Multi-Criteria Decision Analysis (MCDA) Model to Inform Decision Making and Estimate Additional Users Reached Through Scaling Up Implants in the Private Sector

IMPACT FOR HEALTH

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ABBREVIATIONS

AHP ***Analytic Hierarchical Process***[1]

Meaning: The Analytic Hierarchical Process (AHP) converts these evaluations to numerical values that can be processed and compared over the entire range of the problem. A numerical weight or priority is derived for each element of the hierarchy, allowing diverse and often incommensurable elements to be compared to one another in a rational and consistent way. This capability distinguishes the AHP from other decision-making techniques.

PCA ***Principal Component Analysis***

Meaning: Principal component analysis (PCA) is a widely used technique to help analyze large datasets with high number of dimensions/ features per observation. PCA forms the basis of multivariate data analysis based on projection methods. PCA represents a multivariate data table as smaller set of variables (summary indices) to observe trends, jumps, clusters, and outliers. It generates factor weights on relative significance

MCDA ***Multiple Criteria Decision Analysis Process***

Meaning: Multiple criteria decision analysis (MCDA) is a structured process for evaluating options with conflicting criteria and choosing the best solution. MCDA is similar to a cost-benefit analysis but evaluates numerous criteria, rather than just cost.

MNCH ***Maternal and Neonatal Child Health***

[1] Forman, E.H. and Gass, S.I., 2001. The analytic hierarchy process—an exposition. *Operations research*, *49*(4), pp.469-486.

BACKGROUND

Why create an Implant Model?

A model is a representation of a complex system, designed to allow analysis of how the system works and how changes to that system impact outputs. Building a mathematical model allows predictions to be made about what will happen under certain conditions (i.e., different initial conditions and/or parameters) and to observe whether predicted outcomes occur as parameters are modified. For example, by modifying initial parameters, a model can highlight changes in utilisation, efficiency and effectiveness of strategies. Such information can be used to support service planning and management decisions. In the absence of empirical data, or where an experimental study is not feasible, modelling is the best option to understand the potential impact of recommendations.

Previously, models have been developed to estimate the potential use of contraceptives to avert future pregnancies, especially the use of male contraceptives[2]. Such models utilize parameters, such as the population of current users, contraceptive prevalence, and annual continuation or discontinuation rates, to better understand how to achieve certain outcomes such as a couple of years of protection, the number of pregnancies averted or the estimated number of new users.

At present, there is a scarcity of models that can predict the number of new users and/or illuminate the specific recommendations required to scale-up implants in the private sector. In addition, the evidence on the potential implications of cost, feasibility, effectiveness, and sustainability is limited.

Therefore, the main goal of developing a Multi-Criteria Decision Analysis (MCDA) Model to inform decision making and estimate additional users reached through private sector implant scale-up is two-fold, (i) to assess potential uptake under varying conditions by predicting the number of additional new implant users reached through private sector service delivery, and (ii) to use the model to inform decision making.

Why use the MCDA to inform decision making and predict uptake?

A review of existing tools and models that aim to determine the effectiveness and impact of various inputs on uptake was undertaken. The existing tools/models include: the Lives

[2] Dorman, E., Perry, B., Polis, C. B., Campo-Engelstein, L., Shattuck, D., Hamlin, A., . . . Sokal, D. (2018). Modeling the impact of novel male contraceptive methods on reductions in unintended pregnancies in Nigeria, South Africa, and the United States. *Contraception, 97*(1), 62-69.

Saved Tool (LiST) tool; Impact 2 tool; MNCH Asset Tracker; the Mandate model, and the EQUIST tool. A summary of each model's strengths and limitations are summarised below.

1. ***The Lives Saved Tool (LiST):*** Developed by John Hopkins University, LiST is a computer-based model that estimates the impact of scaling up key interventions on MNCH outcomes and can estimate the number of lives saved from various input variables https://www.livessavedtool.org/

2. ***Impact 2 Tool:*** Developed by Marie Stopes International, the Impact 2 tool estimates the impact of reproductive health programmes and can be used to guide planning and monitoring of national-level programmes. https://www.msichoices.org/who-we-are/our-technical-expertise/impact-2/thank-you/

3. ***MNCH Asset Tracker:*** Developed by Path, the MNCH Asset Tracker helps in selecting commodities and tracking associated commodity availability, coverage and potential impact of health outcomes. It provides information on MNCH assets and outcomes that can be improved by the availability of data and information on access, uptake, coverage and scale-up of key MNCH assets. https://tableau.path.org/t/BMGF/views/MNCHNutritionAssetTracker/AssetCascades?%3Aiid=1&%3AisGuestRedirectFromVizportal=y&%3Aembed=y .

