METHOD ARTICLE

What increase in modern contraceptive use is needed in FP2020 countries to reach 75% demand satisfied by 2030? An assessment using the Accelerated Transition Method and Family Planning Estimation Model [version 1; peer review: awaiting peer review]

Niamh Cahill ¹, Michelle Weinberger ², Leontine Alkema ³

¹Department of Mathematics and Statistics, Maynooth University, Maynooth, Ireland
²Avenir Health, Washington D.C., USA
³Department of Biostatistics and Epidemiology, University of Massachusetts Amherst, Amherst, USA

Abstract

Background: Sustainable Development Goal 3.7 aims to ensure universal access to sexual and reproductive health services. One suggested benchmark is to have at least 75% of the demand for contraception satisfied with modern methods (DS) in all countries by 2030. The translation of DS-based targets into targets for the modern contraceptive prevalence rate (mCPR) is needed to make targets actionable.

Methods: We propose the Accelerated Transition (AT) method for determining the mCPR needed to reach demand-satisfied targets by 2030. The starting point for this method is the projection of DS under “business as usual” using the one-country implementation of the Family Planning Estimation Model (FPEMcountry). For countries in which the DS target is projected to be later than 2030, the AT method assumes that meeting the DS target by 2030 requires an acceleration of the contraceptive use transition such that the DS target, and its associated mCPR, will be reached in 2030 as opposed to the later year. The DS-target-associated mCPR becomes the mCPR target for the year 2030.

Results: We apply the AT method to assess progress needed for attaining the 75% DS target for married or in-union women in the world’s poorest countries. For 50 out of 68 countries, we estimate that accelerations are needed, with required mCPR increases ranging from 4.3 to 50.8 percentage points.

Conclusions: The AT method quantifies the acceleration needed – as compared to business as usual projections – for a country to meet a family planning target. The method can be used to determine the mCPR needed to reach demand-satisfied targets.
Keywords
Planning Estimation Model (FPEM), demand satisfied, modern contraceptive use, target setting

Corresponding author: Niamh Cahill (Niamh.Cahill@mu.ie)

Author roles: Cahill N: Conceptualization, Formal Analysis, Methodology, Writing – Original Draft Preparation; Weinberger M: Conceptualization, Writing – Review & Editing; Alkema L: Conceptualization, Methodology, Writing – Original Draft Preparation

Competing interests: No competing interests were disclosed.

Grant information: This work was supported by the Bill and Melinda Gates Foundation [OPP1154144]
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Copyright: © 2020 Cahill N et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

How to cite this article: Cahill N, Weinberger M and Alkema L. What increase in modern contraceptive use is needed in FP2020 countries to reach 75% demand satisfied by 2030? An assessment using the Accelerated Transition Method and Family Planning Estimation Model [version 1; peer review: awaiting peer review] Gates Open Research 2020, 4:113 https://doi.org/10.12688/gatesopenres.13125.1

First published: 21 Jul 2020, 4:113 https://doi.org/10.12688/gatesopenres.13125.1
**Introduction**

Family planning success is typically measured with two key family planning indicators: the modern contraceptive prevalence rate (mCPR) and unmet need for contraception. However, the combination of these two indicators into the more complete ‘demand satisfied’ indicator can better capture a country’s family planning performance. Demand satisfied has thus been incorporated into the Sustainable development goals (SDGs) with SDG indicator 3.7.1 specifying that the international community should assess the ‘Proportion of women of reproductive age (ages 15–49 years) who have their need for family planning satisfied with modern methods’. One proposed benchmark related to SDG 3.7.1 is to have at least 75% of the demand for family planning satisfied with modern contraceptives in all countries by 2030. We refer to this global benchmark of 75% demand satisfied as DS75. Other examples of targets for this indicator allow for country variation and past country experiences to inform country-specific target values.

“Business as usual” (BAU) projections, referring to projections of family planning indicators based on historical trends, can be used to assess if countries are on target to meet DS75 by 2030. The one-country implementation of the Family Planning Estimation Model (FPEMcountry) produces model-based projections of family planning based on parametrization of trends in contraceptive use and unmet need. In summary, FPEMcountry models contraceptive prevalence using logistic growth curves. Estimates of unmet need are obtained by capturing the relationship between contraceptive prevalence and unmet need. BAU projections for DS are obtained from projected contraceptive use and unmet need.

