Reference under Grants.gov (www.grants.gov) and Fedbizopps.gov (www.fbo.gov)
Opportunity Number: GLOBALHEALTH-BAA-2018

Funding Opportunity Title: Intelligent Forecasting: A Competition to Model Future Contraceptive Use

Funding Opportunity Number:
GH-BAA-2018-INTELLIGENT-FORECASTING-ADDENDUM

Via the USAID Development Innovation Accelerator Broad Agency Announcement for Global Health Challenges (BAA-GLOBAL HEALTH-2018)

USAID presents

Intelligent Forecasting: A Competition to Model Future Contraceptive Use

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Expressions of Interests should be submitted to the online entry platform by **September 8, 2020 at 11:00 a.m.** Eastern USA Time via https://competitions4dev.org/forecastingprize Send any questions, comments, or concerns to forecastingprize@usaid.gov. USAID reserves the right not to respond to any or all questions.

Acronyms

AI	Artificial Intelligence
BAA	Broad Agency Announcement
DUNS	Data Universal Numbering System
EOI	Expressions of Interest
eLMIS	Electronic Logistics Management Information System
FAQ	Frequently Asked Questions
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
LMIC	Low and Middle Income Countries
MASE	Mean Absolute Scaled Error
NGO	Non-Governmental Organization
OP	Ouagadougou Partnership
PLGHA	Protecting Life in Global Health Assistance
PRH	USAID Office of Population and Reproductive Health
SAM	System for Award Management
USAID	United States Agency for International Development
USD	United States Dollars

Definitions

1. **Co-creation:** A collaborative approach that brings together a variety of stakeholders to collectively produce a mutually valued outcome, through a process that emphasizes shared knowledge and decision-making.
2. **Consumption**: The quantity of a good (in this case, a contraceptive) provided to or used by clients over a certain period of time.
3. **Contraceptives:** Any method, medicine, or device used to prevent pregnancy.
4. **Forecasting Prize:** A cash reward for the top two competitors for designing an intelligent forecasting model to predict contraceptive consumption.
5. **Field Implementation Grant:** A grant for an organization selected by USAID to field test their intelligent forecasting model in Côte d'Ivoire.
6. **Intelligent Forecasting**: Use of empirically based modeling methods that include but not limited to statistical methods, complex adaptive models, advanced analytics, and artificial intelligence (AI) to power decision making and enhance prediction accuracy over time[1].
7. **Open innovation**: A process to access and leverage knowledge from outside an organization, in this case, USAID.
8. **Service delivery site (Service delivery level)**: A site (or health system level/tier) which provides healthcare, in this case family planning services, to clients; i.e., a hospital, clinic, or any other health service delivery site.

[1] Definition adapted from KPMG's definition of Intelligent Forecasting. See https://advisory.kpmg.us/services/data-analytics/lighthouse/kpmg-intelligent-forecasting.html

Overview

In low- and middle-income countries (LMIC) around the world, health systems **struggle to accurately predict the quantities of contraceptives that are needed at each public sector service delivery site for consumption by clients seeking family planning services**. This leads to inefficient ordering and distribution of contraceptives to service delivery sites, and can ultimately result in stockouts, stock shortages, or overstock. This under and over stocking leads to reduced access to contraceptives for users, inefficient allocation of resources in the supply chain, and potential loss of product due to expiration. There are many reasons why predictions about consumption of contraceptives at facilities may be flawed; these include: limited availability or low quality data, limited staff capacity, limited staff time, and weak business processes. Across most LMIC public sector health systems, one key limitation is that historically facilities have ordered based on calculations that primarily or exclusively rely on logistics data from previous time periods to predict future consumption.[2] However, evolving health systems and digital infrastructure have created an opportunity to utilize advanced methods to more accurately predict future contraceptive needs, even for short-term forecasts for service delivery sites. **The Intelligent Forecasting Competition seeks to encourage innovation and drive progress through intelligent forecasting methods to predict contraceptive consumption at the service delivery level of the public sector health system in Côte d'Ivoire**.

Background

The USAID Office of Population and Reproductive Health (PRH) supports voluntary family planning and reproductive health programs in nearly 40 countries. A key component in this work is to support Ministries of Health and service delivery partners to better predict, procure, allocate, transport, and distribute contraceptives. Greater access to contraceptives enables couples and individuals to determine whether, when, and how often to have children. Contraceptive access is vital to safe motherhood, healthy families, and prosperous communities.

Côte d'Ivoire is a LMIC located in West Africa that is home to approximately 27.4 million people.[3] The government of Côte d'Ivoire has committed to make contraceptives available to the entire population. Since 2017, the national government has increased resource allocation to the purchase of contraceptives by 25 percent.[4] Public health facilities are an important source of

[2] For a traditional order calculation practice in the sector, see "Determining How Much to Order or Issue" on page 57-58 of The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities. USAID DELIVER PROJECT, Task Order 1. 2011.
[3] See https://www.cia.gov/library/publications/the-world-factbook/geos/print_iv.html
[4] See https://www.familyplanning2020.org/news/over-13-million-women-are-using-modern-method-contraception-Côte-divoire

family planning services in Côte d'Ivoire, accounting for 61 percent of the supply of contraceptives nationally.[5] Contraceptives are available at all levels of health care, and this includes community-level distribution.

In Côte d'Ivoire, USAID is committed to increasing the utilization of quality health services, including the contraceptive prevalence rate. To this end, USAID provides expert technical assistance to strengthen health supply chains, while collaborating with multi-level stakeholders to improve the efficiency of the public sector health system. USAID's investments in Côte d'Ivoire have significantly improved the availability of medications and health care services to address HIV/AIDS, malaria, maternal and child health, and access to contraceptives in the country. USAID/Côte d'Ivoire is committed to continue improving access to contraceptives by developing and implementing technologies that empower health facility staff at all levels to improve data quality and the use of data for decision-making.