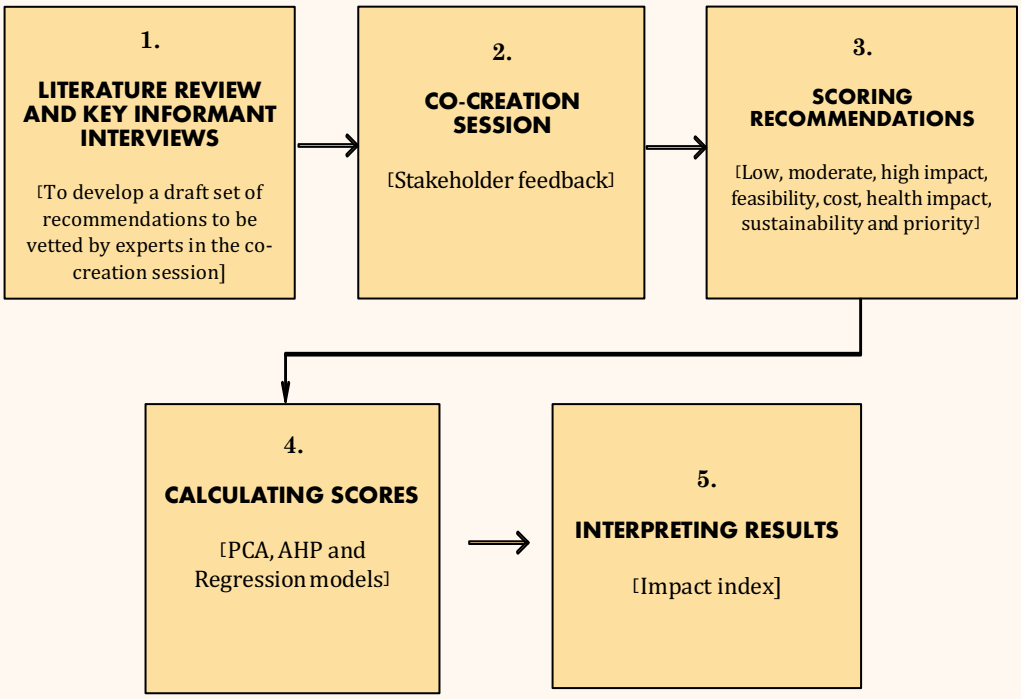
4. ***Mandate Tool (Maternal and Neonatal Directed Assessment of Technology):*** Developed by RTI International, the Mandate tool can be used to determine how and where to allocate resources to have the highest impact on maternal and neonatal mortality. It uses maternal and neonatal health conditions to calculate respective deaths and the prevalence of certain neonatal conditions. https://www.rti.org/news/new-web-tool-mobilizes-innovations-maternal-neonatal-health

5. ***Equitable Impact Sensitive Tool (EQUIST):*** Developed by UNICEF/WHO, EQUIST helps policymakers select strategies that balance the principles of **equity, effectiveness, and efficiency by** leading them through a logical process to identify the most rational and cost-effective solutions for their context. However, it does not include the feasibility, sustainability and cost implications of these strategies. https://score.tools.who.int/tools/review-progress-and-performance/tool/equitable-impact-sensitive-tool-equist-86/

Our review established that none of these tools or models can adequately inform policymakers' decision making on which combination of specific recommendations are required to lead to the highest impact on uptake of implants through the private sector. Due to limitations of these existing models to use a combination of criteria, we propose to develop and use a multi-criteria decision analysis (MCDA) model, which has been developed using discreet choice experiments (DCE).

