RTI Press

Occasional Paper
ISSN 2378-7996
May 2022

Reach Health Assessing Cost-Effectiveness for Family Planning (RACE-FP) Methodology Report: Estimating the Impact of Family Planning Interventions in the Philippines

Kathryn E. L. Grimes, Adam J. Walter, Amanda A. Honeycutt, Cristina Bisson, and Jennifer B. Griffin

RTI INTERNATIONAL

RTI Press publication OP-0072-2205

Suggested Citation

Grimes, K. E. L., Walter, A. J., Honeycutt, A. A., Bisson, C., and Griffin, J. B. (2022). *Reach Health Assessing Cost-Effectiveness for Family Planning (RACE-FP) Methodology Report: Estimating the Impact of Family Planning Interventions in the Philippines*. RTI Press Publication No. OP-0072-2205. Research Triangle Park, NC: RTI Press. https://doi.org/10.3768/rtipress.2022.op.0072.2205

This publication is part of the RTI Press Research Report series. Occasional Papers are scholarly essays on policy, methods, or other topics relevant to RTI areas of research or technical focus.

RTI International
3040 East Cornwallis Road
PO Box 12194
Research Triangle Park, NC
27709-2194 USA

Tel: +1.919.541.6000
E-mail: rtipress@rti.org
Website: www.rti.org

Contents

About the Authors

Kathryn E. L. Grimes, MPH, is a research public health analyst at RTI International.
https://orcid.org/0000-0003-0248-2157

Adam J. Walter, MS, is a research economist at RTI International.
https://orcid.org/0000-0002-5907-2784

Amanda A. Honeycutt, PhD, is a senior economist at RTI International.
https://orcid.org/0000-0003-0166-1399

Cristina Bisson, RN, MPH, is director of health systems at RTI International.

Jennifer B. Griffin, PhD, MPH, is supervising epidemiologist at the Los Angeles County Department of Public Health.
https://orcid.org/0000-0003-4621-2773

RTI Press Associate Editor

Barbara Biesecker

Abstract

In the Philippines, demand for family planning (FP) is high, and the government is committed to helping the population achieve universal access to quality FP information and services. Reach Health Assessing Cost-Effectiveness for Family Planning (RACE-FP) is a decision support tool designed to estimate the impact FP interventions have on averting unintended pregnancies and on downstream maternal and neonatal health (MNH) outcomes. This report provides technical details of the RACE-FP model.

RACE-FP is organized by objectives: improve postpartum FP, improve public sector and private sector provision of FP, improve demand for FP, reduce contraceptive stockouts, and introduce a modern contraceptive method. Although other models have been developed to estimate the impact of contraceptive use on averting unintended pregnancy at the national level for the Philippines, RACE-FP is the only model to provide estimates at national and regional levels, include intervention and commodity costs, disaggregate outcomes by age group and setting (public, private, community), and estimate the broader impact of modern contraceptive prevalence on MNH outcomes. RACE-FP can be an important resource to determine the relative benefit of FP interventions in the Philippines and could support policy decisions globally.

Acknowledgments

This methodology report was written by Kathryn E. L. Grimes and Adam J. Walter of RTI International, who also spearheaded RACE-FP development and parameterization. Jennifer B. Griffin led the RACE-FP development project and reviewed the manuscript. Amanda A. Honeycutt supported model refinement and manuscript writing and editing. Cristina Bisson reviewed the manuscript and is the Reach Health project director.

The authors thank RTI Reach Health colleagues based in Manila, Philippines, without whom RACE-FP development would not be possible; they provided crucial feedback that shaped RACE-FP design, identified Philippines-specific data sources for parameterization, and collaborated with Philippines Department of Health contacts to support model development.

Introduction

Background

In the Philippines, demand for family planning (FP) among women of reproductive age (WRA) is high: the most-recent estimates from the 2017 National Demographic and Health Survey (NDHS) indicate that 17% of currently married women ages 15–49 years and 49% of sexually active unmarried women ages 15–49 years have an unmet need for FP.[*,1] Fortunately, the Philippines Department of Health (DOH) is committed to providing "information and access, without bias, to all methods of FP," as indicated in the Responsible Parenthood and Reproductive Health (RPRH) Act of 2012.[2] In parallel, the Philippines' DOH FP Program's vision is "for Filipino women and men [to] achieve their desired family size and fulfill the reproductive health and rights for all through universal access to quality FP information and services."[3] The Philippines National FP Program and the RPRH Act of 2012 enumerate efforts to achieve this vision. They include strengthening FP commodity procurement and distribution, building demand for FP through public awareness–raising efforts, and facilitating coordination with nongovernmental organizations and the private sector to improve access. These efforts address the National FP Program objectives to (1) increase the modern contraceptive prevalence rate (mCPR)[†] among women from 24.9% in 2017 to 30% by 2022 and (2) reduce the unmet need for modern FP from 10.8% in 2017 to 8% in 2022.[3]

This report conveys technical details of the model Reach Health Assessing Cost-Effectiveness for Family Planning (RACE-FP), a decision support tool developed for FP policy makers in the Philippines. The objective of RACE-FP is to estimate the impact single or combined FP interventions have on averting unintended pregnancies at national and regional levels and on downstream maternal and neonatal health (MNH)–related outcomes. A secondary RACE-FP objective is to estimate intervention and supply costs to inform key decision-makers of how to best allocate limited resources to achieve FP-related goals. RTI International, the lead implementing partner of the US Agency for International Development (USAID) Reach Health Project, initiated RACE-FP.

RACE-FP was based on the Maternal and Neonatal Directed Assessment of Technologies (MANDATE) model. MANDATE is an evidence-based, mathematical model designed to estimate the impact of interventions—such as preventive interventions, diagnostics, treatments, and transfers to different care settings—to reduce maternal, fetal, and neonatal mortality in sub-Saharan Africa and India.[5] Developed in 2014 with funding from the Bill and Melinda Gates Foundation, the MANDATE web-based tool[6] is freely available for public use, used by more than 100,000 unique users across 184 countries, and referenced in multiple publications.[5,7-14] MANDATE has been adapted and expanded to support decision-making on several topics in different contexts; adaptations include Model for Assessment of Pediatric Interventions for Tuberculosis (MAP-IT),[15,16] Assessing Diarrhea and Pneumonia Treatments (ADAPT),[17] and Zimbabwe Averted Pregnancy (ZAP).[18] RACE-FP is the most-recent adaptation of MANDATE.

Guide to This Report

This report describes the analytical framework behind the estimates in the RACE-FP model. First, we present information on the underlying structure of the model and how the population flows through the model to obtain estimates for the baseline scenario. Next, we present the baseline results, along with an example demonstrating how expanding a FP intervention changes results. Additional details on data sources, parameters, assumptions, calculations, and limitations can be found in supplementary materials, which we reference throughout the report. Readers can obtain a full picture of RACE-FP by reviewing both the report text and the supplementary materials (available at https://doi.org/10.5281/zenodo.6029905). This report contains the following sections:

* Unmet need for FP includes the proportion of WRA who (1) are not pregnant and not postpartum amenorrheic, are considered fecund, and want to postpone their next birth for 2 or more years or stop childbearing altogether but are not using a contraceptive method; (2) have a mistimed or unwanted current pregnancy; or (3) are postpartum amenorrheic and whose last birth in the past 2 years was mistimed or unwanted.

† Modern contraceptive prevalence rate is the percentage of WRA who are using (or whose partner is using) a modern contraceptive method at a particular point in time.[4]

- **Model Design and Structure** provides an overview of the RACE-FP model framework, including the conceptual model, modeled outcomes, time periods of analysis, and model inputs.
- **Model Population** describes the modeled population and how it flows through the model to obtain estimates for the baseline scenario. Details on how the main at-risk population was identified are in Supplement A (Model Population), and supplementary information on the parameters affecting the population is in Supplement B (Contraceptive Penetration, Utilization, and Effectiveness).
- **Interventions** outlines the different interventions in the model, intervention parameters, and the relationship between these intervention parameters and the main at-risk population. Supplement D (Intervention Parameters) further elucidates the intervention parameters.
- **Baseline Results** summarizes how RACE-FP uses the intervention parameters to compare baseline values to the user-created scenario. Baseline values for outcomes are also included in this section, and supplementary detail on how these values were calculated is in Supplement E (RACE-FP Outcomes). Information on how contraceptive commodity costs were calculated is in Supplement C (Contraceptive Commodity Costs).
- **Model Sensitivity and Uncertainty Analyses** presents the methods and partial baseline results of the sensitivity and uncertainty analyses. Complete baseline probabilistic sensitivity analysis (PSA) results are in Supplement F (Model Sensitivity Results).

Supplements are referenced throughout the report and include definitions, calculations, assumptions, limitations, and sources used to identify needed parameters for use in RACE-FP.