Côte d'Ivoire has made great progress in achieving and surpassing their yearly annual goals under the Ouagadougou Partnership (OP), which is a network of nine French language speaking African countries that seek to advance access to family planning for health and development. By 2019, 417,000 additional women were using modern contraception, exceeding their 2020 OP objectives of 353,000. OP estimates that in 2019, 1,314,000 women in Côte d'Ivoire were using a modern method of contraception, the highest number of users among all the OP countries. As such, 466,000 unintended pregnancies and 1,900 maternal deaths were averted. Such progress could cause challenges in forecasting family planning inputs to meet needs in real time.[6]

Use of Innovative Methods

Competition

Competitions are a tried and tested method to support innovation discovery and government procurement. They can inspire and incentivize others to explore new methodologies and technologies to improve development outcomes in ways that would not have been possible via more typical, prescriptive contracting. Prize competitions open the problem solving process beyond typical partners and pay for the achievement of specific results. Competitions also facilitate and engage innovators to participate and incentivize problem solving through rewards and recognition.

Co-Creation

Co-creation is a collaborative approach that brings together a variety of stakeholders to collectively produce a mutually valued outcome, through a process that emphasizes shared knowledge and decision-making. USAID has used collaborative approaches for decades, but

[5] Armand, Francoise, Emily Mangone, Sean Callahan, and Virginie Combet. 2017. Côte d'Ivoire Private Health Sector Assessment: Family Planning. Bethesda, MD: Sustaining Health Outcomes through the Private Sector Plus Project, Abt Associates Inc.
[6] OP ANNUAL MEETING BRIEF: Country Progress Summary for USAID Health Offices in West Africa

they have received renewed attention in recent years for their potential to foster innovation and systems change.

The USAID PRH Office will use a competition to engage a wide array of innovators to develop models that improve the accuracy of contraceptive forecasts at the service delivery level, and encourage innovative partnerships to pilot these models in the field. Co-creation will be used to hone models, strengthen partnerships among intelligent forecasting solvers, and communicate findings between implementing partners and USAID.

Competition Goals

The overall goal of this competition is to help partner countries meet the family planning needs of their people by improving contraceptive availability at the service delivery level through the use of intelligent forecasting methods. Intelligent forecasting is the use of statistical methods, advanced analytics, or artificial intelligence (AI) to power decision-making and enhance prediction accuracy over time.[7]

The Intelligent Forecasting Competition is an opportunity for USAID to test how intelligent forecasting methods may improve the accuracy of contraceptive consumption forecasts at the service delivery level; and to identify and fund an organization to pilot intelligent forecasting methods at the service delivery level of the public sector health system in Côte d'Ivoire. Through this competition USAID seeks to:

1. Understand the strengths and limitations of intelligent forecasting methods to predict contraceptive consumption at the service delivery level.

2. Determine whether intelligent forecasting methods increase accuracy over traditional order calculations and for predicting contraceptive consumption at the service delivery level in public sector health systems; and, if so, determine how intelligent forecasting methods can improve the contraceptive supply chain within Côte d'Ivoire.

3. Support stakeholders in Côte d'Ivoire to pilot intelligent forecasting methods for contraceptives at the service delivery level in the national health system.

4. If the intelligent methods do improve forecasting and can be successfully implemented in the field, build a body of evidence to encourage the uptake of intelligent forecasting methods into supply chain decision support systems at the service delivery level in other countries.

[7] Definition adapted from KPMG's definition of Intelligent Forecasting. See https://advisory.kpmg.us/services/data-analytics/lighthouse/kpmg-intelligent-forecasting.html

Solutions Sought

USAID invites individuals and organizations to compete and submit Expressions of Interest (EOI) to the Forecasting Prize, which will be awarded to the model(s) that most accurately predict monthly consumption of 11 contraceptives across 156 health facilities in Côte d'Ivoire. All competitors are required to submit at least one, but no more than three, models to qualify for the Forecasting Prize. If a competitor submits more than one model, USAID will only consider the top-performing model for the prize award.

Competitors may choose to enter the Field Implementation Grant competition by completing the additional questions included in the EOI. The Field Implementation Grant will provide funding to customize, strengthen and pilot the model(s) with selected health facilities in Côte d'Ivoire. There is a limit of one EOI per competing party for the Field Implementation Grant.

USAID will evaluate the EOIs to establish a shortlist of competitors for the Forecasting Prize and Field Implementation Grant. Shortlisted competitors will be invited to a virtual co-creation activity. Competitors who only submit an EOI to the Forecasting Model Prize must state they are willing to partner with a field implementation team to be eligible to participate in co-creation activities.

The virtual co-creation activities are designed to foster an open environment that allows innovators, USAID/Washington, USAID/Côte d'Ivoire, and local stakeholders to constructively engage to strengthen the field implementation approach. During co-creation, shortlisted innovators will develop concept notes for USAID review. USAID will evaluate submitted concept notes and award grant funding to the highest scoring concept note.

Anticipated Awards

USAID intends to award the following incentives:

Forecasting Prize

1. One award for best performing model: 20,000 USD prize;
2. One award for second-best performing model: 5,000 USD prize.

The prize winners will be showcased on a dedicated Intelligent Forecasting page on the USAID Competitions for Development website, as well as other forums.

