# 🇷🇼 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 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, Musanze)
* 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

**Short-Term (0–1 year)**

* Scale up micronutrient supplementation programs for pregnant women and young children
* Expand community-based infant and young child feeding counseling with mobile support tools
* Deploy emergency WASH interventions in high-risk districts

**Medium-Term (1–3 years)**

* Promote nutrition-sensitive agriculture through farmer training and diversified crop production
* Strengthen maternal health services with integrated nutrition counseling and increased ANC coverage
* Enhance multisectoral coordination at district and sector levels

**Long-Term (3–5+ years)**

* Institutionalize nutrition interventions within agriculture, education, and early childhood development systems
* Scale proven community programs nationwide, including nutrition education and kitchen gardens
* Invest in continuous monitoring and data innovation to support early warning and adaptive responses

### 💻 Dashboard & Repository

A user-friendly dashboard was developed to facilitate real-time monitoring and decision-making. Key features include:

* Interactive district-level maps of stunting, wasting, and underweight prevalence
* Visualizations of model-derived feature importance for targeted insights
* Scenario simulation tools to explore potential intervention impacts
* Root cause linkage maps to connect findings with sector-specific actions

Access the project code and dashboard at:

**GitHub Repository:** HiddenHungerRwanda (<https://github.com/uweraliliane/> )

### ⚠️ Limitations & Future Directions

* Current analyses rely on cross-sectional data limiting causal inference
* Additional data on seasonality, food prices, and cultural practices would enhance understanding
* Future work should integrate remote sensing and spatial statistics for more precise targeting
* Qualitative studies recommended to deepen insights on maternal knowledge and feeding norms

### ✅ 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

📁 rwanda-hidden-hunger-hackathon/

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├── 📁 data/

│ ├── cleaned\_dataset.csv

│ └── rwanda\_districts\_shapefile/

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├── 📁 notebooks/

│ ├── 01\_preprocessing.ipynb

│ ├── 02\_modeling.ipynb

│ └── 03\_mapping.ipynb

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├── 📁 app/

│ ├── app.py (Streamlit or Flask)

│ └── requirements.txt

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├── 📄 README.md

├── 📄 policy\_brief.pdf or .md

└── 📄 LICENSE