Model Design and Structure

This section provides an overview of RACE-FP's design and structure, summarizing the main features and assumptions, baseline versus scenario runs, modeled outcomes, modeling time period, and model parameters.

Model Framework

RACE-FP is a deterministic decision tree mathematical model that we initially designed as a modification of MANDATE. We developed the underlying RACE-FP model in Excel and made it available in a user-friendly, interactive web-based platform called UPmod.[19] In 2021, RTI created UPmod to provide an intuitive interface for mathematical models developed in Excel or other programming languages. Hosting RACE-FP on UPmod facilitates use and discussion among key Philippines stakeholders; however, this methodology report focuses on the underlying Excel model.

Interventions, Target Population, and Outcomes

RACE-FP interventions are focused on pre-pregnancy interventions, such as mass media campaigns to increase demand for FP, increase mCPR, and prevent unintended pregnancies. RACE-FP's population of interest is all Filipino WRA whom we follow from method utilization through pregnancy and childbirth. RACE-FP explores the impact of increasing the use of contraceptive methods before a potential pregnancy. The model's downstream outcomes regarding morbidity or mortality post-pregnancy are based on multipliers of unintended pregnancies and live births. MANDATE offers a useful follow-on to RACE-FP, in that it begins with pregnant women and follows them through the postpartum period, focusing on preventing, diagnosing, and intervening in maternal, fetal, and neonatal health conditions.

Setting Classification

RACE-FP includes three settings from which women may obtain FP services: public health care settings, private health care settings, or community settings (such as pharmacies and shops). The model assumes women can use services at any setting, dependent on availability.

Baseline and Scenario Runs

As a deterministic mathematical model, RACE-FP compares estimates from a baseline run to a user-developed counterfactual scenario. RACE-FP runs both the baseline and scenario models with identical starting populations (for details, see Supplement A: Model Population). While the baseline model assumes no change in the availability of FP interventions (i.e., the baseline model estimates status quo contraceptive use and downstream effects), the scenario model takes user changes to the intervention parameters into consideration. WRA who are at risk of unintended pregnancy and not using any method to prevent pregnancy are the main at-risk population. RACE-FP applies a series of probabilities, user-entered decisions, and assumptions around contraceptive access and use to this at-risk population to estimate unintended pregnancy and related downstream outcomes. By increasing intervention exposure parameters, the user is modifying the number of people exposed to the intervention which will, in turn, increase contraceptive access and utilization rates. RACE-FP results display how outcomes differ between the baseline and scenario to support FP policy decisions.

For example, if a policymaker in the Philippines is interested in expanding efforts to train public sector providers in FP service provision, they can use RACE-FP to examine how this expansion would affect FP outcomes, MNH outcomes, and cost. Typically, a user will estimate the impact of expanding an intervention; however, RACE-FP allows reductions as well, which may be useful for resource allocation. RACE-FP is not a stochastic model; therefore, the differences in outcomes between a baseline and scenario run are solely the result of changes in interventions.

Creating a Scenario in RACE-FP

The user can compare baseline outcomes with up to four counterfactual scenarios. To create a scenario, the user first defines the modeled population by selecting the geographic location (i.e., Philippines, National Capital Region [NCR], Central Visayas, Caraga, or other location) and population of interest (e.g., all WRA or married WRA). The user then creates a scenario by selecting FP interventions to target. The user alters parameters related to each FP intervention they intend to include in their scenario. RACE-FP compares outcomes in the user-created scenario to baseline outcomes and includes text that describes which scenario performed the best for each outcome listed on the Results page (e.g., "Best outcome scenario: Scenario 3"). Full details on modeled interventions, exposure parameters the user changes to create a scenario, and the process used to calculate parameters used in the scenario can be found in the "Interventions" section, Supplement D: Intervention Parameters, and Supplement B2: Contraceptive Utilization.

Modeled Outcomes

The primary objective of RACE-FP is to estimate the reduction in unmet need and unintended pregnancy that results from FP interventions. RACE-FP also estimates the number of related MNH outcomes (e.g., maternal death, neonatal death), the number of users of each FP method, and the cost to support increased contraceptive use and intervention expansion. The Results page presents outcomes comparing baseline and scenario(s) for the geographic location specified when the user defines the population of interest. The user can toggle between age groups (adolescents, adults, or all women) when viewing results. Table 1 lists outcomes included in RACE-FP. For details on definitions, calculations, assumptions, and sources used to calculate outcomes, see Supplement E: RACE-FP Outcomes.

Time Period

RACE-FP is a single-time-period model with a baseline year of 2018 representing the status quo. However, the user can adjust the time period by updating baseline model parameters to reflect the year of interest (e.g., updating the parameters that use 2018 Philippines NDHS data when the next report is published). The model assumes all users initiate a method at the start of the modeled time period and are covered through the modeled year. We included a cost and inflation tool within the model so the user can convert costs to a different year by inserting the year of interest and corresponding Consumer Price Index with a base year of 2012 (the Philippines Consumer Price Index used for 2018 was 115.4 with a base year of 2012).

Model Inputs: Parameter Identification and Validation

Philippines-specific data parameters were used whenever possible, ideally from a Philippines government source. If Philippines-specific data

Table 1. Outcomes included in RACE-FP

FP Outcomes	MNH Outcomes	Cost Outcomes
• Number of users in current time period[a] • Number of WRA with met need[b] • Number of WRA with unmet need[c] • Modern contraceptive prevalence rate (mCPR)[d] • Unmet need %[e] • Long-acting reversible contraceptive (LARC) users[f] • Proportion of demand satisfied[g] **Number of Users of Each Method** • Sterilization • Lactational amenorrhea method (LAM) • Traditional family planning (TFP) • Modern natural family planning (MNFP) • Oral contraceptives • Injectables • Intrauterine device (IUD) • Implants • Male condom • New modern method	• Number of unintended pregnancies • Number of total pregnancies (intended + unintended) • Number of unsafe abortions • Number of miscarriages • Number of live births • Number of maternal deaths • Number of stillbirths • Number of neonatal deaths • Birth rate per 1,000 • Number of unintended pregnancies averted from all methods used • Number of unintended pregnancies averted from modern method use • Number of unsafe abortions averted from all methods used • Number of unsafe abortions averted from modern method use • Number of maternal deaths averted from all methods used • Number of maternal deaths averted from modern method use	**Contraceptive Cost[h]** • Sterilization • LAM • TFP • MNFP • Oral contraceptives • Injectables • IUD • Implants • Male condom • New modern method[i] **Cost Summary** • Cost of contraceptives • Cost of intervention(s)[j] • Total cost (cost of contraceptives + cost of intervention[s])

Note: RACE-FP = Reach Health Assessing Cost-Effectiveness for Family Planning; FP = family planning; MNH = maternal and neonatal health; WRA = women of reproductive age.

[a] Includes all users except LARC users who started their method before the modeled time period and are still protected. Does not include abstinent WRA.

[b] Number of current contraceptive users, including those covered by a long-term method (IUD, implant, sterilization) started before modeled time period. Does not include abstinent WRA.

[c] Number of WRA at risk of pregnancy who do not want to become pregnant and are not using any FP method. Does not include abstinent WRA.

[d] mCPR is the percentage of WRA who are using (or whose partner is using) a modern contraceptive method at a particular point in time. The denominator is the total population of WRA. Data for the numerator—the number of users of all modern contraceptive methods—comes from the Philippines NDHS. The numerator includes the total number of modern contraceptive methods among WRA as listed in the Philippines NDHS. For further detail on how contraceptive utilization was calculated for each method, please refer to Supplement B2: Contraceptive Utilization.

[e] Unmet need percentage is the proportion of WRA who are at risk of pregnancy, do not want to become pregnant, and are not using any FP method. Does not include abstinent WRA.

[f] LARC users are IUD and implant users.

[g] Proportion of demand satisfied is the proportion of users who receive a method among those that need one.

[h] Contraceptive costs include direct and indirect commodity costs attributed to the method in the modeled time period. Contraceptive costs were calculated by multiplying the total number of users of each method in the modeled time period by the overall estimated cost per person.

[i] The RACE-FP user controls the unit cost for a new modern method. Indirect costs may not be included if the user does not factor them in.

[j] Intervention costs are calculated by the cost per person exposed to the intervention multiplied by the total number of people exposed to the intervention.

were not available for a parameter, we used regional estimates (e.g., Asia, Southeast Asia) or countries as close geographically or culturally to the Philippines as were available.

If data from 2018—our baseline year—were not available, we used data collected as close to 2018 as possible and either assumed that the available data reflected 2018 values or adjusted the parameter to reflect the best estimate for 2018 (e.g., Philippines Statistical Authority 2015 Census data and multipliers were used to estimate disaggregated population parameters, and cost data were converted to 2018 Philippine pesos [Php]).