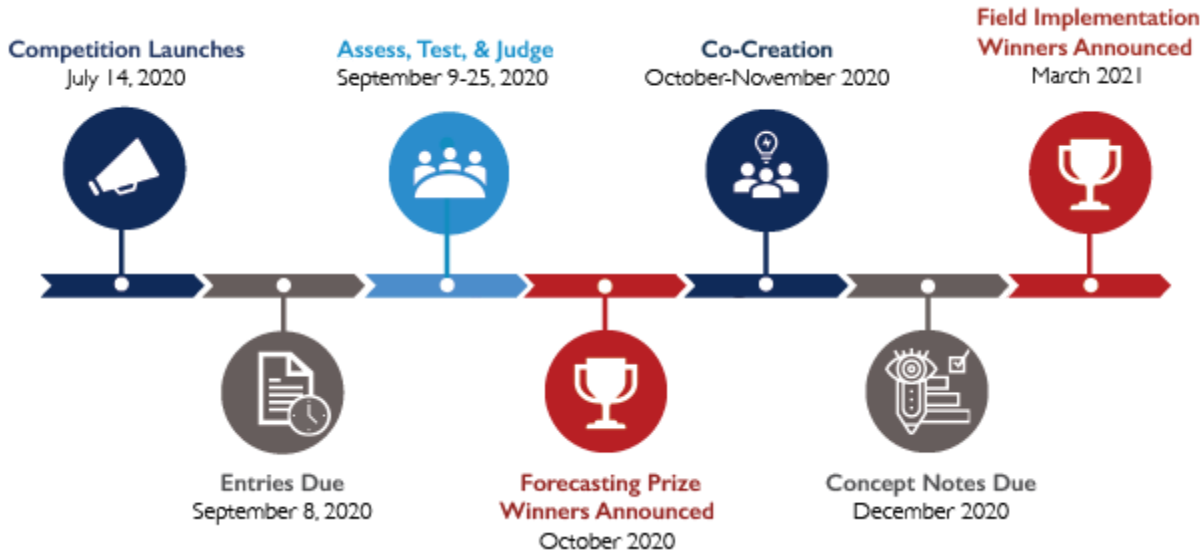
Field Implementation Grant

1. One award of approximately 100,000-200,000 USD for the most compelling Field Implementation Grant concept note.

2. Travel expenses for up to two individuals to support the Field Implementation Grant negotiation process or kick-off.

The grant winner will be showcased on a dedicated Intelligent Forecasting page on USAID's Competitions for Development website, as well as other forums.

Timeline



***Competition Call Launched**:* The competition will launch on July 14, 2020**.** EOIs must be completed and submitted online via the Competitions for Development website prior to the submission deadline.

***Question Submission Deadline**:* Competitors can submit questions about the Forecasting Competition to the email address, forecastingprize@usaid.gov. Questions must be submitted no later than 11:00 a.m. Eastern USA Time on August 4, 2020.

Webinar to Answer Submitted Questions: USAID will host a webinar at 11:00 a.m Eastern USA Time on August 12, 2020 to answer the questions submitted by innovators. The recorded webinar and a list of Frequently Asked Questions (FAQ) will be posted on the Competitions for Development website.

Submission Deadline: Entries for the Forecasting Prize and Field Implementation Grant are due no later than 11:00 a.m. Eastern USA Time on September 8, 2020. Late entries will not be accepted.

Judging the Forecasting Prize: After an internal eligibility screen, USAID will evaluate predictions and test the models. This will take place from September 9 - September 25, 2020.

Prize Winners Announced: The best model and second-best model Forecasting Prize winners will be announced publicly by October 2020. All USAID decisions are final and are not subject to review.

Judging the Field Implementation Grant EOIs: After an initial, internal eligibility screen, USAID will evaluate models and EOIs. This will take place from October - November 2020. USAID will develop a shortlist of competitors to participate in a virtual co-creation activity and submit concept notes.

***Co-creation and Concept Note Development for the Field Implementation Grant*:** USAID will invite selected, shortlisted competitors from both the Forecasting Prize and Field Implementation Grant to participate in a virtual co-creation activity and develop concept notes. Competitors will have approximately six weeks for simultaneous co-creation and concept note development. Concept notes are expected to be due in December. The specific due date will be announced later.

Judging the Field Implementation Grant Concept Notes: A panel of expert judges will evaluate and shortlist the concept notes in December 2020 - January 2021. A panel of experts will then interview competitors who submitted the shortlisted concept notes. Every effort will be made to schedule interviews at a time that is reasonable for both the competitor and USAID staff.

Field Implementation Grant Winner Announcement: The Field Implementation Grant winner will be announced publicly in March 2021. All USAID decisions are final and not subject to review.

***Field Implementation Begins*:** After a series of meetings with USAID staff and other stakeholders in Côte d'Ivoire, the selected grantee will initiate the grant to test the intelligent forecasting model in the field. As the situation with COVID-19 remains very fluid, USAID anticipates the grant will begin in April 2021, but the start date will be pending what is prudent, safe, and feasible.

Eligibility Information and Requirements

Prospective competitors should read the eligibility criteria. Entries that do not meet the eligibility requirements will not be reviewed by USAID or considered for award.

Eligibility Requirements	Forecasting Prize	Field Grant
Competitor Type: Individuals- USAID encourages entries from new competing parties that include women, LMIC residents, and innovators from outside the development sector.	X	
Competitor Type: Organizations - Includes participants from U.S. and non-U.S. based private sector, not-for-profit, faith-based, foundations, industrial, academic, civic groups, and regional organizations. USAID encourages entries from new competing parties that include women, LMIC residents, and innovators from outside the development sector.	X	X
Submission Language - The official language of the competition is English and all questions, EOIs, and concept notes must be submitted in English. Competitors may use translation services, such as Google Translate, to submit in English.	X	X
Eligible to Receive USAID funds - USAID will conduct a responsibility determination prior to award, to ensure that the award to the individual or organization meets applicable U.S. laws and policies, including but not limited to regulations administered by the Office of Foreign Assets Control (OFAC) of the U.S. Department of Treasury.	X	X
Topical - EOIs must center on employing intelligent forecasting methods for family planning supply chains.	X	X
Completeness - Incomplete entries will not be accepted.	X	X
On Time - Late entries will not be accepted.	X	X
Currency - All references to a currency should be in United States Dollars (USD).		X

