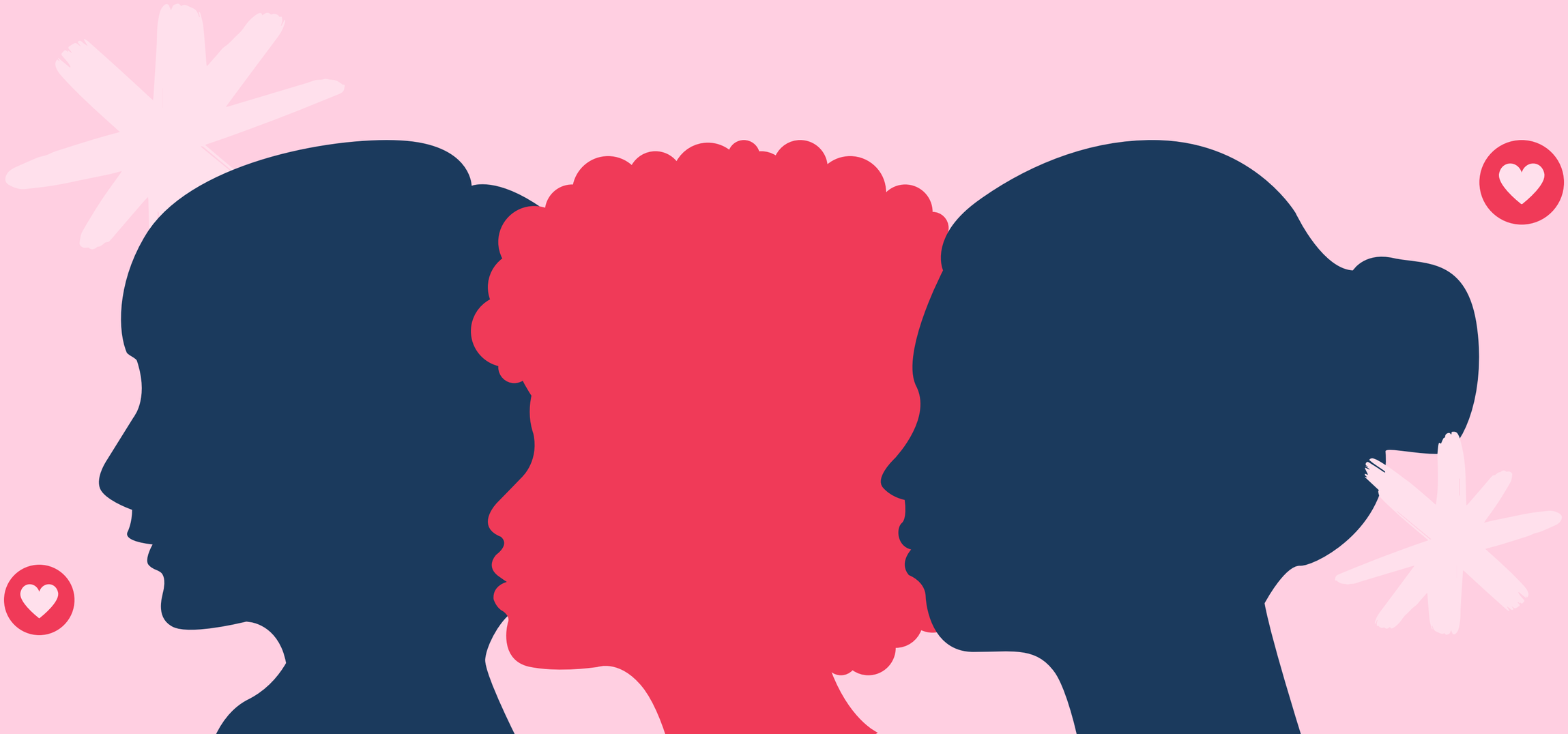
NARI YUKTI - AN APP FOR WOMEN

PERSONALIZING WOMEN'S HEALTHCARE



HEALTHCARE GAPS FOR WOMEN

"ONE-SIZE-FITS-ALL" FAILS; DATA-DRIVEN, PERSONALIZED CARE IS ESSENTIAL FOR WOMEN'S WELL-BEING.

