ongoing analysis, CSV files can be converted into Excel format, making it easier for healthcare providers to continuously monitor and assess the health metrics of early-stage mothers. This structured approach to data refresh and updates is crucial for maintaining accurate and up-to-date information on this population, allowing for effective tracking and timely interventions.

**Dashboard Design and Layout**

KPIs and Metrics

* Health Metric Averages: Average Systolic BP, Diastolic BP, and Blood Sugar across the population. These averages provide a general benchmark and allow for comparisons over time or across different demographics.
* Age Group Risk Distribution:The distribution of risk levels (high, mid, low) across age groups is a key KPI, as it identifies the segments most at risk, which can help in targeting interventions or preventive measures.
* Average Vital Signs by Age Group: Average Heart Rate, Systolic BP, Diastolic BP, Blood Sugar, and Body Temperature by age group are important indicators for assessing the health status of different age demographics. This KPI allows you to track specific metric trends in each group.
* Total Cases by Age Group: This KPI helps understand the population distribution and ensures that resources are allocated appropriately. It can also reveal age groups that might need focused health programs.

Charts and Graphs:

* Risk Level Distribution by Age Group: A pivot table and bar chart visualize the distribution of "Risk Levels" (low, mid, high) across various age groups. Each risk level is color-coded—green for low, yellow for moderate, and red for high—to enhance quick risk identification. The chart is designed to be interactive, allowing users to filter by specific age groups or risk levels, offering an in-depth view of risk patterns among different demographic segments.
* Trend Line: Average Vital Signs by Age Group: A combination trend line and pivot table display average vital signs—such as heart rate, blood pressure, and blood sugar—grouped by age category. This chart highlights how these metrics change across age groups, making it easier to identify trends that might correlate with increased health risks. The trend lines provide a visual representation of gradual increases or decreases, which helps in understanding overall health patterns by age.
* Correlation Matrix Heatmap: A correlation matrix represented as a heatmap shows relationships between key health metrics, calculated using the Excel formula =CORREL(range 1, range 2). Color-coding ranges from green (indicating a strong positive correlation) to yellow (weak correlation) and red (strong negative correlation). This visualization helps identify metrics that move in tandem or inversely, offering insights into potential cause-and-effect relationships or risk factors among health indicators.
* Cluster Chart: Heart Rate vs. Blood Pressure (Systolic and Diastolic): A cluster chart plots heart rate against systolic and diastolic blood pressure, with systolic values on the primary Y-axis and diastolic values on the secondary Y-axis. Each data point represents an individual entry, highlighting variations in blood pressure and heart rate within the dataset. This three-dimensional approach allows users to observe clustering patterns, identifying cases with abnormal vital signs or outliers that might require immediate attention.
* Donut Chart: Age Group Distribution of Cases: A donut chart illustrates the percentage of total cases within each age group, with each segment assigned a unique color for easy differentiation. This chart provides a quick visual overview of the age distribution within the dataset, allowing users to understand which age groups have higher case concentrations and to assess if age-targeted interventions may be warranted.

Design Principles:

The design for this health-focused dashboard centers on an approachable pink background with contrasting colors in charts and visual elements, creating a warm theme well-suited for maternal health. Strategic color coding differentiates risk levels—red for high risk, yellow for mid-risk, and green for low risk—enabling users to interpret risk at a glance and enhancing readability. Key elements follow a visual hierarchy, with the Age Group Summary chart positioned in the top left, guiding users to start with demographic distribution before exploring deeper insights like the correlation heatmap at the bottom, which provides granular, optional analysis. Conditional formatting and color-coded distinctions, such as risk levels and correlation values, emphasize critical data points without excessive text, aligning with the Gestalt Principle of Similarity, which uses similar colors to create recognizable patterns across related data. This organization leverages the F-pattern principle, directing attention from crucial to supplementary information seamlessly.

**Technical Implementation**

The technical implementation of the Health Risk Assessment Dashboard involves various formulas and calculations designed to analyze and visualize health data effectively. Key metrics are calculated using nested IF statements to categorize individuals into specific age groups, enabling targeted analysis.

* Age Group Categorization: To categorize individuals into age groups, the formula used is:

=IF(A16<18, "Under 18", IF(A16<=24, "18-24", IF(A16<=34, "24-34", IF(A16<=44, "34-44", IF(A16<=54, "44-54", IF(A16<=64, "54-64", "Above 65"))))))

This nested IF statement evaluates the age value in cell A16 and assigns a corresponding age group label. This systematic approach helps in segmenting data for analysis and visualization.

* Correlation Calculation: The correlation between two sets of data is calculated using the formula:

=CORREL(range1, range2)

This function computes the correlation coefficient, which indicates the strength and direction of a linear relationship between the two datasets, crucial for identifying relationships between various health metrics.

* Counting Age Group Cases: To determine the total cases for each age group, a donut chart was created using the formula:

=COUNTIF(range of age group column, "desired\_age\_name")

This function counts the number of entries that fall into the specified age group, allowing for a visual representation of the distribution within the donut chart.

* Averaging Vital Signs: The average for critical health indicators such as systolic blood pressure, diastolic blood pressure, and blood sugar is calculated using:

=AVERAGE(range of desired column)

This straightforward formula computes the mean value, providing a snapshot of average health metrics within the dataset.

Pivot tables enhance the dashboard's analytical capabilities by summarizing data, such as displaying the distribution of risk levels across age groups and visualizing average vital signs with trend lines. Conditional formatting, particularly in the correlation matrix, employs a heatmap to illustrate the strength of relationships between metrics, enhancing user interpretation. Additionally, data validation rules ensure data integrity by restricting entries to specific formats and ranges, contributing to the overall accuracy and reliability of the dashboard. This comprehensive approach facilitates informed, data-driven decision-making in healthcare.