Local Right to Operate - Competitors must be a registered entity somewhere in the world, and have, or be in the process of obtaining, the legal right to implement the project in Côte d'Ivoire. Competitors should demonstrate they are based in, have a presence in, or will have a partner(s) in Côte d'Ivoire.		X
Relevant Past Performance - Competitors must have previous experience working on global health projects related to supply chain or health products. Competitors must also have experience working in sub-Saharan Africa.		X
Registered to Receive USAID funds - Apparent awardees must have a DUNS number and be registered in the SAM system before an award is made. This is not required at the time of submission of your entry.		X
Intellectual Property - Understanding the sensitive nature of submitters' information, USAID will work to protect the competitors' intellectual property. EOIs should be free of any intellectual property that the competitor does not wish to share, as the expressions of interest will be shared with USAID partners as part of the selection process. Competitors must submit two versions of their narrative: a version that describes the whole of their process, but will be held in confidence between the competitor and USAID, and a narrative that describes only the information they would be willing to share with USAID, other competitors, and the development industry as part of disseminating learning from the competition. Any intellectual property that competitors are willing to share but wish to protect should be clearly marked as the property of the competitor. Once competitors have been invited to engage in co-creation, submitters will work with USAID to identify proprietary information that requires protection. While competitors entering the prize will retain ownership of their intellectual property, they grant USAID a non-exclusive, royalty-free, perpetual license for government use, specifically for additional USAID learning and applied research. Upon selection as an apparent awardee, USAID and the field grant awardees may further negotiate additional intellectual property exchanges and protections as part of the grant award process.	X	X

Organizations must ensure that any submissions under this competition are free of any third party proprietary data rights that would impact the license granted to USAID herein.		
Protecting Life in Global Health Assistance (PLGHA) - On January 23, 2017, President Trump issued a Presidential Memorandum reinstating the 2001 Presidential Memorandum on the Mexico City Policy for USAID family planning assistance and directing the Secretary of State to implement a plan to extend the requirements of the Mexico City Policy to "global health assistance furnished by all Departments or Agencies." USAID began implementing the policy, now known as the Protecting Life in Global Health Assistance (PLGHA) policy on May 15, 2017 for grants and cooperative agreements that provide global health assistance. The policy requires foreign non-governmental organizations (NGOs) to agree, as a condition of receiving global health assistance, that they will not perform or actively promote abortion as a method of family planning and will not provide financial support to any other foreign NGO that conducts such activities. USAID is currently implementing the Protecting Life in Global Health Assistance policy through a standard provision issued in May 2019. This provision must be included in all new USAID grants and cooperative agreements that include global health assistance. Therefore, the PLGHA standard provision will be included as applicable in the Field Implementation Grant as a USAID assistance award that will receive global health assistance.		X

Ineligible Competitors

1. Public sector entities, government entities, and political parties, groupings, or institutions, or their subsidiaries or affiliates are not eligible for the Forecasting Prize or Field Implementation Grant.
2. USAID employees, USAID personal service contractors, Catalyst and its consortia members' employees, and their family members are not eligible for the prize or Field Implementation Grant.
3. Entities or organizations that participated in the development of this BAA Addendum Intelligent Forecasting Competition, including supplying information, data, or expert review.
4. Entities or organizations that had or have access to the Côte d'Ivoire country logistics data, via the Côte d'Ivoire eLMIS system (i.e., Système d'Information Électronique de Gestion Logistique or eSIGL) or other systems.

5. Individuals are not eligible for the Field Implementation Grant, but may compete for the Forecasting Prize.

Competition Rules

1. The maximum number of model submissions for the Forecasting Prize is three.
2. The maximum number of model submissions for the Field Implementation Grant is one.
3. The competition will allow use of publicly available external datasets, including, but not limited to, the Recommended Supplementary Data Sources listed below. Models using external datasets that are not publicly available will not be reviewed.
4. Competitors must create their model(s) as Jupyter Notebook and upload them to the online entry platform (file extension .ipynb). See Annex II for additional guidance on Jupyter Notebook.
5. All EOIs must be submitted in English.
6. EOIs must be submitted via the Competition for Development website: EOIs submitted via regular mail, facsimile, or email will not be accepted.
7. Complete EOIs must be submitted by the deadline at 11:00 a.m. Eastern USA Time on September 8, 2020 using the online entry platform. No additions or modifications to the expressions of interest will be accepted after the submission deadline.
8. Questions about the competition may be submitted via email to forecastingprize@usaid.gov by 11:00 a.m. on August 4, 2020. Answers will be published on the Competition for Development website after the webinar on August 12, 2020 to ensure transparent communication. USAID bears no responsibility for data errors resulting from transmission or conversion processes associated with electronic submissions.
9. If no qualifying EOI is verified during the assessment stage, the competition may reopen, at the sole discretion of USAID and partners.
10. USAID will not be responsible for any costs associated with the development of EOIs or the forecasting model.
11. Information collected for demographic, research, learning, and outward-facing purposes will be labeled as such and will have no bearing on the evaluation of the entry.

Dataset Features

The goal of the Intelligent Forecasting Competition is to predict consumption (stock_distributed in the Primary Data Dictionary) for 11 contraceptives across 156 health service delivery sites in the public sector health system in Côte d'Ivoire. The predictions should be made monthly for three months: October 2019, November 2019, and December 2019, using the dataset provided. The data field that grantees will be predicting is stock_distributed.

Competitors will have access to 45 months, January 2016 through September 2019, of data. The featured dataset is an extract from the electronic logistics management information system

(eLMIS) used in Côte d'Ivoire to manage contraceptives and other health products across the country's public health system.

You may download the data and accompanying dataset descriptions for the competition only after you have registered or logged into the online entry platform. Both the primary dataset and the secondary datasets are linked in the third section of the entry form.