TAILORED CARE IMPROVES OUTCOMES BY ADDRESSING INDIVIDUAL NEEDS AND EMPOWERING WOMEN.

FOR A LONG TIME, MEDICAL RESEARCH AND CLINICAL TRIALS PRIMARILY FOCUSED ON MALE SUBJECTS, LEADING TO A LACK OF UNDERSTANDING OF HOW DISEASES MANIFEST AND PROGRESS DIFFERENTLY IN WOMEN.

WOMEN'S HEALTH OFTEN OVERLOOKED, LEADING TO MISDIAGNOSIS AND DISPARITIES IN CRITICAL AREAS.

PROBLEM STATEMENT

Women have diverse health needs that are often not adequately addressed by generic healthcare approaches. This lack of personalization can lead to suboptimal health outcomes and limited access to relevant services.

Develop a **data-driven solution** using Hierarchical Clustering and Gaussian Mixture Models to segment women based on their health needs and preferences, aiming to create **personalized healthcare recommendations**.

CHALLENGES IN WOMEN'S HEALTHCARE

Key Challenges

Diversity of needs

- Life stage variations: pregnancy, postpartum, menopause, etc.
- Unique health requirements across different age groups.

Chronic conditions

- Conditions such as osteoporosis, breast cancer, and autoimmune diseases disproportionately affect women.
- Varied symptom presentation compared to men.

Healthcare access

- Socioeconomic disparities affecting treatment availability.
- Cultural stigmas and language barriers.
- Geographical limitations in rural areas.

Addressing these challenges requires a holistic, personalized, and equitable approach to women's healthcare.

PROPOSED DATA-DRIVEN SOLUTION

Objective:

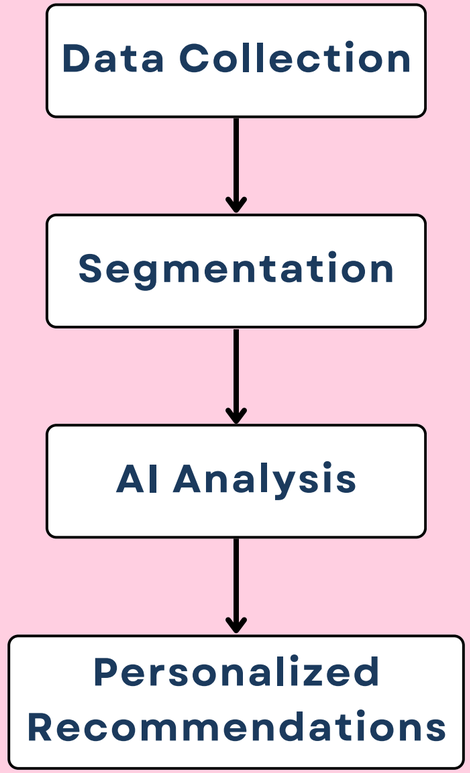
- Segment Women by Health Needs & Preferences

Goal:

- App that provides Personalized Healthcare Recommendations
  - Tailor healthcare plans, treatments, and wellness advice to individual needs.
  - Utilize data from wearables, health history, and behavioral patterns to create more precise and actionable insights.

Approach:

- Data Collection: Gather diverse data points (biological, behavioral, environmental).
- AI/ML Algorithms: Apply machine learning to detect patterns and predict future health needs.
- Real-Time Feedback: Provide continuous monitoring and personalized adjustments to care plans.



DATA SOURCES

- **Wearable device data** (activity, sleep, vitals)
  - Data collected from wearable devices such as smartwatches, fitness trackers, and continuous glucose monitors.
- **Public health datasets** (demographics, disease prevalence)
  - Data collected by government agencies and public health organizations.
- **Genetic testing results**
  - Data generated from analyzing an individual's DNA.

The Critical Importance of Diverse Data

- Ensures representation and equity in health research.
- Addresses health disparities across populations.
- Improves the accuracy and generalizability of findings.
- Mitigates algorithm bias.
- Supports personalized medicine for all.

