Rates and trends in contraceptive prevalence, unmet need and demand for family planning for 29 states and union territories in India: a subnational analysis with the Family Planning Estimation Tool

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Extended abstract for PAA 2016 with selected findings

Abstract
The assessment of progress in improving access to family planning is needed at the subnational level, particularly for a populous country of high demographic diversity like India. We developed a statistical model that can generate subnational estimates and projections for family planning indicators. We packaged this model in the form of a user-friendly web application, the Family Planning Estimation Tool (FPET), which can be operated by local stakeholders. We present annual estimates of rates and trends in the contraceptive prevalence rate, unmet need and demand for family planning for 29 states and union territories in India from 1990 to 2015 produced with FPET. The identification of states/union territories that are performing better or worse help to focus attention on areas where it is most needed. The analysis can be generalized to other countries as well as other types of population subgroups, and carried out in FPET.

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INTRODUCTION

Reproductive health is intricately linked to issues of woman and child health, the spread of sexually transmitted diseases, poverty, education, gender equality and human rights.[1] Improving access to reproductive health is thus central to the process of development, as reflected in Sustainable Development Goal 3.7, which calls for universal access to family planning by 2030.[2]

To date, efforts to assess progress in providing access to family planning have been largely focused on the estimation and projection of family planning indicators at the national level, i.e. based on the United Nations Population Division's global Family Planning Estimation model (FPEM), but such analyses may mask disparities at a more local level. It is thus important to have the ability to track progress at a finer, i.e. subnational level. Such population subgroups can be defined geographically (e.g. states, urban/rural residence) or based on socioeconomic factors (e.g. household wealth quintiles). This shift in emphasis from national assessments and targets to subnational ones is particularly pertinent in light of the equity focus in the post-2015 global development agenda. Additionally, it is also crucial to empower country stakeholders to take agency in planning, monitoring and evaluation at the local level, which is only possible if they have the capability to generate the relevant estimates and projections of indicators of access to reproductive health with little external support.

In this paper, we present a user-friendly web application, the Family Planning Estimation Tool (FPET), which can achieve the aforementioned purpose of subnational monitoring at the local level, and provide an annual series of estimates and projections of rates and trends in indicators of access to reproductive health like contraceptive prevalence, unmet need and demand for family planning at the subnational level. We use the tool to obtain estimates and projections of subnational family planning indicators for India. Currently, the percentage of women of reproductive age that are married or in union who are on modern contraceptive methods in India stands at 52.4%, as opposed to 36.8% in 1990. In absolute numbers, this translates to more than a doubling of women on modern contraceptive methods from 58 million in 1990 to 124 million in 2015.[3] The unmet need for modern methods has fallen from 20.0% (31,760,079 women) in 1990 to 13.1% (30,907,121) in 2015, while the demand for family planning satisfied with modern methods has risen from 59.4% to 71.8% in the same period. This indicates progress on the national level, however, national averages may mask disparities at a more local level, especially in a country of high demographic diversity such as India. To our knowledge, previous studies related to the analysis of rates and trends in family planning indicators for states/union territories (UTs) in India have mainly relied on state/UT-level observations available from household surveys.[4,5] We use FPET to provide an annual series of estimates and projections of rates and trends in indicators of access to reproductive health like contraceptive prevalence, unmet need and demand for family planning at the subnational level in India from 1990 to 2015.

METHODS

Data

The database for this study comprises observations of the contraceptive prevalence rate and unmet need for family planning as well as estimates of the number of the base population of women for 29 states and UTs in India, namely: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand and West Bengal. Observations for the state of Telangana are not separately available as it only separated from Andhra Pradesh in 2014.

The contraceptive prevalence rate is defined as the percentage of women currently using any contraceptive method, while the modern contraceptive prevalence rate is the same but limited to women using modern contraceptive methods, including sterilization, condoms, oral hormonal pills, the intra-uterine device, injectables, implants, vaginal barrier methods and emergency contraception. The unmet need for family planning is defined as the percentage of women who do not want any more children or want to delay the birth of the next child and yet are not using any contraceptive method. Observations for these indicators come from household surveys for India, specifically multiple rounds of the Demographic and Health Survey (DHS) (also known as the National Family Health Survey (NFHS)), the District Level Household & Facility Survey (DLHS) and the Annual Health Survey (AHS). There are 208 observations each of the total contraceptive prevalence rate, modern contraceptive prevalence rate and the unmet need for family planning from 1992 to 2013 from a total of 10 survey series.