**Insights**

The data reveals a concerning statistic of 193 girls under the age of 18 facing pregnancies in underdeveloped regions, highlighting a critical public health issue. This alarming figure underscores the vulnerability of young girls in these areas, where access to education, healthcare, and family planning resources may be limited. Additionally, the distribution of risk levels among these girls is troubling, with 272 categorized as high risk, 336 as mid risk, and 406 as low risk. These numbers reflect the urgent need for targeted interventions and support systems to address the factors contributing to early pregnancies, including socioeconomic challenges, lack of reproductive health education, and inadequate healthcare access. By addressing these issues, we can work towards improving the health and future prospects of young girls in these vulnerable communities.

The average systolic blood pressure of 125 mmHg indicates that the population analyzed falls within the borderline high range, suggesting a potential risk for hypertension if these values are not managed properly. Elevated systolic readings can be indicative of increased pressure in the arteries, often linked to lifestyle factors such as diet, physical activity, and stress levels, and may require further investigation or intervention to mitigate long-term health risks. Additionally, the average diastolic blood pressure of 72.5 mmHg is within the normal range, reflecting adequate vascular health during the heart's relaxation phase. This balance between systolic and diastolic pressures suggests that while there may be concerns regarding systolic readings, the overall diastolic pressure remains stable, indicating effective heart and vascular function. Moreover, the average blood sugar level of 10.5 mmol/L suggests a concerning trend toward hyperglycemia, as values above the normal fasting range could indicate prediabetes or diabetes mellitus. This elevated blood sugar level underscores the need for proactive lifestyle changes or medical interventions to prevent the progression to more severe health conditions, emphasizing the importance of monitoring and managing these vital health metrics collectively to enhance overall well-being.

The bar chart illustrates that the lowest risk levels are found in the age group of 18-24, while the highest risk levels are observed in the 34-44 age group. This trend suggests that younger individuals may have better health outcomes or lower prevalence of health-related issues, potentially due to factors such as higher physical activity levels, better metabolism, and fewer chronic health conditions. In contrast, the elevated risk levels among individuals aged 34-44 may indicate the onset of age-related health challenges, including increased susceptibility to chronic diseases, lifestyle-related factors, or the cumulative effects of long-term health behaviors. This insight highlights the importance of targeted health interventions and preventative measures for the middle-aged population to mitigate risks and promote healthier outcomes.

The trend line chart reveals that the health metrics, including heart rate, blood pressure, and blood sugar levels, predominantly spiked within the age range of 44 to 54 years. This age group exhibited significant fluctuations, indicating a heightened vulnerability to health issues during this critical period. Conversely, metrics for younger and older age groups remained relatively stable, suggesting that individuals in the 44-54 age range may be experiencing increased health risks or changes in lifestyle factors that contribute to these variances. This insight underscores the importance of targeted health interventions and monitoring strategies for this demographic to mitigate potential health challenges.

The scatter plot reveals distinct patterns in the relationships among systolic blood pressure, diastolic blood pressure, and heart rate, potentially offering insights into cardiovascular health. Most systolic blood pressure values cluster between 120- and 160-mm Hg, while diastolic values primarily range from 60 to 90 mm Hg. This clustering suggests a prevalence of borderline to moderately high blood pressure values among the population, indicating that a significant portion may be at risk of hypertension or related conditions. The dispersion of systolic and diastolic values in tight bands implies some consistency in blood pressure, with fewer extreme outliers. Interestingly, the heart rate data points are widely scattered, including values beyond 200 bpm, which are typically abnormal and may indicate instances of tachycardia or potential data entry errors. This broad spread in heart rates, combined with consistent blood pressure readings, may suggest variability in cardiovascular response among individuals.

The correlation analysis reveals notable relationships among key health metrics, particularly highlighting a strong positive correlation (0.79) between Systolic Blood Pressure (SystolicBP) and Diastolic Blood Pressure (DiastolicBP). This finding suggests that as systolic pressure increases, diastolic pressure tends to rise correspondingly, which is consistent with typical blood pressure behavior. Additionally, both SystolicBP and DiastolicBP show moderate positive correlations with Blood Sugar levels (0.43 and 0.42, respectively), indicating a potential link between higher blood sugar and increased blood pressure. Conversely, the analysis uncovers weak correlations between SystolicBP and Body Temperature (-0.29) and very weak associations with Heart Rate (0.10), suggesting that these variables may not significantly impact blood pressure or blood sugar in this dataset. Overall, the results emphasize the importance of monitoring SystolicBP and DiastolicBP alongside Blood Sugar levels, particularly for individuals with elevated cardiovascular risks, to better manage their health outcomes.

**Conclusion**

The pediatric healthcare dashboard stands as a transformative tool designed to enhance the operational efficiency and effectiveness of NGOs in managing pediatric services. Its primary purpose is to provide a comprehensive overview of key metrics and data trends related to pediatric care in the selected hospitals, enabling stakeholders to make informed decisions and allocate resources strategically. By integrating various data sources and visualizing critical information, the dashboard empowers NGOs to identify areas of need, track performance, and ultimately improve health outcomes for children.

This dashboard has been instrumental in facilitating the successful development of pediatric wings in multiple hospitals. By offering actionable insights into the urgent needs of the pediatric population, it has enabled the NGO to effectively advocate for and secure the necessary funding, partnerships, and support for these crucial expansions. The establishment of dedicated pediatric facilities has not only improved access to specialized care but has also enhanced the quality of health services provided to countless children and their families. As the NGO continues to leverage this dashboard, it is committed to refining its strategies, ensuring transparency and accountability, and fostering a healthier future for the next generation.

**Acknowledgments**

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A cartoon of a fortune teller

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