Prioritize diverse data collection for inclusive health solutions.

FEATURE ENGINEERING

Creating Meaningful Variables

When feature engineering a healthcare dataset specifically for women, it's crucial to consider factors that uniquely impact their health. Here's a breakdown of key feature categories

- **Reproductive Health:**
  - Menstrual History
  - Obstetric History
  - Gynecological History
- **Hormonal Factors:**
  - Hormone levels
  - Hormone replacement therapy (HRT) usage
  - Use of hormonal contraceptives
- **Lifestyle Factors**
- **Demographic and Socioeconomic Factors**
- **Chronic Conditions**
- **Genetic Predisposition:**
  - Family history of relevant conditions
  - Genetic testing results

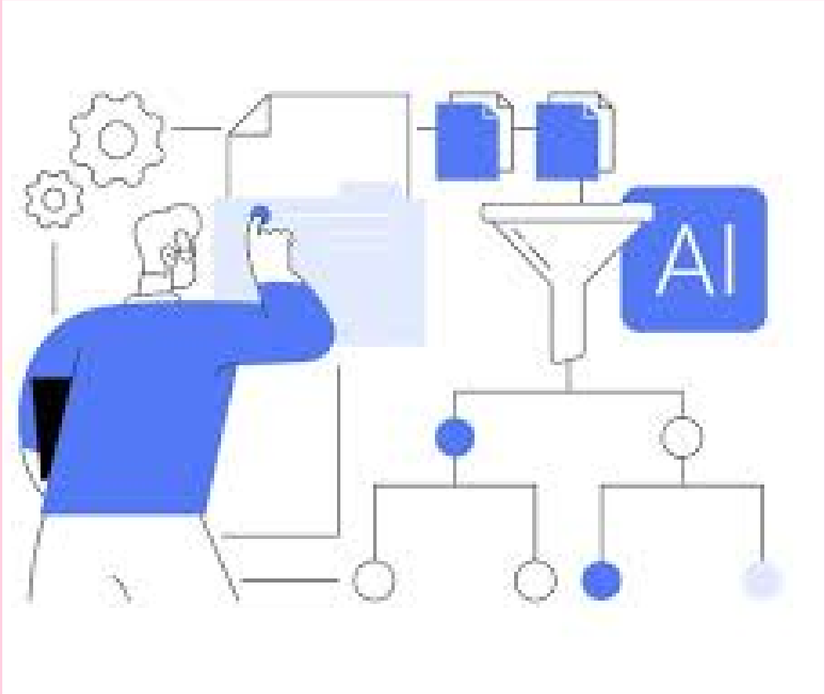
DATA PREPROCESSING

Preparing Women's Healthcare Data for Insight

Here's a breakdown of preprocessing steps for women's healthcare data

- **Cleaning for Accuracy:**
  - **Eliminating missing data & inconsistencies.**
  - **Ensuring reliable analysis.**
- **Normalization for Consistency:**
  - **Standardizing numerical scales.**
  - **Preventing bias in models.**
- **Encoding for Analysis:**
  - **Converting categories (e.g., location, status) to numbers.**
  - **Enabling machine learning.**

Preprocessing optimizes model performance.



