HEALTHCARE ANALYTICS

PROJECT TITLE: CHRONIC DISEASE MANAGEMENT AND EARLY INTERVENTION SYSTEMS

Data-Driven Chronic Disease Management in Rural Africa

A Pilot Program to Combat Hypertension

In the Africa, **Chronic Disease Management and Early Intervention Systems** are emerging but not yet widespread. While the foundational concept is established globally, its implementation across African nations varies due to diverse healthcare infrastructures, resource availability, and policy priorities.

For Examples:

1. **South Africa**: The country has initiated the **Integrated Chronic Disease Management Model**, aiming to enhance the quality of care for chronic disease patients. This model focuses on integrating services for various chronic conditions to improve patient outcomes. https://ijic.org/articles/10.5334/
2. **Ghana and Cameroon**: Both nations have undertaken efforts to develop effective chronic disease interventions. In Ghana, the National Health Insurance Scheme covers some chronic diseases, and there is a culture of patient advocacy and media involvement in chronic disease education. Cameroon has policies on diabetes and hypertension, established clinics, and trained health workers, though community and media engagement are limited. However, systematic evaluations of these interventions' impact on health outcomes and cost-effectiveness are lacking. https://globalizationandhealth.biomedcentral.com/articles/10.1186/1744-8603-6-6
3. In **Nigeria**, the implementation of **Chronic Disease Management and Early Intervention Systems** is still in its nascent stages. The healthcare system has traditionally focused on acute care, and adapting to the rising prevalence of chronic diseases presents several challenges, among others is: **Healthcare Providers' Perspectives**: A study involving Nigerian healthcare providers highlighted the struggle to transition from an acute-care model to one that accommodates chronic disease management. Providers emphasized the need for self-management support and patient education to effectively manage chronic conditions. While the concept of Chronic Disease Management and Early Intervention Systems is recognized in Nigeria, widespread implementation faces challenges related to healthcare infrastructure, policy alignment, and economic constraints. https://pmc.ncbi.nlm.nih.gov/articles/PMC9827480/

Context:

Most African countries are experiencing a rise in non-communicable diseases (NCDs) like hypertension and diabetes due to changing lifestyles, urbanization, and limited access to preventive healthcare. Rural areas, in particular, face unique challenges, including limited access to healthcare facilities, a shortage of skilled professionals, and a lack of health awareness of chronic disease risks among communities.

Objective:

- To develop and pilot a **Chronic Disease Management and Early Intervention System** that identifies high-risk individuals, tracks disease progression, and recommends interventions in underserved rural communities.
- To analyze and give gain insights from and answer the below KPIs.

This Project focuses on **Hypertension**, the higher prevalence of hypertension translates to a greater demand on healthcare services for its management and treatment. Hypertension often requires continuous monitoring, medication, and lifestyle modifications, leading to increased healthcare utilization.

Methodology:

1. **Data Collection**:
    - Utilize CHWs and clinics to collect baseline health data and conduct screenings in rural areas.
    - Deploy mobile health tools for self-reported data collection in areas with poor clinic coverage.
2. **Data Cleaning and Preprocessing**:
    - Address missing values, outliers (e.g., unrealistic BMI), and inconsistencies in health records.
3. **Risk Profiling**:
    - Analyze clinical and lifestyle data to identify high-risk groups (e.g., individuals with high BMI, sedentary lifestyles, or poor diets).
4. **Predictive Modeling**:
    - Develop machine learning models (e.g., Decision Trees, Logistic Regression) to predict disease progression and recommend interventions.
5. **Intervention Framework**:
    - Provide personalized recommendations, such as dietary changes, exercise plans, and referrals to clinics.
    - Send SMS alerts for check-ups and medication adherence in local languages.
6. **Dashboard Development**:

- Build an interactive Power BI dashboard to visualize disease prevalence, risk distributions, and the effectiveness of interventions.

Data Feature Dictionary

1. Health Conditions and Diseases

- **Stroke**: Whether the individual has had a stroke (binary outcome).
- **Diabetic**: Whether the individual has diabetes (binary outcome).
- **Asthma**: Whether the individual has asthma (binary outcome).
- **KidneyDisease**: Whether the individual has kidney disease (binary outcome).
- **SkinCancer**: Whether the individual has skin cancer (binary outcome).

2. Physical Health Measures

- **BMI**: Body Mass Index, a continuous variable reflecting an individual's weight relative to height.
- **PhysicalHealth**: A measure of physical health days in the last 30 days (continuous variable).
- **MentalHealth**: A measure of mental health days in the last 30 days (continuous variable).
- **SleepTime**: The average number of hours of sleep per day (continuous variable).

3. Behavioral and Lifestyle Factors

- **Smoking**: Whether the individual smokes (binary outcome).
- **AlcoholDrinking**: Whether the individual drinks alcohol (binary outcome).
- **PhysicalActivity**: Physical activity level (e.g., sedentary, moderate, active, categorical).

4. Demographic Information

- **Sex**: Gender of the individual (categorical: Male, Female).
- **AgeCategory**: Age group (e.g., 18-24, 25-34, etc., categorical).
- **Tribe**: Tribal group of the individual (categorical).
- **GenHealth**: General health condition (e.g., Excellent, Good, Fair, Poor, categorical).

5. Accessibility and Mobility

- **DiffWalking**: Whether the individual has difficulty walking (binary outcome).

6. Target Feature:

- **HeartDisease (Hypertension):** Whether the individual has heart disease (binary outcome).

KPIs:

1. Health Condition and Disease Prevalence KPIs

- Heart Disease Prevalence Rate
- Stroke Prevalence Rate
- Diabetes Prevalence Rate
- Asthma Prevalence Rate
- Kidney Disease Prevalence Rate
- Skin Cancer Prevalence Rate

2. Physical and Mental Health KPIs

- Average BMI
- Percentage of Obese Individuals
- Average Physical Health Days (Last 30 Days)
- Percentage of Individuals with Poor Physical Health
- Average Mental Health Days (Last 30 Days)
- Percentage of Individuals with Poor Mental Health
- Average Sleep Hours per Day
- Percentage of Individuals with Sleep Deprivation

3. Behavioral and Lifestyle KPIs

- Smoking Rate
- Alcohol Consumption Rate
- Percentage of Physically Active Individuals

4. Demographic and Accessibility KPIs

- Heart Disease Prevalence by Age Group
- Heart Disease Prevalence by Gender
- Heart Disease Prevalence by Tribe
- General Health Distribution
- Percentage of Individuals with Difficulty Walking

5. Risk and Correlation KPIs

- Heart Disease Risk Among Smokers
- Heart Disease Risk Among Obese Individuals
- Heart Disease Risk Among Individuals with Diabetes
- Heart Disease Risk Among Individuals with Poor General Health