The base population of women refers to women of reproductive age (15 to 49 years old) that are married or in union (MWRA). Estimates and projections of MWRA for the 29 states/UTs were produced by fitting polynomial regression curves to MWRA data from 1970, 2001 and 2011 and projections for 2026. The data for the years 1970, 2001 and 2011 were obtained by applying the national marriage rate of 74.8% from DHS 2005-2006[6] to figures on the number of women of reproductive age from the census of India for 1971, 2001 and 2011, adjusting for changing state boundaries in the 1971 census. The 2026 data points are based on the India Expert Committee projection of the percent increase in the total population from 2011 to 2026 (this implicitly assumes that MWRA as a proportion of the total population is constant).[15] The order of the polynomial used for each state/UT was chosen based on the most appropriate fit to the data. The default was to use a third order polynomial, which in many cases produced an exact fit to the data. For some states/UTs a second order polynomial was used to avoid unrealistic estimates/predictions.

Statistical analysis

Our statistical model for subnational estimates and projections builds upon the Bayesian hierarchical model that is currently used by the United Nations Population Division to assess progress in providing access to family planning.[3,7] This existing model, which we refer to as the global Family Planning Estimation Model (FPEM), combines systematic trends in total

contraceptive prevalence modeled and the ratio of modern to total prevalence, modeled by logistic growth curves, with a time series model for fluctuations around these trends. A Bayesian hierarchical model is used to estimate the parameters of the logistic functions, so that the global, regional and subregional experiences are taken into account in the estimation on top of the country experience (since some countries have limited data availability). To estimate unmet need, the model takes advantage of an expected (and empirically observed) statistical relation between total contraceptive prevalence and unmet need. Finally, a data model adjusts for differing data quality as well as data that do not pertain to the base population of interest of MWRA (e.g. data for married women of an age group other than 15-49 years).

The estimates and projections in this paper were obtained from a "country-specific" extension of the global family planning model, referred to as the non-global FPEM. In this model implementation, non-country-specific parameters, e.g. the subregional pace of the uptake of contraceptive methods and the error variances and covariances for different data source types, were not estimated but were fixed at the point estimates from the global model run. The non-global model can be considered as a model with informative priors informed by the global model. When fitted to national data, the non-global model gave very similar results to those of the global one.

In addition to providing national estimates, the non-global FPEM can also be fitted to subnational data to obtain subnational estimates, e.g. for women in a particular geographical region of for women in subgroups defined by socio-economic status. In this paper, we used the non-global FPEM to obtain subnational estimates for India. Subnational estimates were constructed for a subpopulation by changing hierarchical models in the family planning model that refer to a subregion-country hierarchy into a country-subpopulation hierarchy. In other words, we considered each new subpopulation (in this case, an Indian state/UT) as a "country" within the "subregion" of India. For instance, the parameter for the pace of the uptake of contraceptive methods has a subregion-country hierarchy; for constructing subnational estimates for the Indian states/UTs, the subregional parameter was fixed at the point estimate for India from the global model run and state-specific estimates were obtained from the hierarchical model to allow for variability across states.

The Family Planning Estimation Tool

We developed a user-friendly web-based application, the Family Planning Estimation Tool (FPET), that implements the non-global family planning model (Figure 1). The tool is publicly accessible at http://fpet.track20.org.[8] This tool was launched under the auspices of the Track20 Project to monitor progress towards the attainment of the goals of the global FP2020 initiative.[9] FPET was motivated by the need for a monitoring tool which is not only less computationally intensive and time consuming than the global family planning model (which requires at least 10 hours of computation time on an average personal computer with 4 cores) but is also simple enough to use for a local stakeholder without external support and any statistical programming skills. FPET allows the user to generate national or subnational estimates and projections of family planning indicators with either the default World Contraceptive Use database[3] or his/her own input database. This application was created with the R package Shiny[10] and runs using R[11] and JAGS;[12]

however, all that is required for the user to run FPET is an internet connection and a modern web browser like Google Chrome.

Figure 1: Screenshot of FPET.