SEGMENTATION STRATEGY

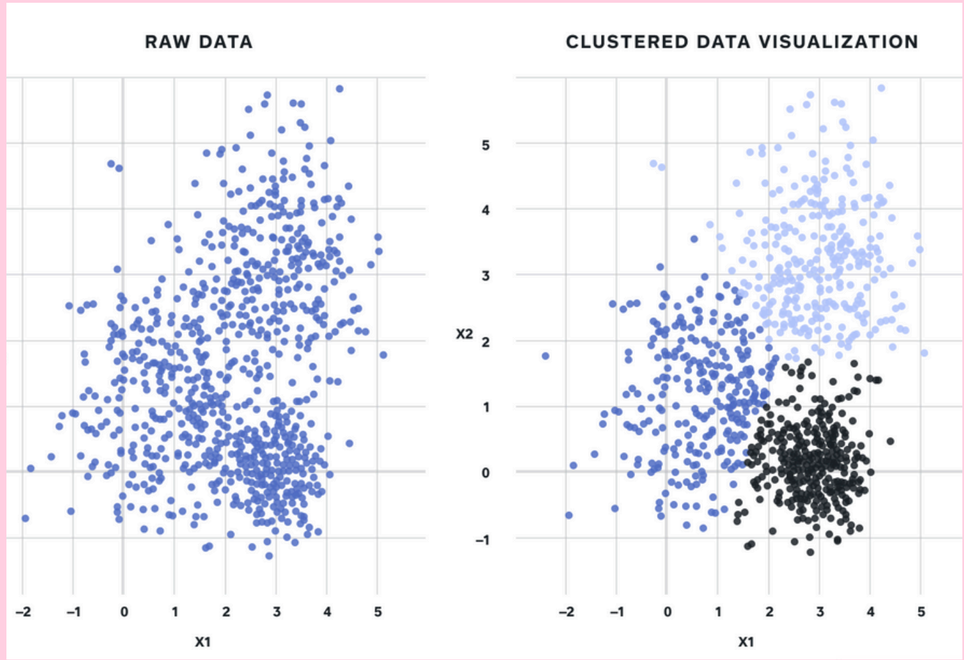
Precision Healthcare: Segmenting Women based on Health Parameters

Layered Segmentation for Personalized Care

- **Hierarchical Clustering:**
  - Establishes broad health dimension clusters.
- **Gaussian Mixture Models (GMM):**
  - Refines clusters with probabilistic precision.
- **Combined Approach:**
  - Delivers robust, nuanced patient segmentation.

- **Benefits:**
  - Targeted interventions & resource allocation.
  - Data-driven, personalized healthcare.
  - Improved patient outcomes.

- Understanding patient subgroups is key to effective healthcare strategies.



HEIRARCHICAL CLUSTERING

Introduction to Hierarchical Clustering

- A method to segment women based on health data, creating a tree-like structure (dendrogram) of clusters that reflects varying health needs and preferences.

Agglomerative vs. Divisive Clustering

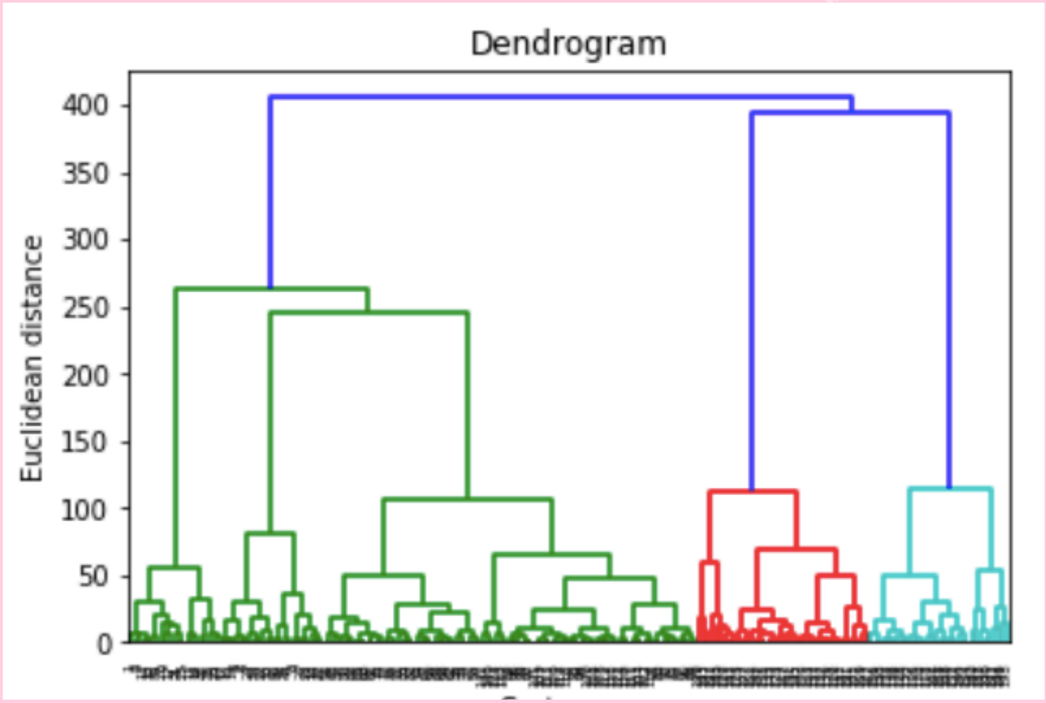
- Agglomerative (bottom-up) builds clusters by merging similar data points, ideal for grouping women with similar health conditions.
- Divisive (top-down) splits large clusters into smaller groups, useful for identifying subgroups within diverse health needs.