Countries that are not currently projected to meet DS75 by 2030 will require a larger-than-BAU increase in the number of users of modern methods of contraception between now and 2030. Estimating the required increase in mCPR and hence required number of additional users for each country can facilitate planning for the appropriate allocation of resources at the country level. A previous study for states in India has estimated the required increases in mCPR and additional users needed to achieve DS targets using 2030 projections of total demand (contraceptive prevalence plus unmet need) for contraception. This method combined accelerated growth in modern use with business-as-usual growth in total demand; the method did not account for faster-than-BAU increases in mCPR to coincide with faster-than-BAU increases in demand that are likely to occur due to, for example, increased efforts in family planning programs. Methods that account for faster-than-BAU increases in demand to coincide with faster-than-BAU increases in mCPR are needed to avoid underestimation of mCPR targets, and thus, failure to meet DS targets.

We present a new method for assessing country-specific levels of mCPR needed to achieve DS targets by 2030, referred to as the accelerated transition (AT) method. The starting point for this method is the projection of DS under BAU using FPEMcountry. For countries in which the DS target is projected to be later than 2030, the AT method assumes that meeting the DS target by 2030 requires an acceleration of the contraceptive use transition such that the DS target, and its associated mCPR, will be reached in 2030 as opposed to the later year. The DS target-associated mCPR is the mCPR target for the year 2030. Based on mCPR targets, we estimate progress needed for attaining DS targets in terms of a mCPR gap. Using the AT method we assess progress for the countries in the FP2020 initiative towards reaching mCPR targets associated with DS75 and quantify the relative acceleration needed to achieve these targets in each country.

**Methods**

**Family planning indicators and data**

Contraceptive prevalence is measured as the percentage of women who report themselves or their partners as currently using at least one contraceptive method of any type (modern or traditional). Unmet need for family planning is defined as the percentage of women who want to stop or delay childbearing but who are not currently using any method of contraception to prevent pregnancy. Observations of unmet need for family planning in our database are, whenever possible, based on the revised algorithm of the indicator designed to improve comparability within and across countries. The estimates reported in this study are for women of reproductive age (15–49 years) who were currently married or in a union (referred to as married/in-union women of reproductive age [MWRA]).

Family planning data were obtained from nationally representative household surveys, the Demographic and Health Surveys (DHS), Performance Monitoring and Accountability 2020 surveys, the Multiple Indicator Cluster Surveys, the Reproductive Health Surveys, Contraceptive Prevalence Surveys and World Fertility Surveys. The estimates presented in this report are based on 558 survey observations of contraceptive prevalence between 1968 and 2019 from 68 countries and 320 survey observations of unmet need for family planning from 66 countries. This survey database was prepared for the FP2020 report and stored in the data set contraceptive_use_track20 in FPEMcountry.

**Model-based projections of Family Planning Indicators using FPEMcountry**

The FPEMcountry R package implements a one-country version of the Family Planning Estimation Model which combines a Bayesian hierarchical model with country specific time trends to yield estimates of contraceptive prevalence and unmet need for family planning for women aged 15–49 who are married or in a union. The model accounts for differences by data source, sample population, and contraceptive methods included in the measure. For every country, the FPEMcountry R package models contraceptive prevalence with an expected trend that assumes contraceptive prevalence will begin with a gradual increase, it will subsequently become more rapid and then it will begin to slow down when high levels of prevalence are reached. The parameters that control the trend are estimated hierarchically, such that estimates are based on the data available in the country of interest, and also the sub-regional, regional, and global experience. Distortions are added to capture how rates of change in the observed data (i.e., faster/slower rates of change in contraceptive prevalence) deviate from the rates of change indicated by the expected trend. Projections are informed by recent changes that have occurred in contraceptive prevalence (i.e., the difference between the two most recent surveys) as
well as past experience. Estimates of unmet need are obtained by capturing the relationship between contraceptive prevalence and unmet need. Similar to the model for contraceptive prevalence, a hierarchical approach is used to estimate parameters. Time dependent distortions are added to capture country-specific changes in the level of the indicator. Estimates and projections of demand satisfied are derived from calculating the ratio of modern contraceptive prevalence to total demand (contraceptive prevalence plus unmet need).

Accelerated Transition (AT) method
We propose the Accelerated Transition (AT) method for assessing the mCPR level needed to reach a specific DS target. The starting point for this method is the projection of DS under “BAU” using projections, in the case of FP, using FPEM-country. BAU projections are illustrated for Afghanistan in Figure 1 (solid lines). For countries such as Afghanistan in which the DS target is projected to be later than the target year, the AT method assumes that meeting the DS target by 2030 requires an acceleration of the contraceptive use transition such that the DS target, and its associated mCPR, will be reached in 2030 as opposed to the later year. The AT method assumes that meeting the DS target by 2030 requires an acceleration of the contraceptive use transition such that the DS target, and its associated mCPR, will be reached in 2030 as opposed to the later year. The AT method assumes that meeting the DS target by 2030 requires an acceleration of the contraceptive use transition such that the DS target, and its associated mCPR, will be reached in 2030 as opposed to the later year.