METHODOLOGY

Figure 1: The MCDA process will follow the following steps



Literature review and key informant interviews

A literature review and key informant interviews (KIIs) with experts in private sector engagement in family planning, specifically implant service delivery was undertaken. The literature review and KIIs resulted in the development of a draft set of recommendations for scaling up implants in the private sector, that were subsequently vetted by experts during a co-creation session. Additionally, the literature review and KIIs provided a preliminary understanding of potential impact of the recommendations in terms of:

a. ***Feasibility:*** the state or degree of being easily or conveniently done.

b. ***Cost***: the amount of time, money, and energy required to obtain, produce and maintain a product or service.

c. ***Health impact (Effectiveness):*** the degree to which something is successful in producing the desired result; success.

d. ***Sustainability:*** the ability to maintain or support a process continuously over time.

e. ***Priority:*** the fact or condition of being regarded or treated as more important than others.

Co-Creation session

A co-creation session with experts was undertaken to present the findings from the literature review and KIIs. The session allowed experts to review and provide insight on the draft recommendations to better understand which combination of recommendations would have the highest impact on uptake of implants among new users through the private sector. The session also allowed expert participants to validate the following criteria: feasibility, cost, health impact, sustainability and priority. These criteria have been widely used in priority-setting environments.

Online survey

An online survey was undertaken to collect quantitative data on the potential implication of adopting or implementing recommendations in terms of feasibility, cost, effectiveness, sustainability and priority. Each of these criteria was rated as low, moderate or high. The online survey attracted input from 50 expert actors, thereby surpassing the minimum required number of inputs (n=30) to run a regression model.

Scoring recommendations

The online survey used quantitative tools, specifically a Likert scale tool, where expert actors ranked (low, moderate, high impact) each recommendation against each criterion.

Calculating scores

Aggregate scores were calculated using statistical model regressions: Principal Component Analysis (PCA); and Analytic Hierarchical Process (AHP). The data were subjected to a multi-variable regression model to establish an impact on the number of new users with the data being the coefficient of the independent variables. The marginal effects (on uptake) from these three models were averaged to generate an overall impact index. Subsequently, this index was used on the baseline number of users to predict the extent of uptake by additional users in the population targeted.

Interpretating results

The data obtained from stakeholders were used to create an impact index. This impact index was applied in the prediction of the number of new users. At the end of the process, an Excel spreadsheet model was developed to predict the number of additional users of implants, informed by stakeholder input (represented by the impact index).