Although we developed the RACE-FP model to support regional decision-making, we scrupulously examined available regional- and provincial-level data and compared them with national-level data for the greatest model accuracy possible. National-level estimates were used if the regional-level data were deemed inadequate (e.g., the sample size was small and considered not generalizable). Currently, data in RACE-FP allow for national-level Philippines estimates and for estimates in the regions of NCR, Central Visayas, and Caraga; if users have access to specific regional-level data where national-level estimates were used, they can update parameters to be more specific as appropriate. Furthermore, if a user is interested in exploring the impact of FP interventions in a region not included in the model, RACE-FP allows the user to add a new geographic area along with relevant parameters specific to the location.

RTI researchers based in the United States collaborated with the RTI Reach Health team based in Manila to identify the most-appropriate parameters for the RACE-FP model. The Reach Health team in Manila coordinated with contacts at the DOH to obtain Philippines-specific data sources and review and validate parameters.

Inputs used to populate the model can be classified into three categories: population, contraceptive, and intervention parameters.

Population Parameters

Population parameters structure the environment of the model. These include estimates of the initial population of WRA and other demographic parameters to identify the population that will be affected by FP interventions in the user-developed scenario(s). The "Model Population" section and Supplement A detail the population parameters used in the model.

Contraceptive Parameters

Contraceptive parameters include the penetration, utilization, and effectiveness (PUE) of contraceptives in the Philippines. Contraceptive PUE parameters used in RACE-FP can be found in Supplement B: Contraceptive Penetration, Utilization, and Effectiveness. RACE-FP uses these contraceptive parameters to identify the target population (i.e., women not trying to conceive who are at risk of pregnancy) and the total number of users of each method for baseline.

- **Contraceptive penetration:** Contraceptive penetration parameters are the first step in the model in assessing the number of women who can access—and later use—a contraceptive method. Penetration represents access to a method depending on the setting (public, private, and community) and age group (adults, adolescents). Most commonly, stockout data were used for each method to determine penetration (100% – stockout % = penetration %).
- **Contraceptive utilization:** Contraceptive utilization represents the proportion of WRA among the population of interest who consistently and correctly use a contraceptive method by setting and age group. We calibrated utilization data available through NDHS to adjust for our population of interest: those at risk of unintended pregnancy, not covered by other methods, and who have access to the method (penetration). Calibration details are in Supplement B2: Contraceptive Utilization.
- **Contraceptive effectiveness:** Contraceptive effectiveness reflects the real-world success of each contraceptive method included in the model. These effectiveness parameters are used to determine who is at risk of pregnancy while using a contraceptive method (i.e., the contraceptive effectiveness parameter identifies the number of users for whom the method did not work and are therefore at risk of pregnancy).

In addition to contraceptive PUE, we calculated **contraceptive cost** estimates for each method to determine the total direct and indirect contraceptive costs presented in outcomes. Cost outcomes reflect the cost to support the number of users of each method and the summed total contraceptive cost. A detailed description of how direct and indirect commodity costs were calculated—including key terms, definitions, calculations, and sources—can be found in Supplement C: Contraceptive Commodity Costs.

Intervention Parameters

Intervention parameters include the **exposure** (likelihood of someone in the target population being exposed to the intervention), **success** (likelihood of using FP as a result of being exposed to the intervention), **method distribution** (the proportion of users of each method as a result of the intervention), and **cost** (the cost per person exposed to the intervention). Intervention parameters are used to calculate the increase in the number of end-users of each intervention based on the scenario run. A detailed description of intervention parameters, assumptions, and sources can be found in Supplement D: Intervention Parameters. The "Interventions" section below outlines how these parameters interact in RACE-FP. Supplement E: RACE-FP Outcomes details how the outcomes presented in results were calculated.

Model Population

This section provides an overview of how the population flows through the model to obtain baseline scenario estimates. As RACE-FP supports the user in determining how best to reduce the risk of unintended pregnancy, the initial population of WRA must be refined to identify the main at-risk population for the baseline and scenario runs. The main at-risk population is WRA who are at risk of unintended pregnancy who are not using any method to prevent pregnancy (Figure 1).

To identify the main at-risk population, we took the following steps:

1. Identify initial population of WRA in the Philippines (disaggregated by geographic location and age group).
2. Identify eligible population of WRA at risk of unintended pregnancy by removing the following WRA:
   a. WRA who are currently pregnant, trying to conceive, or in menopause.
   b. WRA who have continued coverage from a long-acting method (sterilization, intrauterine device [IUD], implants) initiated before the modeled time, as we assume they will not seek secondary contraceptive methods in the modeled time.
   c. WRA who are abstinent, as we assume they will not seek a contraceptive method in the modeled time.
3. Identify the main at-risk population by removing the following WRA:
   a. WRA using non-commodity methods in the current time period (lactational amenorrhea method [LAM], traditional family planning [TFP], and new sterilizations).
   b. WRA using commodity-based methods in the current time period (modern natural family planning [MNFP], oral contraceptives, injectables, IUDs, implants, and male condoms).

Table 2 summarizes the initial population of WRA; eligible population of WRA not trying to conceive and at risk; and main at-risk population of WRA not trying to conceive, at risk, and not using any FP method. Additional detail on how the model population was calculated can be found in Supplement A: Model Population. Note that to move from the eligible population of WRA to the main at-risk population, we recalibrated contraceptive commodity utilization rates from Philippines NDHS to reflect what the utilization would be among our population of interest: those who are not trying to conceive, who are at risk of pregnancy, and who have access to a FP method. Details on how contraceptive utilization rates were calibrated to inform model populations are in Supplement B2: Contraceptive Utilization.

Figure 1. Identifying the main at-risk population

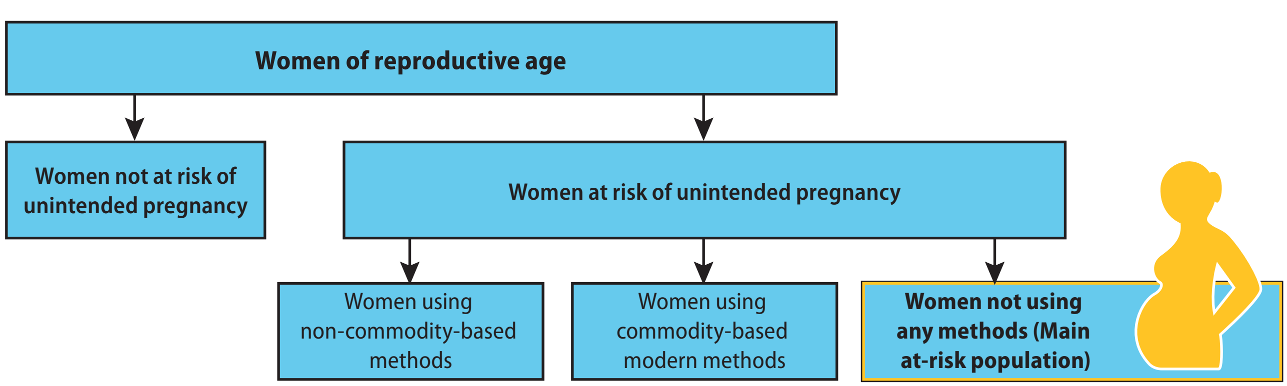


Table 2. Calculating the main at-risk population

		1.Initial Population (total WRA)	2. Eligible Population of WRA at Risk of Unintended Pregnancy			3. Main At-Risk Population[c]
			2a. Eligible population after removing WRA who are pregnant, in menopause, or trying to conceive	2b. Eligible population after removing WRA previously covered[a]	2c. Eligible population after removing WRA who are abstinent[b]	
Philippines National	All women	27,276,379	23,035,304	21,348,929	11,300,439	3,973,217
	Adolescent	5,043,110	4,826,256	4,808,364	304,867	152,149
	Adult	22,233,269	18,209,047	16,540,565	10,995,572	3,821,068
National Capital Region	All women	3,833,563	3,244,121	3,000,542	1,646,232	589,499
	Adolescent	617,861	594,382	592,190	40,440	21,667
	Adult	3,215,702	2,649,738	2,408,351	1,605,791	567,832
Central Visayas Region	All women	1,949,847	1,660,061	1,539,517	820,352	296,543
	Adolescent	361,225	347,860	346,578	24,004	13,022
	Adult	1,588,622	1,312,202	1,192,939	796,348	283,521
Caraga Region	All women	644,845	541,500	502,323	258,811	88,434
	Adolescent	128,674	122,369	121,912	7,007	3,129
	Adult	516,171	419,131	380,410	251,805	85,305

Note: WRA = women of reproductive age.

[a] Removes WRA who are covered by sterilization, IUD, or implant initiated before the modeled time period.

[b] Removes WRA who have never had sex or have not had sex in the prior year. Refer to Supplement B2: Contraceptive Utilization for more detail on how abstinence utilization was calibrated to influence model population.