SELECTED FINDINGS

Modeled estimates and projections for a selected state Assam are presented in Figure 2, focusing on three key indicators: modern contraceptive prevalence, unmet need for modern contraceptive methods. Figure 2 shows that the modeled fit follows the level and trend of the DHS data closely. The comparison of the modeled estimates with data points from other sources shows differences that are due to model assumptions and findings of the global model. Firstly, for non-standard data (e.g. non-standard age group of women, circles labeled with “A”), the model takes into account potential biases associated with the non-standard characteristics in producing the estimates. Secondly, when fitting the model, data are categorized into DHS, Multiple Indicator Cluster Surveys (MICS), national survey data or other survey data. Based on the global assessment of data of these different types of surveys, it was found that the random errors associated with non-DHS data are greater than those associated with DHS data, especially for measuring unmet need.[6] As a result of this assessment, error variances for non-DHS data are estimated to be higher than the error variance for DHS data, and the modeled estimates will be more informed by the DHS data as compared to data from other sources. This explains the discrepancy between the AHS data (black circles) and the modeled estimates for unmet need.

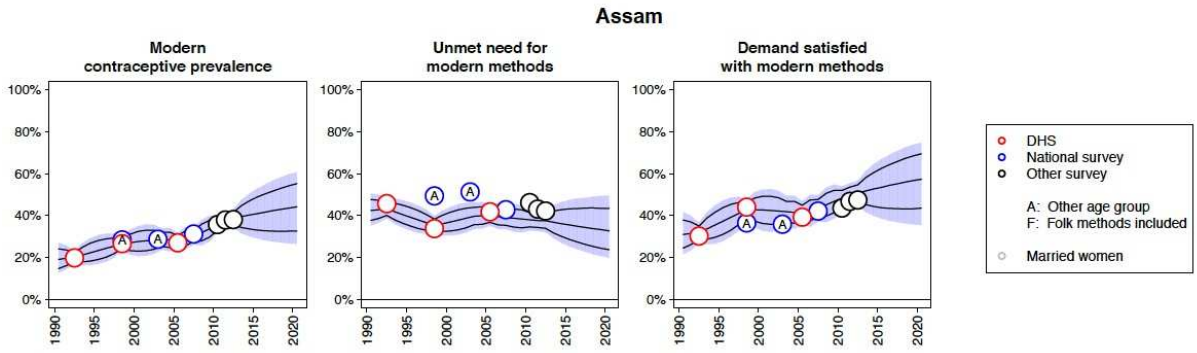

Figure 2: Data and modeled rates and trends of modern contraceptive prevalence, unmet need for modern contraceptive methods and demand satisfied with modern contraceptive methods for Assam. Circles represent survey observations; black lines represent the median fit and 80% uncertainty intervals; blue shaded areas represent 95% uncertainty intervals.

An overview of the current levels in modern contraceptive prevalence, unmet need for and demand satisfied with modern methods is given for the 29 states/UTs in India in Figure 3, showing a large amount of heterogeneity across the country. According to the latest UNPD estimates,[3] India as a whole has a modern contraceptive prevalence rate of 52.4% (95% uncertainty intervals: 36.9%-67.0%) in 2015. At the subnational level, the modern contraceptive prevalence rate ranges from 14.7% (8.9%-22.4%) for Manipur and 18.1% (11.9%-24.4%) for Meghalaya to 66.9% (56.1%-75.9%) for Andhra Pradesh. In other words, Manipur has a level of modern contraceptive prevalence similar to the national level in 1975, whereas Andhra Pradesh is far ahead with a level that India is not even projected to reach by 2035. This represents a stark difference of 52.2% between the worst- and best-performing state/UT, pointing to large disparities between different regions. With the exception of Manipur and Meghalaya, all states/UTs have achieved a minimum of 1 in 5 women on modern contraception with 95% probability.

For unmet need for modern methods and demand satisfied with modern methods, the national level stands at 20.4% (12.3%-30.9%) and 71.8% (55.6%-84.1%) respectively. Andhra Pradesh also performs the best among the 29 states/UTs for both of these indicators, with 8.1% (4.7%-13.2%) unmet need and the highest met demand among all regions of 89.2% (81.5%-94.0%). At the other end of the spectrum, Manipur and Meghalaya consistently lag behind the other states/UTs; unmet need for modern methods is 40.3% (30.8%-50.5%) for Manipur and 40.4% (31.6%-49.5%) for Meghalaya while demand satisfied with modern methods is 26.7% (16.7%-38.6%) for Manipur and 30.9% (21.7%-41.5%) for Meghalaya. In general, the best-performing states/UTs are in the central region of India while the worst-performing ones are in the northeast region (Figure 3).