AT measures: relative acceleration, target mCPR, and progress assessments
We let \( t^* \) be the earliest year in which a country is expected to achieve DS75 (i.e., 2054 for Afghanistan). We estimate \( t^* \) based on projections of the demand satisfied indicator from FPEM-country, with the maximum set to 2100. For countries with \( t^* > 2030 \), the goal is to achieve the target in the target number of years (2030 - \( t^* \)), as opposed to in the BAU projected number of years (\( t^* \)). We quantify the relative acceleration required to meet the DS75 target, \( rel.accel \), by comparing the number of years it would take to meet DS75 under the BAU scenario to the number of years until the desired year for target achievement (i.e., 2030):

\[
rel.accel = \frac{(t^* - t^{\text{current}})}{(2030 - t^{\text{current}})}.
\]

The relative acceleration measurement quantifies the speed up that would make this possible. For example, a required relative acceleration of 2 means that a country must achieve the target 2 times faster (or in half the number of years) than it is currently expected to do.

For countries with \( t^* > 2030 \), the target-associated mCPR \( t_{\text{mod}} \) for 2030 is the mCPR projected for year \( t^* \):

\[
t_{\text{mod}} = t_{\text{mod}, c, t^*}.
\]

where \( t_{\text{mod}, c} \) denotes mCPR in country c in year \( t^* \) and \( t_{\text{mod}} \) is the DS75-associated target mCPR in country c. The difference between the levels of mCPR in \( t^{\text{current}} \) and the target mCPR is the current mCPR target gap, \( gap_{\text{c}} \) given by:

\[
gap_{\text{c}} = t_{\text{mod}, c} - t_{\text{mod}, c, t^{\text{current}}},\]

Continuing with the Afghanistan illustration, Afghanistan needs to increase mCPR by 30.8% percentage points over an 11-year

![Figure 1. An illustration of the Accelerated Transition and Demand-based methods to obtain modern contraceptive prevalence rate (mCPR) targets for Afghanistan. Business as usual projections (solid lines) and accelerated transition projections (dashed lines) for mCPR, total demand and 75% demand satisfied. Accelerated transition (AT)-based mCPR target and total demand for 2030 are indicated with stars, the demand-based mCPR target (75% of total demand in 2030) is shown in red.](image-url)
timescale in order to meet DS75 by 2030 rather than over the 35-year timescale that is currently projected for achieving DS75 (see Table 1).

We compare the assessment of the AT-method-based mCPR gap associated with DS75 to the gap obtained by the approach used in New et al., 2016, referred to as the demand-based (DB) method. Under the DB approach, the target-mCPR is estimated as being 75% of the projected total demand in 2030. For Afghanistan, the DB approach gives a target mCPR of 45.3% (see Figure 1 and Table 1). This is lower than the AT method-based target mCPR of 54.6% because the DB approach is based on accelerated increases in mCPR only, as opposed to accelerated increases in both mCPR as well as total demand.

Results

We constructed BAU projections for 68 countries of the FP2020 initiative and assessed the accelerations needed in each country to meet DS75 by 2030. In total, 50 out of 68 countries are projected to reach 75% demand satisfied in some year after 2030 and require acceleration in their FP transition between 2019 and