[c] Removes current FP users (non-commodity and commodity-based methods) from the population of eligible population at risk.

Interventions

Interventions Included in RACE-FP

RACE-FP is organized by objectives of interest to the Philippines DOH, each of which include one or more interventions. Objectives were identified in collaboration with key stakeholders from the Philippines; many of the objectives aligned with national DOH objectives. Interventions within each objective were informed by available data. For example, although the ideal exposure parameter for an intervention to improve postpartum FP (PPFP) would be the proportion of WRA who received PPFP, those data were not available. Therefore, we used the proportion of WRA receiving postnatal care (PNC) as a proxy. Table 3 lists the objectives and interventions included in RACE-FP.

Intervention Parameters

For each intervention included in the model, we needed to obtain parameter values for intervention exposure, success, method distribution, and cost. Intervention parameter values are not specific to geographic location; however, the user can change values for current exposure, success, method distribution, and cost if—upon reviewing the definitions—the user determines that they have more-accurate estimates to represent their population. Intervention parameter values are used to calculate the number of women in the main at-risk population who are exposed to an intervention within the modeled time period and the number of women for whom the intervention is successful (i.e., those who begin using a contraceptive method within the modeled time period). Detail on all intervention parameters used in the model can be found in Supplement D: Intervention Parameters.

Table 3. Objectives and interventions to improve FP in the Philippines included in RACE-FP

Objectives	Interventions
Improve postpartum FP	Increase the proportion of women receiving postnatal care within 2 days of delivery
	Increase the proportion of public sector providers trained in FP service provision
Improve public sector provision for FP	Increase the proportion of registered Barangay Health Workers who provide FP information, referrals, or services
	Increase the proportion of eligible WRA reached through mobile outreach
Improve private sector provision	Increase the proportion of private sector providers trained in FP service provision
	Conduct a mass media campaign via television
Improve demand for FP	Increase the proportion of eligible participants in Usapan demand generation intervention[a]
	Increase the proportion of adolescent-friendly health facilities
	Reduce stockouts in public sector
Reduce stockouts	Reduce stockouts in private sector
	Reduce stockouts in community settings
Introduce a modern method	Introduce a new, modern FP method to the method mix available in the Philippines

Notes: FP = family planning; RACE-FP = Reach Health Assessing Cost-Effectiveness for Family Planning; WRA = women of reproductive age.

[a] Usapan is an intervention that helps clients choose and obtain a FP method that fits their reproductive intention. The design is conversational, with participatory exercises building on clients' knowledge. Each session has a maximum of 15 participants and groups participants according to their reproductive intentions. At the end of the group Usapan session, interested individuals can receive a one-on-one counseling session with a trained service provider who can immediately give those individuals their temporary FP commodity of choice.

Intervention Exposure

Intervention exposure is the likelihood of someone in the main at-risk population being exposed to the intervention. The intervention exposure parameter is closely linked to the definition of the intervention because the user creates scenarios in RACE-FP by modifying this exposure parameter. For example, to improve PPFP in RACE-FP, the relevant intervention is to increase the proportion of WRA receiving PNC within 2 days of delivery; by increasing this exposure parameter value in the scenario, the user is increasing the number of eligible WRA from the main at-risk population exposed to PPFP, conditional on receiving PNC within 2 days of delivery. These women can then be impacted by the intervention success parameter to become FP users.

Intervention Success

Intervention success represents the likelihood of using FP as a result of being exposed to the intervention. To continue with the PPFP example, the intervention success parameter is the proportion who are served and accept a FP method among WRA exposed to the intervention (i.e., those who receive PNC within 2 days of delivery). The success parameter is linked closely with the increase in the number of users that results from expanding the intervention. Success rates are applied to the number of additional women exposed to the intervention to calculate the number of women who use an FP method because of each intervention. If an intervention is successful, that means that WRA who were exposed to the intervention were served and accepted a FP method.

Intervention Method Distribution

The method distribution indicates the proportion that accepted each method (MNFP vs. oral contraceptives vs. injectables, etc.), conditional on the intervention being successful. For example, from Reach Health data, we know that among the WRA who received FP services via mobile outreach, 85.4% received implants, 8.9% received oral contraceptives, 3.3% received injectables, 1.1% received condoms, 1.0% received IUDs, and 0.4% received LAM. This method distribution affects the number of users of each method in the Results page, which, in turn, affects the estimated cost for expanding the intervention to support these new users.

Intervention Cost

The intervention cost represents the cost per person exposed to the intervention, presented in 2018 Php. This intervention cost does not include commodity costs, as RACE-FP calculates and presents commodity costs separately from intervention costs in the results (refer to Supplement C: Contraceptive Commodity Costs). Therefore, intervention costs can include intervention activities such as capacity-building, paying per diem or transportation reimbursements to providers, or monitoring and evaluation efforts. This parameter represents the total amount spent (excluding FP commodity costs) divided by the total WRA exposed to the intervention. When the user creates a scenario that expands a given intervention, more people will be exposed to the intervention. The model calculates intervention costs for the scenario by multiplying per person intervention costs by the number of additional WRA exposed.

Reduce Stockouts and Introduce a New Modern Method

Two RACE-FP interventions do not follow the exposure and success structure: Reduce Stockouts and Introduce a New Modern Method.

Reduce Stockouts

The Reduce Stockouts intervention provides a structure to improve penetration of commodity-based methods (MNFP, male condoms, oral contraceptives, injectables, IUDs, and implants) in each of the three health care settings (public, private, and community). Reduce Stockouts only contains one parameter: Level of Stockout. If a method is unavailable in one of the three settings, we assume the lack of availability is the result of stockouts. Therefore, to include the Reduce Stockouts intervention in a scenario, the user decreases the level of stockout from the baseline level (100% - penetration % = baseline stockout level) to a lower, desired level of stockout in a given setting (public, private, community). See Supplement B1: Contraceptive Penetration for more detail about these parameters.

Introduce a Modern Method

To improve flexibility, RACE-FP contains a special intervention labeled Introduce a Modern Method. This intervention automatically inserts a new commodity-based modern method into the calculations. If the user selects "yes" to the prompt asking whether they want to include the introduce modern method in the scenario, the user must specify whether the method can be used in combination with male condoms and write in parameters for the total unit cost (direct + indirect costs) of the method for one couple-years of protection[‡,20] and PUE values for each of the delivery settings (public, private, community).

Intervention Population Adjustments

Although all interventions theoretically affect the main at-risk population, the intervention parameters are applied to a population specific to each intervention. For example, increasing the proportion of adolescent-friendly health facilities only affects adolescents, and increasing the proportion of public providers trained in FP service provision only affects those who receive care from public facilities. Therefore, each intervention has a corresponding set of population adjustments to create an "applicable population" that the intervention parameters affect. The Intervention Assumptions column in Supplement D: Intervention Parameters documents applicable populations for each intervention.

Baseline Results

RACE-FP provides results for all WRA, adolescent WRA, and adult WRA for the baseline and scenario run. The Results page displays the difference between the baseline and scenario results for each indicator value. Users should focus on the relative impact and differences in outcomes rather than on absolute numbers for the baseline and scenario runs. The user can convert data in the results into whatever format needed for decision-making (e.g., percentage improvement from baseline or weighing the total cost against the impact on FP and MNH outcomes). Note that because RACE-FP is a population-level model, it considers all contraceptive use for any reason—not just increased use resulting from interventions in RACE-FP—which is why when running a scenario analysis, it is important to focus on the change in outcomes compared with baseline rather than on the absolute values for that scenario.

‡ Couple-years of protection (CYP) is the estimated protection a FP method provides during a one-year period. CYP accounts for how methods are used, failure rates, wastage, and how many of units are typically needed to provide a year of contraceptive protection to a couple.

We conducted a baseline run for the Philippines region and recorded results for 2018 (see Table 4). For a full list of outcomes, definitions, calculations, assumptions, limitations, and sources used to identify results, refer to Supplement E: RACE-FP Outcomes. We also conducted a scenario run to illustrate what expanding a FP intervention in RACE-FP would look like. By comparing the scenario results to the baseline results, a user can see how FP, MNH, and cost outcomes differ.

Baseline FP Outcomes

In this run, we estimated that 7.3 million WRA used a new contraceptive method in 2018, and nearly all (97.9%) method users were adults. We estimated that approximately 322,000 of all 5 million adolescents ages 15–19 (6.4%) had some level of need or demand for contraceptives by adding together adolescents with met need (170,610) and unmet need (152,149); this represents all adolescents except those with no need (i.e., abstinence, current pregnancy, and those trying to conceive). As nearly 90% of adolescents report they are abstinent in NDHS, the low rate of need among adolescents in RACE-FP is not surprising.