Primary Data

contraceptive_logistics_data.csv

year	The year of the observation
month	The month of the observation
region	The higher level geographical area within Côte d'Ivoire
district	The lower level geographical area within Côte d'Ivoire
site_code	The actual health service delivery site
product_code	The unique identifier for each commodity
stock_initial	Stock in hand of previous period. This is quantified in dispensing units.
stock_received	Total quantity received in last period. This is quantified in dispensing units.
stock_distributed*	Quantity dispensed/consumed in last reporting period. This is quantified in dispensing units. **Note: This is the target variable.**
stock_adjustment	All kinds of losses/ adjustments made at the facility
stock_end	Current physical count of stock on hand. This is quantified in dispensing units.
average_monthly_consumption	Average monthly consumption, for the last three months. This is quantified in dispensing units. **Note:** Average monthly consumption in the system actually provides an average of the most recently available Normalized Consumption values. Normalized Consumption is the stock_distributed value adjusted to reflect any stock_stockout_days. Because months are approximated to have 30 days, one which had 15 stockout days would yield a Normalized Consumption of exactly twice its Monthly Consumption.
stock_stockout_days	Total number of days facility was out of stock.

stock_ordered	The requested quantity. This is quantified in dispensing units.

* Note: stock_distributed is the target variable.

Data quality in datasets such as these is a significant issue, as described in Background. For example, not all sites report all data each month. In addition, there are cases in the contraceptive_logistics_data.csv dataset where the Côte d'Ivoire eLMIS system records a '0' value that may in fact represent a "non reported" value or a value entered by a user for convenience. In such an instance, these '0' values do not reflect actual observed values.

These 'invalid 0 values' may be identified, for example, when:
a) All fields (possibly with the exception of stock_ordered) are recorded as '0' for a given contraceptive product, month and service delivery site; or
b) Stock_distributed for a contraceptive product at a service delivery site is reported in a given month as '0', even though stock was available (stock_initial was above 0) and stock_distributed is historically well above 0.

These apparently invalid '0' values have not been cleaned from the primary dataset provided. However, the values that appear to reflect invalid '0' values will be removed from the test dataset, and these fields will not be scored in the model evaluation.

Primary Data Format
For example, a single row in the primary dataset has these features:

year	2019
month	1
region	INDENIE-DJUABLIN
district	ABENGOUROU
site_code	C4001
product_code	AS27138
stock_initial	75
stock_received	0
stock_distributed	21
stock_adjustment	-54
stock_end	0
average_monthly_consumption	18
stock_stockout_days	0
stock_ordered	100

Secondary Data

service_delivery_site_data.csv

site_code	The unique code of the actual health service delivery site
site_type	The kind of health delivery location including hospital, health center, and university hospital/national institute
site_region	The higher level geographical area within Côte d'Ivoire
site_district	The lower level geographical area within Côte d'Ivoire
site_latitude	The site's latitudinal coordinates
site_longitude	The site's longitudinal coordinates

product.csv

product_code	The unique product code
product_type	The contraceptive category for each product
product_name	The product name, dose, and presentation

contraceptive_case_data_(annual, monthly).csv

implant_women_old	Number of women receiving implants during the month, who used contraception previously
implant_women_new	Number of women receiving implants during the month, who did not use contraception previously
injection2_women_old	Number of women receiving injection (2 months) during the month, who used contraception previously
injection2_women_new	Number of women receiving injection (2 months) during the month, who did not use contraception previously
injection3_women_old	Number of women receiving injection (3 months) during the month, who used contraception previously

injection3_women_new	Number of women receiving injection (3 months) during the month, who did not use contraception previously
pill_women_old	Number of women receiving oral contraceptives during the month, who used contraception previously
pill_women_new	Number of women receiving oral contraceptives during the month, who did not use contraception previously
iud_women_old	Number of women receiving IUDs during the month, who used contraception previously
iud_women_new	Number of women receiving IUDs during the month, who did not use contraception previously
iud_number_dispensed	Number of IUDs given to women during that month
implant_number_dispensed	Number of implants given to women during that month
injection2_number_dispensed	Number of injection (2 months) given to women during that month
injection3_number_dispensed	Number of injection (3 months) given to women during that month
pill_number_dispensed	Number of oral contraceptives (one cycle) given to women during that month
iud_number_received	Number of IUDs received in that month
implant_number_received	Number of implants received in that month
injection2_number_received	Number of injection (2 months) received in that month
injection3_number_received	Number of injection (3 months) received in that month
pill_number_received	Number of oral contraceptive (one cycle) received in that month
iud_stock_end	The amount of IUD stock available at the end of that month
implant_stock_end	The amount of implant stock available at the end of that month
injection2_stock_end	The amount of injection (2 months) stock available at the end of that month
injection3_stock_end	The amount of injection (3 months) stock available at the end of that month
pill_stock_end	The amount of pill stock available at the end of

	that month

Recommended Supplementary Data Sources

- Institut National de la Statistique: National Institute of Statistics of Côte d'Ivoire.
- Demographic and Health Surveys (DHS) Program: "Accurate and representative data on population, health, HIV, and nutrition."
- Multiple Indicator Cluster Surveys: "The largest source of statistically sound and internationally comparable data on women and children worldwide."
- WorldPop: "Open and high-resolution geospatial data on population distributions, demographic and dynamics, with a focus on low and middle income countries."
- The Humanitarian Data Exchange: "Côte d'Ivoire administrative level 0-3 boundary polygons, lines, and points shapefiles, geodatabase, KMZ files, and live services, and gazetteer."

Submission Guidance and Requirements

All EOIs must be submitted via the Competition for Development webpage to compete in the Intelligent Forecasting Competition. The EOI submission requirements for the Forecasting Prize and the Field Implementation Grant are defined below.

Forecasting Prize

1. The predicted consumption (stock_distributed) values must be submitted in the 'predicted_value' field of the *submission_format.csv* template file. The template is provided in Annex I, and can be downloaded using this link. The fields in this file include: year (YYYY); month (MM); site_code; product_code; predicted_value. The predictions should be made monthly for three months: October 2019, November 2019, and December 2019.

2. Any submitted model(s) must be uploaded as a Jupyter Notebook (file extension .ipynb). There are instructions on how to create a Jupyter Notebook in Annex II. For USAID learning purposes, please include comments using Jupyter Notebook that clearly document each step taken in the development of the model. These may potentially include, but are not limited to, decisions to include/exclude certain variables, results of tests conducted to assess accuracy, etc.