<table>
<thead>
<tr>
<th>Country</th>
<th>Target year</th>
<th>Target mCPR</th>
<th>mCPR target Gap (% point)</th>
<th>Users Target Gap (million)</th>
<th>Acceleration</th>
<th>DB mCPR gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sri Lanka</td>
<td>2031</td>
<td>58.7</td>
<td>4.3</td>
<td>0.02</td>
<td>1.1</td>
<td>58.9</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>2032</td>
<td>53</td>
<td>15.3</td>
<td>6.35</td>
<td>1.2</td>
<td>52.1</td>
</tr>
<tr>
<td>Madagascar</td>
<td>2032</td>
<td>54.4</td>
<td>12.7</td>
<td>1.27</td>
<td>1.2</td>
<td>54</td>
</tr>
<tr>
<td>India</td>
<td>2036</td>
<td>57.2</td>
<td>7.3</td>
<td>27.74</td>
<td>1.5</td>
<td>56.7</td>
</tr>
<tr>
<td>Nepal</td>
<td>2040</td>
<td>59.3</td>
<td>12.9</td>
<td>1.44</td>
<td>1.9</td>
<td>58.8</td>
</tr>
<tr>
<td>United Republic of Tanzania</td>
<td>2040</td>
<td>55.5</td>
<td>18.1</td>
<td>3</td>
<td>1.9</td>
<td>52.9</td>
</tr>
<tr>
<td>Uganda</td>
<td>2041</td>
<td>58.2</td>
<td>20.8</td>
<td>2.6</td>
<td>2</td>
<td>55.8</td>
</tr>
<tr>
<td>Mozambique</td>
<td>2041</td>
<td>51.4</td>
<td>24.1</td>
<td>1.9</td>
<td>2</td>
<td>46.4</td>
</tr>
<tr>
<td>Djibouti</td>
<td>2047</td>
<td>53.5</td>
<td>28.6</td>
<td>0.05</td>
<td>2.5</td>
<td>46.9</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>2047</td>
<td>51.1</td>
<td>12.9</td>
<td>0.18</td>
<td>2.5</td>
<td>47.8</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>2047</td>
<td>51.4</td>
<td>21.6</td>
<td>1.42</td>
<td>2.5</td>
<td>46.2</td>
</tr>
<tr>
<td>Burundi</td>
<td>2048</td>
<td>55.3</td>
<td>28.5</td>
<td>0.72</td>
<td>2.6</td>
<td>50.8</td>
</tr>
<tr>
<td>Cambodia</td>
<td>2048</td>
<td>59.9</td>
<td>15.6</td>
<td>0.71</td>
<td>2.6</td>
<td>57.8</td>
</tr>
<tr>
<td>Senegal</td>
<td>2049</td>
<td>51.4</td>
<td>24.1</td>
<td>1.08</td>
<td>2.7</td>
<td>44.4</td>
</tr>
<tr>
<td>Sao Tome and Principe</td>
<td>2051</td>
<td>57.1</td>
<td>15.8</td>
<td>0.01</td>
<td>2.9</td>
<td>55.7</td>
</tr>
<tr>
<td>Liberia</td>
<td>2052</td>
<td>53.7</td>
<td>26.2</td>
<td>0.27</td>
<td>3</td>
<td>47.3</td>
</tr>
<tr>
<td>Timor-Leste</td>
<td>2053</td>
<td>55.8</td>
<td>29.1</td>
<td>0.08</td>
<td>3.1</td>
<td>50.6</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>2053</td>
<td>51.6</td>
<td>29.7</td>
<td>0.5</td>
<td>3.1</td>
<td>42.3</td>
</tr>
<tr>
<td>Bolivia (Plurinational State of)</td>
<td>2053</td>
<td>63.5</td>
<td>17.6</td>
<td>0.45</td>
<td>3.1</td>
<td>62.8</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>2054</td>
<td>54.6</td>
<td>30.8</td>
<td>3.38</td>
<td>3.2</td>
<td>45.5</td>
</tr>
<tr>
<td>Niger</td>
<td>2054</td>
<td>48.1</td>
<td>29.1</td>
<td>2.12</td>
<td>3.2</td>
<td>37</td>
</tr>
<tr>
<td>Ghana</td>
<td>2055</td>
<td>55.4</td>
<td>26.7</td>
<td>1.45</td>
<td>3.3</td>
<td>49.5</td>
</tr>
<tr>
<td>Guinea-Bissau</td>
<td>2056</td>
<td>48.2</td>
<td>30.1</td>
<td>0.09</td>
<td>3.4</td>
<td>36.9</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>2058</td>
<td>52.7</td>
<td>32.5</td>
<td>1.74</td>
<td>3.5</td>
<td>43.4</td>
</tr>
<tr>
<td>Congo</td>
<td>2060</td>
<td>55.3</td>
<td>29.8</td>
<td>0.33</td>
<td>3.7</td>
<td>50.7</td>
</tr>
</tbody>
</table>
2030 to meet DS75 by 2030. Required relative accelerations range from 1.1 to greater than 7 (Figure 2), with 35 countries needing to accelerate by at least a factor of 3 (Table 1). Associated mCPRs among countries projected to meet DS75 before 2100 range from 48.1% in Niger to 63.5% in Bolivia (Plurinational State of). It is projected that DS75 will not be met by 2100 in three countries (Chad, Papua New Guinea and Solomon Islands). In these countries, the target mCPR was set to the projected mCPR for 2100, resulting in a relatively low target for Chad (41.0%).

For countries needing acceleration, we estimate that the mCPR target gaps between 2019 and 2030 range from 4.3 percentage points in Sri Lanka to 50.8 percentage points in Somalia (Figure 2 and Table 1). mCPR gaps translate directly into the absolute numbers of required additional users of modern contraceptive methods. Nigeria and Pakistan face some of the biggest challenges needing to accelerate their modern contraceptive use transition by a factor of 4 in order to add 15.9 and 15.0 million additional users respectively by 2030 (Table 1).