The proportion of demand satisfied is the number of WRA with met need divided by the demand (met need + unmet need). Adolescents in the baseline model see about half of demand satisfied (52.9%), whereas adults have nearly 70% of demand satisfied.

mCPR is also higher among adults, at 29.1%, compared with adolescents at just 2.7%. In addition, RACE-FP presents the number of users of each contraceptive, and these figures can be applied to the total number of users in the current time period to determine the method distribution. For example, we estimate that 131,682 adults were sterilized, representing just 1.8% of the 7,174,505 total adult non-continuing users in the modeled time period, implying that sterilization is a relatively uncommon new method among adults (RACE-FP assumes adolescents do not have access to sterilization). Note that the 131,682 adults represent new users in the modeled time period, so the total number sterilized—or using other long-acting methods—will be higher in aggregate. Oral contraceptives are the most popular modern method among both adolescents and adults (estimated total of 3.5 million users). TFP is the second-most popular method overall, with an estimated 2.4 million users in the modeled time period. The third most-popular method (or second-most popular modern method) among all WRA is injectables (834,809 users).

Baseline MNH Outcomes

Reducing the main at-risk population—or, inversely, increasing the number of FP users—is a key driver of MNH outcomes, so unintended pregnancy is the primary outcome RACE-FP measures. Other MNH outcomes (e.g., unsafe abortion, miscarriage, maternal deaths) are contingent on these estimates of unintended and intended pregnancies. At baseline, we estimate there were 1.4 million unintended pregnancies and 2.6 million total pregnancies in 2018. We estimate that there were 1.3 million live births in 2018, which is lower than the 1.7 million cited in the 2018 Philippine Health Statistics report.[21] This discrepancy may be attributable to our parameter for the percentage of pregnancies that end in miscarriage (18.7%), which was recorded using data from 1980.[22]

We estimate approximately 1,600 maternal deaths in 2018, which corresponds to the 1,600 estimate from the 2018 Philippine Health Statistics Report.[21] Baseline results estimate that approximately 2 million unintended pregnancies were averted because of the use of contraceptives. Table 4 shows other downstream effects (e.g., unsafe abortions averted and maternal deaths averted) attributable to modern method use or all method use.

Baseline Cost Outcomes

Contraceptive costs represent the total indirect and direct cost of all commodities WRA used in the modeled year. In effect, this is the number of method users multiplied by the cost for each commodity. In total, we estimate that contraceptives cost approximately 2.9 billion Php in 2018. Total contraceptive cost is calculated by summing the estimated contraceptive costs for each method.

Table 4. Baseline outcomes for RACE-FP

FP Outcomes	Baseline Values (2018)		
Indicator	All WRA 15–49	Adolescents 15–19	Adults 20–49
Number of users in current period[a]	7,327,222	152,718	7,174,505
Number of WRA with met need[b]	9,013,597	170,610	8,842,987
Number of WRA with unmet need[c]	3,973,217	152,149	3,821,068
Modern contraceptive prevalence rate (mCPR)[d]	24.24%	2.68%	29.13%
Unmet need %[e]	14.57%	3.02%	17.19%
Long-acting reversible contraceptive (LARC) users[f]	207,469	7,323	200,145
Proportion of demand satisfied[g]	69.41%	52.86%	69.83%
Number of users of each contraceptive			
Sterilization	131,682	0	131,682
Lactational amenorrhea method (LAM)	88,442	5,043	83,399
Traditional family planning (TFP)	2,402,697	35,302	2,367,395
Modern natural family planning (MNFP)	9,972	0	9,972
Oral contraceptives	3,507,240	70,604	3,436,636
Injectables	834,809	25,216	809,593
Intrauterine device (IUD)	128,328	3,289	125,039
Implants	79,141	4,034	75,107
Male condom—all	303,624	15,129	288,495
Male condom—primary	144,912	9,230	135,681
New modern method	0	0	0
MNH Outcomes	**Baseline Values (2018)**		
Indicator	**All WRA 15–49**	**Adolescents 15–19**	**Adults 20–49**
Number of unintended pregnancies	1,425,817	50,641	1,375,175
Number of total pregnancies (unintended + intended)	2,615,313	212,071	2,403,241
Number of unsafe abortions	841,232	29,878	811,353
Number of miscarriages	489,064	39,657	449,406
Number of live births	1,285,018	142,536	1,142,482
Number of maternal deaths	1,555	172	1,382
Number of stillbirths	13,621	1,511	12,110
Number of neonatal deaths	17,476	1,938	15,538
Birth rate per 1,000	47	28	51
Number of unintended pregnancies averted from all method use	2,077,320	43,867	2,033,452
Number of unintended pregnancies averted from modern method use	1,463,575	34,850	1,428,725
Number of unsafe abortions averted from all method use	1,225,619	25,882	1,199,737
Number of unsafe abortions averted from modern method use	863,509	20,561	842,948
Number of maternal deaths averted from all method use	561	12	549
Number of maternal deaths averted from modern method use	395	9	386

(continued)

Table 4. Baseline outcomes for RACE-FP ***(continued)***

Cost Outcomes	Baseline Values (2018)		
Indicator	**All WRA 15–49**	**Adolescents 15–19**	**Adults 20–49**
Contraceptive cost[h]			
Sterilization	70,079,967 Php	-	70,079,967 Php
LAM	10,036,582 Php	572,300 Php	9,464,282 Php
TFP	97,813,795 Php	1,437,135 Php	96,376,659 Php
MNFP	1,848,875 Php	-	1,848,875 Php
Oral contraceptives	1,936,224,615 Php	38,977,750 Php	1,897,246,865 Php
Injectables	394,499,022 Php	11,915,916 Php	382,583,107 Php
IUDs	72,822,855 Php	1,866,419 Php	70,956,436 Php
Implants	118,283,174 Php	6,029,880 Php	112,253,295 Php
Male condom	191,526,256 Php	9,543,590 Php	181,982,666 Php
New modern method[i]	-	-	-
Cost summary			
Cost of contraceptives	2,893,135,141 Php	70,342,990 Php	2,822,792,151 Php
Cost of intervention(s)[j]	-	-	-
Total cost	2,893,135,141 Php	70,342,990 Php	2,822,792,151 Php

Notes: RACE-FP = Reach Health Assessing Cost-Effectiveness for Family Planning; FP = family planning; WRA = women of reproductive age.

Baseline values are one-year results beginning in 2018. Please refer to Supplement E: RACE-FP Outcomes for a full list of definitions, calculation assumptions and limitations, and sources used to identify results. Other supplements have further detail on the underlying parameters used to arrive at these outcomes.

[a] Includes all users except LARC users who are still protected from starting their method before the modeled time period. Does not include abstinent WRA.

[b] Number of current contraceptive users, including those covered by a long-term method (IUD, implant, sterilization) before modeled time period. Does not include abstinent WRA.

[c] Number of WRA at risk of pregnancy who do not want to become pregnant and are not using any FP method. Does not include abstinent WRA.

[d] mCPR is the percentage of WRA who are using (or whose partner is using) a modern contraceptive method at a particular point in time. The denominator is the total population of WRA. Data for the numerator—the number of users of all modern contraceptive methods—comes from the Philippines NDHS. The numerator includes the total number of modern contraceptive methods among WRA as listed in the Philippines NDHS. For further detail on how contraceptive utilization was calculated for each method, please refer to Supplement B2: Contraceptive Utilization.

[e] Unmet need % is the proportion of WRA who are at risk of pregnancy, do not want to become pregnant, and are not using any FP method (does not include abstinent WRA). Values for numerator and denominator can be found in Table 2; the numerator corresponds to the main at-risk population, and the denominator corresponds to the total population of WRA. For all WRA 15–49 years of age, this is 3,973,217/27,276,379 = 14.6%.

[f] LARC users are IUD and implant users.

[g] Proportion of demand satisfied is the proportion of users who receive a method among those that need one. This is calculated by dividing met need (i.e., current contraceptive use of any method) by met need + unmet need.

[h] Contraceptive costs include direct and indirect commodity costs attributed to the method in the modeled time period. Contraceptive costs were calculated by multiplying the total number of users of each method in the modeled time period by the overall estimated cost per person.

[i] The RACE-FP user controls the unit cost for a new modern method. Indirect costs may not be included if the user does not factor them in.

[j] Intervention costs are calculated by the cost per person exposed to the intervention multiplied by the number of people exposed to the intervention.

Sample Scenario Run

In the sample scenario run, we focused on one intervention: Increase the proportion of public sector providers trained in FP service provision. As detailed in Supplement D: Intervention Parameters, exposure is defined as the proportion of public facilities with a provider who has received FP competency-based training. We expanded the baseline exposure of 45.4% to 60.0%.