3. Provide narrative answers to the questions listed below to describe each of the models submitted. While completing the narrative answers is required, answers will

not be considered in the evaluation and determination of the prize awards. These answers will be used by USAID to better understand the elements of a successful model.

Competitors will have the opportunity to indicate whether the information included in the narrative response is proprietary or confidential, and provide the information USAID can share publicly or with other competitors. Competitors may include the same or duplicate content.

A. Help USAID to understand the model:

1. Provide a brief, high level summary of the submitted model.
2. Provide the three most important blocks of code from the model. Paste each block below and explain what it does and why it is important to the model.
3. How was the model trained (e.g. hyperparameters, training protocols, specialized hardware)?
4. Please share any relevant charts, graphs, or visuals pertaining to model submission and/or performance. (Optional)
5. Is there anything that was tried but did not make it into the final submission? If so, please explain briefly. (Optional)
6. Is there anything USAID should know regarding model performance, potential issues or quirks, and/or biases (including, but not limited to gender bias) inherent to the proposed model?

B. Recommend future steps:

1. Describe any strengths or limitations to implementing this model in the field.
2. If this model is implemented in the field, are there additional recommendations for data, resources, or techniques to try?
3. Please share any questions or concerns about the data provided for this competition.

C. Sharing the Model

1. Can details from the submitted model(s) and narrative (excluding confidential and proprietary information) be included in published research, blogs, or other public forms of learning from this competition?
2. Can the model submitted be shared with other competitors?

D. Intent to Compete for the Field Implementation Grant:

1. For competitors that intend to enter the Forecasting Prize but NOT the Field Implementation Grant:
    a. Please indicate if you would like to participate in the co-creation activity. Even if you are NOT competing for the Implementation Grant, you may be invited to participate in co-creation, where you could share information on the model that you have developed with other organizations, share your

model itself (if desired), and possibly identify an organization to partner with on their proposal for the Implementation Grant.

Field Implementation Grant

The goal of the Field Implementation Grant is to work with stakeholders in Côte d'Ivoire to customize, continually improve, and field test the intelligent forecasting model. The grant winner will work with selected facilities in Côte d'Ivoire to use the model to improve the accuracy of contraceptive consumption forecasting and ordering, and the utility of the model for facilities.

During the approximately one year or longer implementation period, the expected activities may include, but are not limited to:

1. Socializing the model with prospective local stakeholders and users;
2. Customizing and iteratively strengthening the model and data sources with stakeholders;
3. Developing a user interface with and for service delivery site staff;
4. Training users to use the model;
5. Pilot testing at sites for decision support; and
6. Measuring the delta between model performance and traditional order calculation methods.

USAID encourages competitors to propose additional activities that are relevant to the successful implementation of an intelligent forecasting model. The successful competitor will also be expected to provide, to stakeholders in Côte d'Ivoire and USAID/Washington, DC: regular updates, relevant data, and a final report on their results, implementation process, and lessons learned to contribute to the body of knowledge around using intelligent methods to forecast consumption of contraceptives.

Field Implementation Grant Submission Requirements

1. Responses to additional questions on the online entry platform that address the recommended field implementation approach**.** Responses should be clear, thorough, and address the following questions:
    a. **Understanding of the Problem:** Please articulate the problem of contraceptive forecasting and your overall understanding of why and how an intelligent method might be utilized, particularly in Côte d'Ivoire. (500 words)
    b. **Local Applicability:** Please describe how the proposed model will address local needs and context in the Côte d'Ivoire public sector health system. (500 words)
    c. **Implementation Capacity:** Please indicate your capacity to deliver the project, including details of how you will staff and manage the grant. (500 words)
    d. **Past Performance:** Please describe your past experience implementing similar projects. (250 words)
2. Describe your willingness to collaborate. This section will not be evaluated.
    a. Are you willing to share your field implementation approach with other competitors?

b. Are you willing to incorporate another competitor's intelligent forecasting model into your field implementation approach?
c. Are you willing to partner with another competitor through a co-creation process?

Co-Creation and Concept Notes

USAID will test models and evaluate EOIs to develop a shortlist of competitors for the Forecasting Prize and Field Implementation Grant, who will be invited to a virtual co-creation effort. Competitors who only submitted an EOI to the Forecasting Prize must state they are open to partnering with a field implementation team to be eligible to participate in co-creation activities.

During co-creation, shortlisted competitors will have the opportunity to improve their models and field implementation approaches; incorporate new approaches or knowledge specific to working in Côte d'Ivoire; form or strengthen partnerships (if any); and develop strong concept notes. Note that competitors participating in co-creation are not required to partner or collaborate with each other.

The purpose of co-creation efforts are for competitors to:

1. Share lessons learned and good practices in developing intelligent forecasting models and in implementing forecasting methods at the service delivery level in the field;
2. Provide ideas to customize and improve intelligent forecasting models, to optimize field implementation in Côte d'Ivoire;
3. Provide opportunities for organizations that are competing for the Field Implementation Grant to learn from, or possibly utilize, the forecasting models that other organizations developed for the Forecasting Prize;
4. Encourage new partnerships and strengthen existing partnerships to improve the quality of forecasting models and Field Implementation Grant approaches; and
5. Deepen competitors' understanding of operating in the local context in Côte d'Ivoire, such as social norms, patterns of power, and access to resources.

The following activities will be part of co-creation:

1. Co-creation kick off webinar with USAID and shortlisted participants (Required)
2. Follow-up dialogues (by phone, video, or in person) with judges and stakeholders to clarify lingering questions or hone the expression of interest (Optional).
3. Teleconference with USAID/Côte d'Ivoire and other in-country stakeholders to share additional country context (Optional, but recommended).
4. Other activities to be determined.

USAID will make every effort to schedule the co-creation sessions at a reasonable time for all competitors and judges.