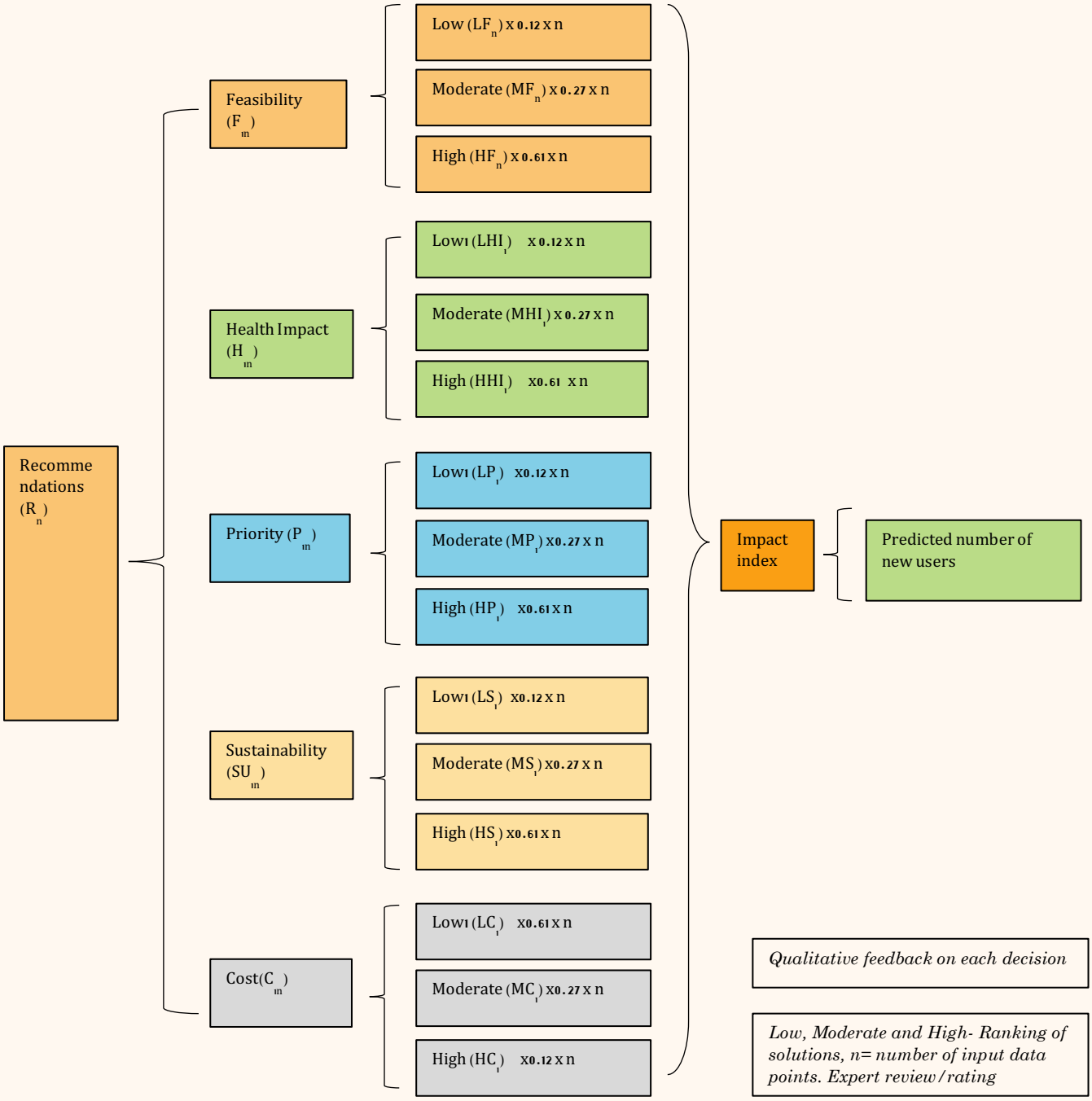
Limitations of Model

Please note the impact model does not take account of geographic differences of countries seeking to apply the model. The model was developed based on input from global stakeholders. To account for geographic differences, further research for specific geographies would be required. This data could then be applied to refine the model in future iterations. In addition, the model does not account for differences in the relationships between recommendations. The weighting of the recommendations that inform the model did not allow for this level of analysis. Further research and refinement of the model would be required in order to reflect such relationships.

Table 1: Ranking of Recommendations by Stakeholders

CRITERIA	RANKING OF RECOMMENDATIONS BY STAKEHOLDERS		
	Low	Moderate	High
FEASIBLE	Low feasibility for implementation	Moderately feasible to implement	Highly feasible to implement
HEALTH IMPACT	Low health impact	Moderate health impact	High health impact
PRIORITY	Low implementation priority	Moderate implementation priority	High implementation priority
SUSTAINABILITY	Low likelihood of solution sustainability	Moderate likelihood of solution sustainability	High likelihood of solution sustainability
COST	Low cost [positive]	Moderate cost	High cost [negative]

Figure 2: Conceptual Framework of Multi-Criteria Decision Analysis model (MCDA)



IMPLANT MODEL RESULTS

The results of the Implant Model are informative in a number of ways.

From the online survey, the 16 most impactful recommendations (out of 24 recommendations) were ranked by experts, as low, moderate or high impact by criteria (feasibility, health impact, priority, sustainability and cost.) Through a series of statistical regressions, a list of most impactful recommendations was identified with the three most impactful recommendations identified as:

- Undertake a policy review to ensure policy environment is supportive of private sector provision of implants.
- Elevate government stewardship to coordinate efforts to build a high-quality supply chain for the private sector.
- Align demand generation activities to the target population and context to address prevailing social and cultural norms.

This information can be used to inform decision making when considering how to increase private sector engagement in contraceptive implant scale-up.

Using context specific data, specifically, data on Women of Reproductive Age and baseline private sector contraceptive implant prevalence rate, the model can be used to predict the additional number of new users that could be anticipated following implementation of one or more recommendations. Such predications can be used to build a case for further investment in private sector engagement in contraceptive implant scale-up.