Table 5 illustrates how a few select indicators are affected compared with baseline results when the proportion of facilities with a trained provider is expanded from 45.4% to 60.0% for a 1-year period beginning in 2018. As a result of the expanded exposure, an estimated additional 105,000 WRA who are at risk of pregnancy and not covered by a preexisting method would begin using a contraceptive method, and mCPR would increase by 9 percentage points. This investment is estimated to prevent 32,700 unintended pregnancies and 19,300 unsafe abortions. Costs of this investment are disaggregated by the cost of the intervention (12 million Php) versus the cost of supplying additional contraceptives to support the increased number of FP users (62 million Php). The user can examine the additional cost associated with this expansion (72 million Php [2018]), examine the improvements in FP and MNH outcomes, and weigh the additional costs against additional benefits.

Although this scenario is an example of expanding just one intervention, RACE-FP users can incorporate multiple intervention changes within their scenarios to compare with the baseline. For example, a user could create a scenario that, in addition to expanding training of public sector providers, expands FP training for private sector providers and reduces stockouts in all three possible delivery settings. RACE-FP also can compare results from multiple scenarios at once to help the user find the optimal set of interventions for their populations of interest (adolescents, adults, all WRA; Philippines national or regional level).

Model Sensitivity and Uncertainty Analyses

RACE-FP contains a multivariate PSA tool to assess the model's sensitivity to uncertainty in the various input values assumed in the model. The PSA assumes a beta distribution for PUE and a gamma distribution for costs. Input values were assumed to vary within a range of plus or minus 5% of the baseline input value, with PUE bounded by zero and one. The PSA can be run for the impact estimates (i.e., difference between scenario and baseline runs) and for results from each of the individual runs. When a user sets the number of iterations to use in the PSA and engages "Run PSA" in the scenario builder, the model randomly draws a value for each model parameter for the number of iterations specified, which results in a distribution of outcome values that reflects uncertainty. PSA output is available for the baseline, the scenario, and differences between the scenario and baseline. Output is also available disaggregated by age: for all women ages 15 to 49, adolescents ages 15 to 19, and adults ages 20 to 49. Minimum, maximum, median, and mean values from across the multiple distributions of values are provided by default. Additionally, a user can obtain the raw output of each iteration of the PSA in an accompanying section in the model.

Parameter Selection

For each region (Philippines, NCR, Central Visayas, and Caraga), the model contains contraceptive PUE parameters for each of the 10 contraceptive methods (abstinence, sterilization, LAM, TFP, MNFP, male condoms, oral contraceptives, injectables, IUDs, and implants), two distinct age groups (adolescents, adults), and three delivery settings (public, private, and community). In total, for each region, the combination yields a total of 191 parameters: 180 PUE parameters plus 11 cost parameters (10 birth control method costs plus total intervention cost).

Because of the complexity of the underlying PUE parameters, for each region, we did not include all 180 PUE parameters in the default PSA. Because the initial population in RACE-FP includes all WRA, if several parameters at the top of the decision tree experience a maximum positive movement, it would choke out the available movement for the downstream sections of the tree. For example, abstinence among adolescents is 93.7%, and

Table 5. Baseline vs. sample scenario outcomes

Indicator	Baseline Values (2018)	Sample Scenario[a]	Difference
Number of users in current period	7,327,222	7,432,594	105,372
Number of WRA with met need	90,135,967	91,189,689	105,372
Modern contraceptive prevalence rate	24.2%	33.4%	9.2%
Number of unintended pregnancies	1,425,817	1,393,094	(32,723)
Number of unsafe abortions	841,232	821,925	(19,306)
Cost of contraceptives	2,893,135,141 Php	2,954,683,370 Php	61,548,229 Php
Cost of intervention	0 Php	12,116,115 Php	12,116,115 Php

Notes: WRA = women of reproductive age. One-year results beginning in 2018

[a] Expand the percentage of public facilities with a provider who has received FP competency-based training from 45.4% to 60.0%.

additional increases would leave little to no room for changes in FP interventions to affect outcomes. Instead, we identified a set of the most-impactful PUE parameters to include in the default PSA, as described below. However, a user can include or remove any of the 180 PUE parameters in the multivariate PSA. We used the overall Philippines region to select parameters as a proxy for the other regions.

After consulting with subject matter experts, we conducted the following process to select a set of 20 parameters to be used in the PSA out of the 191 total parameters (Figure 2):

1. Exclude cost parameters (remaining *N* = 180)
2. Exclude PUEs not relating to FP methods affected by interventions (i.e., remove abstinence and TFP) (remaining *N* = 144)
3. Exclude effectiveness parameters,[§] assuming they are fixed (remaining *N* = 96)
4. Run one-way sensitivity analyses, using the number of unplanned pregnancies as the outcome of interest, on each of the remaining 96 parameters to identify the 20 most impactful via the width of the range on the outcome.

One-way sensitivity analyses examine the impact of varying values of model parameters on selected outcomes, one at a time. Figure 3 presents results of the one-way sensitivity analysis in a tornado chart; the parameters at the top of the diagram had the greatest impact on the outcome (unintended pregnancy), and parameters at the bottom had the least impact.

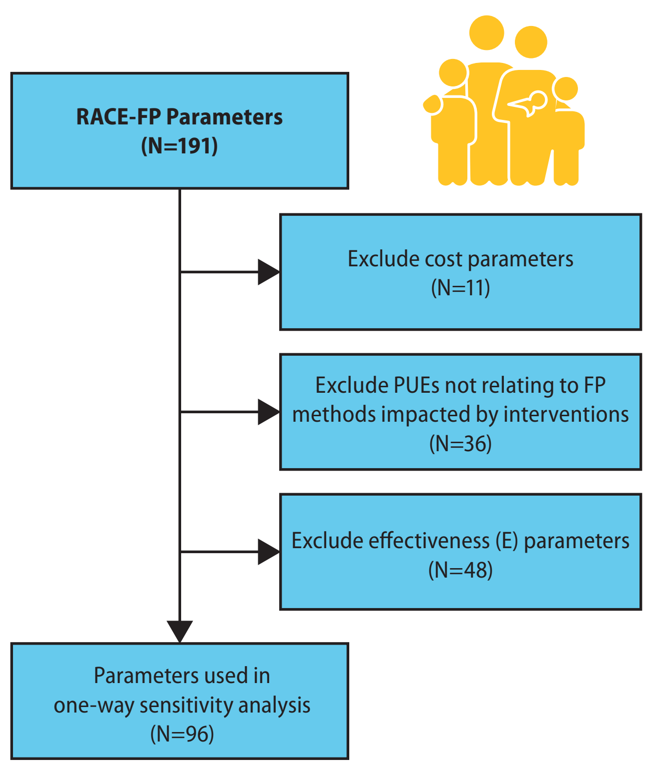
RACE-FP is very sensitive to penetration and utilization parameters related to oral contraceptive use in adults. The most-impactful parameter—the utilization rate of oral contraceptives among adults in community settings—led to a range of nearly 65,000 unintended pregnancies in the one-way sensitivity test. We expected this parameter to be impactful, considering oral contraceptives are the most popular method in the Philippines.[1] Not surprisingly, the 10 most-impactful parameters were five pairs of penetration and utilization rates (Figure 3).

The PSA tool used the 20 parameters highlighted in Figure 3 to generate the full output of a 500-iteration multivariate PSA for the baseline, including minimum, maximum, median, and mean values for all modeled outcomes, as shown in Supplement F: Model Sensitivity Results. Table 6 shows an excerpt of results from Supplement F. The number of contraceptive users had a range of approximately 470,000, varying between 7.10 million and 7.57 million, with a mean of 7.33 million. mCPR was between 23.4% and 25.1%, with a mean and median of 24.3%. The number of unintended pregnancies had a range of roughly 140,000, varying between 1.35 million and 1.49 million, with a mean of 1.42 million.

Discussion

Mathematical models are critical tools for public health decision-making, allowing policymakers to synthesize large amounts of data to ask complex questions. The RACE-FP model can be used to improve strategic planning for FP programs in the Philippines by summarizing existing FP interventions and modeling the impact of changes to inform policies.

Figure 2. Consort diagram of parameter selection for one-way sensitivity analysis



§ See Supplement B3 for details on contraceptive effectiveness parameters.

https://doi.org/10.3768/rtipress.2022.op.0072.2205

At the time of RACE-FP's development, other models existed to support Philippines DOH decision-making to accomplish FP-related goals, most notably the Family Planning Estimation Tool (FPET).[23] FPET is a Bayesian hierarchical model adapted from the United Nations Population Division. FPET is used for estimating FP trends, such as mCPR, unmet need, and demand satisfied, allowing users to incorporate their own data to allow for up-to-date estimates of these FP indicators in lieu of relying on NDHS data. RACE-FP is not intended to replace existing tools available to decision-makers; instead, it is intended as a complementary resource. RACE-FP includes the following unique features to complement other models:

1. Estimates the impact of individual FP interventions or combinations of interventions.
2. Estimates unplanned pregnancies averted and related downstream MNH outcomes. These indicators may be more relevant or concrete than mCPR and unmet need to policy makers when assessing health and budget priorities.