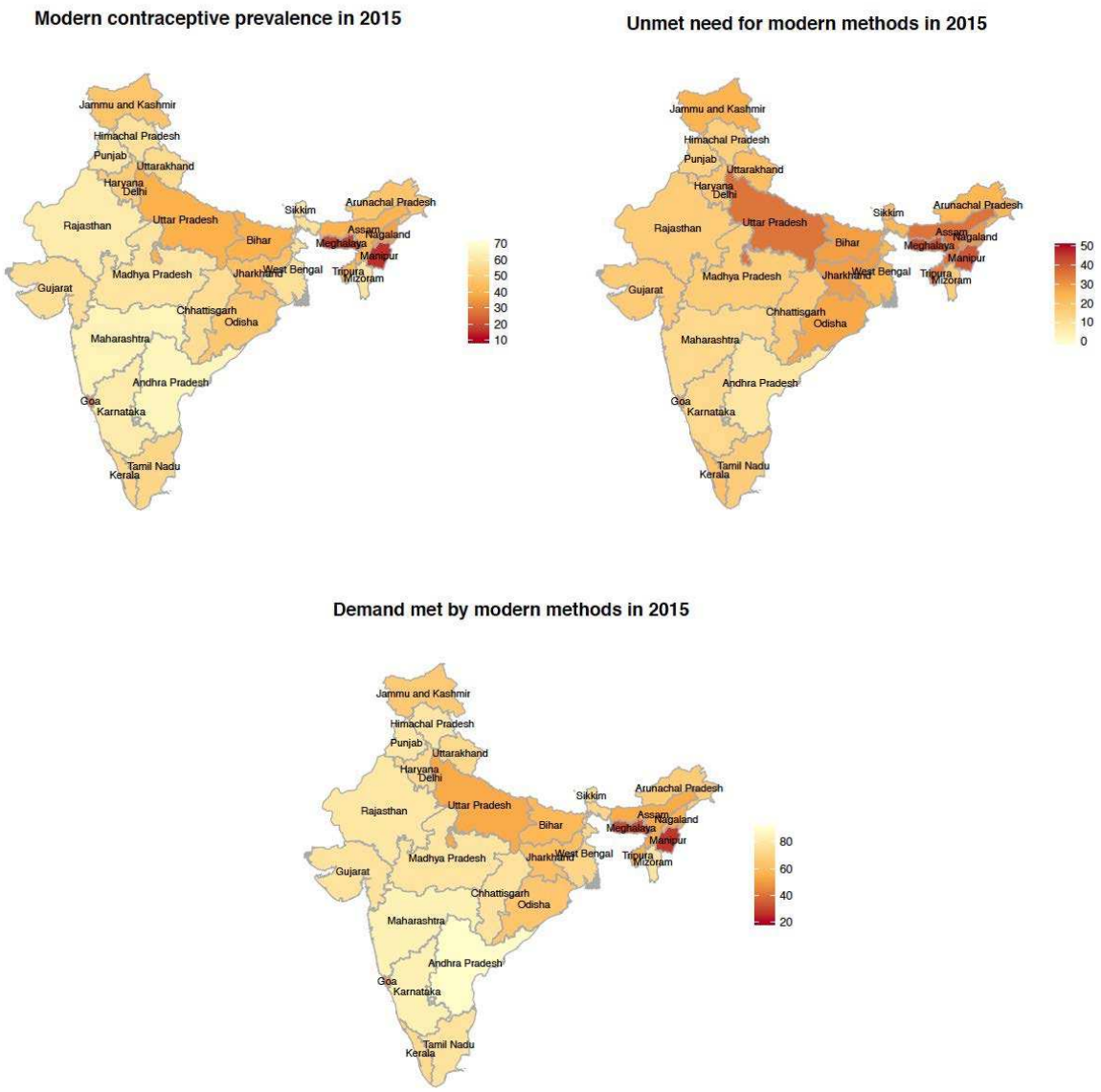

Figure 3: Estimates of modern contraceptive prevalence, unmet need for and demand satisfied with modern methods (%) in 2015 for 29 states/UTs in India.