IMPLANT MODEL APPLICATION

The MCDA model has been initially designed as a desktop Excel spreadsheet that can be used by implementors, governments and partners as a planning tool for resource allocation, budgeting and to appreciate the impact of implementing recommendations/strategies on potential scale-up of implant service delivery in the private sector, where users can input data with formulas already embedded.

The model can be modified by the user to incorporate context-specific data. Users must determine the population of interest (e.g. country or geographic region). Then users should determine/estimate the baseline private sector implant prevalence rate among Women of Reproductive Age (WRA) (15-49 years) and enter this rate (%) into column I for each recommendation of interest (see beige column, circled in red in Figures 3). Then users should determine the size of population of WRA for the given country or geographic region and enter this number into column L for each recommendation of interest (see beige column, circled in red in Figure 3). This information will appropriately contextualize the recommendations and show the impact of varying these parameters on

outputs, by generating additional users by years in columns N, P, Q, R and S (see orange columns circled in green in Figure 3).

As new evidence becomes available, the ranking of these recommendations can be altered to further refine projects of additional new users. While the tool is initially presented as a desktop Excel spreadsheet, it may be developed as an online software in the future.

Note: Numbers in the model are set to automatically round. If numbers entered are too low, this may result in the output rounding to zero.

Implant Tool

#	Parameters	Recommendations	Impact factor%	Baseline PS Implant Prevalence (year1) amongst WRA %	Predicted implant Prevalence Rate (%)	Adjusted Annual rate (%)	Population of WRA (15-49 yrs) (Baseline)	Additional users_year1	Annual Growth rate (0.9%)	Additional_ Users_year2	Users_year3	Users_year4	Users_year5
1	recom_1	1. Link private sector providers to more affordable commodities through public-private partnerships.	31.79	2%	0.03	0.01		0	0.90	0	0	0	0
3	recom_3	3. Elevate government stewardship to coordinate efforts to build a high quality supply chain for the private sector.	35.38	2%	0.03	0.01		0	0.90	0	0	0	0
4	recom_4	4. Ensure private providers anticipated implant commodity needs are included in national quantification exercises.	17.67	2%	0.02	0.00		0	0.90	0	0	0	0
5	recom_5	5. Ensure national implant reporting systems are accessible to private providers.	12.56	2%	0.02	0.00		0	0.90	0	0	0	0
7	recom_7	7. Support introduction of generic implants to create an implant market with lower costs and cost structures.	15.89	2%	0.02	0.00		0	0.90	0	0	0	0
9	recom_9	9. Include contraceptives in national health insurance schemes.	22.60	2%	0.02	0.00		0	0.90	0	0	0	0
10	recom_10	10. Implement Service Level Agreements (SLAs) between private providers and public suppliers, coupled with developing a long-term health financing strategy.	11.95	2%	0.02	0.00		0	0.90	0	0	0	0
12	recom_12	12. Undertake a policy review to ensure policy environment is supportive of private sector provision of implants.	38.78	2%	0.03	0.01		0	0.90	0	0	0	0
13	recom_13	13. Train private providers in appropriate counselling, such as how the implant works, how it's inserted and side effects, to support informed choice.	25.73	2%	0.03	0.01		0	0.90	0	0	0	0
14	recom_14	14. Align demand generation activities to the target population and context to address prevailing social and cultural norms.	34.11	2%	0.03	0.01		0	0.90	0	0	0	0
15	recom_15	15. Develop and implement specific marketing strategies for implants/LARCs for the private sector.	14.93	2%	0.02	0.00		0	0.90	0	0	0	0
17	recom_17	17. Create and/or expand innovative and cost effective training approaches to include private healthcare providers, including to pharmacists and drug shop providers.	23.56	2%	0.02	0.00		0	0.90	0	0	0	0
18	recom_18	18. To support the institutionalization of implant education for private providers and private provider association members, negotiate with government to allow private providers enrolment in public sector implant trainings.	27.84	2%	0.03	0.01		0	0.90	0	0	0	0

Figure 3: Implant Model Excel spreadsheet with customizable columns for Baseline Prevalence of Implant Users in the Private Sector and Population of WRA (beige columns, circled in red), to project additional new users of implants in future years (orange columns, circle in green)