Figure 3. One-way sensitivity analysis for unplanned pregnancies

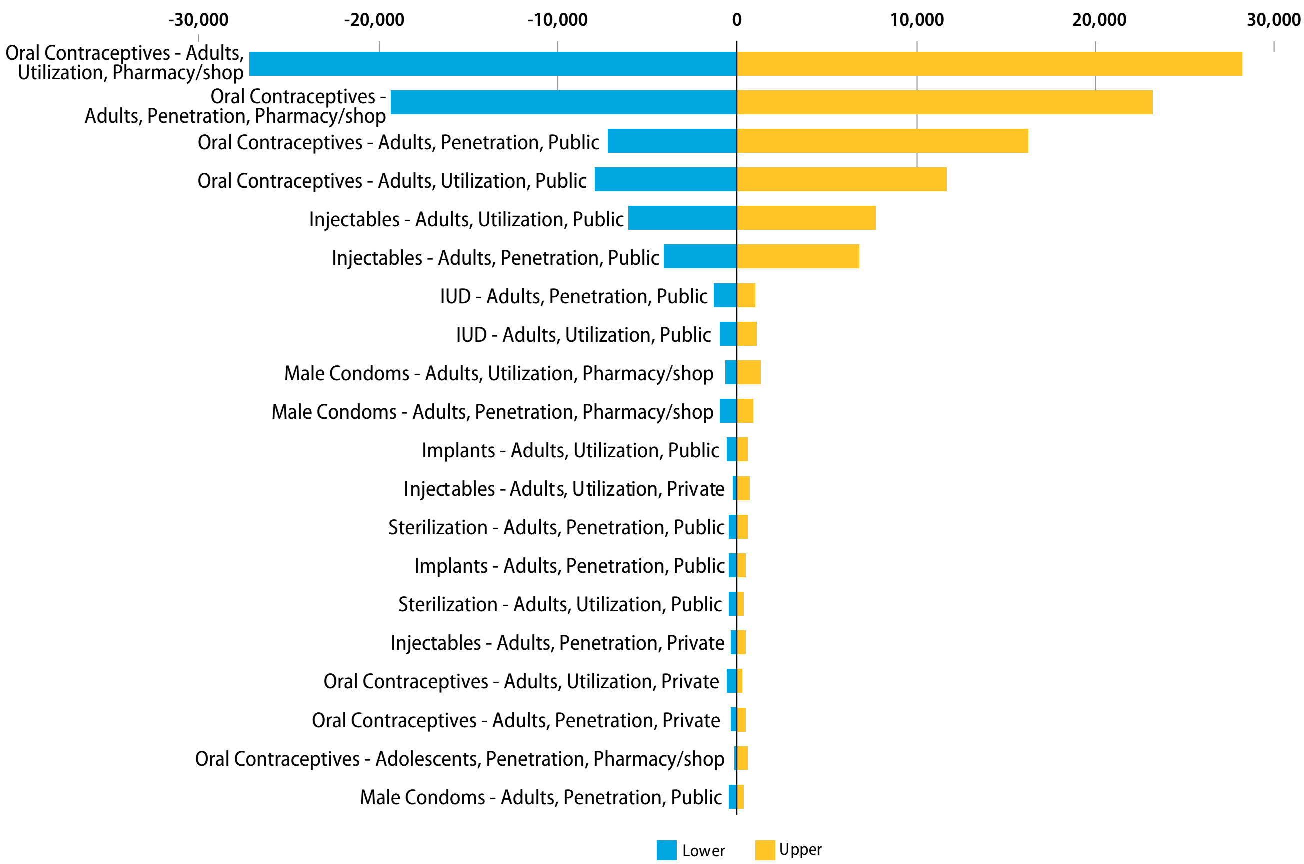


Table 6. Excerpt of PSA results

	All Women—Baseline			
	Min	Max	Median	Mean
Number of users in current time period	7,099,406	7,572,571	7,330,992	7,331,167
Modern contraceptive prevalence rate	23.4%	25.1%	24.3%	24.3%
Number of unintended pregnancies	1,352,551	1,493,268	1,424,732	1,424,644

Notes: PSA = probabilistic sensitivity analysis.

3. Is locally adaptable to support regional decision-making within the Philippines; most data used to populate existing models are at the country or global region level (e.g., Asia). Decentralized modeling allows local governments to enter their own data so they can visualize the results compared with their targets and adequately plan and budget for comprehensive FP programs.
4. Includes cost data, which is crucial for decisions around resource allocation; RACE-FP includes intervention costs and commodity costs disaggregated by FP method.
5. Presents outcomes disaggregated by age and care delivery setting.
6. Is a deterministic cohort model allowing several sensitivity analyses to be run; existing models are deterministic linear models that do not account for the joint uncertainty in inputs and are not built to perform probabilistic sensitivity analyses.

Although we do not discuss the UPmod user interface in this paper, it is worth noting that models are frequently not user-friendly; translating RACE-FP to the UPmod platform provides an intuitive interface that, in conjunction with complementary capacity-building, will facilitate key stakeholders' familiarity and comfort using RACE-FP in the Philippines.

RACE-FP Limitations

All models are based on several assumptions and contain abstractions and simplifications. As such, users should interpret results with some degree of skepticism.[24] It is important for users to understand the limitations of a model and the implications of those limitations for the results of interest. RACE-FP is subject to the same limitations as other mathematical models, and we made every effort to transparently document our definitions, sources, and assumptions to facilitate informed decision-making based on the model results.

The primary challenge of developing the RACE-FP intervention was data availability for model parameterization. For many of the parameters related to the impact of the interventions, we lacked Philippines-specific data and instead used published data from studies conducted in other countries. For some parameters, we were able to use Reach Health data (e.g., Usapan intervention¶ or mobile outreach intervention parameters), but those data may be specific to subpopulations targeted in the Reach Health program and not representative of the full population. In addition, because reliable parameters at the regional level were not always available, we used national-level estimates. Although we generally assumed that intervention parameters were the same across regions, there may be considerable differences within the Philippines in the uptake of different types of FP interventions. We mitigated these challenges by developing a flexible model that allows users to revise parameters if they have more-recent or local data. We also transparently documented parameter values, assumptions, and sources on a resource page that is intended to support users' understanding of how data limitations and assumptions about parameter values may affect model findings (these details can also be found in the supplementary materials referenced throughout this report). Such information can help users avoid unintentional misuse of the model. As with any model, RACE-FP will require maintenance, and parameters will need to be updated regularly to avoid estimates becoming obsolete. Although this upkeep will require time and resources, it will contribute to sustainability.

Another limitation is that RACE-FP uses a decision tree model structure. Decision tree models are useful for modeling acute conditions and situations, like pregnancy, that have a short, fixed time horizon; however, these models cannot capture the complexity of longer-term FP decision-making.[25,26] An alternative model structure, such as an individual-level simulation model, would allow users to assess the impact of changing FP decisions over a longer time horizon, including over the lifecycle of women of childbearing age. This type of model would allow users to assess the impact of increasing uptake of

¶ Usapan is an intervention that helps clients choose and obtain a FP method that fits their reproductive intention. The design is conversational, with participatory exercises building on clients' knowledge. Each session has a maximum of 15 participants and groups participants according to their reproductive intentions. At the end of the group Usapan session, interested individuals can receive a one-on-one counseling session with a trained service provider who can immediately give those individuals their temporary FP commodity of choice.

longer-term FP options, such as sterilization and long-acting reversible contraceptives. Individual-level simulation models can also reflect differences in individual characteristics, such as age, race/ethnicity, and prior pregnancy outcomes, and allow for different parameter values for people with these different characteristics. However, such models require detailed data to parameterize and validate the model, and such granular data are currently unavailable. Additionally, more-complex model structures can be computationally intensive, and it is more difficult for a general user to understand the model calculations than a decision tree model, especially for models like RACE-FP that include a wide range of potential interventions.

Finally, a key limitation is that most of the RACE-FP development work, especially in obtaining local stakeholder input on the model's parameter values, occurred during the COVID-19 pandemic. During this time, international travel from the United States to the Philippines was not permitted, and we obtained all project staff input on model parameters virtually. Moreover, COVID-19 strained the public health system and health professionals, who, as a result of their attention to the pandemic, had little time available to provide input on model parameters, share relevant data, and review assumptions about parameter values in the model. We therefore parameterized the model using the best data available and developed comprehensive documentation of our methods, which we share in this report, to support future collaboration with the relevant officials and project team members to further validate and update the model.