Distance Metrics

- Euclidean: Measures the straight-line distance between points (ideal for continuous health metrics).
- Manhattan: Measures the sum of absolute differences (useful for categorical health data).

Visualizing Cluster Relationships

- Dendrograms visually represent how women are grouped, helping healthcare providers identify distinct health segments.



DENDOGRAM ANALYSIS

Dendrogram Interpretation:

Identify Clusters:

- Visualize clusters based on health data (e.g., medical conditions, lifestyle, age).

Cut-Off for Personalization:

- Define the number of clusters by drawing a horizontal cut at the appropriate height in the dendrogram to group women with similar needs.

Healthcare Segmentation:

- Create tailored recommendations for each segment based on the cluster characteristics.

Objective:

- Enable personalized healthcare solutions by leveraging clustering to better address the unique health needs of women.

GAUSSIAN MIXTURE MODELS

Introduction to GMM

- GMM helps segment women by modeling health data as a mix of Gaussian distributions, reflecting diverse health needs and preferences.

Gaussian Distributions & Components

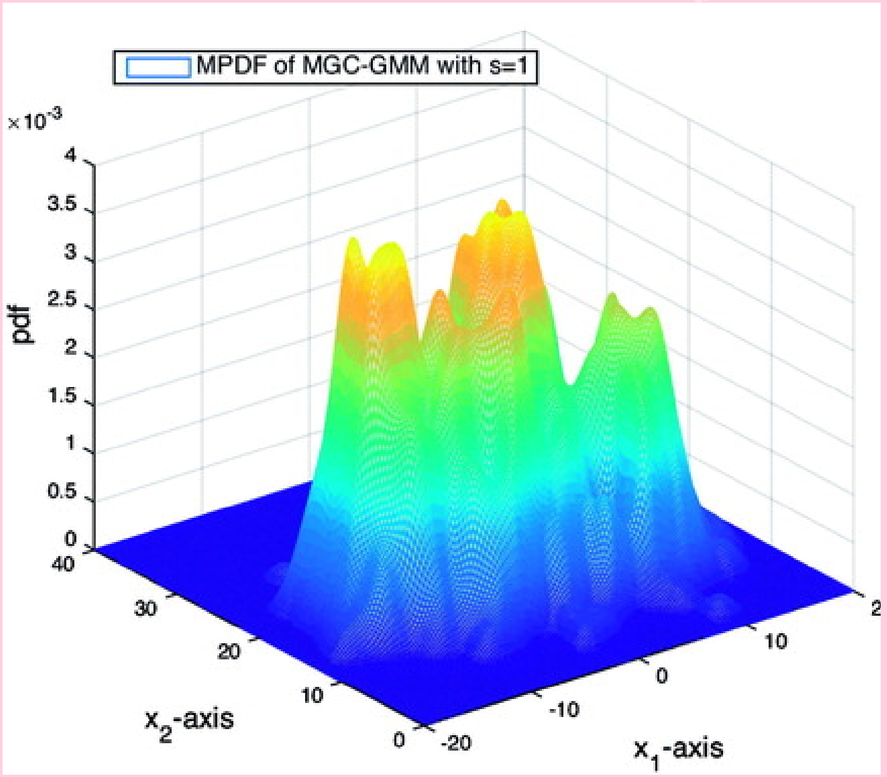
- Each segment (e.g., health condition, lifestyle) is represented by its own Gaussian distribution with unique characteristics.