Across India, the states/UTs with higher changes in modern contraceptive prevalence from 1990 to 2015 generally started out with lower levels of modern contraceptive prevalence in 1990 (Figure 4), although there is considerable variation in the change in this indicator among states of similar levels in 1990. Nevertheless, Goa, Manipur and Meghalaya registered much lower changes in modern contraceptive prevalence in this period than expected compared to other states/UTs, considering their starting level in 1990.

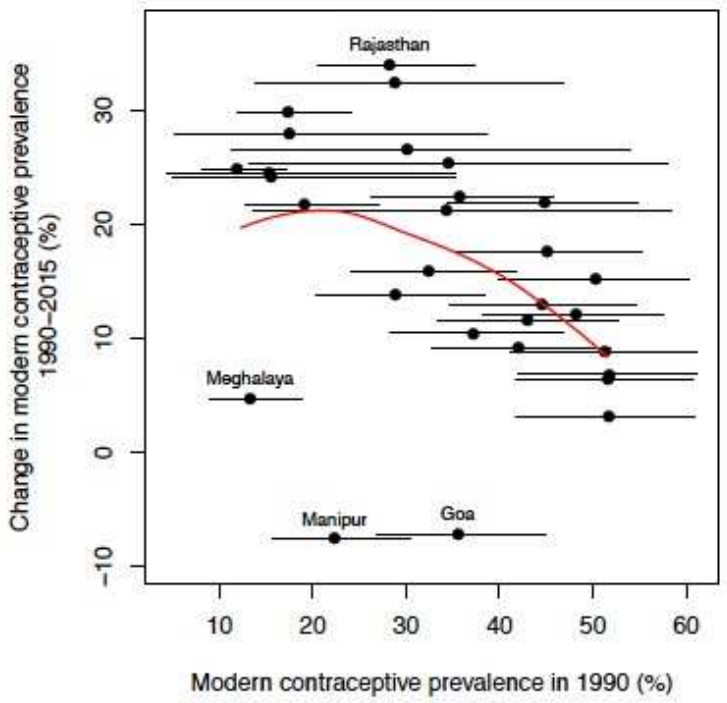

Figure 4: Change in modern contraceptive prevalence (%) from 1990 to 2015 versus the level of modern contraceptive prevalence (%) in 1990 (black dots), with 95% uncertainty intervals in estimates of the level in 1990 (black line segments), including a loess fit to the points (red line).

DISCUSSION

In this paper, we presented estimates and projections of rates and trends in modern contraceptive prevalence, unmet need for and demand satisfied with modern methods in 29 states/UTs in India with associated uncertainty intervals. The estimates illustrate differences across states/UTs both in terms of current levels and past progress from 1990 to 2015 that are masked by looking solely at national averages. Region-specific policy recommendations are necessary to address these different situations. We also wish to highlight that there is considerable uncertainty in the estimates and projections particularly in earlier or recent years without data. Most states have data up to the year 2013, though 4 states/UTs—Delhi, Jammu and Kashmir, Nagaland and Sikkim—only have data up to the year 2006 or 2008. As the demand for estimates grows, the importance of high quality disaggregated data available in a timely manner will only increase. We repeat the call for such data, but at the same time are conducting further research into supplementing our analysis for some indicators (e.g. modern contraceptive prevalence) with non-conventional types of data, e.g. service statistics.

The estimates and projections were constructed using FPET. FPET is a user-friendly web-based application (available at http://fpet.track20.org) implementing the non-global family planning model that allows users to generate national or subnational estimates and projections of relevant

indicators of access to reproductive health with little external support. The provision of FPET means that the results in this paper can be easily reproduced and more importantly, the analysis can be readily extended by any user at the local level to further in-country planning, monitoring and evaluation work. The analysis as carried out in this paper can thus be generalized to other countries and as well as other types of population subgroups, e.g. groups defined by urban/rural residence or wealth quintiles where reliable disaggregated data is available. FPET serves the twin goals of facilitating timely national and subnational monitoring and decision-making and increasing the agency of the local stakeholders. More generally, we believe that developing simple monitoring tools for non-technical country users should, insofar as possible, be the way forward for all global health indicators that have direct relevance at a more local level.

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