Concept Note Submission Requirements

Based on the aforementioned co-creation activities, competitors who wish to continue competing for the grant may submit a concept note. USAID will share the concept note evaluation criteria at the beginning of the co-creation effort. The concept note is expected to be up to ten pages in length and will incorporate the following:

1. Updated intelligent forecasting model (one model), with revisions based on discussion and feedback provided by USAID;
2. Narrative describing the revised intelligent forecasting model, including a description of what changed; what didn't; and a discussion on the reproducibility of the model in the field;
3. Revised and expanded narrative from the expression of interest which incorporates feedback from judges, USAID, and Ivorian stakeholders. This includes:
    a. Understanding of the problem, including technical and social barriers;
    b. Local applicability;
    c. Implementation capacity, including a plan describing the roles of all partners; and
    d. Past performance;
4. Narrative description of the approach and activities that will be undertaken as part of the grant;
5. Sustainability, a discussion of the challenges, and opportunities for the long term technical and financial sustainability of the model in the local public sector health system with minimal external support. Answers can also address how the model can be updated in light of new data and circumstances;
6. Scalability, a discussion of how the model could be scaled in the country, challenges and opportunities for scaling it to other country contexts, and any additional resources required for success;
7. List of deliverables and outputs; and
8. Proposed indicators to measure performance and proposed performance targets.

The following appendices should also be included, but will not count towards the ten page limit:

1. Curricula vitae for staff;
2. Detailed budget and proposed milestone deliverable (see template in Annex III);
3. Activity plan (see template in Annex III);
4. Registration documents;
5. Letters of agreement, memoranda of understanding, or letters of intent solidifying partnerships (if applicable);
6. Documentation verifying local right to operate;
7. Three relevant references including names, email addresses, phone numbers, and a description of the work undertaken;
8. DUNS number (if available); and
9. Other documentation as requested.

Evaluation Process

Forecasting Prize Evaluation Criteria

After conducting an eligibility screen, USAID will review the predicted values submitted. The metric that will be used to evaluate the models is the *mean absolute scaled error (MASE)* of the predictions. The error will be calculated for each prediction in the submission and then averaged across all site level predictions for each contraceptive. The lower the score the better. More information on calculating MASE can be found on Wikipedia.

Evaluation Metric

$$MASE = \frac{MAE}{MAE_{in-sample,\ naive}}$$

The best performing model prize winner and second-best performing model prize winner will be awarded funding under USAID's Innovation Incentive Award Authority. Innovation Incentive Award Authority awards are issued as a funds transfer to the winners' bank accounts and all award monies may be used at the winning teams' discretion.

The model which predicts future consumption, per product and service delivery site, with the highest accuracy will receive a prize award of 20,000 USD, and the model with the second highest accuracy will receive an award of 5,000 USD.

USAID retains sole and absolute discretion to declare winners and award all prizes. Any decision may not be challenged by any of the competitors participating in this contest. All decisions will be final and not subject to review.

Field Implementation Grant EOI Evaluation Criteria

First, USAID will conduct an eligibility screening of all organizations who expressed desire to compete for the Field Implementation Grant. Among organizations who are confirmed to be eligible, USAID will create a shortlist of EOIs from organizations who submitted the most accurate models for forecasting future consumption. The shortlisted EOIs will then be evaluated by an expert judging panel, per the criteria below. All members of the judging panel will sign Non-Disclosure Agreements (NDA), conflict of interest forms, and statements acknowledging that they make no claim to the intellectual property developed by competitors or relevant partners.

The expert judging panel will evaluate the shortlisted solutions against the following criteria. Please note all criteria areas are equally weighted.

Criteria	Expression of Interest Details
Understanding of the problem (500 words)	Articulation of the problem of contraceptive forecasting and overall understanding of why and how an intelligent method might be utilized, particularly in Côte d'Ivoire. The competitor's response should include: key challenges of forecasting contraceptive consumption at the service delivery site level in Côte d'Ivoire; why intelligent forecasting methods are relevant to addressing the key challenges in contraceptive forecasting; and how intelligent forecasting methods can be leveraged to address challenges and improve the accuracy of contraceptive forecasting.
Local applicability (500 words)	Describe how the proposed model will address local needs and context in the Côte d'Ivoire public sector health system. The competitor's response should include: their connections to the Côte d'Ivoire health system; how their intelligent forecasting model could work as part of the system; how they intend to interface with stakeholders; how they will leverage networks and partners to inform the design, development, and implementation of the intelligent forecasting model in Côte d'Ivoire; how they will address challenges, gaps, and opportunities specific to deploying the intelligent forecasting solution in that country; and their connections to the country, which may include a presence or partners in the country.
Implementation Capacity (500 words)	The capacity of the applicant to deliver the project, including details of how they will staff and manage the grant. The competitor's response should include: their approach to staffing, partnering, managing, and implementing the grant, including how it addresses gender; the sequence of activities they intend to undertake to implement this project; and how the model will be maintained over time, keeping in mind factors such as local data science capacity for model updates, accounting for model drift, and/or addressing bugs, etc.
Past Performance (250 words)	The competitor's past experience implementing similar projects. The competitor's response should include: past experience implementing projects of similar scope and in similar contexts; and three references who can speak to past performance and ability.

Field Implementation Grant Concept Note Evaluation Criteria

Competitors who are invited to co-creation will develop and submit concept notes. Concept notes will be reviewed and evaluated by an expert USAID review board. The detailed concept note evaluation criteria will be provided at the beginning of the co-creation effort. Concept notes will be evaluated as follows:

- A Red Light: The concept note will not proceed.
- A Yellow Light: The concept note will revert back to the competitors for additional clarification and co-creation. Competitors will resubmit the review board, who will make a decision. Note that a competitor may go through multiple rounds of review and revision.
- A Green Light: One concept note will receive a 'Green Light' indicating the entry merits an award.

Field Implementation Grant

After receipt of a "Green Light," the selected competitor will work with USAID and stakeholders from Côte d'Ivoire to negotiate and finalize the grant agreement.