Expectation-Maximization (EM) Algorithm

- Iterative algorithm used to estimate parameters for personalized health segmentation.

Soft vs. Hard Clustering

- Soft clustering assigns probabilities to health conditions, offering flexible recommendations, while hard clustering assigns each individual to a single group for targeted interventions.



FEATURE SELECTION & REDUCING DIMENSIONALITY

Feature Selection: Reducing Dimensionality for Personalized Women's Healthcare

Techniques for Feature Selection:

- **Feature Importance from Tree-Based Models:** Identify key health factors (e.g., age, medical conditions) that impact healthcare outcomes using decision trees or random forests.
- **Principal Component Analysis (PCA):** Reduce dimensionality by transforming complex health data into fewer components while retaining key information.
- **Correlation Analysis:** Remove highly correlated features to reduce redundancy and improve model performance.

- **Benefits of Feature Selection:**
  - Improved Model Efficiency
  - Enhanced Personalization
  - Better Generalization

MODEL SELECTION & PARAMETER ESTIMATION

GMM: Model Selection and Parameter Estimation

Model Selection:

- AIC (Akaike Information Criterion): Measures model fit while penalizing complexity. Lower values indicate better models.
- BIC (Bayesian Information Criterion): Similar to AIC but with a stronger penalty for complex models. Lower values are preferred.

Parameter Estimation:

- Means: Average values for each health segment.
- Covariances: Variability of features within segments.
- Mixing Coefficients: Weights of each Gaussian component.

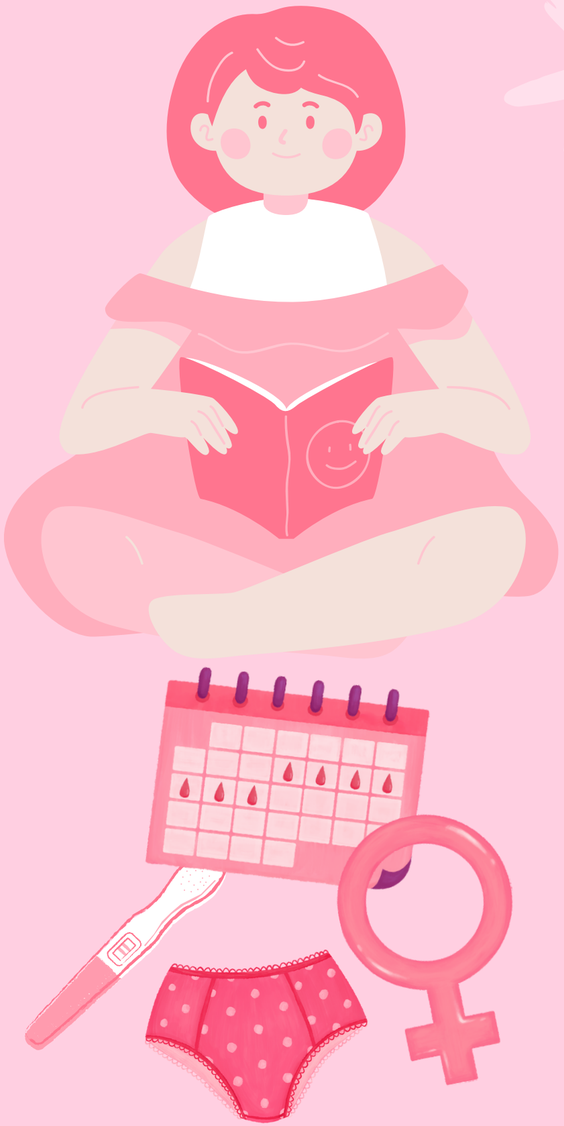
Evaluating Model Fit:

- Use AIC/BIC scores to compare and select the best model for segmenting women's healthcare data.

KEY DRIVERS OF SEGMENTATION

Women's health is influenced by a combination of biological, behavioral, social, and cultural factors. Identifying these key drivers is essential for tailoring personalized healthcare recommendations. Research highlights the following influential factors.

