

PhD title:

# Forecasting improvements for better reproductive health and family planning operations in global health supply chains

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PhD Start date: Year 2

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# What problem(s) does our research focus on?

Inefficient supply chain management in family planning programs in developing countries leads to contraceptive shortages, limiting women's reproductive autonomy and causing societal issues. Current demand forecasting methods inadequately address uncertainties such as product switching, local variations and stockouts, with insufficient research on probabilistic forecasting and inventory management integration.



- **Why:** To improve access to contraceptive products, reducing unintended pregnancies, and preventing unsafe abortions, particularly in developing countries where healthcare resources are limited.
- **Who it impacts:** Women in developing countries, and potentially society as a whole.
- **How:** Governments, healthcare providers, and donor organizations would benefit from reliable probabilistic forecasts, allowing for better resource allocation, reduced stockouts, and more efficient supply chain operations.

# Research aim and questions

The aim of this project is to develop a **novel forecasting and inventory management approach** for contraceptive products in developing countries that accounts **for uncertainties, poor data quality, and local demand variations**. This approach will integrate **probabilistic forecasting methods** with **inventory optimization** to improve supply chain efficiency and reduce stockouts.



1

**How** does a hybrid probabilistic AI model that integrates machine learning and expert knowledge improve the accuracy and reliability of contraceptive demand forecasting in developing countries compared to traditional methods?

2

**What** are the key social, cultural, and demographic factors influencing contraceptive demand, and how can integrating these factors using domain knowledge into the modeling process improve the reliability of demand predictions?

3

**How** can an integrated forecasting and inventory framework effectively address the challenges of censored demand due to stockouts, under-reporting, and discontinuations in contraceptive supply chains?

# Methodology & approach



## Methods:

- Time series models including statistical, machine learning, Bayesian and foundational.
- Simulation and optimization models.

## Research design:

- Integrated forecasting and inventory framework, utilizing probabilistic models.
- Empirical framework/ simulation experiments to assess performance of the analytical models.
- Laboratory experiment setup (TBD).

## Data/ Materials:

Mainly based on secondary data available through,

- Logistics Information Management System of Cote d'Ivoire.
- PMA DataLab
- USAID and DHS
- WorldPop