# 🇷🇼 Tackling Hidden Hunger in Rwanda: Predicting and Preventing Childhood Stunting

### 🔍 Background & Challenge

Childhood malnutrition remains a critical public health challenge in Rwanda, affecting children's growth, development, and future potential. While national surveys report stunting prevalence around 33%, significant disparities persist across districts and socioeconomic groups. This project aims to support Rwanda’s goal to reduce stunting and related malnutrition forms by leveraging data-driven insights for targeted interventions.

The 2025 Big Data Hackathon – Track 2 focuses on:

* Mapping district-level prevalence of stunting, wasting, and underweight
* Identifying key risk factors through predictive modeling
* Informing policy and intervention strategies aligned with Rwanda’s national development frameworks

### 🎯 Objectives

* Generate accurate maps of malnutrition prevalence at district level using the latest (CFSVA)\_2024 available datasets
* Develop machine learning models (e.g., XGBoost, LightGBM, Logistic Regression) to identify significant predictors of malnutrition
* Provide actionable recommendations supporting national plans such as NST-1 and HSSP-IV, with a focus on equity and sustainability

### 📊 Key Findings

**Geographic Distribution**

* High stunting prevalence identified in districts of the Western and Northern Provinces (Nyabihu, Rubavu, Rutsiro, Burera, Gakenke)
* Rural children show substantially higher malnutrition rates than urban counterparts
* Wasting and underweight rates are generally lower but concentrated in specific districts

**Top Predictors**

* **Nutrition**: Low dietary diversity and inadequate complementary feeding practices
* **Health**: Maternal factors such as low antenatal care attendance and poor maternal nutrition status
* **Water, Sanitation & Hygiene (WASH)**: Long distances to fetch water, lack of improved sanitation, and poor hygiene practices
* **Socioeconomic**: Household wealth and maternal education strongly correlate with child nutrition outcomes

### 🧩 Policy & Intervention Recommendations

**Addressing the Root Causes of Childhood Stunting in Rwanda**

Building on predictive modeling, geospatial analysis, and national survey data, the following policy recommendations are designed to support Rwanda’s ongoing efforts to reduce childhood stunting. These actions align with national frameworks such as the NST-1, HSSP-IV, and the National Nutrition Policy, with an emphasis on equity, sustainability, and community-based health systems.

#### 🔹 ****Short-Term Interventions (0–1 Year)****

Objective: Rapid response in high-risk districts to prevent immediate malnutrition and support vulnerable groups.

* **Expand micronutrient supplementation** for pregnant women and children under five through existing supply chains and mobile health clinics.
* **Leverage community health workers (CHWs)** to scale up Infant and Young Child Feeding (IYCF) counseling at the household level, supported by mobile decision-support tools.
* **Distribute fortified blended foods** (e.g., porridge flour) in food-insecure areas, prioritizing households with low dietary diversity scores.
* **Ensure access to clean water** through emergency water trucking and portable handwashing kits in districts with poor WASH indicators.
* **Improve data collection** on child nutrition status through regular CHW visits, especially for under-fives and pregnant/lactating women.

#### 🟢 ****Medium-Term Strategies (1–3 Years)****

Objective: Strengthen systems and build resilience through integrated health, nutrition, and agriculture interventions.

* **Integrate nutrition services into maternal health programs** by expanding antenatal care (ANC) outreach, ensuring every visit includes nutrition counseling and supplementation.
* **Support nutrition-sensitive agriculture** by promoting diversified crops (including iron-rich beans, orange-fleshed sweet potatoes), kitchen gardens, and biofortified seeds.
* **Link CHWs with early childhood development (ECD) centers** to track child growth, follow up on health service uptake, and deliver parent nutrition education.
* **Expand school-based nutrition programs**, especially in rural areas, incorporating WASH improvements and locally sourced school meals.
* **Strengthen multisectoral coordination** between ministries (Health, Agriculture, Education, Social Protection) at district level, supported by local nutrition committees.

#### 🟠 ****Long-Term Vision (3–5+ Years)****

Objective: Institutionalize and scale impactful programs, backed by robust monitoring and policy integration.

* **Institutionalize CHW-led nutrition tracking** within the national health information system, allowing for real-time alerts on child growth faltering.
* **Scale proven community-based programs** such as the "One Cow per Poor Family" (Girinka), integrated with kitchen gardens and nutrition education.
* **Embed nutrition content in the national curriculum** to create lifelong awareness starting at primary school level.
* **Invest in spatial and digital tools** for early warning systems using machine learning, remote sensing, and community-reported data.
* **Promote equity-first budgeting** by allocating more resources to districts with the highest stunting burdens and poorest households.

### 👥 The Role of Community Health Workers (CHWs)

CHWs remain a cornerstone of Rwanda’s health system and play a critical role in stunting prevention:

* Conduct routine growth monitoring and home visits for children under five.
* Track maternal compliance with antenatal and postnatal supplements (e.g., iron, folic acid, vitamin A).
* Educate families on optimal feeding practices, hygiene, and nutrition-sensitive agriculture.
* Report community-level data to health centers and facilitate follow-ups for at-risk children.
* Strengthening the CHW model with digital tools, supervision, and performance-based incentives can greatly enhance early detection and intervention against malnutrition.

### 📍 Implementation Notes

* These recommendations should be locally adapted based on district-level data from the dashboard.
* Community engagement, especially with women’s groups and local leaders, is essential for sustainability.
* Partnering with NGOs, private sector actors, and regional bodies can mobilize additional support and resources.

### ✅ Conclusion

Malnutrition, particularly stunting, poses a significant barrier to Rwanda’s social and economic development. This project demonstrates how predictive analytics applied to national datasets can uncover local risk factors and inform tailored, multisectoral interventions. With continued data innovation and policy alignment, Rwanda can accelerate progress towards its nutrition goals, ensuring healthier futures for its children.

### 📚 References

* Rwanda Demographic and Health Survey (2019–20) – for contextual background
* Comprehensive Food Security and Vulnerability Analysis (CFSVA) 2024
* National Strategic Plan for Transformation (NST-1)
* Health Sector Strategic Plan (HSSP-IV)
* UNICEF Rwanda, WHO Rwanda country profiles and nutrition reports