Future Directions

RACE-FP is a useful tool to support FP decision-making, as it estimates how investments in specific FP interventions in the Philippines may affect FP and MNH outcomes in that country. In the future, we plan to conduct additional validations of RACE-FP, incorporate user feedback from initial testing of the model with intended users, and adapt the model for use in other countries. First, efforts to continue validating and obtaining buy-in from key stakeholders in the Philippines are crucial to ensure familiarity and comfort using RACE-FP. Capacity-building activities and collaborative detailed review of parameters will contribute to identifying parameters that need updating and appropriate values for them, especially at the subnational level. Initiating RACE-FP with one region before bringing to scale, if desired, will further allow for model strengthening. With greater understanding of how the model operates, users will know how best to interpret results.

Second, RACE-FP functionalities can be upgraded. to best suit user needs. We can expand the number of FP interventions of interest; build on the number of geographic regions included beyond NCR, Central Visayas, and Caraga; modify the results to be presented by setting (public, private, community); account for population growth beyond 2018 or allow the model to be run for multiple years at a time; and incorporate other variables, such as disability-adjusted life years or cost-effectiveness outcomes. We can also explore the option to change the pathway of the model algorithm. For example, we can input desired FP outcomes and format results to present areas of potential investment needed to accomplish these goals.

Third, the established RACE-FP framework allows for direct adaptation for other countries, so this tool can support policymakers worldwide. Although initially developed for the Philippines, RACE-FP has broad applicability and can be tailored to support FP decision-making wherever country- and regional-level data are available.

Conclusion

RACE-FP is a decision support model that the Philippines DOH and the larger public health community can use to assess the impact of FP interventions on key FP, MNH, and cost outcomes. In countries with limited resources, interventions that are both impactful and cost effective at preventing unintended pregnancy are essential. RACE-FP can serve as an important resource to determine the relative benefit of many potential interventions for FP in the Philippines and globally.

References

1. Philippine Statistics Authority (PSA) and ICF. *Philippines National Demographic and Health Survey 2017*. Quezon City (Philippines) and Rockville (Maryland, USA): PSA and ICF; 2018. https://psa.gov.ph/sites/default/files/PHILIPPINE%20NATIONAL%20DEMOGRAPHIC%20AND%20HEALTH%20SURVEY%202017_new.pdf

2. Republic of the Philippines. *Republic Act 10354: The Responsible Parenthood and Reproductive Health Act of 2012*. Republic of the Philippines; 2012 [cited 2021 Jul 7]. Available at: https://pcw.gov.ph/republic-act-10354/

3. Department of Health. *National family planning program*. Department of Health; n.d. [cited 2021 Jul 7]. Available at: https://doh.gov.ph/family-planning

4. Family Planning 2020. *Core indicators*. Family Planning 2020; 2020. http://2015-2016progress.familyplanning2020.org/page/measurement/core-indicators#:~:text=Contraceptive%20Prevalence%20Rate%2C%20Modern%20Methods,a%20particular%20point%20in%20time

5. Jones-Hepler B, Moran K, Griffin J, McClure EM, Rouse D, Barbosa C Maternal and Neonatal Directed Assessment of Technologies (MANDATE): methods and assumptions for a predictive model for maternal, fetal, and neonatal mortality interventions. *Glob Health Sci Pract* 2017;*5*(4):571–80. https://doi.org/10.9745/GHSP-D-16-00174

6. Maternal and Neonatal Directed Assessment of Technology (MANDATE). *MANDATE homepage*. RTI International; 2014 [cited 2021 Jul 7]. Available from: http://www.mnhtech.org

7. Griffin JB, Jobe AH, Rouse D, McClure EM, Goldenberg RL, Kamath-Rayne BD. Evaluating WHO-recommended interventions for preterm birth: a mathematical model of the potential reduction of preterm mortality in Sub-Saharan Africa. *Glob Health Sci Pract* 2019;*7*(2):215–27. https://doi.org/10.9745/GHSP-D-18-00402

8. McClure EM, Jones B, Rouse DJ, Griffin JB, Kamath-Rayne BD, Downs A Tranexamic acid to reduce postpartum hemorrhage: a MANDATE systematic review and analyses of impact on maternal mortality. *Am J Perinatol* 2015 Apr;*32*(5):469–74. https://doi.org/10.1055/s-0034-1390347

9. Goldenberg RL, McClure EM, Saleem S, Rouse D, Vermund S. Use of vaginally administered chlorhexidine during labor to improve pregnancy outcomes. *Obstet Gynecol* 2006;*107*(5):1139–46. https://doi.org/10.1097/01.AOG.0000215000.65665.dd

10. McClure EM, Rouse DJ, Macguire ER, Jones B, Griffin JB, Jobe AH The MANDATE model for evaluating interventions to reduce postpartum hemorrhage. *Int J Gynaecol Obstet* 2013;*121*(1):5–9. https://doi.org/10.1016/j.ijgo.2012.10.030

11. Kamath-Rayne BD, Griffin JB, Moran K, Jones B, Downs A, McClure EM Resuscitation and obstetrical care to reduce intrapartum-related neonatal deaths: a MANDATE Study. *Matern Child Health J* 2015;*19*(8):1853–63. https://doi.org/10.1007/s10995-015-1699-9

12. Goldenberg RL, Jones B, Griffin JB, Rouse DJ, Kamath-Rayne BD, Trivedi N Reducing maternal mortality from preeclampsia and eclampsia in low-resource countries—what should work? *Acta Obstet Gynecol Scand* 2015;*94*(2):148–55. https://doi.org/10.1111/aogs.12533

13. Goldenberg RL, Griffin JB, Kamath-Rayne BD, Harrison M, Rouse DJ, Moran K Clinical interventions to reduce stillbirths in sub-Saharan Africa: a mathematical model to estimate the potential reduction of stillbirths associated with specific obstetric conditions. *BJOG* 2018;*125*(2):119–29. https://doi.org/10.1111/1471-0528.14304

14. Griffin JB, McClure EM, Kamath-Rayne BD, Hepler BM, Rouse DJ, Jobe AH Interventions to reduce neonatal mortality: a mathematical model to evaluate impact of interventions in sub-Saharan Africa. *Acta Paediatr* 2017;*106*(8):1286–95. https://doi.org/10.1111/apa.13853

15. Model for Assessment of Pediatric Interventions for Tuberculosis (MAP-IT). *MAP-IT model*. RTI International; 2015. Available from: http://www.mapit4pedstb.org/

16. Faust L, Abdi K, Davis K, He C, Mehrotra C, Stibolt E. The roll-out of child-friendly fixed-dose combination TB formulations in high-TB-burden countries: a case study of STEP-TB. *J Epidemiol Glob Health* 2019;*9*(3):210–6. https://doi.org/10.2991/jegh.k.190812.001

17. Assessing Diarrhea and Pneumonia Treatments (ADAPT). *ADAPT model.* RTI International; 2016. Available from: http://adapt4childhealth.org/

18. Riley T, Madziyire MG, Chipato T, Sully EA. Estimating abortion incidence and unintended pregnancy among adolescents in Zimbabwe, 2016: a cross-sectional study. *BMJ Open* 2020;*10*(4):e034736. https://doi.org/10.1136/bmjopen-2019-034736

19. RTI International. *UPMOD™. The unified platform for modeling.* RTI International; n.d. [cited 2021 Jul 7]. Available from: https://www.rti.org/brochures/upmod-unified-platform-modeling

20. USAID. *Couple years of protection (CYP).* USAID; 2019 Jun 2. Available from: https://www.usaid.gov/global-health/health-areas/family-planning/couple-years-protection-cyp

21. Epidemiology Bureau Department of Health. *2018 Philippines health statistics report.* Republic of the Philippines; n.d. [cited 2021 Jul 7]. Available from: https://doh.gov.ph/sites/default/files/publications/2018%20Philippine%20Health%20Statistics.pdf

22. Hammerslough CR. Estimating the probability of spontaneous abortion in the presence of induced abortion and vice versa. *Public Health Rep* 1992 May-Jun;*107*(3):269–77. Available from: https://pubmed.ncbi.nlm.nih.gov/1594736/

23. TRACK 20. *Technical brief: Family Planning Estimation Tool (FPET).* Avenir Health; 2019 Nov. Available from: http://track20.org/download/pdf/Track20%20Technical%20Briefs/english/Technical%20Brief_FPET.pdf

24. Tappenden P, Chilcott JB. Avoiding and identifying errors and other threats to the credibility of health economic models. *PharmacoEconomics* 2014;*32*(10):967–79. https://doi.org/10.1007/s40273-014-0186-2

25. Briggs A, Sculpher M, Claxton K. *Decision modelling for health economic evaluation*. Oxford University Press; 2006.

26. Caro JJ, Briggs AH, Siebert U, Kuntz KM; ISPOR-SMDM Modeling Good Research Practices Task Force. Modeling good research practices—overview: a report of the ISPOR-SMDM Modeling Good Research Practices Task Force-1. *Med Decis Making* 2012;*32*(5):667–77. https://doi.org/10.1177/0272989X12454577

www.rti.org/rtipress **RTI Press publication OP-0072-2205**