Figure 3 compares the estimated target gaps using the AT method to those obtained using the DB method. As expected, due to keeping demand in 2030 constant in the DB method, we observe that estimated target gaps are larger based on the AT method as compared to the DB method. The differences tend to be larger for countries with larger gaps that need more acceleration.

**Discussion**

We have presented the accelerated transition (AT) method as a new method to calculate mCPR targets associated with DS
targets. As the name suggests, the AT method quantifies the acceleration needed – as compared to business as usual projections – for a country to meet a target. We find that substantial accelerations are needed in countries that are not on track to achieve 75% demand satisfied for married or in-union women by 2030, with required mCPR increases ranging from 4.3 to 50.8 percentage points.

We suggest that the AT method provides more appropriate expectations for the levels of mCPR required to meet DS targets than the DB method. In countries where DS targets are projected to be later than 2030, we argue that the DB method fails to capture the dynamics of how FP indicators evolve. Specifically, the assumption of a fixed level of demand in 2030 accompanying the accelerated mCPR growth required to reach the target in this year is not realistic. That is, we cannot justify the assumption that accelerating mCPR will result in an equivalent deceleration of unmet need plus traditional contraceptive use combined. In fact, evidence suggests that increases in mCPR are likely to coincide with increased demand. To combat this, the AT method uses the FPEMcountry R package to estimate the mCPR in the year in which the DS targets in question is projected to be met, which implicitly accounts for the changes in demand that coincide with reaching this relevant level of demand satisfied. The comparison of the AT and DB methods for assessing DS75 illustrates that for countries with demand satisfied projected to be less than 75% in 2030 mCPR targets from the DB method are lower than AT-based estimates.

Recently, Li et al. also obtained mCPR targets for DS75. They used a regression model to estimate mCPR as a quadratic function of DS, with country fixed effects. mCPR target values at DS75 were obtained by plugging in a DS of 75% in the fitted regression equation. Hence, the Li et al. mCPR targets are based on the assumption that differences in mCPR between countries stay constant with time and DS. While the model provides a good in-sample fit, its predictive performance is not verified. The approach also does not provide any measure of acceleration needed to accomplish DS75. In contrast, the AT method is based on the FPEM, which does not assume that differences in mCPR between countries stay constant with time and DS and has been shown to work well for short-term projection. In addition, the AT method provides a measure of relative acceleration needed for the DS75 target.

While we suggest that the AT method improves upon existing methods, it is not without limitations. The AT method relies on projections of demand and mCPR by FPEMcountry. While this model has been shown to work well for short-term projections, its accuracy for long-term projections cannot be verified. In addition, by definition, the method assumes that accelerated mCPR growth would promote the same changes in demand and unmet need as compared to seeing the same mCPR growth over a longer time period.

We demonstrated the use of the AT method here for evaluating the DS75 target. More general, the approach can be used for any DS-based target. Indeed, given the rapid acceleration needed for a large number of countries to achieve DS75 (35 countries need to accelerate their transition by at least a factor of 3), other country-specific approaches to target setting, i.e. based on attainment probabilities, may result in more realistic targets.

The main contribution of the AT method is to make DS-based targets actionable, that is, to provide the mCPR-associated target that in turn, provides direct information on the number of women needing modern contraceptives under the target. Given that accelerated progress towards demand-satisfied targets is desirable for many countries, we hope that the concrete
information on the remaining gap in mCPR and associated users aids the implementation of successful FP programs.

Data availability
Source data
The processed survey data that support the findings of this study are openly available at https://www.un.org/en/development/desa/population/publications/dataset/contraception/wcu2019.asp and contained in the R package FPEMcountry.

Software availability
Source code is available from Github: https://github.com/FPRgroup/FPEMcountry/tree/v1.0.1

Acknowledgements
We thank Emily Sonneveldt, Kristin Bietsch, John Stover, Win Brown, Aisha Dasgupta, Mark Wheldon and Vladimira Kantorova for their valuable contributions to discussion regarding the development of the AT method and the analysis presented in this paper.

Figure 3. A comparison of the modern contraceptive prevalence rate (mCPR) target gaps according to the accelerated transition (AT) method and the demand based (DB) method. Each point represents a single country. Color indicates the relative acceleration needed according to the AT method. DS75 - 75% demand satisfied.

Archived source code at time of publication: http://doi.org/10.5281/zenodo.389945

License: MIT

References

Page 8 of 8