Upon receipt of funds, the grantee is expected to conduct start-up, implement and iterate the intelligent forecasting solution, and complete close-down and reporting. The total length of the agreement will be decided by USAID and the grantee and will include field implementation of the forecasting model (see description under Submission Guidance and Requirements). In addition to the implementation of the solution and the regular grant reporting relationship, the grantee will be expected to report learning on a regular basis to USAID/Washington, USAID/Côte d'Ivoire, and other Côte d'Ivoire stakeholders. This learning could entail, but is not limited to, modifications to the solution, new data, assessments of efforts to socialize the use of the solution, model performance, setbacks, or successes. A final report detailing the adaptations the grantee undertook to design, implement, modify, and socialize the solution as well as the results of the grant will be a required deliverable.

Additional Resources

To develop a competitive entry, participants are encouraged to consult the following links:

- "An Empirical Comparison of Machine Learning Models for Time Series Forecasting" Ahmed, Nesreen & Atiya, Amir & Gayar, Neamat & El-Shishiny, Hisham. (2010). *Econometric Reviews*. 29. 594-621. 10.1080/07474938.2010.481556.
- "Contraception supply chain challenges: a review of evidence from low- and middle-income countries," Bakali Mukasa,Moazzam Ali ,Madeline Farron &Renee Van de Weerdt, Pages 384-390 | Received 28 Jul 2017, Accepted 15 Oct 2017, Published online: 31 Oct 2017

- "Exploring Fairness in Machine Learning for International Development," Awwad, Yazeed; Fletcher, Richard, Frey, Daniel; Gandhi, Amit; Najafian, Maryam; and Teodorescu, Mike. (2020). *MIT D-Lab*.
- "Healthcare Supply Chains in Developing Countries Situational Analysis" Dowling, Paul 2011. Arlington, VA: USAID Deliver Project, Task Order 4.
- OpenLMIS/eSIGL Profile Page for Côte d'Ivoire: https://openlmis.org/implementation_region/cote-divoire/
- "Reflecting the Past, Shaping the Future: Making AI Work for International Development." Paul, Amy, Jolley, Craig, and Anthony, Aubra (2018). USAID.
- "Statistical and Machine Learning forecasting methods: Concerns and ways forward," Makridakis S, Spiliotis E, Assimakopoulos V (2018). PLoS ONE 13(3): e0194889.
- USAID Family Planning Logistics Toolkit - Forecasting Page: https://toolkits.knowledgesuccess.org/toolkits/fp-logistics/forecasting
- USAID's *Local Systems: A Framework for Supporting Sustained Development*, which provides guidance on how to sustainably embed international development programming in local systems.
- USAID's *A Practical Guide for the Supply Chain Management of Health* Commodities (2017), which provides practical guidance in managing the supply chain, with an emphasis on health commodities.

Please continue to consult the online entry platform for additional updates, relevant dates, examples, and resources.

Annex I: Predicted Consumption CSV Template

The predicted consumption (stock_distributed) values must be submitted in the appropriate 'predicted_value' field of the template file: submission_format.csv. The predictions should be made monthly for three months: October 2019, November 2019, and December 2019. Example values can be found in the table below. Competitors can download this template here.

year	month	site_code	product_code	predicted_value
2019	10	C4001	AS27134	0
2019	10	C4001	AS27132	0
2019	10	C4001	AS27000	0
2019	10	C4001	AS27137	0
2019	10	C4001	AS27138	0
2019	10	C4001	AS27133	0
2019	10	C4023	AS27000	0
2019	10	C4023	AS27133	0
2019	11	C4023	AS27000	0

Annex II: Guidance on Jupyter Notebook

Overview

Jupyter Notebook is the format chosen by the Forecasting Prize to accept and evaluate all competitor model submissions. Competitors are required to use the Jupyter Notebook format exclusively. Any models submitted in a format other than the Jupyter Notebook will not be eligible or evaluated.

Competitors who are unfamiliar with the Jupyter Notebook environment are encouraged to familiarize themselves with the file type using the information provided below as well as any other online resources available.

Project Jupyter

Project Jupyter maintains Jupyter Notebook. Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations, and narrative text. Uses include: data cleaning and transformation, numerical simulation, statistical modeling, data visualization, machine learning, and much more.

- Official Jupyter Notebook User & Installation Guide
- Official Jupyter Notebook User

Creating a Jupyter Notebook using the Cloud

A Jupyter Notebook can be created entirely online without downloading any software to a local machine. Prize competitors who choose to use cloud services to create their Jupyter Notebook may utilize the service of their choice.

- Examples of Cloud Services for Jupyter Notebook

Creating a Jupyter Notebook using Desktop Software

A Jupyter Notebook can also be created using desktop software, such as Python or R. While Python is required to create and run Jupyter Notebook, a Jupyter Notebook can be written in over 40 programming languages, including R, Scala, and Julia.

- Jupyter Notebook Installation Guide for Python Users
- Jupyter Notebook Installation Guide for R Users
- Jupyter Notebook Installation Guide for Stata Users

Markdown

We encourage prize competitors to include comments to submitted code as they see fit to assist in the evaluation process. Jupyter Notebook recommends utilizing Markdown Cells to markup code as needed.

- Official Jupyter Notebook Markdown Cell Guide

Final Model Submission Checklist

The following is a checklist that prize competitors can utilize to ensure all the necessary documentation is included in their Jupyter notebook submission for evaluation:

- ✔ The code being submitted was developed in a programming language supported by Jupyter Notebook?
- ✔ Any critical comments/markups to the code being submitted are included using markdowns cells?
- ✔ The Jupyter Notebook model package is uploaded (file extension: .ipynb) in the *"**Prediction and Model Submission**"* section of the entry form under *"**Please upload your model from Jupyter Notebook.**"*

Annex III: Concept Note Budget and Activity Plan Template

https://docs.google.com/spreadsheets/d/14675-HKA3VZzjrsL4-R2kkx52nXFG17Dmsfo6O3_0Vo/edit?usp=sharing