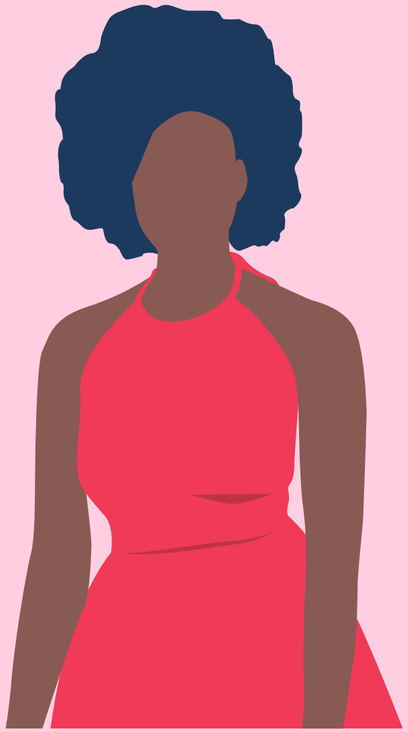
- **Smoking:** Tobacco use contributes to various health issues, including respiratory diseases and cancers.
- **Diet and Physical Activity:** Eating habits and levels of physical activity significantly impact weight management, cardiovascular health, and the risk of chronic diseases.
- **Alcohol Consumption:** Excessive alcohol intake is linked to liver diseases, certain cancers, and mental health disorders.
- **Sexual Risk Behaviors:** Practices affecting sexual health, including contraceptive use and number of partners, influence the risk of sexually transmitted infections and unplanned pregnancies.



UNDERSTANDING THE CLUSTERS: SEGMENT PROFILES EXAMPLES

Tomboy Tara
Age 16
School student & soccer player
Injury prevention while playing

Young Emma
Age 23
College Student
Sedentary life
High stress, binge eats, drinks alcohol



Active Amanda
Age 32
Fitness coach
Highly Active
Healthy and balanced life

Mother Maria
Age 40
Stay-at-home mom
Low Activity
Needs postpartum care

Silver Sarah
Age 68
Retired
Low Activity
Has Age related diseases

PERSONALIZED RECOMMENDATIONS

Personalized Recommendations: Tailored Interventions

- **Segment-Specific Recommendations**
  - Provide personalized treatment plans, wellness tips, and lifestyle adjustments based on health data and preferences for each user segment.
- **Targeted Educational Materials**
  - Deliver relevant health content, articles, and videos tailored to each segment's unique needs (e.g., nutrition advice, mental health support).
- **Customized Treatment Plans**
  - Offer personalized care plans with medication, exercise, and diet recommendations, ensuring alignment with each user's specific health requirements.
- **Support Integration**
  - Integrate with existing healthcare systems to offer a seamless experience, allowing healthcare professionals to access user data and provide ongoing support.

TECHNOLOGY IMPLEMENTATION

Technology Implementation: User-Friendly Platforms

- **Accessible & Intuitive Design:** Developing platforms that are easy to navigate for diverse users.
- **Mobile Apps & Web Portals:** Creating cross-platform solutions for seamless access
- **Integration with Wearables:** Syncing health data from devices for real-time insights.
- **User Engagement & Adherence:** Designing features to keep users motivated and involved in their health journey.
- **Accessibility Considerations:** Ensuring platforms are inclusive (e.g., for different disabilities or tech literacy levels).

POTENTIAL IMPACT

Impacts of Personalized Healthcare for Women

- **Tailored Care:** Improves outcomes with personalized treatments.
- **Better Health:** Reduces chronic diseases through targeted interventions.
- **Increased Access:** Identifies underserved groups for better resource distribution.
- **Efficient Resource Use:** Optimizes healthcare spending.
- **Proactive Prevention:** Identifies high-risk groups early for intervention.
- **Gender-Specific Research:** Advances targeted women's health solutions.
- **Predictive Care:** Anticipates future health needs for proactive solutions.
- **Tech-Driven:** Integrates advanced tools for smarter healthcare.
- **Informed Decisions:** Empowers women to make better health choices.
- **Sustainable Plans:** Data-driven strategies for long-term health.

ENDING WITH HOW CAN WE SUPPORT WOMEN EVERY DAY?